DEPARTMENT OF TRANSPORTATION

COAST GUARD

# MARINE CASUALTY REPORT

## OCEAN EXPRESS (DRILLING UNIT), CAPSIZING AND SINKING IN THE GULF OF MEXICO ON 15 APRIL 1976 WITH LOSS OF LIFE

U.S. COAST GUARD
MARINE BOARD OF INVESTIGATION REPORT

AND

COMMANDANT'S ACTION

REPORT NO. USCG 16732/61865

TECHNICAL REPORT STANDARD TITLE PAGE

| 1. Report No. | 2. Government Accession No. | 3. Recipient's Catalog No. |
|---|---|---|
| USCG 16732/61865 | | |

| 4. Title and Subtitle | 5. Report Date |
|---|---|
| Marine Board Casualty Report OCEAN EXPRESS (Drilling Unit); Capsizing and Sinking in the Gulf of Mexico on 15 April 1976 with loss of life | 1 June 1978 |
| | 6. Performing Organization Code G-MMI-1/83 |
| 7. Author(s) | 8. Performing Organization Report No. |
| 9. Performing Organization Name and Address<br>U. S. Coast Guard<br>Washington, D.C. 20590 | 10. Work Unit No. |
| | 11. Contract or Grant No. |
| | 13. Type of Report and Period Covered<br>MARINE CASUALTY REPORT<br>15 April 1976 |
| 12. Sponsoring Agency Name and Address<br>Commandant (G-MMI-1)<br>U. S. Coast Guard<br>Washington, D.C. 20590 | 14. Sponsoring Agency Code |

15. Supplementary Notes

16. Abstract On 15 April 1976, the self-elevating drilling unit OCEAN EXPRESS, capsized and sank while it was being towed by three tugs from one drilling site to another in the Gulf of Mexico. The crew, except for the barge mover, abandoned the rig in two survival capsules. The barge mover was evacuated by a Coast Guard helicopter just seconds before the OCEAN EXPRESS capsized. All of the crew members in one of the capsules safely transferred to an attending vessel. The other capsule capsized in the vicinity of one of the tugs due to wave action and shifting weight. Seven men escaped from the overturned capsule and safely boarded the tugs, however, thirteen other persons were trapped inside and drowned.

This report contains the U. S. Coast Guard Marine Board of Investigation report and the Action taken by the Commandant to determine the probable cause of the casualty and the recommendations to prevent recurrence.

The Commandant concurs with the Board that the primary cause of the capsizing of the OCEAN EXPRESS was the loss of directional control resulting from the loss of the GULF KNIGHT's engine and the breaking of the GULF VIKING's towline at a time when the weather conditions were worsening. This allowed the OCEAN EXPRESS to drift broadside to the boarding seas.

| 17. Key Words | 18. Distribution Statement |
|---|---|
| Uninspected; self elevating drilling unit; towing; capsizing; sinking; stability; drowning; survivors; survival capsule; forecasts; waves; wind; ABS; oil exploitation; outer continental shelf | This document is available to the public through the National Technical Information Service, Springfield, Virginia 22151 |

| 19. Security Classif. (of this report) | 20. Security Classif. (of this page) | 21. No. of Pages | 22. Price |
|---|---|---|---|
| UNCLASSIFIED | UNCLASSIFIED | | |

Form DOT F 1700.7 (8-69)

# OCEAN EXPRESS (DRILLING UNIT); CAPSIZING AND SINKING IN THE GULF OF MEXICO ON 15 APRIL 1976 WITH LOSS OF LIFE

## TABLE OF CONTENTS


Page

ACTION BY THE COMMANDANT - U. S. COAST GUARD

Remarks..... i
Comments on Conclusions..... iv
Action Concerning the Recommendations..... vi

MARINE BOARD OF INVESTIGATION

Findings of Fact..... 1
Figure 1..... 4
Graph 1..... 35
Table 1..... 36
Conclusions..... 82
Recommendations..... 87

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U.S. COAST GUARD (G-MMI-1/83)
WASHINGTON, D.C. 20590
PHONE (202) 426-1455

16732/OCEAN EXPRESS
1 JUN 1976

Commandant's Action

on

The Marine Board of Investigation convened to investigate the circumstances surrounding the capsizing and sinking of the uninspected self-elevating drilling unit OCEAN EXPRESS, with subsequent death and injury from the capsizing of a USCG approved totally enclosed lifeboat (Whittaker Survival Capsule) on 15 April 1976 in the Gulf of Mexico

The report of the Marine Board of Investigation convened to investigate the subject casualty has been reviewed; and the record, including the findings of fact, conclusions and recommendations, is approved subject to the following comments.

REMARKS

1. On the morning of 14 April 1976, the OCEAN EXPRESS departed a drilling site in the Gulf of Mexico under tow of three tugs en route to a new site approximately 33 miles away. The rig arrived at the new site without incident and the crew commenced jacking the mat (bottom bearing foundation) down to the bottom. The depth of water was 198 feet. The weather began to deteriorate and the jacking operation was halted with the mat at an overall draft of approximately 148 feet. While waiting for the weather to abate, the OCEAN EXPRESS was held in the area of the new site by the tugs. On 15 April the weather continued to deteriorate and boarding seas caused flooding of its interior spaces. In the afternoon of 15 April, one of the tugs experienced an engine failure. It could not maintain its heading into the seas with its remaining engine and dropped back to a trailing position. At about 1930 the tow line of another tug parted and this caused the OCEAN EXPRESS to drift broadside to the seas. The 20 to 25 foot seas boarded the rig's port side, broke loose drill collars and drill pipe which were stowed on deck, and caused the derrick to shift. The port survival capsule was washed overboard by the boarding seas. The crew, except the barge mover, who has complete control of the rig during the move, abandoned the rig in the two remaining survival capsules. The

barge mover was evacuated by a Coast Guard helicopter just seconds before the rig capsized. The rig sank in 167 feet of water. All of the crewmembers in one of the capsules were able to safely transfer to a survey vessel. The other capsule in the vicinity of one of the tugs capsized due to wave action and shifting weight. Seven men managed to get out of the capsule and safely board the tugs, however, thirteen other persons were trapped inside and drowned.

2. The Commandant concurs with the Board that the primary cause of the capsizing of the OCEAN EXPRESS was the loss of directional control resulting from the loss of the GULF KNIGHT's engine and the breaking of the GULF VIKING's towline at a time when the weather conditions were worsening. This allowed the OCEAN EXPRESS to drift broadside to the boarding seas.

3. The incorrect forecast by the National Weather Service and other weather services for 14 April contributed to the casualty. The barge mover made his decision to relocate the OCEAN EXPRESS based upon the forecasted weather. It is imperative that the barge mover consult the weather forecast since the condition of the seas has a bearing on the jacking operation. The operating book for the OCEAN EXPRESS states that the rig is not to be jacked into or out of the water when the sea state exceeds 7 feet. Also once the rig is afloat it is more vulnerable to the elements. The safest position is when the mat is resting on the bottom with the hull jacked out of the water. The weather forecast for 14 April called for 4 to 6 foot seas and 15 to 20 knot winds from the southeast with diminishing winds and seas during the night. When the rig was lowered into the water on 14 April, the seas were 4 to 6 feet and winds were from the southeast at about 10 knots. The weather began to deteriorate when the crew began to jack down the mat at the new location. At 0100 on 15 April, the swells were about 10 feet with winds from the southeast at 30 to 35 mph. The jacking operation was halted since the wave action could cause substantial damage to the mat and legs. The decision to ride out the storm with the rig in the floating mode set the stage for the impending chain of events.

4. Several other conditions contributed to the capsizing of the OCEAN EXPRESS. There was an unexplained list to port which had been discovered 4 months prior to the casualty. Random inspections had been conducted by the barge mover which included checking of void spaces and verifying liquid levels in tanks. These investigations did not identify any weights which accounted for the list. There was also a difference between the calculated freeboard determined by the barge mover prior to moving and the observed freeboard. The observed freeboard on 14 and 15 April was in the 5 or 6 foot range. The barge mover calculated the freeboard to be 7 feet 5 inches. An additional 660 barrels of ballast was taken on board on 14 April after becoming waterborne to offset the port list which could account for about a 3 inch loss in freeboard. This difference between the calculated and the observed freeboard indicates that the OCEAN EXPRESS had an undetected weight on board on 14 and 15 April. The effect of this undetected weight would be a reduction in the reserve buoyancy.

The OCEAN EXPRESS took on water through leaking hatches, doors, and vents on 15 April. Water also entered the yoke houses through the jacking pin holes in the legs. Estimates of this flooding accounted for the loss of 19 inches of freeboard.

The mat at a lowered position also had an adverse effect on the seaworthiness of the OCEAN EXPRESS. The major effect of leaving the mat, which is buoyant, in a lowered position is a marked reduction of the range of stability and the total righting energy. Information on the positioning of the mat and its effect on stability was not contained in the rig's Information and Operating Instruction Book.

The shifting of on deck weight was also a factor in the capsizing, however, not as great a factor as the mat position and the loss of freeboard. The drill collar and drill pipe which were secured on deck became adrift. Also the derrick, which weighs 361.7 tons, shifted about 8 feet to starboard minutes before capsizing. The shifting of drill collars, drill pipe, derrick and other miscellaneous gear caused the starboard list.

Seas were continously washing over the decks in the afternoon with such frequency that the decks did not have a chance to drain. The weight of this water caused an additional loss of freeboard.

Preceding the capsizing, the attending vessels were towing downwind in the direction of the beach which provided an additional capsizing force additive to the sea and wind forces. In addition a "tripping action" would occur if the rig were to touch the bottom. The rig's overall draft was approximately 148 feet and after sinking it was located in approximately 167 feet of water. The likelihood that the rig drifted any appreciable distance after the capsizing is remote. With normal platform draft, no heel, or trim and the mat lowered for an overall draft of 148 feet, a 19 foot bottom clearance would have existed. However, the OCEAN EXPRESS was probably in substantial bottom contact at the time of capsizing because of the undetected weight, partial flooding, shifting of on deck weight and water on deck. Further, it would have started to touch bottom at modest angles of heel. At 2120 the rig was observed to be headed into the wind and seas and listing by the starboard quarter at 20 to 25 degrees. Minutes later it capsized.

Another undetected weight may have been on board. The rig did not take on fuel and there was an unexplained 910 barrel increase in the reported on board fuel. The possibility exists that sea water entered the fuel tanks because of structural failure of the hull or damage to the fuel tank vents. This could account for part of the difference between the observed and calculated freeboard.

5. In 1973 the skirt on the survival capsule was reduced in size by the manufacturer to increase speed to meet the 4 knot SOLAS requirement. The Board did not address the effects of this modification on stability. The full skirt, which is designed to dampen the effects of pitch and roll, tends to "dig into the seas" and provides more resistance to forward motion. The modified skirt has less resistance to forward motion but provides pitch and roll dampening similar to the full skirt. Tests conducted by the Whittaker Corporation and the original producer of the capsule, Life Spheres Corporation, indicated that the full skirted capsule capsizes at approximately 120° and the modified mini skirted capsule capsizes at 115° to 120° inclination angle. The alteration of the skirt increased the speed to 4.72 knots and did not materially affect its stability.

6. Three statements in finding of fact 22(a)(1) regarding the survival capsule are in error. The waiver is stated incorrectly. Title 46 CFR 160.035-11(c) requires that a fully loaded motor-propelled lifeboat be able to maintain a speed of 6 knots for 24 hours. The Coast Guard waived the 6 knot requirement for these capsules. The finding that the engine of the Whittaker capsule requires 54 gallons of fuel at reduced r.p.m. for 24 hours operation is incorrect. The capsule requires about 54 gallons of fuel at full throttle for 24 hours of operation. The finding that the fuel capacity of the capsule is 27.2 gallons which provides a half-hour operation with wide-open throttle is incorrect. This capsule, with a 27.2 gallon fuel capacity, can operate 24 hours at 4 knots which is nearly full throttle.

7. Paragraph 5 of finding of fact 23 is not concurred with. It infers that Mr. [redacted] checked the cooling water intake valve to ascertain if it was open. It is obvious from Mr. [redacted] testimony that he checked instead the valves for the bilge and sprinkler system. The bilge and sprinkler system is completely independent from the capsule's engine cooling system. The statement that the temperature gage for the engine, located on the console, indicated 200°F is also not concurred with. Mr. Walker testified that he did not get a good look at the temperature gage but he thought it was in the 200°F range.

## COMMENTS ON CONCLUSIONS

1. With regard to conclusion 50 the need for formal training and licensing of persons in charge of moving mobile drilling units is recognized. A pilot program for licensing of these individuals has been in effect since 1973. This licensing program is presently conducted only at the Marine Inspection Office, New Orleans. Proposed regulations concerning these licenses are currently being drafted.

The Coast Guard has also contracted the services of an independent research firm to conduct a survey and analysis of industrial and maritime personnel training and qualification requirements for mobile drilling units.

2. With regard to conclusion 12, Mr. [redacted] was not licensed while serving as "training" mate on board the GULF VIKING. However, Mr. [redacted] was in charge of the navigation of his vessel for 12 hours every day it was underway. Title 46 USC 405 requires an uninspected towing vessel to be under the actual direction and control of a licensed operator; however, this statute exempts tugs, i.e., GULF VIKING, GULF KNIGHT, and GULF EXPLORER, that provide services to the offshore oil and mineral exploitation industry from that requirement. While there is no evidence that the lack of a licensed mate on board the GULF VIKING contributed to the casualty, it is apparent from this incident that tugs towing these "mammoth" drilling rigs are subjected to many complex circumstances such as adverse weather, towing forces, and proper towing positions for which the operators must be ready and capable to respond. It is clear that personnel in charge of tugs in the offshore oil and mineral exploitation industry should be required to know more than, not less than, other tug operators who are required to be licensed by statute.

3. Conclusion 25 is approved to the extent that it implies that the barge mover would have been aided by the knowledge to be derived from both intact and damaged stability data on the OCEAN EXPRESS at other than the 2 foot mat separation.

4. Conclusion 39 is not concurred with. The normal operating temperature for these engines is 160°F to 200°F. Since the actual operating temperature of the engines could not be determined, there is insufficient evidence to conclude whether or not the engines overheated. The possibility exists that the engines may have overheated because the cooling water intake valves were not opened. The cooling water intake valve is a three way valve which connects the through hull fitting to the cooling water piping. Also connected to this valve is an adapter for a hose. The capsules' engines can be operated out of the water by connecting a hose to the adapter and then turning the cooling water intake valve. By lining up the valve for engine operation out of the water, the sea intake is closed off.

Regardless of the fact that it can not be determined if the engines overheated, the need for better crew training in the operation of these survival capsules is evident.

## ACTION CONCERNING THE RECOMMENDATIONS

1. Recommendation 1: The Board takes note of the proposed regulations being considered by the U. S. Coast Guard in bringing this class of vessel under the inspection laws of the United States and recommends that those regulations be expedited for implementation and incorporate the several applicable recommendations of this report.

Action: The Coast Guard published a Notice of Proposed Rulemaking (NPRM) for the inspection and certification of mobile offshore drilling units, including self-elevating units on 2 May 1977. It is anticipated that the final regulations will be published approximately 1 June 1978. Some of the recommendations of the Board are already included in the proposed regulations. However, those recommendations which go considerably beyond the current scope of the proposed regulations will require an additional notice of proposed rulemaking.

2. The following Board recommendations relate to an operating booklet for self-elevating drill units.

Recommendation 2: That a comprehensive list of items required to be in the operating booklet be incorporated in the regulations. These requirements should be based on operating experience with self-elevating units in general.

Recommendation 3: That the list of items required to be in the operating booklet for a mat type self-elevating drill unit include the following information:

a. A list of essential items to be checked (in a check list form) prior to making a move. Such items as details on position of each equalizing or cross over valve, derrick position and position of locking devices and condition of doors, hatches, vents and securing for heavy weather should be included.

b. Information needed by the barge mover when encountering unexpected adverse weather such as how varying the mat position affects stability and leg stresses. This information should be presented to permit the barge mover to easily understand what unit motions might produce critical leg stresses and how to position the mat to minimize such stresses and how stability is affected by loading and mat position.

c. The effects of jacking the mat up or down under adverse conditions which might exceed the recommended maximum sea states.

d. Clear guidelines for determining what is a long or short move and the do's and don'ts for each.

e. A towing plan setting forth the required number of towing vessels and their minimum horsepower for long and short moves. Any variations based on towing configuration, bridles vs. single tow lines, etc., should be indicated. The required towing arrangement

should be predicated on the ability to maintain control of the drilling unit. This plan should also set forth minimum strength of towing apparatus and procedures to be followed in the event of various emergency conditions such as weather, loss of communications, loss of a tow vessel, broken tow lines, etc.

f. Guidelines for the use of installed anchoring equipment.

Action: The NPRM of 2 May 1977 proposes requirements for a Coast Guard approved operating manual and lists some of the information required to be contained in it. Consideration will also be given to include all of the items in the recommendation, except item 3(e), in the final rule. With respect to a prescribed towing plan, there are too many variables involved to expect that predeveloped towing plans would be applicable to the wide range of potential situations which might exist.

In addition to requiring the operating manual the Coast Guard has already taken steps to ensure that its review of these manuals places greater emphasis on measures regarding heavy weather and emergency conditions such as the control of unintentional flooding.

3. The following Board recommendations relate to the towing of mobile drill units.

Recommendation 4: That drilling units without suitable winches and space for handling towing lines should be outfitted with an insurance towing line to facilitate a hookup in the event a towing line is broken in rough weather.

Recommendation 12: That the design of this class vessel be changed to provide a more realistic area for towline handling than was provided in the triangular spaces on the port and starboard bow of the OCEAN EXPRESS.

Action: These recommendations are not concurred with. This casualty was the result of a chain of events. The interruption of this chain at any point might have prevented this casualty and the resulting loss of life. The Board outlined two courses of action which could prevent the recurrence of this type of casualty. They were (1) implement design changes to self-elevating units with in-transit safety in mind or (2) take steps to assure directional control of self-elevating units will be maintained by towing vessels in adverse weather. The Coast Guard believes that the former course of action is better since the vessel will be able to endure heavy weather independent of tugs. The Coast Guard is doing research on the stability of self-elevating units; if modifications are necessary they will be initiated.

4. The following recommendations relate to requiring additional equipment on mobile drilling units.

Recommendation 5: That drilling units be outfitted with a line throwing gun.

Recommendation 8: That 12 red emergency flares be required on this class of vessel.

Action: The NPRM of 2 May 1977 proposed requirements for a line throwing device and emergency flares. These requirements will be included in the final rule.

5. Recommendation 6: That a program be established with the long range goal of vesting leadership responsibilities in the toolpusher. The program should include an appropriate industry sponsored training program, and a government sponsored licensing program leading to licensing of the toolpusher. The barge mover's role would then be that of an advisor, similar to the pilot/master concept. Recognizing the long range nature of this recommendation, in the interim, the barge mover's role as the person in complete authority during the moving of a drill unit should be affirmed through mandatory licensing and clearer operating procedures set forth in the operating manual.

Action: The Coast Guard has contracted the services of an independent research firm to conduct a survey and an analysis of industrial/maritime mobile drill unit personnel training and qualification requirements. This research will assist in developing regulations to assure that commercial vessel personnel have the skill and knowledge necessary for safe operation of these units. Industrial experience alone in the drilling mode does not provide the degree of expertise considered necessary to adequately fulfill the responsibilities of the marine oriented master. A combination of both industrial and marine experience appears to be more appropriate.

Upon completion of the survey a program will be developed in regulatory form which will include industrial experience as a qualification standard for licensing marine oriented masters and mates of mobile drilling units. It is anticipated that the regulatory proposal will be published approximately 1 June 1978.

6. Recommendation 7: That this class of vessel be required to obtain a load line assignment.

Action: The NPRM of 2 May 1977 proposed that the load line requirements be made applicable to all new mobile offshore drilling units. Implementing instructions will be promulgated with the final rulemaking, providing instructions to Coast Guard field units on the application of the load line requirements to existing bottom bearing mobile drilling units.

7. Recommendation 9: That 46 USC 405(b)(3) be deleted, i.e., the licensing exemption for tow boats operating in the offshore oil and mineral industry.

Action: The Coast Guard will examine the application of the statute relative to the exemption for the offshore oil and mineral industry for the purpose of ensuring that in certain operations, in order to assure safe navigation, the vessel is under the actual direction and control of a suitably licensed person.

8. Recommendation 10: The following recommendations are addressed to the National Weather Service, herein referred to as NWS.

a. The NWS and USCG consider jointly ways to better disseminate weather information to marine industry users, assess the need for improvements to the overall system and consider the merit of establishing a formalized network of "Marine Service Stations" similar to the Flight Service Station system currently available to the aviation community.

b. NWS should publicize that it currently does not provide specialized services to marine interests.

c. If the NWS (San Antonio, Texas) study of the 14-15 April 1976 forecast has not been completed, it should be completed and a copy furnished the Commandant, U.S. Coast Guard for information as to action taken.

d. The VHF tapes broadcasted by the NWS in coastal areas such as Corpus Christi should identify themselves as primarily serving the Boating Public, if this continues to be the case.

e. The NWS should expand its present system of obtaining existing weather conditions in the Gulf of Mexico.

Action: A copy of this report will be forwarded to the National Weather Service for their consideration. The Coast Guard will maintain contact and follow-up with NWS.

9. Recommendation 11: That the U. S. Coast Guard license program for barge movers and/or other licensed rig personnel as well as licensed tow boat operators include examination material regarding weather phenomena, weather forecasts and weather information.

Action: The Coast Guard, in its licensing modernization program, will continue to upgrade the content of all examinations. Material on weather phenomena, weather forecasting, and weather information sources will be included in examinations.

10. Recommendation 13: That the Commandant, U. S. Coast Guard amend existing specifications and regulations pertaining to lifeboats, or promulgate separate specifications and regulations covering the special characteristics of survival capsules. The following should be included:

a. towing

b. crew training

c. emergency escape when capsized or self-righting features

d. training of operators (lifeboatmen)

e. clear operating instructions for each system, especially the releasing gear.

f. recommended procedures for debarking the capsule while alongside vessels in heavy weather.

Action: The Commandant concurs with the intent of this recommendation and will propose regulations to accomplish it. The regulations will be applicable to all survival craft, and will include features unique to covered craft.

Operating and maintenance instruction placards, as well as manuals which reflect the particulars of the survival craft and its launching equipment, will be required. Also a training manual will be required on each vessel which reflects the emergency procedures for that particular survival craft. This will assist the master in training his crew in vessel abandonment procedures. The Coast Guard will initiate a study to determine the proper content and format of this information to assure that it is effective.

The NPRM of 2 May 1977 provides for the assignment of licensed deck officers, able seamen, or certificated lifeboatmen to each lifeboat and inflatable liferaft in Section 109.323. As stated in Section 108.501 of the NPRM, the survival capsule is included in the term "lifeboat". In support of these proposals, the Coast Guard will coordinate with the Maritime Administration to broaden training programs to include training and testing in survival capsules and enclosed lifeboats for those seamen employed aboard vessels that may be equipped with those survival craft.

The Coast Guard representing the United States in the Inter-Governmental Maritime Consultative Organization will also request similar provisions in the revision of the 1960 Safety of Life at Sea Convention, Chapter III, Life Saving Appliances, which is now in progress.

11. The following Board recommendations relate to survival capsules.

Recommendation 14: That the Commandant, U. S. Coast Guard support the Board's view that the Whittaker Survival Capsule remains an effective means of escape and survival for use on offshore drilling units and platforms.

Recommendation 16: That the U.S. Coast Guard require further evaluations to be made of the seaworthiness of the survival capsule. If it is determined that operational procedures are not sufficient to reduce the risk of capsize to an acceptable level, other safety features such as self-righting features or an escape capable of being used from an inverted position should be required.

Recommendation 17: That manufacturers of survival equipment employing the use of propelling machinery located in a closed compartment in which passengers are riding be required to use materials that assure noxious fumes will not be generated by the heat of the engine. A specified "run in" time may be necessary to accomplish this objective.

Action: The Commandant concurs that the Whittaker Survival Capsule is an effective means of escape and survival for use on offshore units and platforms. The capsules provide more protection from the elements and greater launching reliability than conventional lifeboats and along with other covered lifeboat designs are a great improvement in emergency escape equipment. Two relatively untrained crews were able to launch the capsules, clear the rig, and reach assistance in extremely large seas. Only the capsizing of a capsule marred what would have been a successful rescue.

One of the reasons that the Coast Guard conducts casualty investigations is to determine if modifications to approved equipment are necessary in order to prevent recurrence of casualties. In light of this casualty, the Coast Guard will conduct a study of the stability of survival craft including inflatable liferafts, open lifeboats, totally enclosed lifeboats, and survival capsules in the intact and flooded conditions. The purpose of the study will be to verify the validity of the static stability tests and to develop new dynamic stability criteria if it is found that such criteria are needed.

The Coast Guard, representing the United States at IMCO in the revision of Chapter III of the Safety of Life at Sea Convention, has supported the introduction of a requirement that all totally enclosed survival craft be self-righting when all hatches are closed, all persons are secured in their seats with seat belts and there is no water inside. The United States has also introduced a requirement that all such craft be arranged to allow an above-water escape during any possible condition of flooding or equilibrium. A regulation project has been initiated to incorporate these requirements into the United States approval standard, 46 CFR Subchapter Q.

Manufacturers of motor propelled lifeboats and survival capsules, manufacturers of engines for those craft, and Coast Guard inspectors have been notified of the problem of noxious fumes coming from hot engine parts. Factory inspectors have been directed to ensure that all paint and materials which give off noxious fumes when in contact with heated surfaces have been removed before any lifeboat or survival capsule is approved. Action has been taken to require that the normal operating temperature range of lifeboat and survival capsule engines be indicated on or near the gages.

12. Recommendation 15: That 33 CFR 146.05-25 be revised to incorporate the following:

a. A requirement to conduct drills and training at least weekly to assure each change of crew is adequately prepared for emergency situations.

b. Clearly delineate that it is an owner responsibility to indoctrinate persons in addition to the crew, such as subcontractors and visitors, at the time such persons board the rig.

Action: The NPRM of 2 May 1977 proposes requirements for weekly drills and training for mobile drilling units. The proposed rules did not address persons coming aboard for purposes other than as regular crewmembers. Comments were received on the applicable portions of the proposed rulemaking and the final rule will be amended to ensure that temporary personnel and visitors are advised of their emergency stations and duties upon their arrival aboard the unit. Also consideration is being given to develop a training manual for each crewmember.

A similar regulation project will be initiated for artificial islands and fixed structures on the outer continental shelf.

13. The following Board recommendations relate to the stability of mobile drilling units.

Recommendation 18: That consideration be given by both the American Bureau of Shipping and the U.S. Coast Guard to modify the intact stability criterion to treat separately matters bearing on the survivability of a vessel; i.e. range of stability and righting energy over the full range of positive stability; and downflooding considerations.

Recommendation 19: That the U.S. Coast Guard consider adopting a damaged stability standard.

Recommendation 20: That the American Bureau of Shipping give consideration to include an allowance for sea dynamics and other factors in their damaged stability criterion.

Recommendation 21: That both the American Bureau of Shipping and U.S. Coast Guard be advised of the need to ensure the stability of a vessel, both intact and damaged, is assessed in all operating conditions, including various in-transit mat positions.

Recommendation 22: That the American Bureau of Shipping and the Commandant (G-MMT) be provided with a copy of this report in advance of final U.S. Coast Guard and National Transportation Safety Board action.

Action: A copy of the marine board report and the Commandant's Action has been forwarded to the American Bureau of Shipping for their consideration of recommendations 18, 20, and 21. An advance copy of the report was not forwarded since the report is not complete until approved by the Commandant. A copy of the Board's report was given to Commandant (G-MMT) upon receipt.

The Coast Guard has initiated a research program to more clearly define the stability problems of self-elevating units. Rulemaking action will be initiated if the results of the research indicate a need to change the stability criteria.

The NPRM of 2 May 1977 includes a damage stability standard for all units. It also proposes that the intact stability and damage stability standards of all mobile offshore drill units be assessed in all operating conditions, including various positions when in transit.

14. Recommendation 23: That the U. S. Coast Guard consider establishing a regulation requiring the use of English for all radio transmissions between towing vessels and other units related to the safe moving of drilling units.

Action: Consideration will be given requiring the use of English for all radio transmissions as recommended. An alternate action may be the requiring of IMCO Standard Marine Navigation Vocabulary.

[redacted]

J. B. HAYES
Admiral, U.S. Coast Guard
Commandant

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
Commandant (G-MMI)
U. S. Coast Guard
Washington, D. C. 20590
(202) 426-1455

16732/OCEAN EXPRESS
12 May 1977

From: Marine Board of Investigation
To: Commandant (G-MMI)

Subj: Uninspected Self-elevating Drilling Unit OCEAN EXPRESS, O.N. 569885, capsizing and sinking in the Gulf of Mexico on 15 April 1976 while attended by the three uninspected motor tugs GULF EXPLORER, O.N. 507302, GULF KNIGHT, O.N. 518966, and GULF VIKING, O.N. 506454, with subsequent death and injury from the capsizing of a USCG approved totally enclosed lifeboat (Whittaker Survival Capsule).

## FINDINGS OF FACT

1. TOPICAL SUMMARY: (All times in this report are CST).
On the morning of 14 April 1976 the OCEAN EXPRESS departed a drilling site in Block 803, Mustang Island, Texas area in the Gulf of Mexico under tow of the three tugs GULF EXPLORER, GULF KNIGHT, and GULF VIKING. The OCEAN EXPRESS was initially manned by 29 persons including a Barge Mover who was aboard for the purpose of handling and overseeing the specialized operations of relocating the OCEAN EXPRESS from Block 803 to another drilling site about 33 miles away in the Mustang Island East Extension area, Block A-57. The weather at the time was 4-6 foot seas with 10-15 knot winds and forecasted to be 15-20 knot winds with 4-6 foot seas diminishing the night of the 14th.

The OCEAN EXPRESS was towed to the new site arriving at about 2300 hours on the 14th at which time the tug configuration was changed and jacking operations commenced to put the mat on the 198-foot bottom. At about 0100 hours on the 15th, jacking operations were discontinued at an overall draft of approximately 148 feet as the height of the seas had reached 8-10 feet which exceeded the recommended limitations for jacking operations. While waiting for the weather to abate, the OCEAN EXPRESS was held in the general area of the Block A-57 datum buoy by the three tugs which were made up with the GULF EXPLORER on the starboard stern, GULF KNIGHT on the port stern and GULF VIKING on the port bow. The tugs were on single unbridled tow lines and were heading generally into the seas holding the OCEAN EXPRESS near location with her forward end into the seas. Throughout the 15th the weather continued to gradually deteriorate.

Minor flooding of some interior spaces within the OCEAN EXPRESS from boarding seas entering through vents and leaking doors and hatches occurred throughout the day. The flooding was of considerable concern to some members of the crew which had increased to 35 persons on the morning of the 15th when six additional men had been put aboard by the attending supply vessel M.L. LEVY.

At about 1510 hours on the 15th, the GULF KNIGHT experienced a material failure resulting in the loss of one of its two engines. The casualty was such that repairs could not be effected and the GULF KNIGHT was unable to effectively function

as a towing vessel in the worsening seas and remained in a trailing position off the port quarter of the OCEAN EXPRESS. At about 1930 hours the tow line of the GULF VIKING parted and the 20-25 foot seas boarding from the port side of the rig began to seriously affect the security of heavy drill collars and pipe on deck. This combined with the wind and seas created a modest starboard list on the order of 3-4 degrees. While futile efforts were being made to reestablish a towing line to the GULF VIKING, the GULF EXPLORER and GULF KNIGHT were ineffective in holding the OCEAN EXPRESS into the seas.

At about 2030 hours the Barge Mover ordered the two tugs to turn about and pull the rig from astern dead slow. The weather frustrated efforts of the GULF VIKING to reattach a tow line. At about 2110 hours, the derrick at the aft end of OCEAN EXPRESS shifted to starboard and the rig took a heavier list. This caused the Toolpusher and the Drilling Foreman to have the men, who had been assembled in life jackets on deck since about 2030 hours, to abandon the rig in the two remaining survival capsules located on the starboard side. The one port side survival capsule had been washed away earlier by the heavy seas. The Barge Mover alone remained aboard until at about 2130, just seconds before the rig capsized and sank in 167 feet of water. He was successfully evacuated by one of two Coast Guard helicopters from Corpus Christi, Texas, which were on scene in response to an assistance call relayed by a Marathon Oil Company representative.

The two survival capsules were successfully launched. One capsule with 14 men aboard, transferred all men safely to the attending survey vessel NICOLE MARTIN which made a lee for the capsule in the 25-foot seas and 50 knot winds. The other capsule with 20 men aboard including the Toolpusher and Drilling Foreman, was secured alongside the GULF VIKING but no attempt was made to transfer men to the tug. The capsule capsized and began filling with water from air vents and untightened or open hatches. The 20 men surfaced inside the capsule in an air pocket. The top hatch and the two doors were under water and after 30 to 45 minutes in this condition only 7 of the 20 occupants managed to escape. All 7 were rescued by the tugs GULF VIKING and GULF KNIGHT; the other 13 persons perished by drowning within the capsule.

2. VESSEL DATA:

a. Name: OCEAN EXPRESS (See Figure 1)
Official number: 569885
Material: Welded steel
Service: Self-elevating mobile drilling unit
Barge platform: Length: 166 feet
Beadth: 109 feet
Depth: 16 feet
Bottom mat: Length: 210 feet
Breadth: 170 feet
Depth: 12 feet
Classed: ABS (*A1)
Year built: 1975
Where built: Beaumont, Texas
Owner: Odeco Drilling, Inc.
Canal Street
New Orleans, La.

Operator: Same as owner
Charterer: Marathon Oil Co.

The bottom mat on the OCEAN EXPRESS is equipped with a 2 foot scour skirt which is designed to rest on the marine bottom. The after portion of the mat is constructed with a slot 87 feet long and 90 feet wide. The mat is composed of 14 tanks, 6 of which are permanently flooded, 6 are permanently bouyant and 2 are keel - cooling tanks. The bottom mat is connected to a barge-like platform by three cylindrical legs 12 feet in diameter and 312 feet in height. These legs are permanently attached to the mat and the distance between the mat and the barge is controlled by raising or lowering the legs by means of a jacking mechanism located at each of the 3 podhouses through which the legs extend. These legs are constructed of 1 1/4"-3" wall thickness structural steel. One leg is located at the bow, on the centerline of the barge and there is one leg at the port and starboard stern corners. The legs are raised or lowered through the platform podhouses by means of a hydraulic jacking system whereby pins in the podhouses are fitted into the holes in the legs and then hydraulic pumps raise or lower the barge platform simultaneously at each leg to the desired draft for transit or desired height above sea level to facilitate a drilling mode. The central controls for the jacking system are located in a house on the forward port uppermost deck.

Positioned on the bow of the barge platform is a cantilevered helicopter landing platform which measures 83 feet x 83 feet. There is a slot 50 feet wide by 48 feet long at the stern of the platform over which the drilling derrick is located.

The derrick is 147' in height and is mounted on a longitudinally-movable skid unit carriage upon which in turn is mounted a transversely movable skid unit. The base of the derrick measures 30'x30'. Movement of the unit is limited by stops to a maximum of approximately 8 feet to port and starboard off the center line of the platform. The balance of the main deck is devoted to the pipe rack area, shale shaker and degasser, galleys, recreation and mess rooms, offices, quarters, laundry, storage spaces and radio room. The lower deck contains the mud pits, mud pumps, A.C. generators, bulk mud and bag storage, saltwater distiller, pressure sets, air compressor, stores, hot water heaters, quarters and changing rooms. The combined capacity of the air-conditioned quarters is 56 men. There are 28 tank spaces within the hull which are used for the storage of drill water, fuel oil, salt water, potable water and active mud. Six of these tanks are void spaces. All tanks are separated by watertight bulkheads.

The platform hull is divided into two levels. The lower level contains the machinery spaces, mud room, storage rooms and living quarters. There is a total of 24 watertight doors within the lower level separating the twenty compartments.

The compartment containing the lower quarters area on the bow has 6 staterooms which can accommodate 34 persons, two shower rooms, two washrooms, and two changing areas. There are two overhead hatches between the lower and upper decks located within the washrooms. The crews' washroom, located to starboard of the centerline, is fitted with an 18"x24" watertight hatch. The staff washroom, port of the centerline, has a 24"x36" non-watertight hatch in the overhead. There are two watertight doors opening to the machinery space and two ladders leading to the upper quarters area. This upper level has accomodations for 22 persons in six staterooms along with two fully equipped galleys, separate dining areas

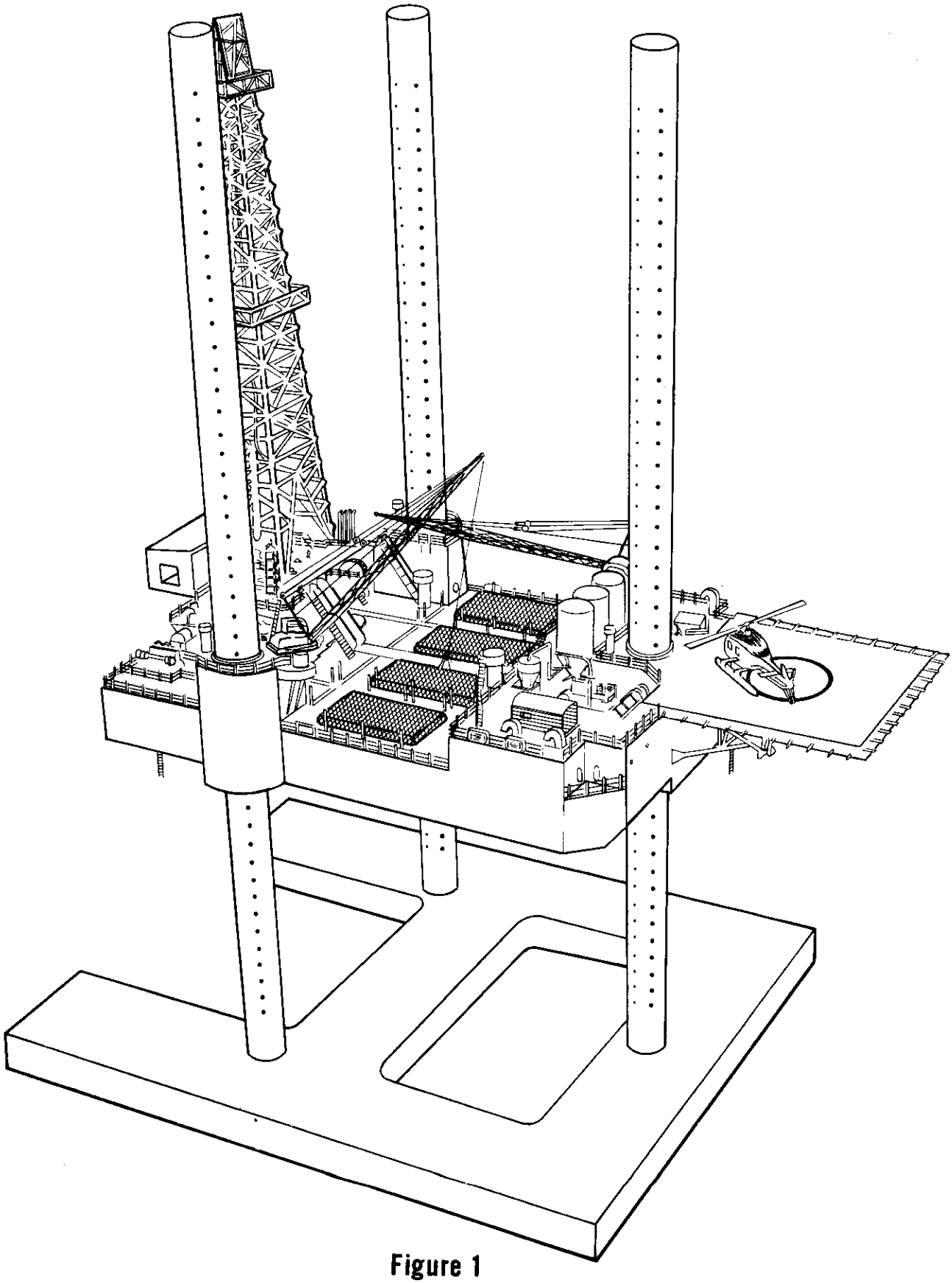

**Figure 1**

for staff and crew and a lounge/game room. There are six watertight doors leading aft to the main deck and one watertight door leading forward into the podhouse. There is a ladder leading up to the control house which is located on the port side. The control house is fitted with a non-watertight door exiting to the roof of the upper quarters where the storage tanks for the bulk cement are located. On the port side of this roof area outboard of the control house is located one of the two National H-65A Pedestal Cranes with an 85-foot boom. They are rated by A.B.S. at 25.25 short tons at a 30-foot radius. The second pedestal crane is located at the forward side of the starboard stern jack house. Just forward of the Control House is the sewerage treatment plant and three airconditioning units. On the starboard side of the roof is the emergency generator house, anchor windlass, cement unit and surge tank.

There is one watertight door on the port forward bow which opens onto a small triangular deck where a towing pad and fairlead is located. The starboard bow has two watertight doors leading onto an identical triangular area where the towing pad and fairlead is located.

Numerous natural vents are positioned on and around the forward house leading to the quarters and the podhouse. All vents are fitted with manually operated closures.

The main deck is fitted with seven watertight hinged hatches which measure approximately 5'4"x6'-3"x3", through which drilling supplies and equipment can be lowered. The main deck has 12 storage racks for 600 tons of drilling pipe and collars.

Three large forced draft intake and exhaust vents are located just aft of the forward house and vent the below deck and machinery spaces. There are two forced draft vents on the after end of the main deck which also vent the below deck spaces. These main deck vents are fitted with manually operated watertight closures. Each pod house is fitted with a natural vent supply through the overhead.

On the after end of the platform is located the derrick and associated drilling machinery.

Primary lifesaving equipment aboard the OCEAN EXPRESS consisted of sufficient lifejackets for each person on board, four fifteen-man life floats and two ten-man life floats. Normally these lifefloats were stowed in racks outboard of the maindeck on the port and starboard sides, in severe weather they were stowed inside. The barge was also equipped with three Whittaker lifesaving capsules each having a capacity of 28 persons. Capsules #1 and #3 were stowed outboard on the starboard side of the upper quarters at the forward end of the barge. Capsule #2 was stored on the port side opposite capsules #1 and #3.

The vessel was equipped with fire-fighting equipment as required by the governing regulations (33 CFR 145).

b. Name: GULF EXPLORER
Official number: 507302
Certificate of Inspection: None.
Material: Welded steel
Service: Towing

Gross tons: 186
Net tons: 129
Length: 117 feet
Breadth: 32 feet
Depth: 10.7 feet
Propulsion: 2 Fairbanks Morse diesel engines, 8 cylinders, of 1800 HP each, twin screws
Horsepower: 3,600
Rudder: Twin
Year built: 1967
Where built: Slidell, La.
Owner: Gulf Mississippi Marine Corp.
Suite 600
225 Baronne Street
New Orleans, La.
Operator: Same as owner
Master: [redacted]

The GULF EXPLORER's engine throttles are controlled from the bridge with separate controls for each engine. The navigational equipment included two radars, fathometer, magnetic compass and an automatic pilot. The tug's radio equipment consisted of a single - side band, VHF/FM and a radio direction finder.

d. Name: GULF KNIGHT
Official number: 518966
Material: Welded steel
Service: Towing
Gross tons: 194
Net tons: 132
Length: 99 feet
Breadth: 30 feet
Depth: 9.7 feet
Propulsion: 2 D-399 Caterpillar turbocharged 16 cylinder engines, twin screw.
Horsepower: 2,400 (as listed in the Merchant Vessel Register of the United States)
Rudder: Twin
Year built: 1969
Where built: Houma, La.
Owner: Gulf Mississippi Marine Corp.
Suite 600
225 Baronne St.
New Orleans, La.
Operator: Same as owner
Master: [redacted]

The GULF KNIGHT's engine throttles may be controlled from the bridge as well as from the stern controls, located just aft of the bridge.

Testimony indicates the GULF KNIGHT was equipped with an inoperative fathometer and capable of radio communications on the FM and single - side band. It was also noted that on 5 April 1976 the main shaft bearing was replaced.

d. Name: GULF VIKING
Official number: 506454
Material: Welded steel
Service: Towing
Gross tons: 148
Net tons: 101
Length: 98.1 feet
Breadth: 27 feet
Depth: 9.7 feet
Propulsion: 2 Fairbanks Morse 6 cylinder diesel engines of 1,200 HP each, twin screw
Horsepower: 2,400
Rudder: Twin
Year built: 1966
Where built: Lockport, La.
Owner: Gulf Mississippi Marine Corp.
Suite 600
225 Baronne Street
New Orleans, La.
Operator: Same as owner
Master: [redacted]

The GULF VIKING was equipped with a hydraulic towing winch manufactured by Marky and driven with a 671 diesel through twin disc gear. This is the original towing winch and is not of the constant tension type. The GULF VIKING was also equipped with Loran - C, a fathometer in good working order, magnetic compass, and radar.

e. Name: NICOLE MARTIN
Official number: Undocumented
Certificate of Inspection: None
Service: Utility vessel (modified offshore supply boat)
Material: Welded steel
Length: 110 feet
Breadth: 25 feet
Depth: 7.5 feet
Propulsion: Two 2D-1671 diesel engines
Owner: Martin Offshore Boats
P.O. Box 475
Golden Meadow, La.
Charterer: John E. Chanch and Associates (Time Charter)
115 Delta Road
[redacted]
Master: [redacted]

The NICOLE MARTIN is radio equipped and has a Raytheon Fathometer model 730 which records depths on graph paper. This graph had been destroyed by the crew of the vessel between the time of the casualty and the investigation. The normal employment of the NICOLE MARTIN is surveying.

f. Name: M/V M. L. LEVY
Official Number: 287213
Certificate of Inspection: None
Material: Welded steel
Service: Offshore supply vessel
Constructed: New Orleans, La.
Year built: 1961
Length: 141 feet
Breadth: 36 feet
Depth: 9.5 feet
Gross tons: 186
Net tons: 126
Propulsion: 2 Caterpillar 379 diesel engines, twin screws
Rudder: Twin
Horse power: 1,000
Owner: Arthur Levy Cargo Boats, Inc.
Morgan City, La.
Charterer: Marathon Oil Company (Time Charter)
Master: [redacted]

The M. L. LEVY is primarily engaged in offshore supply operations to drill rigs. The M. L. LEVY was not equipped for towing employment. The vessel is equipped with Loran, a recording type fathometer which could have been operated had the recording paper been installed. It was noted the vessel had been out of paper for the week prior to 15 April 1976. The vessel was also equipped with radar and a magnetic compass. The radio equipment consisted of a VHF, single - side band and a Marathon Radio.

3. PERSONNEL BACKGROUND DATA:

a. [redacted] of [redacted] was employed by ODECO, INC., as Superintendent of Barge Moving Operations. Mr. [redacted] was issued a Coast Guard license on 30 July 1974 as Master of column stabilized or self-elevating motor drilling vessels of any gross tons, under tow or engaged in mineral and oil exploitation; also radar observer. Prior to the issuance of the Coast Guard license, Mr. [redacted] had also held a Second Mate license which was issued by the Dutch Government and further indicated he had flown for about seven years as navigation instructor with El Almagorda Airlines and held a navigators license. Mr. [redacted] had worked with Kerr-McGee as Assistant Engineer for three years and was involved in moving operations and repairs of drilling barges. Mr. [redacted] had been employed by ODECO, INC., since 1968 and was in charge of moving operations and has experience with respect to moving self-elevating rigs since 1969.

b. [redacted] of [redacted] was employed by ODECO, INC., as Toolpusher. Mr. [redacted] has nineteen years submersible rig experience in the offshore oil industry, with ODECO, INC., and four months experience with self-elevating units.

c. [redacted] of [redacted] was employed by Marathon Oil Company as Drilling Foreman. Mr. [redacted] has been working in the oil fields for the past twenty-five years and has been foreman for the last twenty years.

d. [redacted] of [redacted] was the Master of the tug GULF KNIGHT and has worked for the Gulf Mississippi Marine Corp., for the past two years; however, he has been serving as Master and Mate on various tugboats for the past twenty-two years. The majority of Mr. [redacted] employment has been in association with the Offshore Oil and Mineral Industry. Mr. [redacted] holds the following Coast Guard license and Merchant Mariner's Document:

(1) License as Ocean Operator of not more than 100 gross tons upon the Gulf of Mexico, not more than 100 miles offshore between Pensacola, Florida and Brownsville, Texas.

(2) License as operator of Uninspected Towing Vessels upon oceans, not more than 200 miles offshore, the inland waters of the United States and the western rivers.

e. [redacted] of [redacted] was serving as Engineer on board the GULF KNIGHT and has been employed by the Gulf Mississippi Marine Corp., for some seven years. Mr. [redacted] first worked as a deck hand for approximately two years before pursuing on-the-job training as an Engineer. He has been on board the GULF KNIGHT since June 1975. Mr. [redacted] holds Merchant Mariner's Document [redacted] endorsed as Able Seaman, tug and towboats, any waters and wiper. Mr. [redacted] does not hold a Coast Guard license.

f. [redacted] of [redacted], [redacted] was serving as Master on the GULF VIKING and has approximately thirteen years experience on towing vessels and has been serving as Master for about seven and one-half years. Most of his experience has been with the Gulf Mississippi Marine Corporation, and he has been on the GULF VIKING as Master for the last one and one-half years. He normally stands the 6-12 watch. Mr. [redacted] holds the following Coast Guard license and Merchant Mariner's Document:

(1) License as Operator of Uninspected Towing Vessels upon oceans not more than 200 miles offshore, the inland waters of the United States and the western rivers.

(2) Merchant Mariner's Document [redacted] endorsed as Able Seaman, any waters, unlimited and wiper.

g. Mr. [redacted], of [redacted] was serving on the GULF VIKING as "training" Mate. He has been serving on tugboats on and

off since about 1969 and has occasionally returned to the fishing industry. Mr. [redacted] entire tugboat experience has been with the Gulf Mississippi Marine Corp., and he has been on the GULF VIKING for almost a year, and served as "training" Mate for approximately two months prior to the casualty. Mr. [redacted] holds Merchant Mariner's Document [redacted] endorsed as ordinary seaman and wiper. He does not hold a license.

h. [redacted] of [redacted], was serving as Able Seaman on board the GULF VIKING. Mr. [redacted] has been going to sea since 1940, and for approximately the past five years he has been employed on tugboats for the Gulf Mississippi Marine Corporation. Mr. [redacted] holds Merchant Mariner's Document [redacted] endorsed as Able Seaman, any waters, unlimited.

i. Mr. [redacted] of [redacted], was serving as Master on the GULF EXPLORER at the time of the casualty. He has approximately twenty years offshore experience on tugboats in the capacities of Deck hand, Mate and Master. He obtained his Mate's rating some fifteen years ago and has been serving as Master for approximately the past five years. He has been gainfully employed by the Gulf Mississippi Marine Corporation for approximately nine years and most of his employment has been associated with rig movements. He has been employed as Master of the GULF EXPLORER on and off for the last three and one-half years. Mr. [redacted] holds the following license and Merchant Mariner's Document:

(1) License as Operator of Uninspected Towing Vessels upon oceans not more than 200 miles offshore, the inland waters of the United States and the western rivers.

(2) Merchant Mariner's Document [redacted] endorsed as Able Seaman, any waters, unlimited and wiper.

j. [redacted] who resides at [redacted] was Master of the M/V NICOLE MARTIN. Mr. Conn holds Merchant Mariner's Document [redacted] issued at Houston, Texas on 26 February 1973, for Able Seaman Mineral and Oil Industry and wiper. He also holds an Operator's License of unlimited tonnage, Uninspected Towing Vessels any waters limited to 200 miles offshore, issued at Houston, Texas in 1973. He has been employed by the vessel's owner, Martin Offshore Boat Co., P. O. Box 475, Golden Meadow, Louisiana for two years and nine months.

4. SUPERVISORY RELATIONSHIPS:

The OCEAN EXPRESS, when moved from one location to another, is under the immediate command of an experienced person called the Barge Mover or Rig Mover. In accordance with ODECO, INC. policy, the Barge Mover has complete control and authority during the move. In certain situations where in the judgment of the Barge Mover it should become necessary to deviate from standard procedure as set forth in the "Information and Operations Instruction Book" (hereafter referred to as the "Operating Manual") or company policy, it is company policy that the Barge Mover confer with shoreside supervisory company personnel before executing such action except in extreme emergency situations.

The Barge Mover accomplishes the various tasks of the move requiring assistance through the Toolpusher who is in charge of the rig when it is on location drilling. The Toolpusher may assign various personnel to do the direct bidding of the Barge Mover or he may himself through his subordinates carry out the orders of the Barge Mover. On the OCEAN EXPRESS a combination of these methods was used as a general rule.

On the morning of 14 April, control of the OCEAN EXPRESS passed from the Toolpusher to the Barge Mover at the time the rig was secured and ready to move with the rig still resting on bottom. It was the Barge Mover's responsibility to raise the mat to the desired position for the move. It was also the Barge Mover's responsibility to decide on the configuration of the tugs during the transit. When the rig reaches location and is jacked up, fully secured and ready to drill and the Drilling Foreman accepts the barge as on location, then the Toolpusher resumes command.

The Drilling Foreman is the field representative of the oil company, in this case Marathon Oil. Essentially, while the rig is on location, the Drilling Foreman is in charge of the well while the Toolpusher is in charge of the rig, and the Toolpusher carries out the orders of the Drilling Foreman in order to consummate the purpose of the operation - to drill an oil well. The Drilling Foreman has no official duties during a move; he is essentially a passenger. However, through contractual arrangements the oil company does have a responsibility to provide transportation to and from the rig as necessary, and would also eventually bear the cost of the tugs necessary to move from one location to another. Additionally, the Drilling Foreman could provide courtesy communications over his own company radio if necessary.

The Barge Mover directs the operations of the tugs. He designates the lead tug, in this case GULF EXPLORER. The lead tug only coordinates the courses and speeds of all the tugs during the transit. Repositioning of the tugs and individual maneuvers of the vessels are accomplished by direct communication between the Barge Mover and the specific tug involved. However, the tugs had their own company radio frequency and communicated freely with each other as well as their home office. This might occur with or without the knowledge of the Barge Mover.

Each of the three responsible individuals on board the OCEAN EXPRESS, i.e. Barge Mover, Toolpusher and Drilling Foreman, had a superior in his organization ashore to whom he was responsible. In the case of the Drilling Foreman it was [redacted] Marathon Oil Company's District Drilling Superintendent in Lafayette, Louisiana. Mr. [redacted] the Drilling Foreman communicated with Mr. [redacted] at least twice daily providing him with the customary morning and evening reports. These reports include summaries of the daily activities as well as a mutual exchange of weather information. These reports are passed via the company radio frequency and the Barge Mover or Toolpusher may or may not be aware of their contents or transmission.

Mr. [redacted] the Barge Mover, was directly responsible to ODECO's Manager of Domestic Rigs; on the 14th and 15th of April it was the Assistant Manager, Mr. [redacted].

Mr. [redacted] the Toolpusher, was directly responsible to Mr. [redacted] the Drilling Superintendent for ODECO, INC.

Both Mr. [redacted] and Mr [redacted] are responsible to Mr. [redacted] Vice President, ODECO, INC. in charge of rig operations. Mr. [redacted] testified before this Marine Board and provided some of the facts pertinent to the "chain of command" as it affected the OCEAN EXPRESS.

The six employees of OFFSHORE HAMMERS, INC., who were transferred to the OCEAN EXPRESS from the M. L. LEVY on the morning of 15 April were under the charge of Mr. [redacted] These personnel did not have any assigned duties during the move. Mr [redacted] and his five assistants reported to the Drilling Foreman, [redacted], from whom they received all orders, instructions and guidance. It was intended that they work under his direction in drilling the well. Mr. [redacted] had no relationship with the Barge Mover or Toolpusher, in fact, he never met Mr. [redacted]

The Barge Mover testified that he was the only person aboard the rig with responsibility to be familiar with the operating manual. It was his responsibility to adhere to the manual and company policy in moving the OCEAN EXPRESS. He had authority over the Toolpusher, and he commanded the tugs. If he had felt the need to deviate from the manual or company policy, he was required to confer, if possible, with his immediate superior, Mr. [redacted] He was also responsible for submitting daily reports of the rig's conditions and activities, and he was charged with obtaining weather forecasts to insure that intended operations were within the limitations of the operating manual. He was responsible for the safety of the rig and all personnel aboard. He had the authority to abandon the rig if necessary. According to Mr. [redacted] there is normally no disagreement between the Barge Mover and Toolpusher; however, the Barge Mover should prevail if there is disagreement. He also indicated that since this casualty, ODECO management has instructed their Toolpushers that the Barge Mover has complete authority during a move.

5. LIST OF DEAD AND INJURED:

a. DEATHS:

(1) SAMUEL LEE GOINGS [redacted]

Age: [redacted]

Occupation: Derrickman

Employer:

ODECO, INC.
1600 Canal Street
New Orleans, Louisiana 70112

Next of kin:

[redacted] (Mother)
[redacted]

Cause of death: Drowning

Place of interment:

Ferriday Cemetery
Ferriday, Louisiana

(2) DONALD A. BRITT [redacted]

Age: [redacted]

Occupation: Roustabout

Employer:

ODECO, INC.
1600 Canal Street
New Orleans, Louisiana 70112

Next of kin:

[redacted] (Father)
[redacted]

Cause of death: Drowning

Place of interment:

Mormon Church Cemetery
Lincoln County, Mississippi

[redacted] (3) REGINALD D. HAMMILL [redacted]

Age: [redacted]

Occupation: Floorman

Employer:

ODECO, INC.
1600 Canal Street
New Orleans, Louisiana 70112

Next of kin:

[redacted] (Mother)
[redacted]

Cause of death: Drowning

Place of interment:

Philadelphia Baptist Church Cemetery
Lincoln County, Mississippi

(4) RUSSEL JOSEPH BREAUX, II [redacted]

Age: [redacted]

Occupation: Mechanic

Employer:

OFFSHORE HAMMERS, INC.
P. O. Box 2651
Morgan City, Louisiana 70380

Next of kin:

[redacted] (Son)
[redacted]

Cause of death: Drowning

Place of interment:

Morgan City Cemetery
Morgan City, Louisiana

(5) LEROY PAUL SANCHEZ [redacted]

Age: [redacted]

Occupation: Welder

Employer:

OFFSHORE HAMMERS, INC.
P. O. Box 2651
Morgan City, Louisiana 70380

Next of kin: [redacted] (Sister)

Cause of death: Drowning

Place of interment:

Thibodeaux Cemetery
Thibodeaux, Louisiana

(6) HENRY ARTHUR SYKES

[redacted]

Age: [redacted]

Occupation: Welder

Employer:

OFFSHORE HAMMERS, INC.
P. O. Box 2651
Morgan City, Louisiana 70380

Next of kin:

[redacted] (Father)
[redacted]

Cause of death: Drowning

Place of interment: 16 April 1976 at:

Port Wentworth Cemetery
Port Wentworth, Georgia

(7) CLIFFORD U. BOUWELL

[redacted]

Age: [redacted]

Occupation: Floorman

Employer:

ODECO, INC.
1600 Canal Street
New Orleans, Louisiana 70112

Next of kin:

[redacted] (Wife)
[redacted]

Cause of death: Drowning

Place of interment:

McCormick Cemetery
West Monroe, Louisiana

(8) GERALD FORTUNE ADAMS

[redacted]

Age: [redacted]

Occupation: Driller

Employer:

ODECO, INC.
1600 Canal Street
New Orleans, Louisiana 70112

Next of kin:

[redacted] (Father)
[redacted]

Cause of death: Drowning

Place of interment:

Holy Savior Cemetery
Lockport, Louisiana

(9) JIMMY L. GARNER

[redacted]

Age: [redacted]

Occupation: Floorman

Employer:

ODECO, INC.
1600 Canal Street
New Orleans, Louisiana 70112

Next of kin:

[redacted] (Wife)
[redacted]

Cause of death: Drowning

Place of interment:

Unity Methodist Church Cemetery
Smith County, Mississippi

(10) EDWARD CLIFTON JACKSON, JR.

[redacted]

Age: [redacted]

Occupation: Floorman

Employer:

ODECO, INC.
1600 Canal Street
New Orleans, Louisiana 70112

Next of kin:

[redacted] (Wife)

[redacted]

Cause of death: Drowning

Place of interment:

Sacred Heart Cemetery
Moreauville, Louisiana

(11) CLAUDE WILLIAMS

[redacted]

Age: [redacted]

Occupation: Rig Mechanic

Employer:

ODECO, INC.
1600 Canal Street
New Orleans, Louisiana 70112

Next of kin:

[redacted] (Wife)

[redacted]

Cause of death: Drowning

Place of interment:

Seal-Williams Cemetery
Franklinton, Louisiana

(12) RICKY LEE LOFTIN

[redacted]

Age: [redacted]

Occupation: Roustabout

Employer:

ODECO, INC.
1600 Canal Street
New Orleans, Louisiana 70112

Next of kin:

[redacted] (Father)

[redacted]

Cause of death: Drowning

Place of interment:

Greenlawn Memorial Park Cemetery
Natchez, Mississippi

(13) JOHNNY J. LYALL

[redacted]

Age: [redacted]

Occupation: Welder

Employer:

OFFSHORE HAMMER, INC.
P. O. Box 2651
Morgan City, Louisiana

Next of kin: Mrs [redacted]
(Sister)

Cause of death: Drowning

Place of interment:

Gibson Cemetery
Gibson, Louisiana

b. INJURIES:

(1) [redacted]

Age: [redacted]

Occupation: Motorman

Employer:

ODECO, INC.
1600 Canal Street
New Orleans, Louisiana 70112

Injuries to the neck, shoulders and back while being tossed around inside of capsule #1.

(2) [redacted]

Age: [redacted]

Occupation: Gang Supervisor

Employer:

OFFSHORE HAMMERS, INC.
P. O. Box 2651
Morgan City, Louisiana 70380

Injured on the right elbow and left hip in addition to body bruises when he fell on the deck of the M/V NICOLE MARTIN after transferring from capsule #1.

(3) [redacted]

Age: [redacted]

Occupation: Welder

Employer:

OFFSHORE HAMMERS, INC.
P. O. Box 2651
Morgan City, Louisiana 70380

Received a muscle strain of his left shoulder while transferring from capsule #1 to the M/V NICOLE MARTIN.

(4) [redacted]

Age: [redacted]

Occupation: Rig Welder

Employer:

ODECO, INC.
1600 Canal Street
New Orleans, Louisiana 70112

While attempting to retrieve a broken tow line while aboard the OCEAN EXPRESS, a large wave knocked him against the weather door thereby inflicting a four-inch cut to his left hip.

(5) [redacted]

Age: [redacted]

Occupation: Driller

Employer:

ODECO, INC.
1600 Canal Street
New Orleans, Louisiana 70112

Injuries to the neck, back and shoulders while being tossed around inside capsule #3. While trapped inside the overturned capsule, he inhaled saltwater thereby sustaining lung damage. He also received a wound under his left arm apparently from the use of a boat hook from the M/V GULF VIKING utilized to pull him alongside the vessel in rescuing him.

(6) [redacted]

Age: [redacted]

Occupation: Galley Hand and Room Steward

Employer:

ARA Catering Service
Gray, Louisiana

Injured his head by bumping against the interior of capsule #3 while capsule #3 was bumping up against the rig before being released and while the capsule was alongside the rescue vessel, M/V GULF VIKING.

6. WEATHER DATA:

At the time of the casualty, i.e. at 2130 hours on 15 April, there were about 50 knot winds from the SSE and about 25 foot seas from the same direction. The weather had deteriorated from the time the OCEAN EXPRESS departed Block 803, Mustang Island area on the morning of 14 April when the seas were SSE at 4-6 feet with about 10 knot winds. Forecasts available from the National Weather Service and the private Universal Weather Service varied from each other as well as from the actual conditions experienced by the OCEAN EXPRESS on 15 April in the Gulf of Mexico. This is discussed in detail in paragraph 21 of this report.

7. PREPARATIONS FOR THE MOVE:

On Monday, 11 April 1976, Mr. [redacted] who had been assigned as Barge Mover to move the OCEAN EXPRESS, contacted the tug company to arrange a tow and reviewed the morning reports from the OCEAN EXPRESS. Mr. [redacted] was assigned this move in the regular rotation of such duties shared by several Barge Movers employed by ODECO, INC. ODECO, INC. required its Barge Movers to have considerable training, experience and preferably be licensed before being assigned to those duties.

Mr. [redacted] arrived aboard the OCEAN EXPRESS at her location in Block 803, Mustang Island area off the Texas Coast at 0900 on 13 April. The OCEAN EXPRESS was to be relocated to Block A-57 which was about 33 miles East-Northeast (062°T) of Block 803. Mr. [redacted] was charged with obtaining and directing the operations of towing vessels necessary for the move, insuring that the rig was secure for sea, obtaining weather forecasts to insure that the weather conditions were favorable for the move, and making certain calculations as to the amounts and locations of various equipment and supplies aboard the vessel so that prescribed conditions of draft, trim and stability were maintained. These items were accomplished and evaluated by the Barge Mover to be within the guidelines of the operating manual and company policy. At 0700 on 14 April the OCEAN EXPRESS began jacking down.

At that time, the seas were 4-6 feet and the winds about 10 knots, both out of the Southeast. The National Weather Service 24-hour forecast was for similar conditions in that area of the Gulf of Mexico. The three tugs which had arrived on 13 April were made up with the GULF EXPLORER on the starboard bow, GULF VIKING on the port bow and GULF KNIGHT on the starboard stern.

The responsibility, established by ODECO, INC., for ordering tugs for the move rested with the Barge Mover, provided he ordered tugs from a list of towing companies approved by ODECO and that the tugs met the minimum number and horsepower requirements established by ODECO, INC. for that particular rig. At the time of the casualty, the requirement was a minimum of two tugs of 3,600 horsepower each for the OCEAN EXPRESS. However, since this casualty, ODECO, INC. has increased the minimum requirement for OCEAN EXPRESS-type rigs to two tugs of 4,200 h.p. each. Mr. [redacted] obtained GULF EXPLORER at 3,600 h.p., GULF KNIGHT at about 3,000 h.p., and GULF VIKING at 2,400 h.p. The GULF EXPLORER was designated the "lead tug" which meant that GULF EXPLORER would set the course and speed of all tugs during the move. According

to ODECO, Vice President, [redacted] there was no policy as to how the tugs were to be arranged during the tow. The actual towing configuration was left to the experience of the Barge Mover. It was his opinion that one 3600 h.p. tug could keep the rig headed into the seas.

On location at Block 803, the water depth was 124 feet. The OCEAN EXPRESS commenced jacking down at 0700 and the barge platform was in the water at 0830. However, the mat was still on the bottom and it took approximately 1 1/2 hours to break loose the mat suction. Normally, according to Mr. [redacted] this requires 30 to 45 minutes but has taken longer. After suction was broken, the trim and stability were checked and evaluated as satisfactory by the Barge Mover before the mat was raised to a depth of 80 feet. Mr. [redacted] testified that he examined a chart of the intended route to the new location and determined that this mat depth would provide sufficient bottom clearance for the move. He further stated that the derrick at the aft end of the keyway and all deck gear and equipment was examined and secured to his satisfaction.

The GULF KNIGHT was relocated to the port bow alongside the GULF VIKING, the other two tugs remained as previously described. The OCEAN EXPRESS departed Block 803 at 1100 on 14 April at a platform draft and freeboard as calculated by the Barge Mover of eight feet nine inches and seven feet three inches respectively. This included approximately 460 bbls SW which the Barge Mover indicated had been added to the starboard mud pit. There was no deadline to reach the new location, and the weather was freshening.

8. TRANSIT FROM BLOCK 803 TO A-57:

The course of the flotilla was 062° true and the estimated speed over the ground was about 3.0 knots for the 33 miles voyage. Upon departing Block 803 the seas were generally from the southeast at 5-7 feet and the winds were from the same direction estimated at about 15 knots with some higher gusts. There was little change in this weather from the old location until arriving at Block A-57.

At about 2300 hours, when the rig was approximately one mile from the new location, the Barge Mover commenced jacking-down the mat from the 80-foot draft and repositioned the tugs, putting the GULF KNIGHT on the port stern and the GULF EXPLORER on the starboard stern. The GULF VIKING remained secured to the port bow. At this time the tow lines were shortened to facilitate managing the rig. In this configuration, the rig was swung around toward the location, keyway first, with the bow headed into the seas. At approximately 0100 on the 15th, it was noted that the winds were freshening and the seas had exceeded the recommended height for jacking operations. The Barge Mover ceased the jacking operation at 148 feet of draft and ordered the single tug on the bow, GULF VIKING, to pull into the seas to hold the rig on location. Neither of the other tugs was repositioned at that time.

By 0630 on the 15th, the seas had increased to approximately 10 to 12 feet and this was reported at that time to Marathon Oil Company by their representative aboard the rig.

Sometime during the night, the work platform (TEXAS DECK) underneath the derrick area had broken loose on one side and was resecured.

9. HOLDING ON LOCATION, BLOCK A-57:

For the period from 0100 to 0600 there was a gradual increase in wind and sea and at 0600 the morning report indicated the seas were 8 to 10 feet in height; however, various rig personnel believed the seas were actually closer to 10 to 12 feet in height. At 0600 on 15 April 1976 the M/V M. L. LEVY, out of Rockport, Texas, arrived at the OCEAN EXPRESS and discharged, via the crane and personnel basket, six Offshore Hammer employees.

The morning area weather forecast indicated southeasterly winds 15 to 25 knots and 5 to 8 foot seas; and the OCEAN EXPRESS was experiencing elements that exceeded those conditions. As the morning progressed the on-scene weather continued to worsen and the OCEAN EXPRESS was receiving National Weather Service forecasts that did not match the projected prediction, so shortly after 0900 the Drilling Foreman called his Rockport office and requested a complete weather report.

Marathon Oil Company, the Drilling Foreman's employer, subscribes to Universal Weather Service and his Rockport office advised him that Universal had forecasted (OCEAN EXPRESS area) southeasterly winds up to 40 to 45 MPH with 12 to 15 foot waves. The Drilling Foreman indicated he passed the forecast to the Barge Mover; however, the Barge Mover and Toolpusher denied knowledge of this information.

At approximately 1000 hours, as the winds and seas continued to mount, the Barge Mover ordered the two tugs at the stern of the rig to swing around toward the bow to help hold the rig on location. At this time all three towlines were lengthened.

Heavy spray and an occasional sea crossed the barge deck as the rig worked in the seaway during the forenoon. During the early afternoon the sea and swells continued to build. At this time heavy spray and water was routinely passing over the main deck. The crew had to resecure some drill collars and tighten some chains located on the port side of the rig. Some water had been entering the vent system for the quarters during the entire day and by mid afternoon the crew was constantly mopping up water in the living quarters (details of flooding are discussed elsewhere, under Flooding and Stability). By mid-afternoon water had accumulated in this vent system and was leaking from the overhead, through the light fixture openings.

At about 1510 hours on 15 April the GULF KNIGHT experienced a material failure that rendered one engine inoperative. Repairs could not be made and the tug's home office in Harvey, La. was advised and arrangements were made for a relief tug, M/V Carl Ray, to arrive on scene at 0700 on 16 April. The Barge Mover was advised of this at 1540 hours. Mr. [redacted] asked the GULF KNIGHT if they wanted to take their tow line off and go in. Captain [redacted] replied no, that they would remain until the relief boat came and do the best they could with one engine. Captain [redacted] said he had moved rigs with one engine before. However, the tug GULF KNIGHT could not hold its heading into the heavy seas and dropped back to a trailing position.

At about 1930 on 15 April the towing line of the GULF VIKING broke. The GULF VIKING had been made up to the port bow of the OCEAN EXPRESS and had been holding the 20 to 25-foot seas and 50 to 55 knot winds at that time.

When the towline parted, personnel aboard the OCEAN EXPRESS were dispatched to the port bow triangular deck to retrieve the parted towline and standby to receive another line. They reached the area through a weather door directly from the welding shop. Three men went out onto the triangular deck and heaved the pennant wire aboard but experienced difficulty in getting the pennant shackle to which the broken nylon line was attached over the guard railing in that area. The wet nylon rope was described as very heavy. While the three were out there, a large swell knocked them down and slammed the door closed. A fourth man went out to assist but heavy seas breaking over the area kept knocking the men about and slamming the door. At one point a large wave caused water to a depth of about four feet to enter the welding shop. The Toolpusher and Barge Mover were present at that time and told the men to forget the towline and close the door. The broken line was let loose and went back over the side. The door which had been damaged by the seas was forced closed and never reopened. Additional attempts to retrieve the towline were made from the heliport area without success. Some of the personnel attempting to recover the towline recall the GULF VIKING standing by off the port bow, at close range.

The OCEAN EXPRESS was equipped with one 10,000 pound anchor and about 1,000 feet of 2 1/8 inch cable on a winch. The anchor is lowered by unclutching the winch and removing a pin and releasing the brake. According to Mr. [redacted] this normally requires some power to back the anchor off so that the pin may be released. The holding power of the anchor is estimated at 50,000 pounds. It is stowed under the helicopter deck on the starboard side. Sometime after the GULF VIKING towline broke, exactly when is unknown, Mr. [redacted] asked the Toolpusher, Mr. [redacted], to drop the anchor. The Toolpusher thought the anchor would probably fall on the mat. Mr. [redacted] asked the rig mechanic, Claude Williams, and the electrician, [redacted] to check on the anchor. [redacted] went below to insure that there was power to the anchor winch, there was, but he did not return to check on whether the anchor was dropped or whether the winch was functioning properly. According to Mr. [redacted] electrical power is not absolutely necessary to drop the anchor because the "stopping dog" or pin could be knocked out with a sledge hammer. We do not know what Mr. Williams did in this matter as he did not survive the casualty. In any event, Mr. [redacted] received no reports from Williams or [redacted] concerning anchoring and Mr. [redacted] did not further discuss the matter with Mr. [redacted] and no one made an attempt to drop the anchor.

Shortly after 1930 hours, after the GULF VIKING towline parted, some of the pipe in the racks on deck shifted and when [redacted] told [redacted] number one driller, about it, [redacted] immediately sounded the General Alarm indicating abandon rig without consulting anyone. Mr [redacted] indicated that when he heard the alarm, he was just preparing to sound it. [redacted] said he sounded the alarm to get everyone up and about, just to attract their attention. The Barge Mover questioned the sounding of the alarm, he did not feel that the OCEAN EXPRESS was in danger of sinking. Attempts were made to tighten the securing devices holding

the shifted pipe but this was abandoned when the situation was indicated by the Toolpusher and [redacted]s too hazardous under the conditions; they feared someone would be injured or killed. Efforts to resecure a towline to the GULF VIKING were also abandoned and most all personnel onboard were standing around on the weather deck with life jackets on waiting for further orders. Mr. [redacted] discussed the situation with his supervisor, Mr. [redacted] who suggested that a skeleton crew be left aboard the OCEAN EXPRESS. A little before 2000 [redacted] talked to his supervisor, Mr. [redacted] and requested that [redacted] send Coast Guard assistance. At 2010 the Coast Guard Air Station at Corpus Christi, Texas received a report from a Marathon Oil representative that an oil rig was sinking, and the first Coast Guard helicopter was underway at 2018 hours. The Barge Mover was not aware that the Coast Guard had been called and when communications were established between the OCEAN EXPRESS and aircraft at 2035, Mr. [redacted] reported that the rig was not sinking but that some pipe shifted when they took a large wave but that the tugs were holding the rig into the seas. He did indicate he wanted the helicopters to take most of the personnel off the OCEAN EXPRESS. [redacted] and [redacted] fired flares to guide the helicopter to the rig.

At about 2115 hours on 15 April, the derrick on the OCEAN EXPRESS shifted to the starboard and the rig immediately took an increased starboard list and all of the crew except the Barge Mover adandoned the rig in the Whittaker Survival Capsules. No one inspected the derrick to determine what caused it to shift. After it shifted the Toolpusher [redacted] overheard the Marathon Oil Representative, [redacted], say: "Well, let's all get in the capsules." [redacted] then gave the order to the crew to abandon the OCEAN EXPRESS; he did not consult with the Barge Mover concerning this order. Except for the Barge Mover, everyone on board, all wearing personal flotation devices, entered the two capsules on the starboard side. [redacted] was the last man aboard the capsule as he had approached and tried to talk Mr. [redacted] into leaving with them. The Barge Mover declined, indicating that he thought he could save the rig. However, about 15 minutes later, [redacted] was rescued from the OCEAN EXPRESS by Coast Guard helicopter just seconds before the rig capsized and sank.

At about 2120 hours the CG H-52 helicopter 1444 piloted by LCDR John M. Lewis arrived on scene. LCDR Lewis described the rig at that time as generally headed into the wind and seas with the seas breaking over the port bow and the rig listing by the starboard quarter at 20-25 degrees; all lights were on and he could see two capsules in the water along the starboard, lee side of the rig; the large seas were crashing over the rig cascading from the port bow to the starboard quarter. The Barge Mover requested to be taken off and he proceeded to the forward port corner of the helipad. LCDR Lewis found it difficult to maintain a hover with the aircraft and also noticed that the rig was now listing 25-30 degrees to the starboard quarter. On his second approach to pick up the Barge Mover, which was also unsuccessful, LCDR Lewis noticed an even greater list, estimated at 45 degrees, with spray from the seas actually coming into the helicopter. On the third approach the personnel basket had already been lowered as they neared Mr. [redacted] and the Barge Mover climbed into the basket. At this time LCDR Lewis first thought the helicopter was rapidly loosing altitude but later realized that the rig was capsizing and the helipad was coming up toward him. The rig capsized within seconds after Mr. [redacted] was removed.

Just before he got off the rig, the Barge Mover had ordered the GULF KNIGHT and GULF EXPLORER to let go their towlines. Both tug Captains put this time at 2130 and both described the rig as capsizing to starboard while sinking by the starboard quarter. The OCEAN EXPRESS turned her port side broadside into the seas just before capsizing with the port leg the last part of the rig visible before sinking out of sight at about 2135. At 2130 the GULF KNIGHT took a LORAN fix which showed the position of the OCEAN EXPRESS at 27 degrees 52' N; 96 degrees 16.5' W in Block A-9. Just before the OCEAN EXPRESS capsized the master of the NICOLE MARTIN, about two miles south of the OCEAN EXPRESS took a fathometer reading which showed 155 feet of water, but Capt. [redacted] did not know what correction factor to apply to his fathometer for that reading.

Subsequently, on 25 April 1976, an underwater survey of the OCEAN EXPRESS was made and the wreckage was positioned in Matagorda Island Block A-9 at position 27 degrees 52' N; 96 degrees 18' 19" W, in about 167 feet of water with a soft mud bottom. The rig was in an inverted position with the forward port corner of the mat and skirt just breaking the surface. The wreck was buoyed as a hazard to navigation and remained so until in February 1977 when the mat and approximately 100 feet of each leg was salvaged. There are no plans to conduct further salvage operations. The wreckage is no longer a hazard to navigation. The underwater survey report of damage to the OCEAN EXPRESS did not reveal any damage to the mat or skirt nor did survey after salvage. All three legs were in good condition between the mat and where they entered the upper platform yoke houses about four feet beyond the jacking holes at the 135 foot elevation marks. The upper portions of the legs above the barge were broken off.

10. GULF VIKING

Referring to his daily log, Captain [redacted] Master of the GULF VIKING, related the movements of the vessel. The GULF VIKING departed Bayou Chene, Louisiana on 7 April 1976 at 1545 hours to move the drilling rig Mr. MEL. They arrived at the Mr. MEL at 0900 hours on 8 April and stood by until 1830 hours on 9 April at which time they passed a towline to the rig. Assisting with the tow were the M/V GULF KNIGHT, M/V GULF EXPLORER, and M/V Carl Ray. The Mr. MEL is a triangular-shaped LeTourneau rig and is bigger than the OCEAN EXPRESS. The rig was off location and under tow at 2400 hours enroute to High Island area, Block H-317. They arrived on the new location on 11 April at 2400 hours, and his tug was released at 0400 hours on the 12th of April. The towline used by the GULF VIKING to tow the Mr. MEL was the same line used to tow the OCEAN EXPRESS. Nothing occurred during the tow of the Mr. MEL which would have put an unusual strain on any parts of that towing line. The seas encountered were not rough.

The M/V GULF VIKING received orders at 0830 on 12 April to proceed to the rig OCEAN EXPRESS. At 0800 hours on the 14th of April, a towline was passed to the OCEAN EXPRESS. The rig was off location at 1000 hours and under tow at 1100 hours. The GULF VIKING was secured to the port bow of the rig with the GULF KNIGHT. The GULF EXPLORER was towing from the starboard bow. The tow was proceeding to Block A-57, Mustang Island area. During the move, the engines of the GULF VIKING were running at 850 RPM's and experienced

no mechanical difficulties during the tow. The Barge Mover had designated the GULF EXPLORER as the lead tug for the move. CAPT [redacted], Master of the GULF VIKING, received his orders directly from the Barge Mover. He testified that he was satisfied with every decision the Rig Mover made and there was nothing about the operation, in his opinion, that was not perfectly safe. He did not receive any orders from the lead tug except course changes. They arrived at the new location at 2230 hours, 14 April.

The GULF VIKING towline was made up of a pennant wire of 1 1/4 inch in diameter approximately 50 feet in length with one end of the pennant wire made fast to the port bow of the rig. The other end was made up to an eleven-inch soft nylon snatch line 200 feet in length. The nylon snatch line was also made up to a steel cable with a 35-ton shackel passed through a thimble spliced into the snatch line. The steel cable was 1 5/8 inch in diameter, 1600 feet in length and had been aboard the vessel for approximately five months.

Upon arriving at the new location, CAPT [redacted] slowed his vessel and shortened his towline from 1200 feet to 400 feet in preparation for maneuvering the rig on location. The tugs GULF KNIGHT and GULF EXPLORER were ordered by the Barge Mover to shift to the port and starboard stern bits, respectively. The seas were running 8 to 10 feet at this time. The GULF VIKING remained on the port bow of the rig. While maneuvering the rig to the location, the Barge Mover gave orders to the tugs for them to hold up into the sea and put the bow of the rig into the sea to await better weather. This was at 0130 hours on 15 April, the rig was in Block A-57. With the GULF EXPLORER pulling from the starboard stern with the bow into the seas, the rig had a tendency to move to port so the GULF VIKING angled to the starboard slightly to keep the rig straight into the seas. CAPT [redacted] was in the wheelhouse of the GULF VIKING and was trying to keep the tug in position to keep the rig heading into the seas, which were from the SSE.

Shortly before 1200 on the 15th, CAPT [redacted], GULF VIKING, increased the length of his cable from 400 feet to approximately 900 feet. Usually the Engineer, [redacted] is called to operate the towing winch to lengthen or shorten the line; he did not recall being summoned to do so. CAPT [redacted] was relieved by the Mate, [redacted] at this time. The engines were running ahead at 3/4 throttle, 700 RPM's, and remained at that speed during Mate [redacted] watch from 1200 to 1800. [redacted] did not deem it necessary to change the speed during his watch, although the weather was deteriorating. Mr. [redacted] recalled that the tug GULF KNIGHT, which was pulling the rig from the port stern bits, dropping back from its position some time during the day to pull the rig from the stern. The time he is unsure of, but he thought it was because the rig was moving past the location. At 1800 hours on the 15th, Mate [redacted] was relieved by CAPT [redacted] [redacted] then went to bed. The seas were estimated at 25 feet at this time by [redacted]. CAPT [redacted] was aware that the towing draft of the rig had been 148 feet. CAPT [redacted] did not find it necessary to increase the speed of the GULF VIKING above 3/4 throttle because the tugs were holding their own with the rig.

Chief Engineer [redacted], GULF VIKING, came on watch at 1800 hours and stated that he started the engine to the towing winch after he came on watch so as to have it ready when it was needed. At this time, the towline was observed entering

the water 40 to 50 feet from the stern of the tug and surfacing about 100 feet from the rig. The crew of the GULF VIKING felt that the catenary (belly) of the line was normal and sufficient.

The GULF VIKING was unaware of any trouble on the rig and all seemed normal until their towline broke at 1930 hours. CAPT [redacted] testified that he had approximately 1300 feet of towing wire out when the line parted. The GULF EXPLORER was about 400 feet out in front of the GULF VIKING at this time and the GULF KNIGHT was still pulling from the port stern in the opposite direction. The engines of the GULF VIKING were running at 700 RPM's at 1930 hours. Chief Engineer [redacted] stated the engines were not holding a steady RPM at this time because of the heavy seaway. The towing winch was not running at the time the line parted. Mate [redacted] did not hear the towing winch operating from the time he went off watch at 1800 until the line parted.

The nylon snatch line parted approximately 50 feet from its union with the pennant wire. It was a clean break of the line.

At this time, CAPT [redacted] went to the stern controls, Chief Engineer [redacted] summoned [redacted] and the rest of the crew and all went on the afterdeck and pulled the parted line back aboard with the towing winch. They then started making up another towing line. The new towing line was made up of a new pennant wire of 1 1/4-inch, another used 11-inch nylon snatch line and the original 1600 feet of 1 5/8-inch steel cable on the towing winch. This operation took approximately 45 minutes. The GULF VIKING then stood by the OCEAN EXPRESS watching for the rig crew so they could pass another towline to them.

The testimony and evidence concerning the towline which parted indicate that it was an 11-inch soft nylon line 200 feet in length. The line was yellowish white in color and was made up of three strands. It was not braided. Each end of the snatch line had an eye with a thimble spliced in the eye. These splices were made by Mate [redacted] when the line was new. It was placed on board the vessel on 4 February 1976. This nylon snatch line was used several times prior to towing the OCEAN EXPRESS. Mate [redacted] was in charge of the towlines and inspected this new line as it was brought aboard the tug from a spool on the dock. No fault was found with the new line.

CAPT [redacted] examined the snatch line that parted a few days before it was used in this tow; its condition was satisfactory at that time. He did not examine it on 14 April, the day the tow was made up. The same line was used for the tow of the rig, MR. MEL, and no discrepancies were noted then.

The inspection of the nylon line by [redacted] prior to it being passed to the OCEAN EXPRESS, did not reveal any kinks, nicks or burrs. He did not recall seeing any grease on the line. [redacted] testified he had not washed the line and it was normally stowed uncovered on deck, looped around a bitt to keep it secured when not in use.

There was no evidence of any surveying agency or inspection agency recently inspecting any of the towing gear on the GULF VIKING.

Neither the Master nor the Mate of the GULF VIKING knew the breaking strength of the cable or nylon line; they did not know which was stronger - cable or nylon. CAPT [redacted] has towed with the same type and size line as used with the OCEAN EXPRESS in similar seas without experiencing difficulties. He does not know why the line to the OCEAN EXPRESS parted. CAPT [redacted] does understand "catenary." He felt that as long as the snatch line did not rise out of the water there was not an excessive strain on the line. He has broken towlines several times in the past while towing rigs in the Gulf. Excessive power on the part of the tug caused those lines to break. During those previous times only the pennant and snatch line were in use.

11. GULF EXPLORER:

The GULF EXPLORER also assisted in moving the MR. MEL. Upon completion of that assignment, she then proceeded under orders toward the Eugene Island area. While at sea, GULF EXPLORER received orders at 0900 hours on 12 April to proceed to the rig OCEAN EXPRESS. The GULF EXPLORER arrived at the site of the OCEAN EXPRESS at 1200 hours on 13 April. At 0800 hours, on 14 April, a hawser was passed to the OCEAN EXPRESS. At 1000 hours, the rig was off location and towing commenced at 1100 hours. At this time, the rig was drawing 80 feet. The GULF EXPLORER was designated as the lead tug for this move by the Rig Mover and remained so until the OCEAN EXPRESS arrived on the new location. Being lead tug meant that the GULF EXPLORER directed the courses and speeds of the assisting tugs. These determinations were made solely by the Master of the GULF EXPLORER, Captain [redacted] Departing Block 803, the GULF EXPLORER was made up to the starboard bow of the rig while the GULF KNIGHT and GULF VIKING were towing from the port bow. The GULF EXPLORER was pulling at approximately 1/4 speed which was sufficient to maintain speed of three knots.

The OCEAN EXPRESS arrived on the new location, Block A-57, Mustang Island area, at 2230 hours on 14 April. Upon arriving on location, the Barge Mover, Mr. [redacted], asked the condition of the seas, and he was advised by the GULF EXPLORER that they were from the southeast at about six feet, the same as at the time they had left the old location. The wind was estimated at 15 to 20 m.p.h. from the southeast.

Once the rig arrived on location, orders were given to each tug by the Barge Mover. At 2400 hours, the Barge Mover ordered the towlines shifted to bring the rig on location. The GULF EXPLORER was shifted to the starboard stern and the GULF KNIGHT was shifted to the port stern. The GULF VIKING remained at the port bow. Once the GULF EXPLORER and GULF KNIGHT shifted to the stern of the rig, the role of lead tug was relinquished to the Rig Mover.

When the GULF EXPLORER shifted her towline to the starboard stern, she initially hung off the stern at about a 45 degree angle. At about 0130, on the 15th, the Barge Mover ordered that she turn and head into the seas.

The fathometer on the GULF EXPLORER was inoperative and the water depth was not checked when they arrived on location. Captain [redacted] did not advise his office that the fathometer was not operating.

At 0530 hours on 15 April, CAPT [redacted] relieved his Mate, Mr. [redacted], who holds a similar license as CAPT [redacted] the tugs were in the same configuration as they had been right after midnight. CAPT [redacted] noted that the weather had picked up. The seas were now 10 to 12 feet and the windwas estimated at 25 m.p.h. They were still holding the rig near location. CAPT [redacted] did not consider moving the GULF EXPLORER or the GULF KNIGHT to the starboard bow of the rig on the morning of the 15th.

The GULF EXPLORER had 2,000 feet of two-inch cable on its towing winch. They also had a 12-inch nylon snatch line and 1 1/2-inch pennant vire. When the GULF EXPLORER began pulling from the stern of the rig, it had about 800 feet of towline out. At about 0730 hours, the GULF EXPLORER received the order from the Barge Mover to pull the rig ahead. The tug then turned and headed into the seas. At about 1200 hours, the length of towline was increased from 800 feet to about 1200 feet due to rough weather. CAPT [redacted] made this decision on his own. The GULF EXPLORER remained in this configuration until after the towline of the GULF VIKING parted at about 1930. The throttle remained at less than 1/4 speed ahead during the period 1200 hours to 2000 hours on 15 April.

The GULF EXPLORER was in communication with its Harvey, Louisiana office on 14 and 15 April by single side-band radio. CAPT [redacted] did not ask his office for weather information on the afternoon of 15 April because the rig was getting weather forecasts. He had no information available to him concerning weather on the morning of 15 April indicating that the seas would pick up or that the weather would deteriorate. On the afternoon of 15 April, CAPT [redacted] was off watch but was up and about the vessel.

At about 1510 on 15 April, the GULF EXPLORER was made aware that the GULF KNIGHT lost one engine due to clutch problems. Captain [redacted] overheard the GULF KNIGHT advise the rig of this by radio at about 1545, after the GULF KNIGHT had advised its home office. The tugs exchanged communication concerning this and other matters on the "company" radio, frequently in French. He did not hear any conversation about the GULF KNIGHT being relieved because of engine failure.

After the towline of the GULF VIKING parted, the Barge Mover remained in charge of the tugs. During the gradual increase in the weather, CAPT [redacted] did not let out more towing line because he believed that with the power he had on the tug, the cable was sufficiently played out. He had a constant length of cable (1,200 feet) and a constant throttle from 1200 hours on the 15th until after the towline on the GULF VIKING broke at about 1930. The Master of the GULF EXPLORER, with more horsepower, felt she could have gotten close enough to get a towline on the bow of the rig, but did not feel confident that the rig could receive her line under the existing conditions. In any event, CAPT [redacted] testified that the Barge Mover did not want to attempt this.

The GULF EXPLORER increased power and tried to hold the rig into the seas until about 2030 on the 15th. At that time the Barge Mover ordered a change and the GULF EXPLORER put her stern to the seas. At 2030, the rig was listing and the list increased noticeably at 2115. The GULF EXPLORER released her towline at 2130 as the rig capsized to starboard and sank. The Master recorded

a LORAN position he heard over the radio from the GULF KNIGHT as 27°52' N, 96°16.5' W. The GULF EXPLORER did not check this position as her LORAN antenna had been damaged in the heavy weather encountered earlier that day.

12. GULF KNIGHT:

On 8 April, CAPT [redacted] boarded the GULF KNIGHT in the Ship Shoal area, Block 290, where the tug was standing by to move the rig MR. MEL. After moving the MR. MEL, the GULF KNIGHT received orders to proceed to Block 803, Mustang Island, for the move of the OCEAN EXPRESS.

The GULF KNIGHT arrived at the OCEAN EXPRESS on 13 April at 1200 hours. At 0745, on 14 April, a hawser was passed from the GULF KNIGHT to the keyway end of OCEAN EXPRESS. At 1000 hours, the OCEAN EXPRESS came off location and at 1030 hours the GULF KNIGHT relocated its towline from the keyway and resecured to the port bow. The GULF VIKING was also secured to the port bow. At 1100, the tow was underway for Block A-57.

At 2230 hours on 14 April, the rig arrived at the new location and was held into the seas while the rig's legs were lowered. At 0030 hours, on 15 April, the towline of the GULF KNIGHT was switched from the port bow to the port stern and secured to a bit so as to pull the rig over the new location. Shortly thereafter, CAPT [redacted] was ordered to turn the rig around and hold the stern into the seas. The seas at this time were from seven to eight feet and it took 10 to 15 minutes to switch the towline. No difficulty was encountered during repositioning of the GULF KNIGHT.

The GULF KNIGHT was equipped with an 11-inch nylon snatch line, a towing cable of 1 5/8-inches and a pennant line of 1 1/4-inches and 45 to 50 feet long. CAPT [redacted] did not testify how much towing cable was out while secured to the port stern area.

At about 0730 on the 15th, the Barge Mover ordered the GULF KNIGHT to hold the bow into the sea since the seas were thought to be too rough to get on location.

The GULF KNIGHT helped hold the rig in Block A-57 until 1510 hours. At that time, the clutch on the starboard engine, turning at 700 RPM's ahead, malfunctioned and rendered the engine inoperable. The port engine continued to operate normally.

CAPT [redacted] was sleeping at the time of the clutch failure, being off watch. He was awakened by the noise caused by the failure as was the Engineer, Mr. [redacted] CAPT [redacted] went to the bridge and logged engine failure at 1510. Engineer [redacted] went to the engineroom to check the engine. He noticed the oil pump was dislocated from the housing and the housing for the clutch gear assembly was cracked in three places. Repairs could not be accomplished at sea due to the lack of spare parts on board and the extent of repairs required. The Engineer notified the Master of the difficulty and the Master attempted to call his office in Harvey, Louisiana on the single side band radio. He was unable to raise them for 15 to 20 minutes, so he called the company at Morgan City and requested that they call the Harvey office of Gulf Mississippi Marine Corp. and asked them to give the tug a call. The Port Engineer, [redacted], was reached on the tug radio and was advised of the damaged machinery. Mr. [redacted] advised the GULF KNIGHT that a relief tug, M/V CARL RAY, was enroute to the OCEAN EXPRESS

with an estimated time of arrival of 0700 on the 16th of April. At 1540 hours on 15 April, the Barge Mover was notified by CAPT [redacted] of the mechanical failure and the ETA of the relief tug. The Barge Mover asked the GULF KNIGHT if they wanted to take their towline off and go in, and CAPT [redacted] replied: "No, that they would remain until the relief boat came and do the best they could with one engine." During his testimony CAPT [redacted] stated that "he had moved rigs with one engine before." However, the GULF KNIGHT dropped back to a trailing position.

At the time of the parting of the towline to the GULF VIKING, 1930 hours, the GULF KNIGHT had out about 700 feet of towline. The GULF EXPLORER had 1200 feet out. At that time, the GULF KNIGHT let out additional towline because the weather was getting rougher. It was the opinion of CAPT [redacted] that they were approximately 1 to 1 1/2 miles off the location at the time the towline broke on the GULF VIKING.

At 2115 hours on 15 April, the rig was abandoned and began to sink, and at 2130 the hawser was taken completely off the towing winch of the GULF KNIGHT and released. This vessel later assisted in bringing survivors of the overturned capsule on board.

CAPT [redacted] was unaware of any previcus engine or clutch failures of the GULF KNIGHT. The Engineer, Mr. [redacted] who had been aboard since June 1975 maintained the engines and kept the engineroom logs. The engineroom log was produced and Mr. [redacted] stated he put oil in the gears every two or three days while operating in the Gulf. He stated there was a small leak from a line right near the front oil seal of the starboard gear box. The log indicates that on 26 February 1976, six gallons of oil added to the starboard gear; 7 April 1976, three gallons of oil were added to the starboard gear box; none to the port gear box; 8 April 1976, eight gallons of oil added to the starboard gear, none to the port; 12 April 1976, two gallons of oil added to the starboard gear box, none to the port gear. Mr. [redacted] had known about the leak for eight months and he stated that another GULF KNIGHT Engineer had reported it to responsible company personnel. He estimates that he had to add 15 gallons more oil to the starboard gear box than to the port gear box per month. The starboard gear box had been operating a total of 81 hours since he had last added oil to it on 12 April 1976, until the time it failed. Mr. [redacted] did not find the oil or dip stick hot when he examined it just after the failure. He later drained the oil from the starboard gear box and found it full. Mr [redacted] stated he had made no repairs to the starboard gear box between 12 April 1976 and the time of its failure. The last time Mr. [redacted] actually changed the oil was between August and December 1975. He was advised by a manufacturers representative that after the first 200 hours of operation, the oil must be changed. After that it is not necessary.

[redacted] a Port Engineer for Gulf Mississippi Marine Corp., supervises the maintenance on 10 diesel-powered tugboats of the company. Mr. [redacted] has a Honduran Chief Engineers license. He has sailed as 2d Engineer on a Liberian flag ship and as Engineer on a British vessel. He has neither British nor Liberian licenses.

He states that maintenance manuals are furnished to the Engineers working on the vessels but is not sure if the proper manuals were aboard the GULF KNIGHT.

The maintenance manual calls for the reduction gear oil change every 1,000 hours or at six-month intervals. He does not know how many hours were logged on the starboard gear box of the GULF KNIGHT prior to the failure on 15 April. He stated that the gears are normally run until they fail. To his knowledge there had been no history of malfunction of the propulsion machinery of the GULF KNIGHT. It was standing instructions to the Engineers to keep the gear boxes full and recommended that the oil level be checked on every watch. When the GULF KNIGHT was at Fredman's Shipyard on 5 April 1976, all the oil lines were tightened up. One line on top of the gear was found loose. He did not find any line that would leak 12 gallons of oil in a 20 to 30-hour period. He took the vessel on a trial run after repairs and did not see any leaks. He told the Engineer to report to him if he found any more leaks. The tug's Engineers are expected to provide him a list of needed repairs when necessary. He does not recall whether, prior to 5 April 1976, a request was made regarding engine repairs on the GULF KNIGHT.

Mr. [redacted] stated that the adding of oil to the starboard gear box was considered abnormal but presents no major difficulty, as long as the oil is kept full, there will be no trouble prior to repairs. At the time of the casualty he believes the gear had sufficient oil because if it had run low there would have been a malfunction of the clutch and it would have been discovered before it did any damage.

13. NICOLE MARTIN:

The pertinent voyage for the NICOLE MARTIN began at Intracoastal City, Louisiana and proceeded to Port O'Conner, Texas with its three-man crew to pick up a two man surveying crew and their equipment. The vessel departed Port O'Conner at 2000 hours on 12 April and proceeded to Block 105, Brazos area. The first surveyor was dropped off on a rig at 0015 on 13 April. The vessel then proceeded to Block 54, Mustang Island area where the second surveyor was placed on board a rig with his surveying equipment at 0145 hours. Seas at the time were estimated at four to six feet.

Between 0145 to 0500 on 13 April, a marker buoy was dropped and checked for accuracy. This buoy marked the new location for the OCEAN EXPRESS. At 0515 on 13 April the vessel was anchored and remained so the rest of the day. The depth of water where the reference buoy was located was 199 1/2 feet.

The OCEAN EXPRESS was sighted by the NICOLE MARTIN during daylight hours on 14 April. The exact time is uncertain. At approximately 1830 hours on 14 April, the NICOLE MARTIN picked up anchor to place a light on the reference buoy so the rig could see it at night. The NICOLE MARTIN was in VHF radio contact with the OCEAN EXPRESS from time-to-time beginning in the early hours of 13 April. At 0155 hours on 15 April the Barge Mover informed the NICOLE MARTIN that the weather prevented them from moving on location. At this time the survey boat dropped anchor again almost on location. The vessel remained at anchor until 1145 hours on the 15th when the anchor started slipping. The distance between the NICOLE MARTIN and the OCEAN EXPRESS varied from 1/2 mile to 4 1/2 or 5 miles. The anchor was slipping due to sea action. Approximately 1,200 to 1,400 feet of anchor cable was out. The anchor was picked up about 1200 hours on the 15th and the vessel stemmed the seas until 1300 hours.

At 1300 hours the anchor was dropped again and remained so until 1700 hours on 15 April. At that time it was again deemed too rough to remain at anchor so the anchor was raised and the vessel stemmed the seas. In CAPT [redacted] opinion the OCEAN EXPRESS appeared to be having difficulties on the evening of the 15th due to the very rough weather. He heard that one of the tugs had broken its towline over the radio. He was about five miles away at the time and immediately proceeded towards the rig; he could see the rig was taking a beating. The crew members of the NICOLE MARTIN discussed the feasibility of getting the men off the rig at this time. The OCEAN EXPRESS did not ask the NICOLE MARTIN for assistance. CAPT [redacted] heard the rig talking to the tugs with someone on the rig saying the rig was pitching four or five degrees. The NICOLE MARTIN was to the starboard side of the rig and was headed south southeast. The bow of the rig was headed southeast to stem the seas. He could not see the motion of the rig just prior to capsizing well enough to describe it.

14. M. L. LEVY:

The M/V M. L. LEVY, a supply vessel, got underway late in the evening on 14 April from Rockport, Texas. [redacted] and five other personnel employed by Offshore Hammers boarded the vessel at 2300 on the 14th. As the vessel got underway the winds were blowing about 25 to 30 m.p.h., and the seas were very choppy with a height of six to seven feet. Enroute to the OCEAN EXPRESS, a deck log notation indicates the weather as: "Fair, sea conditions 10-12 feet, visibility fair." This observation was made shortly before arrival at the OCEAN EXPRESS. At 0600 on 15 April, the vessel arrived at the OCEAN EXPRESS and discharged the six passengers. The seas were six to eight feet maximum when the M. L. LEVY came alongside the starboard side of the OCEAN EXPRESS and placed the Offshore Hammer employees on board the rig. Mr. [redacted] estimated the freeboard of the OCEAN EXPRESS at this time to be four to six feet. He observed two tugs tied off at the stern of the rig and one on the bow. He was downwind of the rig and the tugs were facing him. At 0630, the M. L. LEVY departed the OCEAN EXPRESS and anchored at 0700 about 1/2 mile west of the rig OCEAN EXPRESS. The vessel remained at anchor throughout the day of the 15th awaiting fair weather to unload its cargo on the OCEAN EXPRESS. The survey boat, NICHOLE MARTIN, was also on the scene. The wind kept picking up. At 1200 hours on the 15th, CAPT [redacted] Master of the M. L. LEVY, believed the waves to be eight to ten feet. At 1630, the Mate on the M. L. LEVY received a call from Mr. [redacted] the Supervisor for Marathon, aboard the rig and he told them if it was too rough to go ahead into shallower water. At 1600 hours, the winds were estimated by CAPT [redacted] to be 35-40 m.p.h. At 1700 hours, CAPT [redacted] went to the wheelhouse to check for drift and noted the seas to be 12 to 14 feet. At 1800, it was blowing "pretty good" and the seas were 12 to 14 feet. The crew ate supper and commenced raising anchor at 1900 hours on the 15th. At this time, Mr. [redacted] called and informed CAPT [redacted] that the tug on the bow had broken its towline and that a big wave had washed one of the capsules off the rig and asked if he would keep an eye on it. At 1930, the M/V M. L. LEVY was off the rig's port side, but no one saw the capsule. As the M. L. LEVY was raising its anchor at 1900 hours, CAPT [redacted] overheard a radio conversation between the tugs. One unidentified tug stated that all they were doing was using the clutch to keep their lines from tangling in the wheels. The way CAPT [redacted] understood it was that the tugs were underway just enough to keep the towlines clear of their propellers.

According to CAPT [redacted] the seas were 20 feet at the time of the casualty. The waves would come two or three at a time and then slack off. In his opinion, the weather was worse than forecasted when he left Rockport.

He heard the Coast Guard Cutter POINT BAKER requesting a countdown so as to get a fix on the rig's location. CAPT [redacted] complied on Channel 2182. CAPT [redacted] noticed some lightning and thunder during the casualty, but no rain squalls were encountered.

15. FLOODING AND STABILITY:

Factors bearing on the ability of the OCEAN EXPRESS to survive wind and sea are discussed below.

a. Undetected Weight:

The presence of undetected weight was evidenced in two ways; an unexplained list to port and the difference between observed freeboard estimates and the freeboard calculated by the Barge Mover.

(1) Unexplained list to port: Commencing with the placing of the OCEAN EXPRESS in service some four months prior to the casualty, there had been difficulty with an unexplained list to port. Various investigations had been made which included checking of void spaces and verifying liquid levels in tanks.

The Barge Mover concluded that the light ship information, on which calculations to predict trim, heel and draft are based, may have been in error. This is a possibility; however, the chances of such an error are normally minimized by careful verification of light ship weights on board at the time of the inclining experiment. Further, the various investigations which were made to try to locate undetected liquids after the unit was placed in service were not complete systematic checks of all liquids, supplies and consumables on board. Therefore the weight causing the port list was more likely in the form of undetected liquids or undocumented consumables rather than an error in the light ship data. Determination of how much weight was involved is not possible.

(2) Observed freeboard estimates: The second indication of undetected weight occurs through the difference between various estimates of freeboard on 14 and 15 April, placing the freeboard of the OCEAN EXPRESS in the five to six-foot range, and the Barge Mover's calculated freeboard of seven feet five inches. The collective effect of the various estimates shows that the OCEAN EXPRESS was at a lesser freeboard than the calculated value, which by the Barge Mover's own testimony had not been visually checked.

A portion of the difference is accounted for by the same undetected weight which caused the list to port. Additionally, ballast had been taken aboard which the Barge Mover estimated at 460 barrels in the starboard mud pit and 200 barrels in the #3 saltwater tank. The additional ballast accounts for something less than a three-inch loss in freeboard. Whether there were significant amounts of additional consumables, ballast, or drilling supplies on board, not documented in the Barge

Mover's loading calculation or the morning reports, is not known. Partial flooding of various compartments is known to have occurred, and is discussed in the next section along with the effects of possible additional consumables, which according to testimony may have been on board.

b. Flooding, Ballast and Consumables:

Ingress of water from such sources as the pin holes in the legs, leaking hatches, doors and vents, occurred during the day of 15 April. There were differences in the estimates of the amount of flooding in various compartments of the OCEAN EXPRESS; however, this is not surprising. The unit was in motion in a seaway, the times of observation differ, the exact point of observation even within the same compartment would not be the same, and the judgment of the individuals making the estimates would vary. One witness testified all three mud tanks were nearly full, contrary to other testimony.

For the purposes of the following tabulation, estimates of flooding, ballast and consumables introduced into the record which either were not included or exceed those used by the Barge Mover in his calculated loading for the start of the move are used:

7p & 7s - 1/2 full

Mud pits - All 3 assumed filled within 2 feet of top

1 Center - full plus 3 feet in podhouse

#3 SW - 200 bbls

Additional bulk cement - 20 KIPS

Additional drill water - 700 bbls

Lube oil - 492 gals

Laundry 2 inches

Upper living area - 6 inches including galley

Lower living area - 12 inches

Supply room - 4 feet

Storeroom port - 2 inches

Chemical storeroom - 6 inches

Pumproom - 6 inches

Mud mixing room - 6 inches

Expressed in terms of lost freeboard, the above assumptions account for the loss of approximately 19 inches of freeboard. Subtracting the 19 inches from the Barge Mover's initial calculated freeboard of 7 feet 5 inches, a 5 foot 10 inch freeboard results. This loss of freeboard is in addition to the reduction in freeboard due to undetected weight causing the port list, discussed previously.

The portion of the freeboard loss due to partial flooding was progressive through the day of 15 April. Undoubtedly some further flooding occurred between the last times of observation of the various compartments and the time the unit capsized; however, there is no basis to make further estimates. Visual checks were reported up and until 10 to 15 minutes prior to the capsizing. No testimony was

given which indicated major breaches in the hull or damage on deck which would have allowed massive flooding.

What combination of undocumented consumables, supplies, ballast or flooding caused the freeboard reduction is not known. However, it is clear some loss of freeboard did occur. Visual observations place the freeboard of the OCEAN EXPRESS in the five to six foot range. The effects of loss of freeboard on the seaworthiness of the OCEAN EXPRESS is discussed in the next section in association with the position of the mat.

c. Position of the Mat:

The Barge Mover chose to leave the mat at a lowered position (approximate 148 foot overall draft) subsequent to the attempt to go on bottom during the night of 14 April. This decision had a direct effect on the seaworthiness of the OCEAN EXPRESS. Table 1 sets forth approximate figures which give an indication as to the relative significance of this decision.

As can be seen in the second column of Table 1, the major effect of leaving the mat in a lowered position is a marked reduction of the range of stability and the total righting energy. Further degradation of righting energy is noted in the third column which shows the combined effects of the lowered mat and a 19-inch loss of freeboard. The comparisons are made to a base condition shown in column one (9 foot platform draft).

These are extremely significant effects, as the survivability of a vessel, with doors, hatches and vents reasonably watertight, is directly dependent on the range of stability and total righting energy. It is clear the decision to leave the mat in the lowered position had an adverse effect on the seaworthiness of the OCEAN EXPRESS.

d. Shifting of On Deck Weight:

Assessing the effects of on deck weight shifts is hampered by the discrepancies in testimony. The major discrepancy in testimony is the distance the derrick may have slid to starboard. If it did exceed the normal limit of its athwartship's travel of approximately 8 feet from the centerline, an additional significant, unknown overturning moment may have existed.

For purposes of estimating the relative magnitude of the effect is of shifting on deck weight, the following information is taken from testimony:

Derrick shift - Upper skid unit weighing 723.4 KIPS - 8 feet to starboard

Drill collars weighing 154 KIPS - 15 feet to starboard

Drill pipe weighing 120 KIPS - 5 feet to starboard

Pipe and miscellaneous - 42 KIPS - 5 feet to port

At the 2 foot mat separation, an approximate seven-tenths degree heel would have resulted from the above weight shift. This is as expected; due to the large

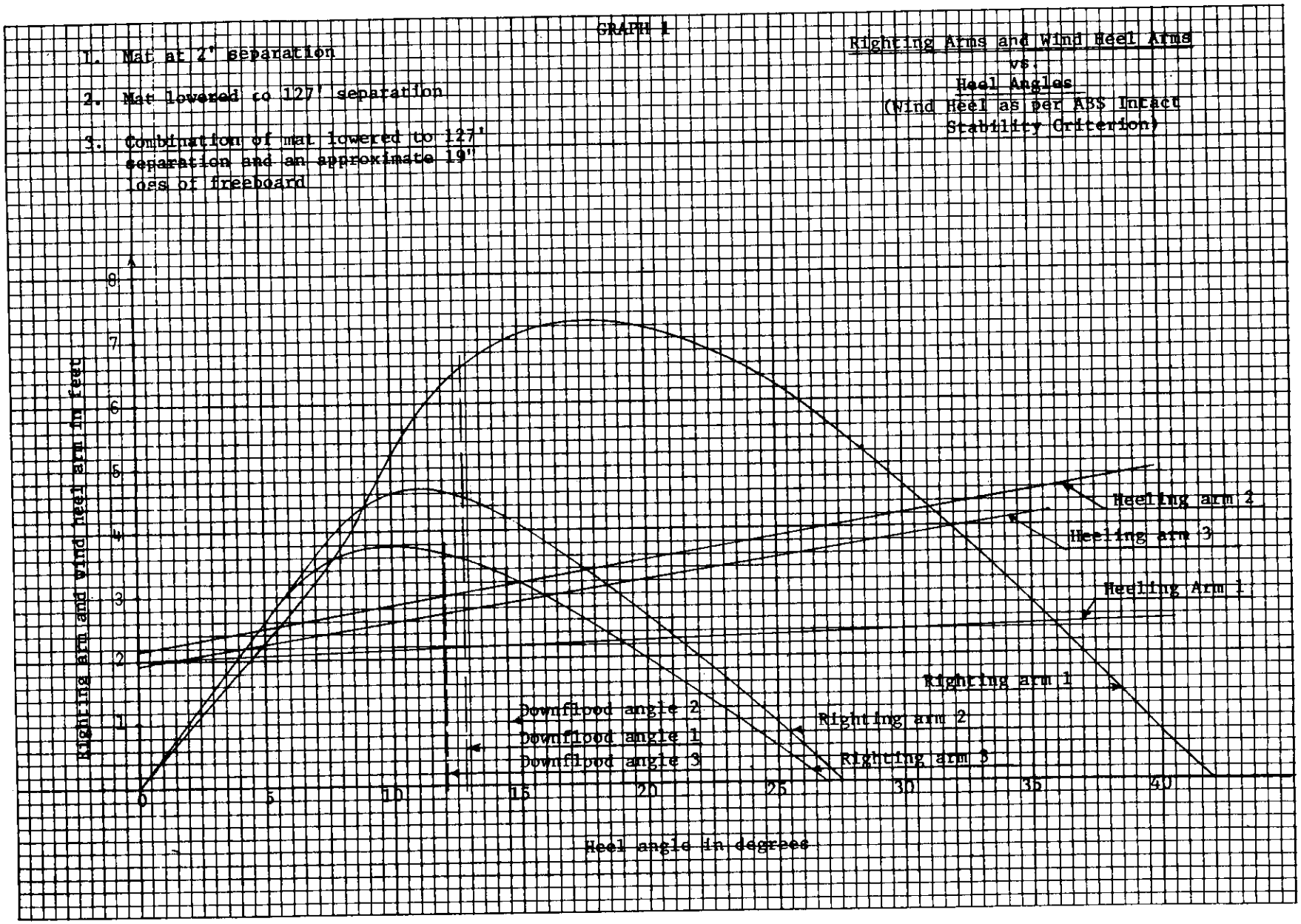
GRAPH 1
Righting Arms and Wind Heel Arms
vs.
Heel Angles
(Wind Heel as per ABS Intact Stability Criterion)
1. Mat at 2" separation
2. Mat lowered to 127' separation
3. Combination of mat lowered to 127' separation and an approximate 19" loss of freeboard
Righting arm and wind heel arm in feet
Heel angle in degrees
Heeling arm 2
Heeling arm 3
Heeling Arm 1
Righting arm 1
Righting arm 2
Righting arm 3
Downflood angle 2
Downflood angle 1
Downflood angle 3

TABLE I

| | Mat at 2' separation (9' platform draft) (23' overall draft) | Mat lowered to 127' separation (9' platform draft) (148' overall draft) | Combination of mat lowered to 127' separation and an approximate 19" loss of freeboard * (10.6' platform draft) (149.6' overall draft) |
|---|---|---|---|
| Range of positive stability | $42^{o}$ | $28^{o}$ | $26^{o}$ |
| Total righting energy over full range of positive stability (foot-degrees) | 182 | 75 (59% loss) | 60 (67% loss) |
| Downflooding angle | $12.8^{o}$ | $14.5^{o}$ | $12.1^{o}$ |
| Righting energy to downflooding angle (foot-degrees) | 41 | 44 (7% incr) | 32 (22% loss) |
| Maximum righting arm | 7.3' | 4.7' | 3.8' |
| Angle of maximum righting arm | $18^{o}$ | $11^{o}$ | $10^{o}$ |
| Percent excess area, righting moment curve to heeling moment curve, as per ABS intact stability criterion ** | 40% | 11% | 10% |
| Nominal wind speed as per ABS intact stability criterion ** | 100 KTS. | 91 KTS. | 89 KTS. |

* Based on maximum estimates of flooding, ballast and consumables. Corrections for additonal free surface are not included; comparmentation, pocketing, tank sizes and permeabilities are such that free surface corrections would be small.

** Section 3, ABS Rules for Building and Classing Offshore Mobile Drilling, 1973 Edition

beam of the OCEAN EXPRESS, relatively large shifts of on deck weight produce relatively small changes in heel.

The righting arm is also affected by the shift in the transverse center of gravity to a commensurate degree. For the above case, the righting arm at 10 degrees heel would have been reduced on the order of 8%. The effects of on deck weight shifts are less as the mat is lowered.

The above estimates reveal that while on deck weight shifts do cause heel and an associated loss of righting energy; considerably more weight had to have shifted than was brought out through testimony before weight shift, in itself, could have caused the capsize of the OCEAN EXPRESS. As mentioned above, if the derrick slid in excess of eight feet to starboard, an additional significant, overturning moment would have existed.

From the above estimates, it can be seen that the shifting of on deck weight was a factor in the capsizing of the OCEAN EXPRESS, however not as great a factor as the mat position and the loss of freeboard previously discussed.

It should be clearly pointed out, however, that a major hazard was posed to the OCEAN EXPRESS when heavy weights such as drill collars became unsecured. The potential for damaging deck structure or vents in such a fashion to allow rapid flooding below decks was great. That this did not happen prior to the abandonment of the OCEAN EXPRESS can only be considered fortuitous.

e. Boarding Seas:

A major factor, not easily reduced to even approximate quantitative terms, is the effect of boarding seas. Testimony places waves as high as 8 to 10 feet washing over the decks of the OCEAN EXPRESS. At a time near abandonment, one witness indicated that seas were boarding with such frequency that the decks did not have a chance to drain. A feeling that the waves were "packing" the OCEAN EXPRESS "down" was expressed. What was taking place was the additional loss of freeboard due to the weight of significant amounts of water on deck.

As can be seen from Table 1, the cumulative effects of the lowered mat position, ballasting and partial flooding degraded the stability characteristics of the OCEAN EXPRESS to a marked degree. Adding the adverse effects of shifting on deck weight and boarding seas, it is clear the OCEAN EXPRESS was suffering from a severe loss of stability. Boarding seas, in effect, partially submerged the OCEAN EXPRESS.

This highlights an extremely important facet in the loss of the OCEAN EXPRESS. Allowing a low freeboard self-elevating drilling unit to drift broadside to boarding seas, regardless of leg or mat position, loading, partial flooding, or other peripheral matters; is an invitation for loss. Seas rolling over the decks of a low freeboard contrivance of such height and frequency that the decks do not have a chance to drain, renders meaningless the academic righting arm curves.

f. Location of the Derrick:

The derrick was positioned in a more aft position than shown in the sample loading conditions for moving the OCEAN EXPRESS set forth in the Information and Operating Instruction Book. This created a need for a compensating forward moment to assure the OCEAN EXPRESS remained at a satisfactory trim. This was accomplished by placing drill water in the forward drill water tanks rather than aft tanks.

Leaving the derrick in the aft position was not against any stated operating procedure. Based on the initial loading of the OCEAN EXPRESS for the 14 and 15 April move as reflected in the Barge Mover's loading calculation sheet, the decision to leave the derrick aft had no other effect than influencing whether drill water was carried forward or aft. Under these conditions, it is understandable that operators might feel it unnecessary to shift the derrick forward for short moves in good weather.

Whether the operating history of the unit involving an unexplained list to port should have caused the Barge Mover to place the derrick in a more forward position for moving, is a debatable point. In retrospect, it is clear the Master would have had the additional ballasting flexibility with on board drill water, rather than using seawater, if the derrick had been shifted forward.

g. Towing Forces:

During a period of time immediately preceding the capsize of the OCEAN EXPRESS, the towing vessels were under instructions from the Barge Mover to tow downwind in the direction of the beach. At the time, the GULF EXPLORER was attached to the starboard quarter of the rig, the GULF KNIGHT to the port quarter. The GULF KNIGHT was operating on one engine.

The exact power settings or headings used by the Masters of the towing vessels were not established in the testimony; however, an intent to tow slowly was expressed which would be consistent with the weather conditions at the time. The heading of the OCEAN EXPRESS was such that wind and seas were generally from the port beam or port bow subsequent to the breaking of the GULF VIKING's towline. Therefore, any attempt to tow downwind in the direction of the beach would have tended to provide an additional capsizing force generally additive to the sea and wind forces. Testimony indicates the OCEAN EXPRESS did in fact capsize to starboard with several witnesses indicating the starboard quarter going under first.

Whether the towing vessels were exerting any significant towing forces precisely at the time of capsize is not known; however, available evidence suggests that their collective efforts during the few minute period prior to capsize did tend to increase the starboard heel and aft trim of the OCEAN EXPRESS.

Perhaps the most significant effect of any attempt to tow the OCEAN EXPRESS in the general direction of the wind and seas would be to cause a "tripping action" if the rig were to touch the bottom. The possibility of grounding is discussed separately in this report.

h. Stability Criteria:

The stability of the OCEAN EXPRESS was evaluated by both The American Bureau of Shipping pursuant to classification and the U. S. Coast Guard pursuant to load line assignment. Both organizations employed the same intact criterion found in Section 3 of the Rules for Building and Classing Offshore Mobile Drilling Units, 1973 Edition. The damaged criterion employed by the ABS is found in Sections 3 and 4 of the same publication.

The essence of the intact criterion is to stipulate a heeling force, and to require the righting energy to be a stated margin above the heeling energy. For the intact case, a 100 knot static wind is used as the heeling force, and the margin required is that the righting energy be 40% in excess of the heeling energy, measured to the point of downflooding.

The essence of the damaged criteria is to assume certain compartments flooded, and to require the unit be sufficiently stable so as not to suffer downflooding, with a 50 knot static wind.

Both the intact and damaged criteria used by the ABS and USCG employ several simplifications. One of the most obvious simplifications employed in the intact criteria is the gross approximation of sea dynamics by the simple requirement that righting energy be 40% in excess of a nominal wind heeling energy. The damaged criterion ignores sea dynamics.

The Board notes and appreciates that a satisfactory stability criterion, the primary purpose of which is to aid in comparing the stability characteristics of one vessel against another, might well be a simplified approach to a very complex discipline. The test of whether a criterion is useful is whether meaningful information is produced bearing on whether a vessel will survive anticipated environmental conditions under the normal exercise of seamanship. The question of whether the loss of the OCEAN EXPRESS offers insight into the sufficiency of the intact and damaged stability criteria needs to be addressed.

Intact Stability: All guidance contained in the Operating Booklet for the OCEAN EXPRESS related to stability at the two foot mat separation. As has been demonstrated, the seaworthiness in terms of righting energy and range of stability was markedly reduced when the mat was lowered as compared to the two foot separation. The need for including information relative to stability at other than the two foot mat separation is discussed elsewhere in this report.

There is a further shortcoming in the intact stability criterion as applied to the OCEAN EXPRESS. The criterion calls for comparing righting and heeling energies only to the point of downflooding. The underlying reason for this is to encourage designers to incorporate the basic seaworthiness of a vessel into its hull form, rather than relying on watertight closures. This is perhaps a valid approach when the heel angle to reach the potential point of downflooding is sufficiently high to insure righting and heeling energies are compared over a significant portion of the range of positive stability. In the case of the OCEAN EXPRESS, the downflooding angle was so low (less than 15 degrees) that the use of the intact criterion resulted in misleading indications concerning the effects of mat position and loss

of freeboard on the seaworthiness of the vessel. In fact, it can be seen from Table 1 that the nominal wind velocity which the unit could withstand and still meet the intact stability criterion is only slightly decreased at the lowered mat position. This is at variance with the markedly reduced range of stability and righting energy shown in the same Table and is an inaccurate representation of the unit's ability to survive wind and seas. Assessment of a vessel's ability to survive wind and seas must consider righting energy over the full range of positive stability as well as the range of positive stability itself.

Damaged Stability: The ABS investigated eight damaged conditions involving the flooding of various compartments in varying combinations at the two foot mat separation. The worst case investigated the simultaneous flooding of four spaces with the superposition of a nominal 50 KT wind. Sea dynamics are not incorporated in the damaged stability criterion. A static heel on the order of 4.5 degrees resulted. While the damaged stability criterion employs simplifications which would not correlate with actual unit motions in a seaway, the calculated results do give insight into the ability of the OCEAN EXPRESS to withstand flooding due to assumed damage.

The flooding experienced by the OCEAN EXPRESS on 15 April as documented by testimony, was considerably less than that assumed in the ABS damaged stability studies. However, there were so many other adverse factors bearing on the OCEAN EXPRESS, some of which cannot be quantified, that comparison with the damaged conditions assumed in the ABS damaged stability studies is not meaningful.

As in the intact case, it is clear that damaged stability studies should extend to mat positions other than the two foot separation. Also, for damaged stability studies to be meaningful, the criterion should include some allowance for real life conditions such as sea dynamics, shifting weight and free surface.

16. GROUNDING:

The possibility of the OCEAN EXPRESS having grounded was raised through testimony and is a distinct possibility based on draft and depth of water. The separation between the mat and platform was confirmed by underwater survey to be approximately 127 feet. This would have resulted in an overall draft of approximately 148 feet. The water depth was confirmed to be approximately 167 feet, with a soft bottom. No damage was found to the mat or its skirt.

The designer's representative, owner's representative and Barge Mover were among those expressing the opinion that the OCEAN EXPRESS grounded. As evidenced by the damaged stability investigations performed by the American Bureau of Shipping and previous discussion in this report concerning weight shifts, it is clear the OCEAN EXPRESS was capable of withstanding significant winds, flooding and shifting weight without being placed in jeopardy.

Opinion was expressed by several witnesses, however, that the capsize occurred without benefit of grounding. If the more severe estimates of loading, flooding and shifting weight are used, taken in combination with the lowered mat position and boarding seas, a case can be made that the OCEAN EXPRESS could have capsized without grounding. If however, testimony is sanctioned which leans to the

more modest estimates of loading, flooding and shifting weight, one tends to look for an additional factor to help explain the capsize.

Irrespective of the above, there are additional factors which shed light on the possibility of grounding. It is unlikely the OCEAN EXPRESS drifted any appreciable distance after capsize as its 312 foot legs would have experienced bottom contact almost immediately after capsize. Therefore, grounding, if occurring, would have been approximately in the same water depth in which the unit was found; i.e., 167 feet.

With a 9 foot platform draft, no heel, trim or heave and the mat lowered to an overall draft of 148 feet, a 19 foot bottom clearance would have existed. There is ample testimony that the OCEAN EXPRESS was drawing more than the 9 foot platform draft due to undetected weight, partial flooding and other factors. Further, the unit was heeled significantly to starboard due to wind, sea and towing forces (in excess of ten degrees according to testimony) and was trimmed by the stern prior to capsize. Although dampened by the mat, the OCEAN EXPRESS was also experiencing some heave. Water on deck further increased the draft of the OCEAN EXPRESS. Under these circumstances it is probable the OCEAN EXPRESS was in substantial bottom contact at the time of capsize. Further, the OCEAN EXPRESS would have started to touch bottom at quite modest angles of heel; i.e., in the 5 to 6 degree range.

The effect of bottom contact in the form of the low side of the skirt dragging in the soft bottom sedimentary material would have caused increased trim or heel rather than the "pounding" effect which is usually associated with a vessel going aground in rough seas. The "tripping" action occasioned by bottom contact would have been additive to the forces tending to heel the rig toward the starboard quarter caused by wind, seas and towing. The crew would not have detected any unusual "feel" to the rig associated with grounding under these circumstances. The soft bottom and substantial construction of the skirt would further account for the lack of damage to the mat or its skirt.

17. TRAINING AND DRILLS:

The Toolpusher, [redacted] was in charge of training and drills on the OCEAN EXPRESS. There was a Fire and Abandon Platform Bill posted. That bill indicates the abandon platform signal to be at least seven short rings and one long ring on the general alarm system. It indicates that orders to abandon the platform will be given by the Toolpusher; that the Toolpusher will be responsible that all visitors are familiar with emergency procedures; that personnel will familiarize themselves with their respective duties and stations and proceed to stations as quickly as possible, and that abandon platform drills will be conducted monthly with one capsule lowered, weather permitting. The bill indicates which survival capsule all personnel on board are assigned to except the Toolpusher and Barge Mover. The #2 Driller, [redacted] was to be in charge of #3 capsule; the Rig Mechanic, Claude Williams, was to be in charge of #1 capsule, and no one was assigned as in charge of #2 capsule. [redacted] had attended a drill on the OCEAN EXPRESS on 31 March 1976, and for the first time entered a Whittaker Survival Capsule. He had no previous experience or training concerning the capsule. He had not seen a training film nor an operations manual for the capsules, although he had been on board the OCEAN EXPRESS since October

1975 while the rig was still in the shipyard. [redacted] thought that the after capsule on the starboard side was the #1 capsule. Although he admits that he was somewhat confused at the drill as to how the capsules were numbered, he does recall that the after starboard capsule was the one to which he was assigned and the one to which he reported at the 31 March drill and abandoned the OCEAN EXPRESS in on 15 April 1976. He thought his job in the capsule was to assist the Toolpusher; he was not aware he was in charge.

As part of the sale package, the Whittaker Corp. provides crew training in the operation of the capsules. Normally this consists of a training film and actual lowering, release operation and recovery of the capsule with all hands participating. Whittaker Corp. personnel were on board the OCEAN EXPRESS on 13 and 14 January 1976, to provide that service. On the 13th of January the full services were provided to each of two crew sections totaling 29 personnel. On the 14th a new crew - the same crew which manned the OCEAN EXPRESS on 15 April 1976 was to be instructed. Records provided by Whittaker Corp. show that two training films were shown on the 14th but that the capsules were not launched because of fog, rain and high winds. Furthermore, the records show that only nine crewmembers participated. One of those crewmembers, Mr. [redacted] recalled that they had seen one sales film and one training film. None of the films nor actual planned operations covered towing the capsules or disembarking onto vessels in the water.

During the four months that Toolpusher, [redacted] had been on the OCEAN EXPRESS, drills for his crew had been conducted, but none of the three capsules had been lowered into the water. He was aware that several of his crew knew how to operate the capsules because of their previous experience on the other rigs; this was confirmed by testimony of other crewmembers.

Prior to the OCEAN EXPRESS casualty, the conduct of drills in accordance with the station bill were not adhered to. New personnel assigned to the rig were not given any instructions until they by chance picked them up at a later drill. This policy has since been changed to ensure that drills are held on the day of crew changes and that all personnel are adequately instructed.

This Marine Board of Investigation recognized in the early stages of its investigation that additional attention to training in the use of lifesaving appliances was needed. Accordingly, a preliminary recommendation was made to the Commandant, U. S. Coast Guard relative to this need. The Commandant initiated a boarding and training program in response to this recommendation.

18. REGULATORY STATUS AND OPERATIONS:

a. U. S. Coast Guard Inspection

46 USC 395 requires that all sea-going barges of 100 gross tons or over possess a Certificate of Inspection issued by the U. S. Coast Guard. A review of the history of drilling units reveals that most drilling units including semi-submersibles, ship types and catamarans have been considered as falling under the sea-going barge act and have been inspected and certificated essentially from their inception. Self-elevating, and submersible type drilling units have been excepted.

The forerunner of self-elevating units were platforms which were infrequently moved, involving removal and resetting of structure and were first considered as not being contrivances subject to vessel inspection laws (1953). In the late 1950's and early 1960's, self-elevating units evolved to a highly mobile device and began in most aspects to take on the character of a vessel rather than a platform which was struck, moved and reconstructed on an infrequent basis. Several efforts sponsored by the U. S. Coast Guard to bring self-elevating and submersible drilling units under inspection are noted. It is noted rule-making action was withdrawn from the Federal Register in July of 1972 to allow additional time to develop rules more specifically designed to cover drilling units. A further three-year effort is noted by the National Offshore Operations Industry Advisory Committee and the U. S. Coast Guard toward the development of Rules specifically for mobile drilling units, and proposed regulations have been submitted to the Commandant for consideration.

While the ongoing efforts of both the U. S. Coast Guard and the duly constituted industry advisory body are noted, it appears the U. S. Coast Guard has had a duty to inspect and certificate self-elevating drilling units occurring at the time self-elevating units were recognized as having evolved to a character to be deemed vessels. This occurred in approximately 1965. While a certain time period would have been justified to gather advice from advisory bodies, an excessive period has occurred.

Vessels of this class are not required to have a licensed person in charge.

b. Documentation

The owner of the drilling rig had applied for a document to be registered as a U. S. vessel in December 1975. The processing of the application and the drawing of the documentation was handled by the New Orleans MIO documentation section. Except for inscribing the official number on the vessel's main beam and having that number confirmed by a Coast Guard Marine Inspector, its documentation status had been completed.

c. Operating Booklet

The Operating Booklet is a requirement of the American Bureau of Shipping Rules for Building and Classing Offshore Mobile Drilling Units, 1973 edition. The information required to be included is listed in Section 1.11, and among the requirements is "Instructions for operation of the unit including adverse weather, changing mode of operation, any inherent limitations of operations, etc."

Stability information is required by the U. S. Coast Guard in connection with load line assignment. The Master is to be furnished the vessel's maximum permitted draft and other conditions including reference to Commandant approved operating stability features, which may be applicable (46 CFR 42.09-1(a)).

It became apparent from the testimony of two senior ABS officials that the Bureau does not apply independent judgment on whether the information submitted in a proposed operating booklet concerning operating procedures fully meets the intent of their own rules. ABS relies on the builder or owner to supply appropriate information without a critical review by their staff. The Coast Guard's review

of the operating booklet for the OCEAN EXPRESS was narrow and limited to intact stability at the two foot mat separation. In that self-elevating units are not currently required to meet vessel regulations other than those associated with load line assignment, the Coast Guard had no duty to review the operating booklet other than as pertained to load line; however, in retrospect it is clear that both organizations should have required stability investigations at other than the two foot mat separation.

The operating booklet for the OCEAN EXPRESS carried the approval stamps of both organizations, which gave the appearance that the booklet had received the complete blessing of both organizations. As discussed above, neither organization gave an in-depth review.

The Barge Mover testified that he relied on information in the operating booklet, including the absence of certain information, in making his decisions. The importance of having pertinent information available is apparent. The operating booklet did not contain some information required by the ABS Rules (Section 1.11 ABS Rules for Building and Classing Mobile Drilling Units, 1973 edition). No information on procedures when encountering adverse weather were included; neither was information included concerning optimum leg positions to minimize leg or jack house stresses should the unit be caught in adverse weather, nor was there information relative to the effects on stability for various mat (leg) positions.

19. LICENSES FOR TUG OPERATORS:

46 USC 405 essentially requires licensed operators to be in charge of the navigation of towing vessels. However, this statute exempts tugs that provide services to the Offshore Oil and Mineral Industry from that requirement. Consequently neither the Master nor the Mate of the GULF VIKING, nor any of the tugs in this case were required to be licensed by law. Yet they each directed the navigation of a vessel for 12 hours every day they were underway.

20. A.B.S. RULES:

The ABS Rules define a "field move as one that would require no more than a twelve (12) hour voyage to a location where the unit could be jacked up or to a protected location." Industry frequently refers to this type of operation as a "short move".

A move that would require more than a twelve (12) hour voyage is identified in the ABS Rules as an ocean transit and is referred to in the industry as a "long move".

The testimony of ABS representatives indicate the American Bureau of Shipping does not interpret the definition in the same manner as other responsible persons in the maritime industry. (This is discussed in greater detail in paragraph 2 of the Preface to Conclusions.)

21. WEATHER:

The National Weather Service, an organization within the National Oceanic and Atmospheric Administration (NOAA), is responsible for providing appropriate marine weather forecast to the interested mariner. In general such information as surface observations, upper air observations, radar information and satellite

information, is fed to a computer at Suitland, Maryland which in turn provides data, forecasts, advisories and warnings to all weather information users. The period of forecast is for approximately 48 hours and the frequency in which forecasts are prepared is four times daily. There are provisions for updating a forecast that is going "sour", with no limit to the number of times a forecast can be updated. The finished product is put on a teletype circuit for internal use and other subscribers as well as the NOAA weather wire, which goes to the radio, television stations and the general public. The National Weather Service has management of NOAA Weather Radio, which is a VHF system that normally operates on 162.55 or 162.40 megahertz. NOAA Weather Radio provides continuous, audible, local forecast and is usually programed to play for approximately a three to four minute duration. In this instance the National Weather Service office at San Antonio is responsible for all forecasts for south central, southwestern and southeastern, Texas. The weather service office within these areas, such as Corpus Christi and Galveston publish VHF zone forecasts from the information obtained from the San Antonio Office. The VHF tapes are updated on a routine basis; however, the actual tape recording is not kept after they are used as the tape is erased each time the tape deck is updated. National Weather Service indicates the VHF transmission is a summary of the regular area forecast.

Mr. [redacted] of ODECO INC. is Vice President in charge of operations for off-shore rigs, indicated that moves are not made in weather that is outside the operating conditions of a particular unit. The weather conditions are reviewed twice daily, once at a formal operations meeting in the morning and again during an informal afternoon review. The manager of domestic drillings who is responsible for monitoring the weather conditions and instructions from the morning and evening weather review is posted in the company's telex room. These procedures have been established for many years and were primarily set up for the hurricane season. However, storm warnings of changing forecasts are immediately distributed to various personnel within the ODECO organization and the Barge Movers are advised of adverse weather which may affect safety.

Mr. [redacted] also indicated ODECO receives telex weather information from the National Weather Service which includes marine advisories and storm warnings. To the best of his knowledge his company does not subscribe to a private weather service, and he is not aware of any avenue to obtain specific forecasts from the National Weather Service. Furthermore, ODECO did not receive any storm warnings on 15 April 1976 nor was he aware of storm or other warnings having been transmitted to the OCEAN EXPRESS on that date.

Mr. [redacted] indicated he received some training with reference to interpreting weather phenomena when he was studying for his U. S. Coast Guard license as master on drill units and his (Dutch Government) license as second mate. He further indicated he was also required to have some weather knowledge when he was licensed (Dutch) navigator and flew as a navigation instructor for about seven years with El Almagorda Airlines. Technically he did not consider himself acquainted with the prevailing weather and sea conditions for the Gulf of Mexico area for the month of April.

Mr. [redacted] stated that he obtained his local weather forecast from the National Weather Service (VHF) which originated at San Antonio and Galveston,

Texas. The daily morning reports that are submitted at approximately 0600 by the Toolpusher indicate actual on-scene weather conditions. He further stated that he relied solely on the local NWS advisories.

Mr. [redacted] stated that he was given the assignment to move the OCEAN EXPRESS on Saturday, 10 April 1976, and in preparation for the move he watched the TV weather forecast to observe the general weather trend for the area of employment.

On the morning of 13 April 1976 the Toolpusher reported the weather as rainy with south winds at 15 miles per hour and 3 to 4 foot waves. At approximately 0900 Mr. [redacted] boarded the OCEAN EXPRESS and the weather at that time was about the same as reported earlier by the Toolpusher. Normally, [redacted] obtained his weather advisories from the ODECO home offices; however, on this occasion the OCEAN EXPRESS was experiencing radio communication problems so he listened to the area forecast on the VHF Corpus Christi band. During the afternoon of 13 April 1976 the forecast called for south to southeast winds at 15 to 20 knots accompanied by 4 to 6 foot seas with diminishing wind and seas during the night.

At 0600 on 14 April 1976 the Toolpusher reported southwest winds of 28.3 miles per hour accompanied by 6 foot seas. At 0700 on 14 April 1976, Mr. [redacted] commenced to "jack down" and the rig moved off location (block 803) at 1000. During the transit from block 803 to A-57 the winds and seas increased slightly. CAPT [redacted] Master of the tug GULF KNIGHT, recalls listening to the weather forecast on the VHF radio which indicated 15 to 25 knot southeast winds and 5 to 8 foot seas. The forecast was for the period of 14 and 15 April and the forecast did not change as he ([redacted] continued to listen to the weather station. When the OCEAN EXPRESS arrived at the new location (block A-57), Mr. [redacted] the Drilling Foreman, estimates the wind velocity was 30 to 35 MPH (southeast) with 6 to 8 foot seas. Shortly after arrival and at approximately 2300 Mr. [redacted] commenced to "jack up"; Mr. [redacted] was concerned with respect to the weather and discussed the situation with Mr. [redacted] the Toolpusher. Mr. [redacted] and Mr. [redacted] advised the Barge Mover that the seas appeared to be too rough to "jack up" and Mr. [redacted] concurred, and at approximately 0100 on 15 April 1976 he halted all jacking operations. At this time it was estimated that the swells were about 10 feet in height with little or no increase in wind velocity. For the period of 0100 to 0600 (15 April 1976) there was a gradual increase in wind and sea and the morning report reflected 8 to 10 foot seas.

The morning forecast indicated southeasterly winds 15 to 25 knots and 5 to 8 foot seas. The on-scene weather continued to worsen, and the OCEAN EXPRESS was receiving National Weather Service forecast that did not match the actual weather. At a little after 0900, [redacted] called his Rockport office and requested a complete weather report. Marathon Oil Co., [redacted] employer, subscribes to Universal Weather Service, and Rockport advised [redacted] that Universal had forecast (OCEAN EXPRESS area) southeasterly winds up to 40 to 45 MPH with 12 to 15 foot waves. [redacted] stated that he copied Universal Weather information on a piece of paper and he and Boudreaux advised Mr. [redacted] of the report; however, the Barge Mover chose to ignore this information. ([redacted] and [redacted] denied knowledge of this information.)

At 1400 the Universal Weather Service forecast south, southeast winds at 20 to 30 MPH with gusts to 40 MPH and occasional gusts to 45 MPH by late afternoon. At 1539 the National Weather Service forecast southeasterly winds of 15 to 25 knots and gusty. At 1745 the National Weather Service updated their forecast and called for 20 to 30 knot winds that would be gusty during the night.

The wind and seas continued to build during the evening and at approximately 1930 the mate on the tug GULF VIKING estimated the wind as 40 to 50 MPH with 25 foot seas. At 2025 the National Weather Service forecast southeast winds 25 to 35 knots with local gusts to 50 knots during the night.

The master of NICOLE MARTIN estimated that at the time the OCEAN EXPRESS capsized (2130) wind velocity was 45 to 55 MPH. "There was a smokey condition which indicated to him Force 9 on the Beaufort Scale."

During the week of 12 April 1976 the aircraft carrier USS LEXINGTON was operating within 100 nautical miles of the Naval Air Station at Corpus Christi, Texas. At 2320 on 13 April 1976 the LEXINGTON received an operating area weather advisory from Naval Weather Service Detachment at Corpus Christi, which forecast southeast winds for the period from 0300 on 14 April 1976 to 0300 on 15 April 1976 at 8 to 12 knots, increasing after 0900 on 14 April to 12 to 16 knots with gusts by 1200 which would be over 20 knots, but less than 30 knots.

At 1700 on 14 April 1976 the LEXINGTON received an additional weather advisory from Fleet Weather Central, Norfolk, Virginia, which indicated no significant sea heights were expected in the Gulf of Mexico for the period from 0600 on 14 April 1976 to 0600 on 16 April 1976.

The LEXINGTON was in receipt of additional advisories which discussed tropical weather; however, the information inferred the weather anticipated for the operating area would generally be fair. The LEXINGTON had qualified meteorologists onboard who made surface weather observations and provided on-scene forecasts. The Executive Officer indicated that daily on-scene forecasts were not available, but he did state the LEXINGTON experienced some high winds during the week of 12 April 1976.

At 1800 on 15 April 1976 the LEXINGTON was located approximately 18 miles southwest of the OCEAN EXPRESS and at that time the wind was from the direction of 160 degrees at 18 knots (21.6 MPH) with 21 foot seas. At 1900 the Carrier was approximately 7 1/2 miles southeast of the OCEAN EXPRESS, experiencing winds from 140 degrees at 40 knots (45.2 MPH) accompanied by 23 foot seas. At 2000, approximately 19 miles east of the OCEAN EXPRESS, the winds were from 150 degrees at 45 knots (50.9 MPH) with 25 foot seas. At 2100, 25 miles east of the OCEAN EXPRESS, the winds were from 140 degrees at 52 knots (58.8 MPH) and 28 foot seas. At 2200, approximately 32 miles east of the OCEAN EXPRESS the winds were from 160 degrees at 52 knots, (58.8 MPH) and 28 foot seas. At 2300, approximately 45 miles northeast of the OCEAN EXPRESS, the winds were from 150 degrees at 42 knots (47.5 MPH).

Mr. [redacted] the meteorologist in charge of the National Weather Service forecast office in San Antonio, Texas indicated that local marine forecasts

are primarily of benefit to persons using small craft over a short period of time. The present service is geared to "small boats" and while it may be of benefit to other marine interests, the intent is to exclude commercial users.

In terms of additional services Mr. [redacted] indicated that at the present time there is only one telephone line into the NWS San Antonio Office, and the chances of mariners obtaining the best information available is fairly slim because of the lack of communications equipment.

Mr. [redacted] indicated an improper prediction could reflect inaccuracy in both the local input as well as the skill of the forecaster and one or both might need improvement. He also emphasized that it was the state of the art rather than the qualifications of any particular meteorologist that needed improvement.

Mr. [redacted] indicated that based on hindsight, he was not in a position to second guess the forecast, but the movement of the upper trough was faster than anticipated; however, there is nothing in the particular forecast which would indicate gradually decreasing winds later Thursday (15 April) evening. He also stated the forecast issued was not incorrect; however, a better forecast may have been possible.

Mr. [redacted] further indicated the "high" over the eastern part of the United States definitely had an influence on forecasts. He also stated that the effect of the "high", apparently, was to preclude the front to the west of the Gulf of Mexico from moving forward and through the Texas coast. Consequently when the upper disturbance moved through, above the slow moving front, pressure gradients fell and wind speeds increased. The sea and land masses contribute differently to weather conditions in that the temperature of the land changes more dramatically than does the temperature of the seas. The effect of this analysis is that winds over sea might be a little higher.

Mr. [redacted] indicated that the service his agency provided for aviation users is considerably more extensive than that provided for marine use and the present services are not geared to emphasize weather forecasts of several days for the maritime user. Furthermore, he stated this type of marine information is considerably lacking and he does not foresee any great improvement in service. Furthermore, he indicated that exact weather prediction capability is not available and probably will not be available for a long time. He would like to see a system that provides forecasters with all information regarding weather factors. With all information available, exact predictions are feasible. For instance, additional off-shore observations would be necessary.

Mr. [redacted] also stated that the National Weather Service Regional Headquarters had initiated a study of the satellite pictures and the forecast in general for the applicable period of 13 to 15 April 1976. Mr. [redacted] and [redacted] of the San Antonio office were given the responsibility to conduct that study. Mr. [redacted] and Mr. [redacted] Southern Regional Counsel for the National Oceanic and Atmospheric Administration assured this U. S. Coast Guard Marine Board of Investigation that a copy of their complete report would be made available to the Board. However, as of this writing the Board has been unsuccessful,

at both the Regional and National Offices of NWS in obtaining any information with respect to that report.

At the request of the Marine Board, Dr. [redacted] gave testimony as an expert witness. It should be noted that at the time of Dr. [redacted] appearance all the Parties in Interest were aware that he was under contract by ODECO, INC., or more accurately he was retained by [redacted] Esq., of Royston, Rayzor, Vickery and Williams of 3710 One Shell Plaza, Houston, Texas 77002. In view of Dr. [redacted] background, experience, reputation, and candid discussion, the Board did not consider it necessary to request the appearance and/or assistance of an additional expert meteorologist.

Dr. [redacted] is currently employed as the Director of Research and President of the Institute for Storm Research and a Professor at the University of St. Thomas in Houston, Texas. The Institute for Storm Research is a nonprofit organization, chartered under Texas law which allows employees to furnish professional services for a monetary fee. Individual forecasts are a function of the organization with fees being made payable to the Institute for Storm Research. There are no Federal funds supporting the organization; however, there have been contracts or grants which have produced work and/or information for the Federal government. Particularly for the National Science Foundation, the United States Army, United States Navy, the Atomic Energy Commission and the Environmental Protection Agency.

In reviewing Dr. [redacted] background it was disclosed he received a Bachelor's Degree in Mathematics from Rice Institute in Houston, he served in the United States Army Air Force and was assigned to the California Institute of Technology where he received a Master's Degree in Meteorology; he then served as a meteorologist for the Army Air Corps and the United States Air Force for five years before he attended Brown University to study applied mathematics. He worked on the first numerical weather prediction at the Institute for Advanced Study in Princeton, New Jersey and received a Doctorate in Meteorology from the University of Chicago. He then became a Professor in the Department of Oceanography at Texas A&M University. In 1955 and 1956 he started a consulting firm for the purpose of studying and forecasting weather and oceanographic conditions. A few years later the consulting firm was incorporated into a larger organization which was called the National Engineering Science Company. In 1966 Dr. [redacted] left the National Engineering Science Company and started the Institute for Storm Research. As previously indicated the Institute for Storm Research is a nonprofit research and educational institution that also performs services related to weather and oceanography; one of the services is to provide weather forecasts for offshore operations.

The Institute for Storm Research did not make a weather forecast for the area in which the OCEAN EXPRESS was operating, but at the request of ODECO, has since made a study of the weather in the Gulf of Mexico area that existed on 15 April 1976. Dr. [redacted] primary focus was on the National Weather Service forecasts.

Dr. [redacted] indicated that private weather services, like the Institute, use the same material as NWS and their employees are of equivalent education, experience

and training. Their objective is to provide a specialized service to their clients and they do not pretend to provide a report that is better than the National Weather Service.

Dr. [redacted] is of the opinion that several National Weather Service forecasts that were issued on 14 and 15 April 1976 were substandard compared to products expected from a modern offshore forecasting system with experienced offshore forecasters.

The 0339 and 0934 forecast of 14 April 1976 call for 15 knot winds with short period increases of gusts to 20 to 30 knots and 4 to 6 foot waves on Wednesday and Thursday. The mention of 30 knot wind gusts was added in the 0934 forecast. Wind and wave forecasts are supported by prognostic charts of pressure, which were developed by a highly sophisticated NWS computer in Washington, D. C. These prognostic charts are transmitted to various weather stations and available to every forecast center that has responsibility for the Continental United States.

Dr. [redacted] indicated that his study of those prognostic charts provided him with quantitative estimates of the wind speeds and wave heights at 1800 CST, Wednesday, 14 April, at any point along the Texas Coast. Offshore, near Corpus Christi, that quantitative estimate showed the wind to be 24 to 27.8 knots for the 36-hour forecast.

When these winds are applied to a standard wave estimate chart the resulting significant wave height forecast for 1800 CST, 14 April 1976 would have been 8 to 9.8 feet for the 36-hour forecast.

This information was available to the San Antonio NWS at both 0339 and 0934. Dr. [redacted] said that the forecaster would have been expected to be particularly alert to increasing south winds and their resulting waves, because it was obvious that a pre-frontal south wind situation was developing and that the prognostic charts indicated its continued development and intensification.

Dr. [redacted] explained that the pre-frontal south wind is the most common producer of waves over 8 feet high in the Gulf of Mexico and there is a clear sign on the weather maps when such a front is developing. For example, a north-south oriented cold front moves in over the Rocky Mountains and the mountains of Mexico; the pre-frontal south wind situation results in sustained winds with minimum values of 15 knots and sometimes values of sustained winds reach 40 knots or more. The winds last for many hours in these situations.

At the time the 0934 forecast was issued, the NWS forecaster had the upper wind observations at Corpus Christi, which indicated 25 knot winds at 2,000 feet. This information was one of the alerting factors to confirm that a pre-frontal south wind situation had developed (when winds of 25 knots or over are occurring at 2,000 feet). This was an indicator that the expected situation was developing, but this knowledge was not reflected in the 0934 forecast. Furthermore no wind increase for Wednesday (14 April 1976) night was forecast.

The NWS forecast issued at 0334 called for very little change from previous forecasts except for slightly higher waves. Winds were forecast at 15 to 25 knots

even when the winds at the second standard level (2,000 feet) were 30 knots at Brownsville and 25 knots at Corpus Christi.

Dr. [redacted] also indicated the small craft advisory that was issued at 0915 on Thursday (15 April 1976), calling for 20 to 30 knot winds, was verified by his observations; however, there was no prognostic chart calling for a decrease in winds on Thursday evening, yet one was forecast in that advisory. The prognostic chart called for southeast, 23 to 25 knot winds with 8 - 10 foot waves and occasional 12 foot waves for Thursday evening and night. Dr. [redacted] said that the forecast issued at 1539 Thursday, if it followed the numerical prognostic charts, did not take into account that the 12 hour prognostic charts had consistently been showing wind weaker than those observed for the past several days. According to Dr. [redacted] the special (updated) forecast issued by NWS at 1745 Thursday indicated by its timing and its content, some persuasive pressure (either observational or administrative) was exerted for a change in the forecast. The change was a sudden one indicating that the forecaster learned something new or that a supervisor decided that the prior forecast was erroneous. The Institute was unable to determine which of these was the case. Winds 20 to 30 knots and waves 6 - 10 feet were more in line with indications available. Dr. [redacted] evaluated the NWS forecast issued at 2025 as better related to observations, except that the sea states in that forecast were somewhat low for the wind speeds. The forecast issued at 2110 was more consistent between wind and waves.

The Board requested that Dr. [redacted] review the forecasts received by Marathon Oil from Universal Weather Service and, if possible, make an appropriate evaluation and/or comment with respect to their content. Dr. [redacted] indicated that he was of the opinion that Universal Weather Service did not have any additional information available than was available to the Institute or the National Weather Service. Dr. [redacted] did not believe the Universal Weather Service forecasts and the National Weather Service forecasts were significantly different. What differences existed were favorable to Universal Weather Service. Dr. [redacted] further indicated that, in his office, the National Weather Service forecasts would have been called a missed forecast and there would have been a seminar held discussing it, regardless of whether a casualty was associated with it. He was of the opinion that the National Weather Service forecast was a missed forecast and again the Universal Weather Service forecast was not significantly different from it. Furthermore he would not let a forecast like that one (Universal) out of his office because it does not provide any real information. Also the Institute of Storm Research missed its forecast (for Galveston rather than Corpus Christi area) for Thursday, 15 April 1976. Further, if they (Institute of Storm Research) had been called upon to forecast for the area near Corpus Christi on Thursday night, every indication is that they would have also missed the forecast.

Dr. [redacted] indicated the phenomenon that caused the winds of 50 miles per hour was on too small a scale to be predicted by the numerical systems presently available to forecasters. Small scale disturbances in the Gulf of Mexico and the North Sea invariably do not show up in forecasts.

In response to an inquiry from the Board regarding improvement of weather predictions, Dr. [redacted] indicated the first thing he would recommend for improving general weather services in the Gulf of Mexico would be a special marine section or a special marine designated forecaster on each shift within the National Weather

Service. Further, a sustained on the job training program for that group should be implemented to emphasize the marine forecast capability. Also, the observation network for 150 miles offshore is inadequate, as is the observation network for 150 miles inland. There were budget limitations in developing the inland observation network and more observations are needed. Recently a coastal engineering group met in Hawaii and it was learned that there will be two continuously operating buoys in the Gulf of Mexico for weather observations. This is, in Dr. [redacted] opinion, a trend in the right direction toward more readily available observations from the Gulf of Mexico.

Dr. [redacted] indicated that it was his experience that the National Weather Service will give specialized and individual attention to weather forecasting for as long as you can hold the forecaster on the telephone. It is his understanding as a member of the American Meteorological Society, that the National Weather Service has a policy against giving specialized weather service on any other basis than being polite and answering short simple questions over the telephone. When the information required is particularly specialized, the forecaster has been advised by his supervisor to recommend the service be obtained from a commercial source because the request requires more attention than he can give.

With reference to material that is placed on tapes for broadcast, Dr. [redacted] indicated that he has heard VHF taped weather information on several occasions. It was his understanding that the National Weather Service taped forecasts are considered and expected to be accurate and useful; however, on this particular occasion (15 April) the forecast was missed. Dr. [redacted] also indicated that the tapes were written in a way that would lead him to believe the forecast would be useful for only 20 to 25 miles offshore.

22. CAPSULES IN GENERAL:

Testimony was heard from three witnesses concerning the designing, testing and approval of the Whittaker capsules of the type aboard the OCEAN EXPRESS. They were [redacted] and [redacted].

a. [redacted] is employed as Engineering Manager of the Survival Systems of Whittaker Corporation. He has held this position since 1962. He has been with Whittaker since 1960. He has an extensive formal engineering educational background. Mr [redacted] gave the following historical summary and information:

In 1966, [redacted] of Life Spheres Corporation, submitted plans to the Coast Guard for a round lifeboat. These plans were first given Coast Guard approval in 1966. In 1968, Life Spheres Corp. was acquired by Whittaker Corporation. Whittaker refined the drawings of [redacted] and obtained Coast Guard approval #160.035 under the category of lifeboats.

The advantage of the round shaped lifeboat according to Mr. [redacted] is that it is more maneuverable, and the direction of the seas upon the capsule is not considered an important factor. Also, only one fall is required to lower it whereas two falls are required for a lifeboat. The Launching System for the capsule consists of a platform and electric winch. Whittaker assists in placing the launching

platform aboard a vessel if requested. The capsule is lowered by gravity. The launching mechanism is fitted with a "dead man" brake. This arrangement enables all men to be on board at time of launching. The winch is fitted with 135 to 140 feet of usable cable. To launch the capsule, securing pins are released from the outer perimeter of the capsule prior to boarding; after all men are aboard, a man opens the top hatch from the interior and reaches out to release the brake. The lowering speed is governed to 120 feet per minute. The Whittaker Corp. recommends that the engine be started while lowering. Once the craft is waterborne, a ratchet type disengaging apparatus, Rottmer type, on the upper dome's interior is operated to open the hook lock attached to the lowering cable. There is also a hand operated handle on the top dome exterior to release the hook.

The 40 horsepower engine in the capsule is a Westerbeke, model 4107, 4 cylinder diesel with hydraulic starter. The capsules involved in the OCEAN EXPRESS casualty were Whittaker model 9091. They are equipped with tillers fore and aft and provisions for five days for a maximum of twenty-eight persons.

The craft has an air intake on each side with two 12" doors on the interior side of the upper dome. There is an interior fan to circulate the air. There is also an air purification system to convert $CO_2$ into oxygen when the capsule is completely closed during an emergency, such as a fire around the exterior. The air for the engine is drawn from the outside through a baffled intake pipe in the top of the capsule. This is the only air supply for the engine. The engine exhaust is expelled through a separate baffled pipe in the top. The lights are battery. An alternator is provided for charging the battery. The capsule is fitted with a fixed bilge pump coupled to a sprinkler for external cooling of the capsule in a fire. This pump/sprinkler is hand operated. An instruction manual is provided with each capsule.

Tests performed in 1969 by the manufacturer on capsule model 9091 are discussed below:

(1) Speed Tests: The capsule was driven over a measured mile, fully loaded at wide-open throttle.

Results: Attained 3.04 knots in calm seas.

To operate the engine at reduced R.P.Ms. for 24 hours requires 54 gallons of fuel. The Coast Guard waived this 54 gallon fuel requirement. The fuel capacity is 27.2 gallons which provides a half-hour operation with wide-open throttle which the manufacturer and Coast Guard feel is sufficient to get the capsule away from danger but to remain in the area for rescue. In 1971, the stabilizer skirt on the lower hull which is employed to reduce the severity of sea motion was reduced in size which increased the capsule speed to 4.72 knots. Solas requires lifeboats to attain 4 knots.

(2) Chock Test: (Strength test)

The capsule is supported by two lines attached to the pad eyes and given a 100% overload. This load was 20,480 lbs. The light condition is 4,690 lbs. and loaded condition is 9,880 lbs. While in this 100% overload condition, the capsule was measured for distortion and damage; none was noted.

(3) Suspension Test:

The capsule is hung from the center hook with 100% overload; no damage was noted. No test of releasing gear was performed at this time. At a later time, the releasing gear was tested with a load of 1.1 tons while suspended 4" above mats in a warehouse. The releasing gear operated satisfactorily.

(4) Stability Test:

For this test the standard followed was for lifeboats. Twenty-eight persons were placed in the capsule, which is the maximum load. Twenty-two persons were seated around the interior perimeter seats and six were seated around the center column seats. Fourteen persons were removed from the capsule. All fourteen were from one side. The capsule passed the standard which states that the freeboard lost must be 10% or under the total freeboard on the heavy side.

The stabilizer skirt is for minimizing motion. Tests indicate the larger skirt allowed better handling, but the smaller skirt allowed a faster top speed.

(5) Seating Test:

The capsule was filled to maximum capacity of twenty-eight persons with life jackets on each person. All had seat belts on. Twenty-two persons sat on the outer seats and six sat around the center column. All were comfortable.

(6) Flood test:

A fully loaded capsule (simulated person weight) was filled with 2,300 gallons of water, up to the edge of the doors. Two persons walked the outer perimeter catwalk at this time. The capsule remained stable and did not sink. In the film viewed by the Board, the statement, "The capsule will absolutely not sink," was made at this time.

(7) Swing Test:

The standards call for the vessel to be suspended from a 20' length of cable, moved off the perpendicular 8 ft. and let go into a solid embankment.

The actual test on the capsule was from a cable greater than 20' in length, and the capsule pulled out approximately 14 feet and let go to swing into a solid concrete sea wall. Slight grazing occurred to the gel coat of the outer surface of the catwalk where it struck. It was checked for damage and operated to determine its seaworthiness. It passed.

(8) Drop Test:

A fully loaded capsule was dropped 10 feet into the water. A popping sound was heard as it landed, but no damage was incurred. The hook release was not used for this test.

(9) Releasing Test:

The ratchet releasing gear was operated with a load of 1.1 tons and dropped 4" onto mats. It operated satisfactorily.

(10) Towing Test:

The capsule was towed in moderate weather at a speed of 5.2 knots over a course of 1,000 yards. A line was attached to a steel pad eye on one side of the catwalk. It is fitted with two steel pad eyes, one on each side which were intended to be used for lifting and securing the capsule during transit. The pad eyes can also be used for securing the capsules to the rigs during heavy weather. The pad eyes are not marked and can only be reached by capsule personnel exiting the front door, moving along the catwalk for approximately six feet to secure a towing line. The sea painter supplied with the capsule can be used to tow the capsule. There are no instructions in the manual for towing or the rigging of a towline. The manufacturer does not recommend or want the capsules towed. Mr. [redacted] feels that if a towline was attached to the top at the hook, it would flip the capsule. There were no tests of this nature performed by Whittaker or anyone else. There are no provisions or recommendations in the manual for righting the capsule if it should capsize.

(11) Capsizing Test:

Whittaker performed this capsizing test in 1974 although not required by the Coast Guard. A fully loaded capsule (simulated weight), not a model, was inclined at various angles. The capsule righted itself at $50^{\circ}$ and capsized completely at $115^{\circ}/120^{\circ}$. The capsule was held in the inverted position for two minutes to measure water leakage. Two hundred gallons of water entered in two minutes through bolt holes holding weights simulating the weight of people and through air intake openings. It was not tested to determine the integrity of the capsule with people resting on the top in an inverted position. Mr. [redacted] assumes the capsule would capsize easier if it was full of water. It was his opinion that the capsule would be more difficult to right if it was full of water. Capsizing tests with unloaded capsules were not performed.

(12) Fire Test:

The capsule was floated in a pool of burning oil. The sprinkler system was employed. The test showed humans could survive for eight hours within the capsule. This is moot since the air filtration system, to be employed when the capsule is completely closed during an external fire, is designed to be effective for one hour with twenty-eight persons aboard.

Mr. [redacted] feels Coast Guard requirements are strict. The capsule's hull is constructed of 5/16" laminated fiberglass. The Coast Guard requires laminated strength that meets the requirements for class 4. The results of all tests were given to the Coast Guard. No tests were run with the capsule in a submerged condition. No tests were conducted to determine at what point the capsule would turn over under dynamic conditions since the government did not require them to do so.

Mr. [redacted] related that this type capsule has been subjected to winds of 45 knots with gusts to 65 knots and seas to 18 feet during a rig casualty in the Persian Gulf. The capsule is reported to have performed without difficulty and all on board were rescued. Gulf of Mexico Hurricanes Camile and Carmen, having winds up to 200 m.p.h. and 55 foot seas, tore two capsules from rigs, and after the storms passed both were found upright and the interiors fairly dry.

According to Mr. [redacted] several accidents on record were attributed to operator error due to lack of being informed on how to properly launch the capsule. One capsule with six men aboard was released by the operator using the ratchet mechanism and dropped 90 feet to the water. Three men were killed. This occurred during an emergency evacuation of a rig. It must be assumed that the capsules are going to be used under panic conditions or seasickness which may effect judgment, and therefore thorough instructions and familiarization is essential to avert tragedy and accidents.

Mr. [redacted] indicates seas of twenty feet washing on a secured capsule in the North Sea did not have any damaging effect.

Mr. [redacted] also indicated that Whittaker Naval architects are of the opinion that no sea state exists which would flip the capsule.

Mr. [redacted] does not recommend securing the capsule to a rescue vessel in rough seas. He states that the engines normally run up to 200 degrees at wide open throttle. The company has received a few complaints about the raw type of asbestos that is on the exhaust pipe.

At this time, no changes or modifications are planned by Whittaker Corp. to capsule model 9091.

The only areas in which the capsule does not meet the Coast Guard requirements for lifeboats is in the speed and endurance test (fuel consumption).

Mr. [redacted] continued that Whittaker Corp. manufactures a fifty-man capsule that has a self-righting feature. This feature is not required by the Coast Guard, but the Coast Guard approved the feature in February 1976.

Mr. [redacted] does not feel a 165 lb. man with a life jacket on can exit through the top hatch. No difficulty would occur if the hatch was enlarged.

Mr. [redacted] could only speculate as to why capsule #2 on the port side of the OCEAN EXPRESS was torn loose from the rig. He thought possibly a cotter pin worked loose. He feels that this capsule, found on a Texas beach after the casualty, capsized as it hit bottom approaching the beach. However, several witnesses sighted it in the capsized position while it was alongside the OCEAN EXPRESS.

All capsules are operated for two hours in a pond at the factory prior to delivery, to insure they are properly working and there are no leaks. The releasing apparatus is also tested at this time.

Entrance doors are only on one side because the company did not want doors located over or near the propeller area.

Whittaker is undertaking additional studies due to inquiries from customers since the OCEAN EXPRESS casualty. There are more than 650 capsules in use worldwide.

b. [redacted] who resides at [redacted] is the Chief of Survival Systems Branch of the Office of Merchant Marine Safety of the U. S. Coast Guard in Washington, D. C. Mr. [redacted] graduated in 1961 from Illinois Institute of Technology in Chicago with an Engineering

degree in Fire Protection and Safety. He entered the U. S. Coast Guard in 1962 and was commissioned through the Officer Candidate School Program. He served on active duty at U. S. Coast Guard Headquarters in the Technical Branch of the Office of Merchant Marine Safety through 1965. He was released to inactive duty and took a civil service position with the Coast Guard. He was named Chief of the Branch in 1968. The Branch is responsible for the standards for approval of lifesaving and firefighting equipment on merchant vessels. His office was involved in the approval of the Whittaker capsules. Mr. [redacted] offered the following information:

The Branch standards are based on the 1960 Solas Requirements for lifesaving devices. These requirements are presently under revision by IMCO. They are discussing the self-righting feature for lifeboats.

Manufacturers submit plans to the Branch for approval and then they build a prototype and tests are conducted. The capsule was first approved in 1968 for drill rigs, fixed structures and artificial islands, under 46 CFR 160.135 and subchapter N as an alternate for lifeboats, inflatable life rafts or life floats. The operations manual was also approved.

One test performed by the Branch under favorable sea conditions was the transfer of men from a capsule to a boat, which is considered the highest risk point of rescue efforts. There were no tests for watertightness of air intakes. An escape hatch in the bottom has been discussed with Whittaker Corp.

The U. S. Delegation to the current Solas Convention stated that the open lifeboat has been greatly improved over the years and see no need for self-righting boats. They are presently reconsidering this stand.

Regulations require monthly drills on offshore islands. Company records are required to be kept on all drills.

The manufacturer has no legal obligation to report to the Coast Guard any casualties involving its equipment on foreign vessels.

Mr [redacted] feels the capsules were capsized by large seas and the doors could have popped open with people falling against them.

Mr. [redacted] testified that the open lifeboat specification is the standard the Coast Guard has used to judge the adequacy of the Whittaker Survival Capsules. He further testified the question of capsizing is a recent consideration, within the last year. In other areas of his testimony he compares the capsule with the lifeboat. For example he indicates a lifeboat which could return from a 120 degree static list would be a "pretty favorable lifeboat," a direct comparison with the static righting characteristics of the capsule. A similar indication is made when discussing what a Coast Guard naval architect might have done had he been formally consulted as part of the approval process for the capsule; i.e. that he would have compared the capsule with the open lifeboat standards.

c. [redacted] who resides at [redacted] is a field Service Manager for Whittaker Corporation. He has been with Whittaker in this capacity for five years, that time being served in the New Orleans area. His duties are maintenance and repair of equipment, supervision of equipment,

installation and training personnel in the use of the capsules. He is not involved in sales. He underwent several months of on-the-job training.

He did not supervise the installation of the capsules on the OCEAN EXPRESS, but a member of his office did. He personally supervised the installation of the capsules of the OCEAN DRILLER, an ODECO rig, in October 1971. This rig has three model 9089 B capsules. The Whittaker Corp. provides two days free training for each capsule placed on board. During training sessions on the OCEAN DRILLER, winds of 35/40 knots and 15 foot seas were encountered. A capsule was loaded with ODECO representatives and rig personnel and lowered and operated. All aboard were amazed as to how well it handled and rode. On the second day, crew-members of the rig took it out in 16 foot seas, the waves having a 12 second period with no breaking waves. The rig was in 400 feet of water at this time. The crew drove the capsule in a 1/4 mile circle, shut it off and drifted. No problems were experienced. They were in the water for one hour. The company has only had seven or eight reports in six years that seasickness is aggravated in a closed capsule. Other Whittaker men have held training sessions in 20/22 foot seas. There is no written Whittaker policy on the maximum seas to be tolerated for training sessions. The Whittaker instructor obtains the rig supervisor's permission prior to launching capsules and the trainer will advise him if weather conditions are safe. Visual aids of movies and slides are also used in training rig personnel. Training sessions last a minimum of 40/45 minutes and may extend to several hours depending on rig activity at the time. Customers may call for additional training if so desired.

There is no training on how or when to disembark from the capsule, on towing, or how and when to go alongside another vessel, or instructions if the capsule should capsize.

He has accompanied sales representatives on trips and the words "will not capsize" were not used but may have been conveyed during the sales presentation.

Whittaker records indicate that a shore side training session was held aboard the OCEAN EXPRESS on November 11, 12 and 19, 1975, while in the shipyard. [redacted] of ODECO called Whittaker on 9 January 1976 at 1105 hours for crew training at a shore type operation for OCEAN EXPRESS. This was accomplished on the 12th of January. On the 13th and 14th of January 1976, the vessel was visited at High Island area, Block 539. On the 13th, a capsule was operated by 17 men as the first training cruise and by 12 men on the second cruise. Movies and slides were also shown to the men. On the 14th, the capsules were not lowered due to fog and rain. The movies and slides were shown to 9 men at this time. There were two days free training due the OCEAN EXPRESS but were never used.

Mr. [redacted] has aided oil companies in their own training programs. He has never experienced problems with the releasing gear.

Repair records indicate that cosmetic repairs to a scratch in hull 436 (#3 capsule) were done.

23. CAPSULE #1:

Capsule #1 was the forward most capsule on the starboard bow. It was suspended from a framework with a power winch for raising and lowering it outboard

of the hull of the OCEAN EXPRESS. The bottom of the capsule when stowed is approximately fifteen feet above sea level. At 2030 hours on 15 April the twenty-five foot seas were striking the OCEAN EXPRESS on the port side. Capsule #1 was in the lee of the rig.

At approximately 2115 hours the decision was made to abandon the OCEAN EXPRESS after the derrick shifted to starboard and the list to starboard increased. At that time fourteen men entered capsule #1. As the men entered the capsule, they took seats closest to the doors so that the last man in had to go to the opposite side from where the doors were located. All fourteen men had life jackets on when they entered the capsule and all fastened their seat belts except for two men. All were seated around the outer perimeter seats.

When the rig's Electrician, [redacted], entered the capsule, he opened the top hatch to look for other rig members coming to the capsule. He was one of the last men to enter.

The Crane Operator of the OCEAN EXPRESS, Mr. [redacted] was the last man to board the capsule. Mr. [redacted] stated that he was in charge of capsule #1. The other crewmembers were unaware of this since no one remembers orders being given. Mr. [redacted] closed the capsule doors as he entered. Mr. [redacted] then asked the Toolpusher, Mr. [redacted] several times if they were ready to lower. Mr. [redacted] who was on deck gave [redacted] a signal and [redacted] then pulled the release pin connected to the winch and closed and latched the top hatch. The capsule lowered to the water without incident. [redacted] did not realize when the capsule became waterborne, so he asked several of the others if the capsule was in the water yet. Receiving an affirmative answer, he pulled the release pin on the ratchet mechanism and operated the ratchet lever three times. The capsule did not release, so he continued the back and forth motion on the lever to the releasing gear in the overhead. Suddenly he felt the capsule surge and knew then they were loose from the securing cable. Mr. [redacted] then started the engine without difficulty, and he put it in gear, turned on the interior lights and fans steering away from the rig and with the seas. Mr. [redacted] then took over steering from the forward tiller. He did not use the magnetic compass.

Mr. [redacted] and Mr. [redacted], Motorman, acted as lookouts. They sighted the lights of a vessel in the distance and headed for it. After running the capsule a short while, it was noted by the crewmembers that an odor of burning paint and diesel fumes prevailed in the hot interior, and some of the men were nauseated by now. The temperature gauge for the engine, located on the console, indicated 200°F, and Mr. [redacted] asked [redacted] if he had checked the hand operated water valves to the engine. [redacted] was not sure, so he released his seat belt and checked the valves and assumed he put them in proper order. This did not alter the temperature of the engine. Mr. [redacted] opened the top hatch a crack to let fresh air into the capsule. He closed and latched it after two to three minutes. No water came in the top hatch while it was cracked open.

Meanwhile, the Electrician, [redacted] noted what he thought were engine instructions on the center column and the bulkhead of the capsule. He saw one placard marked "Bilge and Sprinkler." He tried the lever at this sign, along with several other levers and the engine remained hot. He asked for some water to prime the bilge pump, and none could be found within the interior of the capsule.

[redacted] then told [redacted] he was shutting down the engine before it burned up. The engine was then shut down and immediately [redacted], who was still acting as a look-out, asked that the engine be started for a few seconds since he had sighted the lights of a nearby vessel. [redacted] immediately restarted the engine, and [redacted] hollered to shut it off and yelled, "We are going to ram." The capsule and the survey vessel, NICOLE MARTIN, then came together heavily.

At this time [redacted] opened a door of the capsule to get some water in a bucket for the overheated engine. It was then that he and other crewmembers noticed a vessel alongside.

[redacted] opened the top hatch and after two attempts from crewmembers of the NICOLE MARTIN received a 1/2" fiber rope. The line had an eye in the end, so he looped it over the hook mechanism on top of the capsule. The other end appeared to be secured to the bulwarks of the starboard side of the NICOLE MARTIN. This event was logged by the Master of the NICOLE MARTIN as happening at 2145 hours.

The Master, Captain [redacted] first noticed the capsule in the spotlight of a tug. The survey boat, being more maneuverable than a tug gave chase after the capsule and kept it in its spotlight. The capsule was approximately twenty-five feet from the starboard side of the NICOLE MARTIN when the first line was thrown from the deck. The first line was initially secured to the starboard stern bitt as the NICOLE MARTIN was headed into the seas.

[redacted] stated that someone in the capsule suggested tying another line to the boat because it was so rough. Captain [redacted] acknowledged receiving a 1/2" nylon line from the capsule although [redacted] does not recall passing a second line to the NICOLE MARTIN. He came down from the hatch and awaited his turn to evacuate the capsule. [redacted] was observed by [redacted] standing through the top hatch and receiving or sending a second line which was secured to the grab rail on the upper dome of the capsule, the other end being secured to the bulwarks of the NICOLE MARTIN. [redacted] claims to have passed this line a 5/8" nylon, approximately 150' in length to Patin.

Captain [redacted] then reversed the engines of the NICOLE MARTIN and put the capsule in the lee of the vessel which was now broadside to the seas. The seas were very rough, and the first line was released from the starboard stern bitt and the capsule was worked toward the starboard midship section of the boat where a 12' opening was available in the bulwarks. The doors of the capsule were facing the vessel and the two vessels collided repeatedly as they rolled in the heavy seas. It was estimated that there was an eight to ten foot variation between the doors of the capsule and the deck of the NICOLE MARTIN caused by rolling seas. The lines between the capsule and boat were not tight, and no attempt was made to tow the capsule in this mode.

The afterdeck of the NICOLE MARTIN was illuminated by two of its floodlights to aid in the rescue. Seas did not break over the capsule during the transfer of men from the capsule to the deck of the NICOLE MARTIN. The greatest concern was the possibility of men falling between the capsule and the boat, since each man had to leap the varying distance between the vessels. [redacted] jumped for the boat but fell slightly short and was grabbed by crewmembers and hauled aboard. Captain [redacted] and his crew aided every man on board. Three men were seen to exit the capsule from the top hatch.

There was no panic or confusion by the capsule personnel before or during the transfer. All agreed to abandon the capsule, and all agreed that the capsule handled and rode well for the conditions. There were no equipment failures within the capsule other than what was thought to be an overheated engine. The time from abandoning the OCEAN EXPRESS until the securing of the capsule alongside the NICOLE MARTIN, is estimated at thirty to forty minutes. Evacuation of the capsule took an estimated fifteen to twenty minutes. Some water entered the capsule when the door remained open during evacuation. The evacuation was orderly with each man taking his turn to disembark.

Once all had boarded the NICOLE MARTIN the capsule was led astern of the vessel where it slipped its lines and accumulated water through the open doors.

No one actually saw capsule #1 turn over, but it was recovered in the inverted mode by the USS LEXINGTON during the early morning hours of 16 April. It was hoisted aboard the flight deck via cable attached to the lifting eye on each side of the catwalk. A 21" fracture in the upper dome of the capsule radiating from the top hatch along with severe damage to the center post within the capsule cannot be accounted for at this time.

24. CAPSULE #2:

Capsule #2 was located on the port bow of the OCEAN EXPRESS just aft of the heliport deck. This capsule was suspended from a framework outboard of the hull of the OCEAN EXPRESS. The bottom of the capsule was approximately fifteen feet above the surface of the water. The station bill of the OCEAN EXPRESS indicates that twelve men were assigned to capsule #2 in event of abandoning the rig.

Capsule #2 was observed secured to the port side of the rig by the crewmembers until shortly after 1900 hours on 15 April. The doors were closed at that time, and the seas were estimated to be twenty to twenty-five feet. The seas were striking the port side of the rig after 1930 hours.

The Barge Mover, Mr. [redacted] said that capsule #2 was struck by a large wave and was lost from the rig at approximately 2015 hours. The Drilling Foreman aboard the OCEAN EXPRESS contacted the M/V M. L. LEVY which was standing by the port side of the rig approximately one mile away, and informed that vessel of the loss of capsule #2 and directed the vessel to stay with the capsule.

The capsule was observed floating upright with the doors closed on the port side of the rig by several crewmembers of the OCEAN EXPRESS. There was conflicting testimony as to whether the releasing pin and a portion of the lowering cable was attached to the top of the capsule once it was free of the rig.

The operators of the attending tug and supply vessels were unable to detect the capsule on radar due to sea return.

After the sinking of the OCEAN EXPRESS at 2130 hours, the tug GULF KNIGHT, which was towing the rig from the port stern, released its towline and proceeded to capsule #2, thinking there were survivors inside. It was found floating inverted, half submerged. Crewmembers attempted to attach lines to the capsule to right

it but were unsuccessful. They called for assistance from the GULF EXPLORER who went to their aid. The M/V M. L. LEVY also arrived to render assistance in righting the overturned capsule. The M. L. LEVY placed its spotlight on the capsule as the GULF EXPLORER was doing. The GULF EXPLORER succeeded in attaching a line to the capsule but was unable to right it. At about 2200 hours, the M/V NICOLE MARTIN advised the GULF EXPLORER via radio that the capsule #2 was empty. The M/V M. L. LEVY and GULF KNIGHT then proceeded to assist in rescue efforts from the other capsules. The GULF EXPLORER remained with the capsule #2. None of the GULF EXPLORER crewmembers who testified recalled observing a number on that capsule.

Capsule #2 was recovered after it was washed up on a Texas beach approximately five days following the casualty. It was found inverted with the inverted dome extensively damaged. This capsule was transported to Alvin Callendar Naval Air Station, New Orleans, Louisiana, and stowed and examined with capsules #1 and #3.

25. CAPSULE #3:

The OCEAN EXPRESS station bill designated the #2 Driller as in charge of capsule #3. Twenty men entered capsule #3 and were evenly seated within the capsule. For most, it was their first time in a capsule, and they were unfamiliar with its operation. Eighteen men were spaced on the outer perimeter seats and all had their seat belts fastened prior to launching; two men were standing in the center of the capsule. [redacted] Derrickman, in effect designated himself as the driver of the capsule since no one else took the controls. He positioned himself at the aft tiller, opposite the doors. The Rig Mechanic, Claude Williams, and the Driller, [redacted] took charge of lowering the capsule. [redacted] attempted to lower the capsule. He was unsuccessful, so Williams raised himself through the top hatch and pulled the releasing pin on the "dead man" and activated the automatic release to lower the capsule the fifteen to eighteen feet to the water. Williams closed the top hatch as the capsule was lowered away. [redacted] read the instruction manual, which he had never read before. After descending for approximately twelve feet the descent stopped for several seconds, the cause being unknown.

Testimony indicates that Williams started operating switches on the console after several men yelled that the capsule had stopped lowering. Immediately the capsule resumed lowering to the water. The capsule did not strike the rig while lowering nor while it was suspended momentarily at the twelve foot level. Once in the water, Williams operated the releasing ratchet several times with negative results. He then opened the top hatch and attempted to release the capsule by manipulating the releasing gear from the outside handle. He stood on the center column seat below the hatch with Loftin steadying him by holding his hips. The capsule was bobbing in the seas and a spinning motion developed. The capsule struck the starboard hull of the rig heavily on at least three occasions while floating alongside the rig, which was listing to starboard. Seas continued to run at a height of twenty to twenty-five feet. Mr. Williams remained in the top hatch for approximately three minutes. Williams reentered the capsule and informed Mr [redacted] that he was unable to release the capsule from the lowering cable. He then asked the men for a rag to wrap around his bleeding right hand. The

autopsy report of Claude Williams indicated the tip of the right ring finger was missing. Upon hearing the request for a rag, [redacted] removed his life jacket and shirt and gave the shirt to Williams. [redacted] who was under the impression that [redacted] was in charge, was ordered by him ([redacted]) to put his life jacket back on and to keep it on. What Williams did to release the capsule from the cable while outside is unknown. [redacted] then stood on the center seat and reached out of the top hatch in an attempt to free the capsule. When first viewed by [redacted], the lowering cable was slack from the winch to the capsule. There were approximately three turns of the cable with an eye in it around the hook and releasing mechanism. [redacted] first used his hands to try to uncoil the cable from the hook. Failing, he then was handed a small hatchet from the equipment within the capsule by [redacted] beat on the releasing mechanism and the hook and then attempted to chop the lowering cable. He was not able to free the capsule with the hatchet. At this time additional slack appeared in the cable and [redacted] shook the cable and it detached from the releasing mechanism. [redacted] said his efforts took approximately seven minutes. He reentered the capsule and [redacted] and Williams started the motor without difficulty. The capsule then motored away from the rig with [redacted] at the after tiller. He kept the lights of the rig directly astern of the capsule. Williams and [redacted] seated themselves around the center column. All who testified agreed the capsule rode well in the rough seas. The driver, [redacted] stated the capsule maneuvered well in all respects. His only difficulty arose in the inability to see above the seas.

The capsule continued away from the rig for fifteen to twenty minutes with its stern to the seas. During the transit the engine appeared to overheat accompanied by exhaust and diesel fumes which caused headaches and seasickness among several of the crewmembers. The interior fan was turned on but its operation was not satisfactory, and an attempt was made to ventilate the capsule by occasionally opening the top hatch. The interior light was on. There was no noticeable accumulation of water in the capsule's interior at this time.

At approximately four hundred yards from the rig several men saw the lights of a tugboat (GULF VIKING) and warned [redacted] of the impending collision, so he applied right rudder turning the capsule and then noticed the tugboat following them. At this time [redacted] saw the spotlight from the tug and stood in the top hatch. He saw a towline to his right in the water, and the tug was to his left. The tug was headed into the seas while the capsule was still stern to the seas. A capsule occupant, [redacted] stated that the engine of the capsule was killed about fifteen feet from the tug. Several others state that the engine was left running at the time of the capsule's capsizing. [redacted] was then handed the sea painter, a nylon line of 5/8" diameter and about 100' long. This line was passed to [redacted] by [redacted] and [redacted] then tied the capsule's flashing light to the end of this line. The other end of the line was tied to a "pad eye" on the releasing mechanism prior to [redacted] attempt to throw the line to the tug.

In the meantime, CAPT [redacted] of the GULF VIKING proceeded to the capsule when the Barge Mover [redacted] asked the tugs via radio to pick up the men in the capsules. The GULF VIKING was at the port bow area of the heavily listing drill rig when he received the message. It took the GULF VIKING approximately five to six minutes to reach the capsule after leaving the port bow area of the rig. CAPT [redacted] was at the wheelhouse controls of the GULF VIKING when

the tug came alongside the capsule. He circled the capsule, put the stern of the tug to the seas and placed the engines in neutral with the capsule on the port side of the tug. The tug started to broach with the engines in neutral, so the engines were operated with one ahead and one astern. One of the two engines was placed in neutral periodically. CAPT [redacted] states that he never came ahead with the tug while he maneuvered the engines. The crew of the GULF VIKING was on the afterdeck at this time. The Mate, [redacted] was in charge of the afterdeck operations. His crew was [redacted] Able Seaman; [redacted] Engineer; and [redacted] cook.

[redacted] asked [redacted] for a line from the capsule. [redacted] threw the line towards the tug, but it landed short in the water. At this time a large wave came from the stern of the capsule and slammed it into the side of the tug. The capsule was approximately fifteen feet from the tug prior to the collision. The sides of the tug are protected by large rubber tires. This collision was seen by the crew of the tug and felt by the men in the capsule. More than half of the men in the capsule had their seat belts off at this time and were thrown about violently. A sound of cracking fiberglass was heard by several capsule personnel and some stated that water was coming in and was ankle deep. Others did not recall water inside the capsule prior to capsizing. [redacted] lost his footing and fell back into the hatch. He stood back up and retrieved the first line and threw it again. The line and light landed closer to the tug and was fished from the water with a spike pole by [redacted] who gave it to [redacted] led this line to the port bitt on the bulwarks near the after end of the house. The line was passed between the two uprights of the bitt, a half turn (or more) taken around the forward upright and led over the horn (ear) with a half turn. No one instructed him on how to tie the line. [redacted] said the line seemed to be slippery with oil. the capsule was slightly aft of the bitt when the line was secured. The Captain backed the tug, and the capsule came alongside. [redacted] then told [redacted] that he would pass a second line to the capsule from the tug. [redacted] and two crewmembers went to the port bow area of the tug and a line of 1 1/4" nylon 60' long was thrown to [redacted] It took several attempts by [redacted] to reach the line. He retrieved the line when it landed on the side of the capsule. He had two capsule personnel hold his ankles as he reached for the line. The line had an eye spliced in it and [redacted] slipped it over the release hook at the top of the capsule. [redacted] then secured the other end to the forward bitt with two or three figure eight turns and a half hitch. The lines as secured allowed the capsule to move a maximum of five feet off the tug. It took approximately five minutes to get both lines secured.

The main doors of the capsules were facing generally toward the side of the tug. Bush states the capsule's catwalk was generally underwater. [redacted] reentered the capsule after the second line was secured, closing the top hatch behind him.

[redacted] stated that he intended to rig a grab line to the capsule for the men to use to get aboard the tug. This could not be done since [redacted] had reentered the capsule. [redacted] then stepped over the bulwarks onto the tire fenders and grabbed the handrail on the capsule with one hand and hollered at the two men he saw through the windows to come aboard the tug. [redacted] did not feel there was a danger of the capsule capsizing while it was secured alongside the tug. About ten to fifteen seconds after this [redacted] opened the top hatch, stuck out his head and arms and threw off the second line. He did this after a discussion with his

fellow crewmembers. Testimony by [redacted] states that [redacted] and Claude Williams told [redacted] to tell the tug to tow them to shallower and calmer water. [redacted] testimony confirms this statement. [redacted] denies using the words, "tow us" but did say words to that effect, "get us to calmer water." [redacted] indicates the "OK" sign was given to him by [redacted] meaning that [redacted] understood the last verbal communication. [redacted] denies this sign ever took place. At the time, the wind was reported to be 65 m.p.h with 25 foot seas. The loud exhaust noise from the tug hampered verbal communication. The tug crew denies pulling on the first line in unison although [redacted] stated that they did.

When the tug's 1 1/4" line was thrown off, the capsule with sea painter still attached to the releasing hook, immediately drifted aft of the tug. CAPT [redacted] shifted to the stern controls and attempted to maneuver the tug closer to the drifting capsule by reversing the engines. Meanwhile, on the after deck [redacted] was trying to hold the nylon line attached to the capsule. There was a heavy strain on the line and it was jerking as it played out from the bitt on the tug. [redacted] without gloves, was experiencing burning of his hands while attempting to play the line out slowly. No other member of the tug crew aided him in holding the line.

[redacted] and [redacted] testified that [redacted] the operator of the capsule, was backing the capsule with the engine to get away from the tug. [redacted] heard the capsule engine operating until it capsized. [redacted] saw the tug's lights through the windows as they backed away from the tug. He said the tipping motion started before [redacted] was completely inside and before the top hatch was secured. [redacted] was looking out of a window and saw the nylon line coming out of the water and pass the window as the slack was being taken up between the two vessels. He then felt a jerk. He did not see the line go tight, but he felt a jerk at that time. Capsule personnel stated the capsule flipped toward the tug. As the capsule tilted on edge, the men who were not strapped in fell to the low side of the capsule and on top of [redacted] and [redacted] who were seated by the doors.

The only actual eyewitness to the capsizing was CAPT [redacted] He says the capsule was about thirty feet away, was at a crest of a breaking wave and it flipped with the seas. The crew on deck had lost their footing and did not observe the capsule turn over. [redacted] had let go of the line when there was approximately two feet of line left on deck. There is a conflict of testimony concerning the path of the last two feet of line. [redacted] states it went straight over the side with the light attached. [redacted] said the line slid aft on the bulwarks for a distance before going over the side. Once the line was lost, [redacted] looked for the spike pole on deck. It was on the after deck and was picked up by [redacted] who used it to reach for the line with the light attached.

When the capsule flipped, it started taking on water through the doors. [redacted] hollered, "hold the doors tighter." There was a difference of opinion among those testifying as to how fast the water entered the capsule and from what openings, if any. In a short time the capsule filled half full. [redacted] urged all to remain calm and to remove their boots, so as to facilitate swimming. All men still had their life jackets on and some expressed fear which led to praying and crying. Someone wanted to open the doors, others disagreed. An air pocket formed in the top of the inverted capsule. It was very hot and the odor of diesel oil was prevalent. The water seemed to stop once reaching the half full point. Some

of the survivors testified that it seemed that the efforts to right the capsule by the tugboat caused more water to come in. The light remained on for a few minutes after capsizing, and [redacted] noted the top hatch was open and water was coming in. [redacted] felt the water rushing in around his feet from the bottom of the inverted capsule. The men did not immediately attempt to evacuate the capsule since they expected the capsule to be righted by the tug very shortly.

CAPT [redacted] maneuvered the GULF VIKING astern and came alongside the capsized capsule. He was at the stern controls on the after side of the house, eight feet above the main deck on the port side. This control station is covered with a canopy and is just aft of the port stack. He stayed at the stern controls until 0200 on the 16th. He did not direct the rescue efforts. He did not make a lee for the capsule. The stern area of the tug was well lit. There were two searchlights played from the upper wheelhouse to the stern area, two floodlights on the after side of the house shining on the water and one searchlight at the stern controls shining directly on the capsule.

The tug was backed by placing the starboard engine slow astern, the port engine in neutral and rudders amidship. The propellers on the GULF VIKING are not fitted with guards; only a shoe extends from the underbody aft to the propellers. The capsule was approximately ten feet from the tug when the line was retrieved by Engineer [redacted] who made it fast to the stern bitt and attempted to right the capsule. He was aided by [redacted], [redacted] and [redacted] They pulled on the line by hand and the half inch nylon line parted close to where it was still tied off to the releasing hook. [redacted] pulled the line back aboard, made a lasso and placed it around the capsule skirt. The line broke again at the point where the bowline was tied to make the loop for the lasso.

Apparently, the efforts to right the capsule caused the water level to rise in the capsule. The men started to panic. The doors were being held shut by [redacted] and [redacted] at this time. The jerking motion of the capsule caused disorientation of the capsule personnel. One heavy jerk caused the men in the capsule to fall on top of [redacted] and [redacted] who were holding the doors. At this time [redacted] was forced out of the capsule door along with [redacted]x. [redacted] states the capsule was about 3/4 full of water at this time. They floated to the surface and [redacted] grabbed a wooden spike pole extended to him by [redacted] and was pulled to the side of the tug and helped aboard by [redacted] who was standing in the tire fenders. [redacted], still in the water observed another line placed around the skirt of the capsule and the skirt was pulled off. This line was placed around the skirt by [redacted]. [redacted] estimates the time he spent in the inverted capsule at twenty to twenty-five minutes. He was helped aboard the tug by [redacted]. He was covered with oil.

After the first two men came out of the capsule, CAPT [redacted] got on the radio and asked the other vessels to assist with the men in the water. CAPT [redacted] of the GULF KNIGHT responded and picked two persons from the water when he arrived near the scene. These persons were [redacted] and [redacted], the last two men to escape from the capsule. The GULF KNIGHT did not aid in attempts to right the capsule. The M. L. LEVY laid off 150' from the scene. The crew of the GULF VIKING attempted to right the capsule by tying a line to the propeller area of the capsule, but it was cut by the propeller blades.

[redacted] escaped by diving down and out through a hatch with his life jacket on. He surfaced with the capsule between him and the GULF KNIGHT. He was thrown a life jacket on a rope and was pulled to the tug. [redacted] grabbed [redacted] by his life jacket and pulled him aboard the tug. He laid on the deck unconscious. [redacted] dove out an opening without touching the sides while wearing a life jacket. He surfaced and swam towards the capsule. He heard a yell from the tug and grabbed a wooden stick and [redacted] pulled him aboard the tug. It took twelve to fifteen minutes for the GULF VIKING to pick up the five men.

[redacted] a messman aboard a drill rig for two weeks, is eighteen years old and a recent high school graduate from Minnesota. He stated that the top hatch was not secured before the capsule flipped. He is sure the tipping motion started before [redacted] reentered the capsule and before he was seated. He was one of the few that had his seat belt on at the time the capsule capsized. He is sure the engine was running just prior to capsizing since he saw the tug increase its distance from the capsule, and the capsule was backing away from the tug. A second before completely capsizing someone hollered to shut the engine off. The engine was off after capsizing, but the light in the inverted dome remained on for several minutes which allowed him to see the ingress of water through the open top hatch now in the bottom in that the capsule was inverted. [redacted] told everyone the hatch was open and water was coming in. No effort was made to close the hatch. When the lights went out he told the others that he would find the hatch. Air was getting short and it was very hot in the air pocket. He found the hatch with his feet and told the others to leave. One man said "no" so [redacted] went out feet first through the hatch.

26. CAPSULE RECOVERY:

At 2244 hours the Captain of the USS LEXINGTON was requested to render aid, so he changed course and proceeded at a maximum twenty-four knots to the casualty sight. He radioed the M. L. LEVY asking for assistance in retrieving the capsule. At 0238 the Carrier approached the capsule from upwind. The M. L. LEVY used its wheel wash to push it close to the carrier. There were two Navy divers and two Coast Guard divers in the water, deployed from helicopters prior to the arrival of the LEXINGTON. None were familiar with the capsules. One diver sighted open doors on the capsule at about 0330 hours. The Captain of the LEXINGTON was unsure of the location of the sunken drill rig and limited the movement of his vessel in the area. At approximately 0400 a diver attached a line to the releasing mechanism on the capsule and the GULF KNIGHT attempted to right the capsule but the line came off. At 0530 the divers tied a line to a handrail but broke the handrail while attempting to right it. The divers were taken aboard the GULF KNIGHT at this time.

At approximately 0600 a cargo net was rigged to a crane on the deck of the LEXINGTON and was used in an attempt to pick up the capsule. This attempt failed. At 0615 the divers sighted bodies inside the capsule through the open doors. They did not enter due to fear of being trapped within the capsule. At 0942 a cable and shackle were attached to a securing eye on the catwalk of the capsule. The capsule was picked up on its side and hoisted to the deck of the carrier. Four bodies fell out while it was hoisted and were retrieved by the M. L. LEVY. The capsule was dragged by the crane over the edge of the safety nets on the edge of elevator #3. It was found almost full of water with nine bodies.

The M. L. LEVY did not observe any damage done to the capsule by the crew of the LEXINGTON. The M. L. LEVY was several hundred feet from the carrier at the time of the recovery of the capsule.

27. HEROICS:

a. NICOLE MARTIN Rescue:

As capsule #1 proceeded away from the sinking drilling rig, it was sighted by the crew of the survey vessel, NICOLE MARTIN. The Master, [redacted], immediately gave chase and overtook the capsule in a matter of minutes. When the two vessels were approximately 25 feet apart, [redacted] the Mate of the NICOLE MARTIN, fashioned a lasso from a 1 1/2" nylon line and successfully managed to loop it over the releasing mechanism on the top of the capsule and made the bitter end fast to the stern bitt on the starboard side of the vessel. CAPT [redacted] then maneuvered his vessel to the windward side of the capsule and made a lee in the 25 foot seas and 50 knot winds. The NICOLE MARTIN was now lying broadside to the seas and in a trough. The Cook, [redacted], tended this first line and worked the capsule to the midship area where there is a 12 foot opening in the bulwark. This 12 foot section had wooden planks which had been removed. The main deck was close to the waters edge. As the capsule was brought closer to the vessel, [redacted], OFFSHORE HAMMER Foreman, opened the capsule door and threw a 5/8" nylon line from within the capsule to [redacted] aboard the survey vessel. [redacted] then made this line fast to the bulwark and [redacted] secured his end to the guardrail on the upper portion of the capsule immediatley. The capsule repeatedly smashed heavily into the side of the survey vessel and CAPT [redacted] departed the wheelhouse and came down on deck to help in the transfer of the capsule personnel. At this time he saw a man in the door of the capsule and heard him yell, "get away from us." The variation between the deck of the vessel and the doors of the capsule was 8 to 10 feet as they rode the waves side by side. Once CAPT [redacted] was standing by to help the men aboard, the capsule personnel started jumping to the deck of the NICOLE MARTIN. All fourteen men from the capsule were successfully transferred. One man bumped his head on the bulkhead of a deckhouse and was tended to personally by CAPT Conn. Once all the men were safely aboard, and below deck, the Mate released the forward line from the bulwarks and let the capsule drift aft. The 1 1/2" nylon line was still attached to the stern bitt and CAPT [redacted] returned to the wheelhouse. Before he could get under way, his Mate reported that the capsule had filled with water and had slipped free from the noose in the lasso. CAPT [redacted] proceeded toward capsule #3 to render assistance to the GULF VIKING.

b. GULF VIKING Rescue:

Capsule #3 was in an inverted state and the crew of the GULF VIKING had been trying to right the capsule. [redacted], Able Seaman, had passed a line around the flanged skirt and had succeeded only in tearing the skirt from the capsule. CAPT [redacted] maneuvered the vessel with the stern to the seas while his crew tied a 3/4" nylon line to the rudder post of the capsule. This line was quickly cut by the capsule's propeller. Approximately fifteen minutes after the time the capsule flipped, the first survivor managed to exit the capsule through its doors which were forced open by the bodies of the men who were being tossed

around violently during the righting attempts by the crew of the GULF VIKING. [redacted] was the first to float to the surface approximately 25 feet from the capsule. He saw the capsule illuminated in the floodlights from the GULF VIKING and swam to it. Upon reaching the capsule, the crew of the GULF VIKING hollered for him to swim to their vessel, which was now approximately 30 feet from the overturned capsule. [redacted] reached the tug but was too exhausted to climb aboard. The Mate, [redacted] stepped over the bulwarks in one of the large tires of the fenders system. Suspended within the tire, without the aid of a life jacket, [redacted] leaned outboard and grabbed [redacted] by his life jacket and dragged him to the vessel and hoisted him up the bulwarks to the GULF KNIGHT's Chief Engineer, [redacted] who was poised with one leg over the bulwarks, also without a life jacket. [redacted] was then aided over the bulwarks by [redacted] and the Cook [redacted] and laid on deck. Meanwhile, six other men had managed to find their way out of the capsule and were floating in the 25 foot seas. Captain [redacted] maneuvered the GULF VIKING toward the men, stern to the seas. The next man to be rescued was [redacted], Toolpusher of the OCEAN EXPRESS. He was helped aboard in the same manner as [redacted]. The five men remaining in the water were drifting further apart and away from the vessel. At this time, [redacted] removed his life jacket, tied it to a heaving line and threw it to a survivor too weak to swim and pulled him alongside where he was lifted aboard by [redacted] and the rest of the crew.

c. GULF KNIGHT Rescue:

The tug GULF KNIGHT, with one of its two engines still inoperative, approached two of the men in the water. [redacted] Chief Engineer of the GULF KNIGHT, threw a ring buoy with a heaving line attached to [redacted], (a very large man) a welder from the OCEAN EXPRESS, and pulled him alongside the vessel. [redacted] was too weak to board the vessel, so [redacted] climbed over the bulwarks onto the vessel's fender system of tires and lifted [redacted] to the Mate, [redacted], who was leaning over the side to assist [redacted]. [redacted] was hauled aboard where he collapsed on deck. The last man to be rescued was [redacted] [redacted]-years-old, who served as a galley hand for two weeks aboard the OCEAN EXPRESS. He was pulled from the water in the same manner as [redacted].

d. U.S. Coast Guard Rescue:

When the H-52 helicopter #1444 departed Corpus Christi, Texas at 2018 hours on 15 April, LCDR John Marin Lewis was the pilot, ENS [redacted] was copilot and Petty Officer Second Class [redacted] was crewmember and hoist operator. At the helicopter's altitude of 1300 feet, the visibility was about fifteen miles. When they were about twenty miles from the rig, LCDR Lewis asked the Barge Mover to fire another flare as he had not seen the previous ones Mr. [redacted] had indicated that he had fired. LCDR Lewis saw that flare and was guided directly to the rig where he arrived at 2115 hours. At that time there were two capsules in the water alongside the rig and the OCEAN EXPRESS was listing by the starboard after corner with the wind and seas on its port bow and waves breaking over the port bow cascading across the deck towards the starboard quarter. Mr. [redacted] was the only person on board, and he was located at the port, forward quadrant of the helipad. In order to maintain a hover to get the Barge Mover on, it was necessary to approach from downwind; however, the

forward leg of the rig extended more than 100 feet into the air and was downwind of Mr. [redacted] position. In the words of pilot Lewis, here is what happened:

"As I came down I stayed away from those legs which were jacked up maybe a hundred feet and I came in and tried to establish a hover and then to move in to the left and try to take him off of there. I don't really want to get into the problems that I had, but I might as well tell you. The helicopter, when it hovers you have to have a reference, otherwise it could be moving right, left, back or forward, so you have to be able to see something. When I was establishing my hover out here, of course everything in front of us was black, and the water and the sea had no horizon, so I was looking at the rig to try to get a reference, but the rig -- you know, it wasn't straight, it was tilted and the helipad was canted up now to about 25 to 30 degrees I guess, and when I would look at that it would really make me -- a type of vertigo I guess, so I tried to move in over him the first time and it was rather turbulent in there, too, because the winds were still coming up in there and the rig was moving quite a bit and I couldn't hold the helicopter steady enough to effect a hoist.

I don't think I mentioned that I had a crewmember who was about eight feet behind the pilot on the starboard side on the helicopter, and he runs the hoist. From the pilot's seat in our helicopter you can't see what you are hoisting because you have a pontoon out there, and so you have to depend on your crewmember to talk to you, and usually he says come forward, come right, come left, he talks and tells you to hold. I was unable to hold it, although my crewmember, [redacted] was outstanding, real good that night, but I couldn't hold the first time. I got on out here where there was no reference. Then I made an instrument climb back out, came back downwind. I could see the Captain (Barge Mover) standing up there. He was talking to us and trying to direct us in.

So I came around the second time, and about this time our Commanding Officer in the H-52 1429 arrived on scene. He had the Night Sun on his helicopter. We have one big light we use as a searchlight at night and his helicopter had it installed that night rather than mine.

I told him I had been down there and I couldn't do it but I was going to go back and try again. So he came in behind me and shone the light down on the operation to try to illuminate it. The lights were still all on, on the rig at this point, or most of them. It was well lit, but the helicopter pad, I believe some of the blue lights were showing on my first approach, I don't remember seeing them on my second one. At this time I elected, instead of trying this hover to try to come straight over the Barge Mover and the rig now was listing even more and I can tell you almost definitely that it was listing to starboard and slightly aft. And we went in again over the Captain, and on this second approach as long as I had him in sight and some reference I was all right but as soon as I would get to where I had to move out beyond the rig, the only reference I had was to look over at this tower here (Derrick) and it was laying over and moving quite a bit. So I abandoned that approach, but time seemed to be of the essence now, so rather than climbing out I moved over to the side and we moved back, and we had a little discussion, the crew and I, and tried to get a little better organized for this next approach because it looked like the rig was maybe 45 degrees by

this time, and when we were over the port bow the waves that were hitting hard and actually some of the waves and spray were getting up into the helicopter.

I asked the copilot, ENS [redacted] to monitor a 75 foot hover on the radar altimeter and try to keep me as close to that as he could. We went in the third time, and I told [redacted] to just start letting the basket down and to be sure that he had it down on the platform. This is immediately when we got over, because I knew I couldn't stay in there very long, it was too turbulent. I don't want to say that the helicopter was out of control but when I got over there it was blowing so hard and it was so turbulent that it was, just about out of control.

So this time when we came in over it, [redacted] had, I guess, the basket almost all the way down and we were at least at a level where we could come in -- and I got out beyond the place where I had any reference again and thought we had missed him that time. And about this time the copilot told me that we were losing altitude rapidly and I saw the thing coming up underneath us at that time, and I began climbing out, getting above it. We thought we were going down at the time, but in retrospect and since what the Captain told us and looking at this model we believe that the rig was turning at that time and the helipad was actually coming up, and Captain [redacted] was in the basket, [redacted] had gotten the basket close enough to him and the Captain got in, and as I climbed out [redacted] said that the Captain was swinging underneath us in the basket, and I think that was a pretty happy situation."

## PREFACE TO CONCLUSIONS

### 1. CAPSIZING OF THE OCEAN EXPRESS

The Board is apprehensive that despite a careful discourse on the specifics of the OCEAN EXPRESS casualty, that similar casualties will continue to occur. Meaningful corrective action involves recognition of certain limiting inherent characterisitics of self-elevating drilling units and implementing the necessary procedures to keep self-elevating units out of trouble on a class basis.

Self-elevating units, of which the OCEAN EXPRESS was typical, are vulnerable contrivances due to:

a. minimal freeboard

b. potentially destructive legs should the legs fracture in a seaway

c. potentially destructive weights in the form of drilling equipment and supplies on deck, often in such quantities that it becomes almost impossible to secure all items against breaking loose in extreme weather.

The inherently vulnerable self-elevating unit is frequently trusted to a minimal number of tugs of minimal collective horsepower and thrust into a potentially hostile environment, the ocean.

It is the Board's belief that the safety record of the self-elevating units is wanting when compared with other types of vessels or drilling units. This seems to be

confirmed by Management of Mid-Atlantic Offshore Development Risks by Snider, Buffleben, Harrald, Bishop and Card, October 1976; however, the lack of information on the numbers of the various types of drilling units in operation over the time period used for the casualty statistics in the report renders conclusions on the relative safety of one drilling unit type compared to another somewhat inconclusive.

The OCEAN EXPRESS casualty involved a relatively short move (approximately 33 miles) during which time unexpected adverse weather was encountered. The Board notes that the Gulf of Mexico, being one of the more extensively traveled bodies of water in the world, serviced collectively by the most advanced national and private weather services in the world; is still subject to unexpected, unforecast, adverse weather. The Board believes that units such as the OCEAN EXPRESS will continue to be "caught" in transit in adverse weather, particularly if considered in a worldwide sense.

When only the minimum number of tugs of minimal collective horsepower are used, essentially each towing line and vital component of the towing vessel's machinery or control systems become part of a "single" component system. The loss of anything be it a towline, an engine, a rudder, a clutch, etc., carries with it the probability that directional control of the drilling unit will be lost with the attendant dire consequences.

Two approaches appear to present themselves for consideration:

(1) Implement design changes to self-elevating units with in-transit safety in mind.

(2) Take steps to assure directional control of self-elevating units will be maintained by towing vessels in adverse weather.

Although some minor design changes can be implemented with in-transit safety in mind, this alternative essentially is not practical. The major characteristics which result in vulnerability when a self-elevating unit is waterborne are essentially dictated by the primary purpose of the vessel; i. e. drilling holes in a "jacked up" configuration. Therefore, alternative (2) above appears to offer the most practical hope for improving the in-transit safety for self-elevating units. The number of towing vessels, horsepower, and towing configuration including the use of bridles vs. single tow lines are all factors which render any given arrangement the ability to suffer at least one casualty in adverse weather without dire consequences.

It is clear the casualty record of self-elevating units tends to show that neither the influence of underwriters nor the policies of drilling companies or persons-in-charge of moving operations have provided the necessary consistent safeguards to avoid a continuing series of casualties. Therefore, the Board concludes that a mandatory system of specifically approved towing plans which prescribe numbers and horsepower of towing vessels and towing configuration, delineating specific actions in worsening weather, is necessary. Such a concept goes far beyond what is presently contained in the American Bureau of Shipping Rules for Classing Offshore Mobile Drilling Units and the rules contemplated by the U. S. Coast Guard for self-elevating units.

## 2. CONCEPT OF A FIELD MOVE

Section 4.5.1(c) of the ABS Rules defines a "field move" as one that would require no more than a 12 hour voyage to a location where the unit could be jacked up or to a protected location. The concept of field and ocean moves provides a means to specify the appropriate degree of preparedness. In the case of the OCEAN EXPRESS, removal of a portion of the legs, a tighter degree of closure and mat position were stipulated incident to an ocean move.

Presumably, the 12 hour limitation is related to the diminishing accuracy of weather forecasting with increasing time spans. Normally weather can be reasonably accurately predicted for a 12 hour period, therefore a drilling unit not configured for an ocean move can get jacked up or get to shelter before a storm hits.

Testimony from both operators and the ABS reflected some confusion on the concept of a field move. The Barge Mover indicated there was nothing unusual about commencing a voyage even though weather conditions were expected to worsen to the point that the OCEAN EXPRESS could not go on bottom and jack up, as long as the anticipated conditions were something short of the conditions requiring preparations for an ocean move. Various questions arise, such as:

a. If conditions worsen, is the Barge Mover suppose to go on bottom while he still can, even though he may believe his unit is not in danger and may have a forecast that the weather will improve again in a short while?

b. If the Barge Mover receives a weather forecast of deteriorating weather in 12 hours, is he supposed to go on bottom right then because technically he will be longer than 12 hours away from being able to go on bottom if the weather worsens as predicted?

c. If the Barge Mover finds himself in weather too poor to go on bottom and jack up and the poor weather is expected to last over 12 hours, is the unit technically on an ocean move?

d. If in (c) above, the unit is not configured for an ocean move, is the unit not in class?

The essence of the field move appears to be to go on bottom and jack up or get to a protected location prior to encountering weather which would prevent going on bottom. Neither the Barge Mover's nor ABS testimony gave a clear indication that there was anything wrong with continuing a voyage as in (a) above. This of course leads to the distinct possibility that the weather may continue to worsen rather than improve, as expected, to the point of danger to the unit, which is exactly what happened in the OCEAN EXPRESS.

The Board finds this interpretation of the field move concept as unacceptable, both in terms of what happened to the OCEAN EXPRESS and also recognizing that the science of weather forecasting is inexact to the point that it can be said with certainty that the weather will not be as predicted fairly frequently. This is particularly true at sea where observation stations and other means for gathering

raw data needed for accurate predictions are relatively few compared to populated land areas.

## 3. SUPERVISORY RELATIONSHIPS

The functional relationships between supervisory personnel on board the OCEAN EXPRESS were no doubt typical of the relationships between supervisory personnel on most self-elevating units which might be engaged in a similar operation; i. e. moving from one block to another in the Gulf of Mexico. These relationships are best characterized as being relatively informal with on-scene oil field personnel physically performing most of the duties connected with moving the unit.

The Barge Mover, an individual possessing special knowledge of the drilling unit and hopefully the marine disciplines which might be needed in connection with the move, is placed on board the unit for the move. He is a representative of drilling company management. He is by reason of his special knowledge and experience considered to be the man in overall charge of the move. He accomplishes little in the way of direct labor himself or direct supervision of persons on board in that his directions are normally carried out through the Toolpusher.

In the instant case, Mr. [redacted] was an experienced long term employee of ODECO. He was well known to both ODECO and Gulf Mississippi Marine personnel. As nearly as can be ascertained from testimony offered into evidence, Mr. [redacted] enjoys a good reputation and is capable of presenting himself well. In essense, he had as much "going for him" as could have been expected of any Barge Mover.

Yet, the record is replete with instances of personnel on board the OCEAN EXPRESS questioning his judgement during the 24 hour period prior to the casualty and undirected individual acts in regard to initiating distress calls, sounding the alarm, and taking steps toward abandonment. With the vision of hindsight, it appears fortuitous that various persons took advance actions without waiting for instructions from Mr. [redacted]. In fact, Mr. [redacted] in all likelihood owes his life to the action Mr. [redacted] took in initiating a call to the Coast Guard. It is not difficult to perceive however, that under most circumstances, either a lack of leadership or an unwillingness on the part of a "crew" to be led, could have disastrous results. Therefore, while recognizing the fortuitous results of some of the advance actions of certain individuals associated with the loss of the OCEAN EXPRESS, the Board feels it appropriate to comment further on the very real possibility of disastrous results in cases where the person in charge does not, or cannot obtain the cooperation of all on board in a coordinated effort to save the vessel, thus avoiding the dangers of having to abandon under adverse conditions.

Effective leadership normally does not evolve "by definition." In other words, real leadership in crisis situations usually gravitates to the capable, "natural" leader, regardless of "paper" designations. It is the Board's opinion that no amount of written standing instructions or formal declarations relative to Mr. [redacted] position as the person in charge (the master) would have increased his actual control of the situation. It is an artificial relationship leadershipwise,

to expect ODECO personnel to initially look to anyone other than the Toolpusher for leadership. They know him, he is the recognized "boss" and it is completely natural for the "crew" to look to their "work-a-day" leader for direction in a crisis situation. The situation was further complicated on the OCEAN EXPRESS as certain persons employed by Marathon Oil Company were on board, and it was natural for them to look to the Drilling Foreman, Mr. [redacted] for direction.

For a "chain of command" to operate under these circumstances, both the Toolpusher and Drilling Foreman would have had to make a conscious decision to defer to the Barge Mover, and make this known to the men under them. Without overt cooperative actions and statements such as "Mr. [redacted] is in charge, we do what he says," the chain of command could not function as far as the crew was concerned. The actual happenings on the OCEAN EXPRESS confirm this. Mr. [redacted] enjoying as much stature as a Barge Mover could be expected to enjoy, did not control the actions of individuals on the OCEAN EXPRESS.

It is the Board's opinion that it cannot be expected that Toolpushers or Drilling Foremen will be the type of individuals who would avoid leadership roles or who would automatically suscribe to the "chain of command" concept in a crisis situation. It is much more likely that crisis situations on drilling units will produce the simultaneous exercise of leadership in some form on the part of most persons in supervisory capacities and perhaps on the part of several other less bashful oil field personnel who never heard of the "chain of command." This abundance of leadership is, however, as dangerous as the lack of leadership.

The Board's solution to this dilemma is simple; vest the leadership responsibilities in the one man who is also the "natural" leader, the Toolpusher. Clearly define the Barge Mover's role as one of advisor. Station bills and drills should emphasize that the Toolpusher is "the man." In most situations it would also be more "natural" for employees of other than the drilling company to look to the Toolpusher for leadership rather than the Barge Mover, who is less known and only on board for short periods.

Clearly this solution places greater demands on the Toolpusher, both as to the type of individual selected for this position and the knowledge and experience he must possess in the industrial and marine sense. A major desirable end result should be, however, an undisputed person-in-charge who will know his responsibilities.

It should also be clear as to who the "number two" man is. In the event the Toolpusher becomes incapacitated or he fails to exercise his authority, it should be clear to the "crew" who is next in line.

## 4. ROLE OF THE BARGE MOVER

The Barge Mover employed on the OCEAN EXPRESS at the time of the casualty was well experienced, having been employed by ODECO Inc. in charge of moving operation since 1968 and employed as an assistant engineer with another company involved with offshore equipment for some three years prior to joining ODECO. With this level of experience and as indicated by the Barge Mover's testimony,

there is no doubt the Barge Mover should have been familiar with the factors which go to make up a successful move of a drilling unit including the responsibilities and interrelationship of all persons and companies involved. It is possible that the Barge Mover may not have considered that he had full authority over all the matters identified below; however, in that the Barge Mover is presumed in overall charge, he must take the responsibility for all occurrences which bear on the operational safety of the unit.

The Barge Mover exhibited a lack of knowledge concerning specific aspects of the OCEAN EXPRESS.

a. The Barge Mover was unsure of the operation of the anchor gear in that he apparently accepted the opinion of the Toolpusher that the anchor might fall on the mat.

b. The Barge Mover did not have knowledge of the most favorable mat position to minimize leg stresses or knowledge of what additional stability calculations might be necessary for afloat conditions other than normal moving conditions, nor was it provided. There is no evidence that leg stresses were a factor in this casualty; however, this does not excuse the Barge Mover for his apparent lack of knowledge in this area, possibly a very important item in certain sea states with the mat full up. Had the Barge Mover had a knowledge of the effect of mat position on stability, he may have chosen to reposition the mat after the abortive attempt to go on bottom on the night of 14 April.

c. The Barge Mover had no knowledge of the limitations of the locking devices which held the derrick and substructure in place, nor was this information readily available to him. The Board feels the Barge Mover should have had a general knowledge of the design limitations of the unit and its significant components. The limitations of the derrick and substructure securing devices would seem to fall in this category.

d. The Barge Mover lacked knowledge of the number and location of the so called "equalizing" valves. As emphasized in the Operating Booklet, it is important that the interconnected tanks be isolated to prevent unwanted shifts of liquids during the move. The Board feels such an important item requires the personal attention of the Barge Mover if not by actual physical check, certainly through specific knowledge of the number and location of the valves so as to be able to judge whether the man sent to close the valves in fact knew the systems well enough to locate and close the proper valves. The Board notes that several valves are involved, and a knowledgeable person is required to insure all the proper valves are closed. The Board also notes the Barge Mover's assumption was that only one valve was involved.

e. The Barge Mover testified as to his lack of knowledge of inherent limitations of the OCEAN EXPRESS, specifically in regard to mat positions related to possible critical stresses in the legs due to unit motions, in regard to stability characteristics in other than normal moving conditions and in regard to the design limitations on the derrick and substructure locking devices. He accurately points out that there is no guidance information on how to prepare for a storm while in transit in the Operating Booklet. He also testified that jacking up outside of the limitations of the manual is not a decision that you take on your own, that he would

have consulted his office. It is apparent to the Board the Barge Mover lacked the essential information on which to base a judgment of what weather conditions and unit motions posed a real hazard to his unit. Presumably this information would be forthcoming from "the office," a situation the Board finds unacceptable in the extreme, and in the Board's judgment, most hazardous.

f. The Barge Mover further exhibited a lack of caution or concern about several factors involving the safety of the OCEAN EXPRESS. Specifically:

(1) It is difficult for the Board to understand the Barge Mover's reactions to the observed weather and weather information available to him. The Barge Mover's testimony gave evidence of a good understanding of weather systems. His experience includes experience with both aircraft and vessels, both vulnerable to the vagaries of weather phenomenon. By the Barge Mover's own testimony, the seas had picked up to 10 to 12 feet by 1400 on the afternoon of 15 April. By this time there was weather information available through the Marathon radio and their private weather service projecting worsening conditions. The observed conditions were such that precautionary measures for heavy weather should have at least been considered, and a plan of action formulated. There is evidence that certain weather information was transmitted to the OCEAN EXPRESS relative to worsening conditons by means of the Marathon radio during the morning of 15 April. Although perhaps not forcefully offered, both the Toolpusher and Marathon Drilling foreman expressed concern about the weather forecast to the Barge Mover. The Barge Mover's testimony that he felt justified in relying solely on the NWS forecast received by means of the VHF tapes is not understood in the light of the counter-trends both observed and as evidenced by the forecast information provided by Marathon. It is of note that at 1400 on the 15th the private weather service offered an update indicating maximum seas of 18 feet, up from 15 feet from the 0600 forecast. Presumably this updated information would have been provided if sought, and in fact there is evidence that certain of the information was provided to the OCEAN EXPRESS at the time of the Marathon evening reports on 15 April.

(2) In view of the available weather information, the personal concern expressed by other responsible personnel on the unit and the observable worsening conditions, it is felt the Barge Mover failed to take proper precautions on the afternoon of 15 April for the approaching evening and night hours. The risk associated with possible weights becoming adrift should have caused the Barge Mover to reposition the tugs while sea conditions permitted, and by daylight, to give the best chance of controlling the drilling unit in the event of casualty to a towing vessel. If there was question as to the capability of two tugs to control the unit in the worsening weather conditions, an extra tug should have been ordered. This action seemed of utmost importance when the Barge Mover became aware of the loss of one engine of the GULF KNIGHT, in the afternoon of 15 April. The Barge Mover's reaction, i.e., to offer to let the GULF KNIGHT return to port with no relief tug under the existing conditions was particularly imprudent. The Master of the GULF KNIGHT very properly indicated he would remain on scene until relieved in order to provide what help he could with his remaining engine.

(3) The Barge Mover should have positioned the mat to minimize motions consistent with leg stress and stability considerations. As discussed elsewhere

in this report, pertinent information was lacking in the Operating Booklet and the Barge Mover also lacked knowledge in these areas.

(4) The Barge Mover at one point in his testimony offered that he was considering a 5 1/2 foot sea limitation as governing, because of the water depth being so close to 200 feet at Block A 57. Later the Barge Mover corrected his previous testimony and indicated the 7 foot limitation associated in going on bottom in less than 200 feet of water applied. On this very important safety consideration, it is difficult for the Board to understand why the Barge Mover's testimony vacillates after the casualty. If the 5 1/2 foot sea limitation applies, he was not exercising proper caution in starting to go on bottom on the night of 14 April when the seas were running from 5 to 7 feet according to his own testimony. If the 7 foot limitation applied, the Barge Mover did show caution in this instance by not trying to go on bottom in marginal conditions.

(5) It is noted the Barge Mover indicated the three towing vessels in attendance of the OCEAN EXPRESS, in his judgment, were the minimum acceptable for going on location. The 3600 HP tug was necessary for pulling on one corner. He further indicated three 2,400 HP towing vessels would be sufficient for towing alone. The towing aspects of this casualty are discussed separately in this report; however, it is clear from the Barge Mover's testimony that having an "ace in the hole" to make up for the unexpected loss of a towing vessel, was not a significant factor in the Barge Mover's mind when discussing the adequacy of towing equipment. As reflected elsewhere in this report, the Board considers the lack of attention to the vulnerability of self-elevating units due to towing vessels becoming disabled or a tow line parting as a most serious aspect of this casualty.

(6) The Barge Mover exhibited lack of caution in three additional aspects of this casualty. To allow additional persons to be brought on board the OCEAN EXPRESS during the morning of 15 April violates a stated industry policy as reflected in the Manual of Safe Practices in Offshore Operations dated 23 November 1967. The Manual states "During raising, lowering and moving operations only those persons should be on the mobile unit who are necessary for the conduct of these operations, or whose presence has been authorized by the Supervisor." Clearly if this practice had been followed, none of the employees of Offshore Hammers would have been lost.

(7) The Barge Mover's choice to leave the derrick in an aft position is noted as being at variance with the sample load calculation for the moving condition contained in the Operating Booklet. While there is nothing in the Booklet expressly prohibiting leaving the derrick in an aft position for moving, it is clear that additional ballast forward is necessary to compensate for the aft moment created by the derrick being in an aft position. This results in having to use salt water for other ballast needs, less freeboard and less reserve stability. This decision, coupled with the Barge Mover's reliance on a calculated freeboard, apparently not confirmed by actual observation during the voyage, portrays a certain casualness on the part of the Barge Mover.

(8) The Barge Mover's choice of leaving the mat lowered to 148 feet, within five miles of a possible grounding location, in worsening weather conditions, with minimal towing vessels in attendance also represents a lack of caution and poor

judgment in the absence of any stability or structural related reasons for doing so. After loss of control of the OCEAN EXPRESS, it took the unit less than two hours to drift in danger of grounding.

5. SURVIVAL CAPSULE

Testimony indicates a possible misjudgment on the part of the representatives of the Coast Guard involved in the approval of the capsule. As a general principle, it cannot be assumed that a specification pertaining to one type of device is sufficient to judge all devices even though designed for the same purpose. This is particularly true in a transportation sense, as comparing an open lifeboat with a survival capsule is somewhat akin to comparing an airplane with a helicopter.

Crewmembers, and to a large extent even passengers, on sea going vessels have some concept that it is necessary to exercise seamanship in handling an open lifeboat to keep from broaching and possible capsize in a seaway. Further, it is intuitively obvious what one does to extricate himself from an open lifeboat if he is unfortunate enough to find himself in an overturned lifeboat. This is not the case with the survival capsule. The round shape tends to lessen the apparent need for the exercise of seamanship. It is not intuitively obvious what to do should the capsule become inverted.

Woven through the sales and training literature published by the Whittaker Corporation is a claim of "impossible" to capsize. Coast Guard approval automatically strengthens sales claims made by the manufacturer. Yet neither the manufacturer nor the Coast Guard saw fit to sponsor meaningful seaworthiness evaluations which related to the capsule's ability to remain upright in varying sea states or what the options were to the occupants should the capsule capsize. A high degree of initial stability or stability inherent to a certain hull form does not give assurance that a device will not capsize no matter what the sea state. The Whittaker Corporation clearly had a duty to make appropriate investigations prior to claiming the capsules were fully seaworthy or impossible to capsize.

6. WEATHER

The Barge Mover of the OCEAN EXPRESS has made it clear his primary source of information was the VHF weather information broadcast on a continuous basis through the facilities of the NWS. Mr. [redacted] was not suspicious about the latest weather because the United States Government always gave the best information and they (NWS) would advise of any perilous weather. He said if severe weather is anticipated the VHF stations will include such information in their broadcast.

The NWS has made the following clear:

a. Forecasts are a product of computer produced information issued regularly from the National Meteorological Center at Suitland, Maryland, and local input such as data gathered from regional National Weather Service offices, military installations, and offshore observation reports.

b. There is a deficiency in the number of observation stations which affects the NWS forecasting ability.

c. The experience of the individual Meteorologist-In-Charge (MIC) bears on the quality of any given forecast.

d. The state of the art in the use of such information as provided by satellite photographs is still under development.

e. The NWS position is that:

(1) They are not staffed for and do not advertise weather services for the specialized needs of the marine industry.

(2) Their offshore forecasts are generalized in nature and oriented to the boating public.

(3) They encourage the use of private meteorological services for specialized industry needs.

f. There are no radio frequencies or telephone lines specifically set aside for marine users who might wish a personal contact with a weather forecaster.

g. During working hours, a marine user could call the National Weather Service on the same basis as the general public; however, the National Weather Service's ability to handle phone call inquiries is severely limited, both by the number of telephone lines available and the availability of personnel to handle incoming calls.

There is a direct conflict in what the National Weather Service perceives as to the level of service they are offering and what was understood to be offered by ODECO and the Master of the OCEAN EXPRESS. Indeed, a continuous weather forecast which speaks to offshore areas within 50 miles of the coast, specifically including information on offshore winds and sea conditions, implies that the National Weather Service is, in fact, offering competent marine forecasts. It could be further assumed that if the NWS believed they were not offering a useful service to marine users in general that there would be some widely publicized exceptions to their service. This would be particularly true if the NWS realized their service was significantly inferior to private weather services for certain uses.

The Board notes that by comparison, the specialized forecasting services offered the aviation community by NWS, available to the recreational private pilot as well as airline transport pilots, far exceeds the services offered the marine community. The NWS considers this a specialized service with a "retail" outlet through the Federal Aviation Administration's Flight Service Station system. Nevertheless, the total system is Federally sponsored by tax dollars. Even a private pilot can call weather briefers at a flight service station by special use telephone numbers, or call flight service stations by means of specially designated radio frequencies, and receive forecasts over his route of flight, at any time day or night. Hourly sequence reports from a network of various reporting stations are immediately available by teletype for the briefers to use. This is backed up by a well established

system of pilot reports, both voluntary and mandatory in the case of pilots on instrument flight rules encountering unforecast severe weather. Such items as locations of fronts, likelihood and locations of thunderstorm activity, winds at specified altitudes, turbulence, ceiling information and cloud layers, icing levels, temperature, dew points, visibility information, radar observations and automatic inclusion of significant pilot reports are included. The Board further notes that there is an established system of issuing AIRMETs and SIGMETs, which recognizes there is a differing level of weather severity which should be called to the attention of smaller aircraft versus phenomena which is also applicable to larger aircraft capable of greater safety in more adverse weather. While there is an analogy in the marine forecast system to the SIGMET in the form of small craft warnings, there is no direct analogy to the AIRMET, in the marine weather service system.

It is not within the Board's province to provide a detailed analysis on the need for expanded marine forecasting service as the assessment of where the resources of finite budgets are placed must consider the dangers posed to property and life on land, sea and in the air in a comprehensive manner. It is of significant interest to the Board, however, to note that the owners of the OCEAN EXPRESS and the Master of the OCEAN EXPRESS were relying on NWS forecasts, an unfortunate circumstance in light of the NWS's testimony concerning the limitations of their service and that their service cannot provide for the specialized needs of the marine industry. The Board further points out that NWS's emphasis on weather forecast aimed more at the boating public, its emphasis on the immediate 12-hour period vs the longer 36-hour or 48-hour period, its misgivings on the sufficiency of their forecast system for marine industry users who might have a need for weather information in a localized area over a protracted period, are all factors not made clear to potential marine users. In short, the visible products of the NWS, including the continuous taped marine forecasts imply more service to the various marine users than the NWS intends or is able to deliver.

Concerning the differences between the NWS and private forecasts for 15 April, the Board feels that although there may be room for debate between professional meteorologists on the proper prognosis based on the data available to the MIC for the 15th of April, the professional competence of the MIC is not in question, nor are there indications of irresponsibility involved in the preparation of the pertinent forecasts.

There is a further inconsistency which the Board finds troublesome. Seas are known to be a product of the duration of the disturbing force (usually wind), the depth of water, and the bottom gradient. There is no indication given in the marine forecast of whether the sea states predicated are an average over the geographical area covered by the forecast, the maximum expected anywhere in the area, or represent sea states expected at the 50 mile seaward limit of the forecast area. This is a different question than that of the localized effect on seas by isolated squalls or thunderstorms. The Board recognizes forecasts can only speak in a general way to the likelihood of highly localized disturbances and their effects; however, it does appear more definition as to the nature of the sea state forecast is in order, particularly if the welfare of the boating public is primary.

## CONCLUSIONS

1. The capsizing of the OCEAN EXPRESS resulted from a series of events. The primary cause in the opinion of the Board was the loss of directional control of the OCEAN EXPRESS resulting from the breaking of the GULF VIKING's towline and the loss of the GULF KNIGHT's engine at a time when the weather conditions were worsening. Additional factors are identified throughout the report and are dealt with separately in the Conclusions and Recommendations of this report.

2. All thirteen deaths listed in paragraph 5a of the Findings resulted from accidental drowning while trapped in capsule #3 and are the result of this casualty.

3. The six injuries listed in paragraph 5b of the Findings are the result of this casualty.

4. A piece of metal, apparently a bolt from the cracked housing of the clutch gears, fell into the gears and rendered the starboard clutch inoperative thereby reducing the power of the GULF KNIGHT by half. The reason that the housing cracked is unknown. The Board has been unable to establish any causative relationship between the excessive oil consumption in the starboard gear and this casualty. However, the Board considers it to be very poor engineering practice to continue to run the equipment in this condition without determining the cause of the continuous need for the addition of lube oil and taking corrective action. The Board also notes that the general maintenance of navigational equipment aboard all three tugs was relatively poor.

5. The towline of the GULF VIKING was apparently in good condition and sized adequately for the intended tow of the OCEAN EXPRESS on the relatively short (33 mile) field move, utilizing three tugs. The Board concludes that the parting of the line was due to additional strain caused by the heavy seas in combination with the loss of towing power of the GULF KNIGHT.

6. The efforts to secure another towline between the GULF VIKING and OCEAN EXPRESS were extremely unprofessional. Communications between the tug and rig were lacking. The Barge Mover and Tug Master should have remained in frequent communication and consultation until another line had been established between the two vessels. Apparently neither was aware of the gravity of the situation and the consequences of their failure to reestablish the towline, at that time.

7. If the towline had been reconnected between the GULF VIKING and the OCEAN EXPRESS and directional control of the OCEAN EXPRESS regained, it is believed that this casualty may have been avoided. This failure is a significant causative factor in this accident.

8. A line throwing apparatus may have been useful in the attempts to reconnect the towline from the GULF VIKING. A line throwing apparatus would also be useful in placing a messenger line aboard a tug for the purpose of picking up a prerigged insurance towing line.

9. The triangular areas in the port and starboard bow of the OCEAN EXPRESS are too confined to be suitable areas for attaching the heavy towlines required by this rig. In even moderate weather at sea it is doubtful that sufficient personnel could work adequately in this area to receive a towline without fear of injury. The area is also too close to the water to provide protection from adverse seas and weather. It is concluded that the design of these areas is poor.

10. The GULF EXPLORER, having the most power of the three tugs, was not utilized to the fullest advantage. It is believed that the Barge Mover should have repositioned the GULF EXPLORER to the bow of the OCEAN EXPRESS when it became apparent that jacking operations were indefinitely delayed. Daybreak on the morning of 15 April was probably the best time to shift the GULF EXPLORER. Also the Master of the GULF EXPLORER should have more firmly urged the Barge Mover to do this.

11. The practice of communications in French between the tug Masters is not considered in the best interest of safety.

12. It would appear that the exemption in 46 U.S.C. 405 of licensed operators on Mineral and Oil tugs is imprudent. From this investigation, it can be readily seen that a tug towing a rig such as the OCEAN EXPRESS must be ready and capable to respond to circumstances not normally encountered in other towing activities. While it is not suggested as causative to the casualty, the fact that the Mate of the GULF VIKING was not licensed is a matter of concern. It would seem that personnel fully in charge of a watch under these conditions should be required to know more than, not less than, other tug watchstanders who are required to be licensed by statute.

13. While the 1 1/2 hours required to break suction was longer than normal, nothing significant can be implied to this casualty.

14. The events occurring on the OCEAN EXPRESS during the afternoon and evening of 15 April, prior to the capsize, reveal the Barge Mover did not exercise control over the crew of the OCEAN EXPRESS. While the Board recognizes the fortuitous aspects associated with the undirected actions on the part of certain individuals in the instance of this particular casualty, the Board feels that in general, the inability of the person in charge to control those under him is a hazardous situation.

15. Although not required on the rig, flares were useful in guiding the Coast Guard rescue helicopter to the OCEAN EXPRESS.

16. It is unknown whether the anchor would have helped this situation, it certainly would not have hurt. Mr. [redacted] should have carried through with the wishes of Mr. [redacted] if it was possible to anchor and reported back to him when it was accomplished. It is concluded that the anchor would not have fallen on the mat. It is believed that the anchor could have been dropped regardless of available power and could have been useful in heading the rig up into the wind and sea.

17. The capsize of the OCEAN EXPRESS was aided by the combined effects of partial flooding, mat position, shifting of on-deck weight, undetected weight, boarding seas, towing forces and grounding.

18. In the absence of improved weather conditions and reboarding to control flooding, it is probable the OCEAN EXPRESS would have capsized or foundered at some later time, irrespective of grounding.

19. The OCEAN EXPRESS, with its low freeboard, was placed in jeopardy when the towing vessels were no longer able to provide directional control, allowing the unit to drift broadside to the seas. This was due to the effect of boarding seas partially submerging the OCEAN EXPRESS and because of the potential for damage to structure and deck fittings posed by on-deck drilling supplies shifting or becoming unsecured.

20. Movable on-deck weights consisting of drilling supplies, equipment and the derrick were not adequately secured to withstand the forces resulting from loss of control of the unit in a seaway.

21. It cannot be positively determined whether there was a failure of the locking devices or a personnel error in not properly engaging the locking devices which allowed the derrick to slide. The Board feels the design of the locking devices was adequate and concludes the possibility of the derrick not having been secured in place by the locking devices exists.

22. It is probable the OCEAN EXPRESS possessed sufficient intact stability to have withstood the wind and seas of 15 April 1976 while drifting, had the unit been operated within the constraints assumed in the intact stability review performed by the American Bureau of Shipping and the U. S. Coast Guard. Among the constraints assumed were no flooding, no shifting of weights and a two foot mat separation.

23. The intact stability criterion employed by the American Bureau of Shipping and the U. S. Coast Guard does not adequately reflect the adverse effects of such occurrences as the mat being lowered, loss of freeboard or shifting weight on the capability of the OCEAN EXPRESS to survive storm conditions. This is due to the criterion calling for the comparison of righting and heeling energies only to the point of downflooding.

24. The damaged stability criterion employed by the American Bureau of Shipping omits allowances for sea dynamics and other real-life factors which places the usefulness of the criterion in question.

25. Both intact and damaged stability studies should have been performed in the case of the OCEAN EXPRESS for other than two foot mat separation to provide further operating guidance.

26. The potential for damage affecting the watertight integrity of self-elevating drilling units, as well as other types of drilling units, is such that the U. S. Coast Guard should develop and adopt a damaged stability standard.

27. There are inconsistencies on the part of ABS representatives and OCEAN EXPRESS operating personnel on the concepts embodied in the terms "field move" and "short move" found in the American Bureau of Shipping Rules for Building and Classing Offshore Drilling Units, 1973 edition, and the Information and Operating Instruction Book, Mobile Drilling Platform "OCEAN EXPRESS."

28. Although a load line was assigned the OCEAN EXPRESS, the Coast Guard's current policy of considering load line assignment optional for self-elevating units is inconsistent with existing law.

29. The need for a comprehensive list of items to be included in an operating booklet, in more detail than is provided in the ABS Rules is apparent. The list should reflect the need for information based on operating experience with self-elevating units in general. The OCEAN EXPRESS casualty revealed the need for additional information in the operating booklet in several areas as indicated in the Recommendation Section of this report.

30. The capsizing of capsule #3 is attributed to wave action and shift of weights when persons not using seat belts fell to the low side. There was conflicting evidence as to whether a 5/8" nylon line between capsule #3 and the GULF VIKING was in fact attached and made fast to the GULF VIKING at the moment of capsize. The Board was not able to resolve this issue but does conclude the capsule could have capsized even if the line was not made fast and did not exert a capsizing force at the moment of overturning.

31. Training and drills pertaining to abandonment of the OCEAN EXPRESS and the use of lifesaving appliances and equipment were inadequate. This resulted in the crew being unfamiliar with the operation of lifesaving equipment, emergency procedures and a lack of knowledge as to the availability of certain emergency equipment within the capsule.

32. Lack of knowledge, training and discipline reduced the likelihood of an orderly evacuation of capsule #3 while alongside the GULF VIKING.

33. The owner, ODECO, INC. who had the primary responsibility for the training of the crew and safety of other persons on the OCEAN EXPRESS such as subcontractors and visitors, did not provide a sufficient level of training or indoctrination.

34. The Whittaker Corporation and the U. S. Coast Guard should have anticipated that users of survival capsules would attempt towing operations and that the need might arise to secure a survival capsule alongside a rescue vessel. The absence of suitable fittings on the capsules and instructions setting forth correct procedures, and in particular a warning not to tow from the top of the capsule created a potential hazard in the conduct of such operations.

35. The Whittaker Corporation had a duty to make appropriate investigations prior to claiming the capsules were fully seaworthy or impossible to capsize.

36. The Coast Guard had a responsibility to evaluate the features of survival capsules, which were unlike the open lifeboat, in their approval process: and to require such instructions, warning placards, equipage, design evaluation and safety features as necessary to eliminate unsafe features. Assuring compliance with Specification 160.035 was not sufficient due to the dissimilarity between open lifeboats and survival capsules.

37. The Board is unable to determine how capsule #2 entered the water, became damaged or under what circumstances the capsule capsized.

38. It is concluded that wave action capsized the partially flooded capsule #1 after it was released from the NICOLE MARTIN. Partial flooding resulting from seas washing into the open doors would have reduced the capsule's ability to remain upright.

39. The engines of Numbers 1 and 3 survival capsules, while exhibiting symptoms which could easily be associated with overheating, did not overheat.

40. The Whittaker Survival Capsules remain an effective means of escape and survival for use on offshore drilling units and platforms.

41. The general grouping of survival capsules into the category of lifeboats is not considered a good practice for the U. S. Coast Guard to follow. These capsules differ sufficiently from lifeboats to necessitate special consideration.

42. The lack of a self-righting feature or an adequate means to escape from capsule #3 in the inverted position contributed to the loss of life.

43. Difficulty in releasing capsule #3 from its lowering cable is attributed to three factors:

a. Persons within the capsule were unfamiliar with the ratchet releasing mechanism.

b. Instructions on how to release the capsule were not sufficiently clear.

c. The excess of cable which formed several turns around the releasing hook mechanism would have accounted for a lack of tension on the hook, which is required to have the cable automatically swing free.

44. The scope of the weather services offered the marine users by the NWS is not adequately publicized.

45. There is an apparent need for increasing the scope of weather services for marine users.

46. There is an apparent lack of weather observation stations in the Gulf of Mexico.

47. Differences between NWS and private forecasts for the 14-15 April time period, while reflecting a lesser accuracy on the part of the NWS, do not apparently extend to questions of professional competency or irresponsibility on the part of NWS personnel. The forthcoming analysis of weather forecasts being conducted by the NWS should provide additional information regarding this conclusion.

48. On the morning of 14 April, the existing weather conditions and the weather forecasts available to the Barge Mover were within the acceptable limits of the operating manual and favorable for the move.

49. The Barge Mover and Tug Masters did not aggressively obtain, evaluate and use weather information available from the NWS, private, and company sources. Licensing programs should insure weather knowledge.

50. There is a need for formal training and licensing of persons in charge of moving mobile drilling units. This is apparent from the discussion of the Role of the Barge

Mover (para. 4, Preface to Conclusions) wherein several areas of lack of knowledge and training were pointed out as contributory to this casualty.

51. There were several heroic, commendatory, and praiseworthy actions of various personnel described in paragraph 27 of the Findings that have been made the subject of separate correspondence to the Commandant recommending appropriate awards and recognition for the following personnel listed alphabetically:

[redacted] - Mate, M/V NICOLE MARTIN
[redacted]Able Seaman, M/V GULF VIKING
[redacted] - Master, M/V NICOLE MARTIN
ENS [redacted] - USCG, Copilot H-52 #1444
LCDR John M. Lewis - USCG, Pilot, H 52 #1444
[redacted] - Mate, M/V GULF VIKING
[redacted] - Engineer, M/V GULF VIKING
[redacted] - Engineer, M/V GULF KNIGHT
[redacted] - Deckhand, M/V GULF KNIGHT
[redacted] - Cook, M/V NICOLE MARTIN
AD2 [redacted] - USCG, Crewmember H-52 #1444

## RECOMMENDATIONS

1. The Board takes note of the proposed regulations being considered by the U.S. Coast Guard in bringing this class of vessel under the Inspection Laws of the United States and recommends that those regulations be expedited for implementation and incorporate the several applicable recommendations of this report.

2. That a comprehensive list of items required to be in the operating booklet be incorporated in the regulations. These requirements should be based on operating experience with self-elevating units in general.

3. That the list of items required to be in the operating booklet for a mat type self-elevating drill unit include the following information:

a. A list of essential items to be checked (in a check list form) prior to making a move. Such items as details on position of each equalizing or cross over valve, derrick position and position of locking devices and condition of doors, hatches vents and securing for heavy weather should be included.

b. Information needed by the Barge Mover when encountering unexpected adverse weather such as how varying the mat position affects stability and leg stresses. This information should be presented to permit the Barge Mover to easily understand what unit motions might produce critical leg stresses and how to position the mat to minimize such stresses and how stability is affected by loading and mat position.

c. The effects of jacking the mat up or down under adverse conditions which might exceed the recommended maximum sea states.

d. Clear guidelines for determining what is a long or short move and the do's and don'ts for each.

e. A towing plan setting forth the required number of towing vessels and their minimum horsepower for long and short moves. Any variations based on towing

configuration, bridles vs. single tow lines, etc., should be indicated. The required towing arrangement should be predicated on the ability to maintain control of the drilling unit. This plan should also set forth minimum strength of towing apparatus and procedures to be followed in the event of various emergency conditions such as weather, loss of communications, loss of a tow vessel, broken tow lines, etc.

f. Guidelines for the use of installed anchoring equipment.

4. That drilling units without suitable winches and space for handling towing lines should be outfitted with an insurance towing line to facilitate a hookup in the event a towing line is broken in rough weather.

5. That drilling units be outfitted with a line throwing gun.

6. That a program be established with the long range goal of vesting leadership responsibilities in the Toolpusher. The program should include an appropriate industry sponsored training program, and a government sponsored licensing program leading to licensing of the Toolpusher. The Barge Mover's role would then be that of an advisor, similar to the pilot/master concept. Recognizing the long range nature of this Recommendation, in the interim, the Barge Mover's role as the person in complete authority during the moving of a drilling unit should be affirmed through mandatory licensing and clearer operating procedures set forth in the operating manual.

7. That this class of vessel be required to obtain a load line assignment.

8. That 12 red emergency flares be required on this class of vessel.

9. That 46 USC 405b(3) be deleted, i.e., the licensing exemption for tow boats operating in the offshore oil and mineral industry.

10. The following recommendations are addressed to the National Weather Service, herein referred to as NWS.

a. The NWS and USCG consider jointly ways to better disseminate weather information to marine industry users, assess the need for improvements to the overall system and consider the merit of establishing a formalized network of "Marine Service Stations" similar to the Flight Service Station system currently available to the aviation community.

b. NWS should publicize that it currently does not provide specialized services to marine interests.

c. If the NWS (San Antonio, Texas) study of the 14-15 April 1976 forecast has not been completed, it should be completed and a copy furnished the Commandant, U.S. Coast Guard for information as to action taken.

d. The VHF tapes broadcasted by the NWS in coastal areas such as Corpus Christi should identify themselves as primarily serving the Boating Public, if this continues to be the case.

e. The NWS should expand its present system of obtaining existing weather conditions in the Gulf of Mexico.

11. That the U.S. Coast Guard license program for Barge Movers and/or other licensed rig personnel as well as licensed tow boat operators include examination material regarding weather phenomena, weather forecasts and weather information sources.

12. It is recommended that the design of this class vessel be changed to provide a more realistic area for towline handling than was provided in the triangular spaces on the port and starboard bow of the OCEAN EXPRESS.

13. That the Commandant, U.S. Coast Guard amend existing specifications and regulations pertaining to lifeboats, or promulgate separate specifications and regulations covering the special charateristics of survival capsules. The following should be included:

a. towing

b. crew training

c. emergency escape when capsized or self-righting features

d. training of operators (lifeboatmen)

e. clear operating instructions for each system, especially the releasing gear.

f. recommended procedures for debarking the capsule while alongside vessels in heavy weather.

14. That the Commandant, U.S. Coast Guard support the Board's view that the Whittaker Survival Capsule remains an effective means of escape and survival for use on offshore drilling units and platforms.

15. That 33 CFR 146.05-25 be revised to incorporate the following:

a. a requirement to conduct drills and training at least weekly to assure each change of crew is adequately prepared for emergency situations.

b. clearly delineate that it is an owner responsibility to indoctrinate persons, in addition to the crew, such as subcontractors and visitors, at the time such persons board the rig.

16. That the U.S. Coast Guard require further evaluations to be made of the seaworthiness of the survival capsule. If it is determined that operational procedures are not sufficient to reduce the risk of capsize to an acceptable level, other safety features such as self-righting features or an escape capable of being used from an inverted position should be required.

17. That manufacturers of survival equipment employing the use of propelling machinery located in a closed compartment in which passengers are riding be required to use materials that assure noxious fumes will not be generated by the heat of the engine. A specified "run in" time may be necessary to accomplish this objective.

18. That consideration be given by both the American Bureau of Shipping and the U.S. Coast Guard to modifying the intact stability criterion to treat separately matters bearing on the survivability of a vessel; i.e. range of stability and righting energy over the full range of positive stability; and downflooding considerations.

19. That the U.S. Coast Guard consider adopting a damaged stability standard.

20. That the American Bureau of Shipping give consideration to including an allowance for sea dynamics and other factors in their damaged stability criterion.

21. That both the American Bureau of Shipping and U.S. Coast Guard be advised of the need to ensure the stability of a vessel, both intact and damaged, is assessed in all operating conditions, including various in-transit mat positions.

22. That the American Bureau of Shipping and the Commandant (G-MMT) be provided with a copy of this report in advance of final U.S. Coast Guard and National Transportation Safety Board action.

23. That the U. S. Coast Guard consider establishing a regulation requiring the use of English for all radio transmissions between towing vessels and other units related to the safe moving of drilling units.

[redacted]

VADM W. F. REA III, USCG
Chairman

[redacted]

CAPT R. [redacted] SIMONDS, USCG
Member

[redacted]

CAPT R. L. BROWN, USCG
Member

[redacted]

CDR R. H. HICKS, USCG
Member and Recorder