National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation Log M-356

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In reply refer to: M-89-88 through -96

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Commandant
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Washington, D.C. 20593

At 1605 on December 15, 1988, the 297-foot-long U.S. mobile offshore drilling unit ROWAN GORILLA I capsized and sank in the North Atlantic Ocean about 500 nautical miles southeast of Halifax, Nova Scotia, Canada. The ROWAN GORILLA I, a self-elevating type drilling rig, was being towed by the 245-foot-long Bahamian tug SMIT LONDON from Halifax to Great Yarmouth, United Kingdom when the towline broke about 0220 on December 15, during a severe storm. At 1340 on December 15, the 27 persons aboard the ROWAN GORILLA I abandoned the rig using one of the rig's survival capsules. When the rig was abandoned, there were 50-foot-high seas and the wind was blowing at about 60 knots. About 1200 on December 16, when the seas had subsided to about 15 feet in height, the 27 persons were rescued from the survival capsule by the SMIT LONDON crew. The estimated value of the rig was $90 million.[1]

For the ROWAN GORILLA I to capsize on December 15, 1988, either the rig did not have sufficient intact stability for the environmental conditions or its stability was reduced by flooding below a level capable of withstanding the overturning forces of the wind and seas. However, once the rig capsized, it would only be a matter of minutes before it sank as the result of flooding of internal compartments through ventilation openings on the main deck. To determine the cause of capsizing, the Safety Board requested that the Marathon LeTourneau Offshore Company, the designers and builders of the ROWAN GORILLA I, perform stability calculations representing the vessel and environmental conditions at the time of the capsizing. In addition, the Safety Board examined several sources of flooding before capsizing including hull structural failures, flooding through ventilation openings on the main

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[1]For more detailed information, read Marine Accident Report--"Capsizing and Sinking of the U.S. Mobile Offshore Drilling Unit ROWAN GORILLA I in the North Atlantic Ocean, December 15, 1988" (NTSB/MAR-89/06).

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deck, and flooding as the result of damage on the rig's main deck from loose cargo.

With its legs in the severe storm condition 25 feet below the hull, as they were at the time of capsizing, the intact ROWAN GORILLA I was designed to have sufficient stability to withstand the overturning forces imposed by a sustained wind of 100 knots during severe storm conditions provided that the rig was loaded properly. In addition, the rig was designed to withstand the overturning forces imposed by a sustained wind of 50 knots with any one compartment or tank, located within 5 feet of the exterior hull, flooded. Based on meteorological information from the rig, the tug, other vessels in the area, the National Weather Service and other meteorological sources, the Safety Board estimated that the maximum sustained wind speed at the time of capsizing to be about 60 knots. Thus, the wind speed at the time of capsize was well below the design maximum speed of 100 knots for the intact rig, but in excess of design maximum speed of 50 knots for the rig with one compartment flooded. However, the stability calculations performed by Marathon after the accident indicate that as loaded on December 15, 1988, and with both preload tanks 14 and 15 flooded, the ROWAN GORILLA I's righting moment was several times greater than the overturning moment from a 60-knot wind, and the rig would have almost no stern trim. Therefore, the Safety Board believes that the ROWAN GORILLA I, as loaded on December 15, 1988, had sufficient stability to withstand the overturning moment of the wind even with preload tanks 14 and 15 flooded.

The Safety Board next considered how much flooding would be required to reduce the rig's stability below a level at which a 60-knot wind could capsize the ROWAN GORILLA I. The rig crew testified that in addition to the water entering preload tanks 14 and 15 through hull cracks, water was entering both propulsion rooms through cracks on the main deck, water was entering the air compressor room through an opening in the main deck, and the mud pit room was flooding through an opening on the main deck whose hatch cover had been torn off by the loose container. In addition, the Safety Board assumed that water was being trapped in the shale shaker house on the rig's stern because the house was open near the top for ventilation but otherwise constructed of corrugated steel plating. The stability calculations performed by Marathon showed that with water in all the above tanks and compartments, the ROWAN GORILLA I's righting moment would still be about twice the overturning moment due to the 60-knot wind and the stern trim would be about 2^{o} to 3^{o}. Thus, the Safety Board does not believe that the ROWAN GORILLA I would have capsized from water in preload tanks 14 and 15, the propulsion rooms, the air compressor room, the mud pit room and the shale shaker house.

About 0900 on December 15, the rig superintendent stated that the stern trim had increased from about 2^{o} to 6^{o} although all the equipment on deck, except for the containers which had broken loose earlier, was still in place. The Safety Board estimated that it would take a 5^{o} to 6^{o} stern trim for the after edge of the main deck of the ROWAN GORILLA I to be under water in still water. Therefore, with a 6^{o} stern trim, the rig's after deck was now almost constantly under water. The barge engineer stated that although the crew was dewatering preload tanks 14 and 15, the stern trim continued to increase indicating to him that other after tanks must be flooding. Since both the rig superintendent and the barge engineer stated that up to the time the crew abandoned the rig, the crew was able to pump out the internal compartments as fast as the water entered the compartments, the Safety Board believes that additional after preload tanks had to be flooding to cause the 6° stern trim.

Because the ventilation openings for the after preload tanks were only about 30 inches above the main deck which was about 10 feet above the mean water level with a 2° stern trim, and about 50-foot-high waves were breaking over the rig's stern, it is probable that the after preload tanks were taking on water through their ventilation openings. It is also possible that hull structural failures had occurred in additional after preload tanks resulting in their flooding. Another possible cause of flooding of after preload tanks was flooding through their 30-inch-high access hatches. The crew reported that on December 14, they had found some access hatch covers loose and had attempted to tighten all hatch covers, but could not reach those hatch covers near the stern because of the waves breaking on deck. Because the rig sank in about 16,000 feet of water and there are no plans to salvage the rig, the Safety Board was not able to examine the hull of the ROWAN GORILLA I after the sinking to determine what caused the flooding of after preload tanks. The Safety Board believes that the flooding of after preload tanks was probably due to a combination of hull structural failures, loose access hatch covers, and ventilation openings.

The ROWAN GORILLA I was not equipped with a remote method of determining the amount of liquid in its preload tanks. The only method available to the crew of the rig was to go out on the main deck and measure the amount of liquid in each tank through either its tank sounding tube or access opening. The rig superintendent stated that from about noon on December 14 to the time they abandoned the rig, the crew was not able to safely go on deck because of the waves breaking on deck. The Safety Board believes that had the ROWAN GORILLA I been equipped with remote gauges for its preload tanks, the crew would have been able to determine that preload tanks in addition to 14 and 15 were flooding and they may have been able to repair or plug the leaks, drain those tanks and thereby reduce the loss of freeboard and the amount of boarding seas.

Once the after trim reached 6°, the after main deck would be constantly under water and the ROWAN GORILLA I would rapidly loose stability. In addition, other empty tanks and compartments would begin taking on water through ventilation openings as the after main deck sank deeper into the water. When the stern trim reached 12° just before the crew abandoned the rig, probably the entire main deck aft of the deckhouse was under water and all internal compartments and tanks in this area were taking on water through their main deck ventilation openings. Thus, as tanks and compartments flooded, the ROWAN GORILLA I slowly lost stability, the overturning forces of the wind and waves exceeded the righting ability of the rig, and it capsized.

Before the first hull fractures were discovered about 0730 on December 13, the rig had experienced maximum rolling of 2 $1/2^{\circ}$ every 8 seconds, which was well within the design limits of the legs afloat curve in the rig's operations manual, and a maximum wind speed of 40 knots, which was well below the 100 knot design limit. During the day on December 13, the rig experienced maximum rolling of 1^{o} to 3 $1/2^{o}$ every 8 seconds and maximum pitching of 1^{o} to 3 $1/2^{o}$ every 8 seconds and maximum winds of 33 knots which were still well within design limits. No changes regarding the fractures in tanks 14 and 15 were reported by the crew, but about 1200 on December 13, the crew discovered cracks in welds on the support columns for the starboard leg and a crack in the structure on the inboard support column for the port leg. In anticipation of encountering a severe storm the next day, the rig superintendent at 2131 on December 13, lowered the rig legs from 12.9 feet below the hull to the severe storm position 25 feet below the hull to reduce rig motions, and at 2315 on December 13, the tug master turned the tow so that the wind and waves were on the stern of the rig.

The December 14 morning report from the rig stated that the rig was rolling 2 $1/2^{o}$ every 7 seconds and pitching 3^{o} every 6 seconds. These motions were still well within design limits. However, about 2230 on December 14, the rig manager received a report from the rig that the maximum winds were 45 knots, the maximum waves were 20 feet high, and the rig was rolling 3 $1/2^{o}$ to 7^{o} every 5 to 8 seconds and pitching 2^{o} to 5^{o} every 6 to 7 seconds. The rolling motion was now getting close to the design limits; however, the rig superintendent could do nothing to reduce the motions. The legs were not structurally designed to be lowered beyond the 25-foot level, and according to the tug master, a heading change under the severe weather conditions to reduce the motions would not have been possible. However, after the towline broke, the rig superintendent attempted to maneuver the rig to reduce the motions but he stated that the rig was pitching about 8^{o} every 6 to 7 seconds which was close to the design limits. At 0729, the rig superintendent reported that the maximum pitch motion had been 14^{o} every 4 to 6 seconds, which is well outside design limits, and that he had turned off the thrusters because the rig rode better without the thrusters. The Safety Board believes that because the rig motions on the evening of December 14 and on December 15 were at or above the structural design limits of the ROWAN GORILLA I, it is probable that the rig's hull experienced further hull fractures during this time. Since the crew were not able to go on deck because of the waves breaking on deck and there were no remote gauges for the periphery preload tanks, the fractures went undetected.

The hull fractures in preload tanks 14 and 15 which were discovered on the morning of December 13, before the rig experienced severe weather conditions and before the rig had the wind and waves on its stern, raise questions regarding the structural design of the rig. The ROWAN GORILLA I had sustained similar fractures in 1983 during an ocean tow when the rig experienced 50-knot winds and 9^{o} rolls. (Rowan records do not indicate the period of roll.) Marathon LeTourneau Offshore Company determined that the 1983 fractures were the result of deficient construction methods and modified the construction details, near the location where the cracks occurred, on the ROWAN GORILLA I and subsequent gorilla class MODUs. Thus, no design studies were conducted to determine if the 1983 hull fractures were the result of high stress levels.

A Marathon vice president stated that there had been no reports of hull structure failures on the ROWAN GORILLA I from 1983 until December 1988, and that he believed there was no correlation between the cracks in 1983 and the cracks in 1988. A Rowan vice president stated that because the cracks in 1988 did not extend to the propulsion room floor as the cracks did in 1983, the construction modifications "in that area did work." The Rowan vice president testified that Rowan had made about 70 ocean tows with its self-elevating MODUs and 14 of these tows were in "North Atlantic type conditions." However, when asked to provide documentation of these trips, the Rowan vice president informed the Safety Board that the logs and other records of these transits had been destroyed.

The Safety Board believes that the 1983 and 1988 cracks are related because although the ROWAN GORILLA I was classed by American Bureau of Shipping (ABS) and certificated by the U.S. Coast Guard for ocean towing in 100-knot winds, the rig experienced hull structural failures in after preload tanks in both 1983 and 1988 when the wind speed was 50 knots or less. Both the 1983 and 1988 cracks were probably the result of stresses in the hull produced by the dynamic movement of the 504-foot-long legs in the seaway. The probable reason that the cracks did not extend to the propulsion room floor in 1988 was that the structure had been reinforced in this area after the 1983 fractures. The ROWAN GORILLA I was designed and built to ABS rules that do not require any dynamic analysis of the structure while under tow in a seaway and no dynamic analyses were ever conducted. The Safety Board believes that because the 1988 cracks occurred on December 13, when the rig motions were well within the design limits, the structural design criteria for the rig was inadequate for ocean tows.

Another concern of the Safety Board is that although the ROWAN GORILLA I legs were in the severe storm position, the rig motions on December 15, 1988, were at or above design limits with 50-knot wind speeds and the rig superintendent was not able to reduce the motions by maneuvering the rig. The ERICA observations of the December 14 and 15, 1988 storm show rapid changes in wind speed and chaotic seas which probably produced the rig motions. The Safety Board believes that the sea conditions observed during the ERICA project may account for the large motions experienced by the ROWAN GORILLA I.

The Marathon vice president stated that a dynamic structural analysis of the ROWAN GORILLA I design afloat could not be done because there are no commercially-available computer programs which can accurately and reliably predict the motions of a triangular-shaped hull with legs extended below the hull in a seaway. However, the Safety Board has determined that there are commercially-available computer programs which can be used reliably for the dynamic analysis of rigs provided the computer programs are calibrated using model tests to predict the rigs's motions in a seaway. The Safety Board believes that a dynamic structural analysis of the gorilla design can and should be conducted to determine the environmental limits of the design. In addition, the Safety Board believes that the U.S. Coast Guard, in conjunction with the ABS, needs to revise the structural design criteria for self-elevating MODUs under tow to account for dynamic loads in a seaway.

The Safety Board examined how the marine crew qualifications and manning of the ROWAN GORILLA I may have affected this accident. Present U.S. Coast Guard regulations required that the minimum manning level for the ROWAN GORILLA I under tow to be two able seamen and one ordinary seaman documented by the U.S. Coast Guard. In addition, the owner must designate an individual to be the person in charge of the unit. To receive a U.S. Coast Guard Able Seaman document, an individual must pass an examination showing knowledge of nautical terms, distress signals, firefighting, and the operation of lifeboats found on rigs; there are no knowledge requirements for ordinary seaman or the person in charge. The ROWAN GORILLA I rig superintendent was the person in charge and an able seamen; there were also four other able seaman aboard at the time of the accident. Thus, the minimum U.S. Coast Guard manning and marine crew qualifications were met.

According to the Petroleum Extension Service of the University of Texas, qualified rig movers "are now in charge of moving" self-elevating MODUs because of the high accident rate of self-elevating MODUs under tow or being moved from 1955 to 1975. A home study course by the Petroleum Extension Service states that a rig mover must utilize good seamanship and marine judgment before and after the rig enters the water, is responsible for ensuring the rig's watertight closures are secured, and is responsible for maintaining contact with a weather service and planning the tow according to the weather forecasts. The ROWAN GORILLA I operations manual, which was developed for the rig by Marathon, indicates that a rig mover should be employed by the owner to be in complete charge of the rig while it is being prepared for a move and is in the process of moving. However, Rowan did not employ a rig mover aboard the ROWAN GORILLA I for the tow from Halifax to Great Yarmouth, but designated their shoreside rig manager as the rig mover.

Both the Rowan chairman of the board and the Rowan vice president stated that their rig managers and rig superintendents are trained and capable of moving rigs, and they believe it is safer to have a Rowan employee be in charge of all rig operations, whether moving or drilling. The Chairman of the Board of Rowan stated, "we consider our personnel to be better qualified to move our rigs than a 'rig mover.' Typically, a Rowan rig manager has been employed by Rowan for more than twenty years." Although the ROWAN GORILLA I rig manager may have been qualified to serve as a rig mover, he was not aboard the ROWAN GORILLA I for the intended month-long tow to the North Sea. A rig mover has responsibilities before, during, and after a tow. In addition to preparing the rig for the tow as done by the ROWAN GORILLA I rig manager, a rig mover is also responsible for the safety of the rig underway including maintaining adequate stability, maintaining the watertightness of the hull, and planning the tow according to weather forecasts and actual wind and wave conditions. The Safety Board does not believe that a shoreside manager can serve as a rig mover during a month-long tow across the North Atlantic Ocean.

Based on the statements by the chairman of the board and vice president of Rowan, the ROWAN GORILLA I rig superintendent should also have been qualified as a rig mover. The Rowan vice president stated that Rowan rig superintendents get on-the-job experience in moving rigs and that the ROWAN GORILLA I rig superintendent had experience under North Atlantic sea conditions while the rig was operating off the east coast of Nova Scotia. In addition, he stated that the rig superintendent had taken the mandatory Canadian survival training, had a U.S. Coast Guard Able Seaman document, had on-the-job training in stability, had been taught how to use the maximum motion curves in the ROWAN GORILLA I operations manual which indicate the structural design limits of the rig, and had been given written guidance on what to do regarding rig motions in anticipation of a storm.

Although the rig superintendent had been aboard the ROWAN GORILLA I while the rig was operating off the east coast of Nova Scotia for about 5 years, the December 1988 tow was his first ocean tow. The Safety Board does not believe that one short field move and one tow in good weather during the 5 years off the coast of Nova Scotia provided the rig superintendent with sufficient experience in ocean towing to supervise the December 1988 tow. The Rowan vice president stated that a rig superintendent had to have some experience with rig motions to interpret the maximum motion curves; the ROWAN GORILLA I rig superintendent had no experience with large amplitude rig motions. Also, when the SMIT LONDON master informed the rig superintendent about 1130 on December 15, that the rig was listing astern and the similar circumstances experienced by the DAN PRINCE, the tug master stated that the rig superintendent asked, "Do you think this is an emergency situation?" and requested that the tug master advise him concerning the situation because "Please appreciate that we are drilling men, and not seamen." The Safety Board believes that a qualified rig mover aboard the ROWAN GORILLA I would have realized that when the rig motions exceeded design limits on the morning of December 15 and the rig's stern trim increased from 2^{0} to 6^{0}, that the rig was probably in a dangerous condition and would not have had to rely on the advice of the tug master, who stated that he was not familiar with rigs, regarding the condition of the ROWAN GORILLA I. The Safety Board believes that the circumstances of this accident and the historical accident record of self-elevating MODUs indicates a need for trained rig movers aboard self-elevating rigs under tow.

The Safety Board has been concerned with the lack of U.S. Coast Guard regulations for MODU personnel qualification and manning standards since the self-elevating rig OCEAN EXPRESS[2] capsized and sank with the loss of 13 lives in 1976. Vessels engaged in offshore oil exploration, collectively designated MODU's, are divided into three major categories: Self-elevating rigs--vessels which utilize bottom bearing legs to raise their hull above the surface of the sea; column stabilized rigs--vessels supported by columns on submerged buoyant lower hulls; and drill ships, or drill barges--vessels with conventional hulls. Self-elevating rigs and drill barges have to be towed from location to location, drill ships are self-propelled vessels, and column stabilized rigs can be either self-propelled or non-selfpropelled. All these vessels are considered vessels in navigation, except self-elevating rigs when fully elevated above the surface and, thus, are subject to the Coast Guard manning and crew qualification laws and regulations. In addition to the

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[2]Marine Accident Report--"Capsizing and Sinking of the Self-elevating Mobile Offshore Drilling Unit OCEAN EXPRESS near Port O'Connor, Texas, April 15, 1976" (NTSB-MAR-79-5)

ROWAN GORILLA I and the OCEAN EXPRESS, the Safety Board has investigated two other major marine accidents involving MODUs while in navigation. On February 15, 1982, the column-stabilized OCEAN RANGER[3] capsized and sank with the loss of 84 lives, and on October 25, 1983, the drillship GLOMAR JAVA SEA[4] capsized and sank with the loss of 81 lives. The capsizing and sinking of the OCEAN EXPRESS, the OCEAN RANGER, and the GLOMAR JAVA SEA all involved matters putatively under the cognizance of mariners and not industrial personnel.

In 1978, the Coast Guard published regulations for the inspection and certification of mobile offshore drilling units. However, the regulations did not include personnel qualifications or manning standards for MODUs, except to specify the number and qualifications of lifeboatmen required to man primary lifesaving equipment and to require that the owner must designate an individual to be the master or person-in-charge of a MODU. As a result of its investigation of the capsizing and sinking of the OCEAN EXPRESS, the Safety Board issued the following Safety Recommendation M-79-43 on April 17, 1979, recommending that the Coast Guard:

> Expedite the promulgation of regulations for personnel qualifications and manning standards for self-elevating mobile offshore drilling units, and require that industrial personnel who perform seafaring duties obtain appropriate training and licenses.

As a result of its investigation of the capsizing and sinking of the OCEAN RANGER, the Safety Board on February 28, 1983, issued the following Safety Recommendations M-83-8, M-83-9, and M-83-10 to the Coast Guard. Safety Recommendation M-83-8 superseded Safety Recommendation M-79-43 by calling for similar regulations for all types of MODUs.

> M-83-8
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> Expedite the promulgation of regulations regarding personnel qualifications and manning standards for mobile offshore drilling units.

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[3] Marine Accident Report--"Capsizing and Sinking of the U.S. Mobile Offshore Drilling Unit OCEAN RANGER off the East Coast of Canada, 166 Nautical Miles East of St. John's, Newfoundland, February 15, 1982" (NTSB-MAR-83-2)

[4] Marine Accident Report--"Capsizing and Sinking of the United States Drillship GLOMAR JAVA SEA in the South China Sea, 65 nautical miles south-southwest of Hainan Island, People's Republic of China October 25, 1983" (NTSB-MAR-84-8)

In a letter dated July 20, 1983, the Coast Guard stated:

> The Coast Guard concurs with this recommendation. The licensing qualifications and examination requirements for masters, mates, chief engineers, and assistant engineers on mobile offshore units, which include mobile offshore drilling units, are part of a major regulatory revision project of 46 CFR Part 10. The Notice of Proposed Rulemaking is undergoing the final clearance process and is expected to be published shortly.

<u>M-83-9</u>

> Require that the master and the person-in-charge of a mobile offshore drilling unit be licensed and that their licenses be endorsed as qualified in mobile offshore drilling operations, including knowledge of U.S. Coast Guard regulations, stability characteristics of mobile offshore drilling units, the operation of ballast systems on mobile offshore drilling units, and the use of lifesaving equipment peculiar to mobile offshore drilling units.

In its July 20, 1983 letter, the Coast Guard stated:

> The Coast Guard concurs with this recommendation. The Coast Guard is initiating a regulatory project to revise 46 CFR Subchapter 1-A. As part of this project, 46 CFR 107.111 will be revised to indicate that the master of mobile offshore units (which includes mobile offshore drilling units) shall be the person-in-charge. All mobile offshore units will be required to have a licensed master, either as a master of mobile offshore units or a conventional master's license. Included in the 46 CFR Part 10 revision is a list of examination topics for a license as a master of mobile offshore units. This list includes all of the subjects mentioned in this recommendation. ...

<u>M-83-10</u>

> Require that the person-in-charge of a mobile offshore drilling unit also be a certificated lifeboatman.

In its July 20, 1983 letter, the Coast Guard stated:

> The Coast Guard concurs with this recommendation. The 46 CFR 10 revision requires that licensed deck officers hold a merchant mariner's document. The deck license examinations for service on mobile offshore units will cover those topics included in the lifeboatman examination. Masters and mates with the industrial

> mobile offshore unit license will therefore qualify for the endorsement "any unlicensed rating in the deck department including able seaman" on their merchant mariners's document. This endorsement includes the lifeboatman certification.

Based on the Coast Guard response to Safety Recommendations M-83-9 and M-83-10, the Safety Board on October 26, 1984 classified these two Safety Recommendations as "Open--Acceptable Action." However, as a result of its investigation of the capsizing and sinking of the GLOMAR JAVA SEA on October 25, 1983, the Safety Board classified Safety Recommendation M-83-8 as "Open--Unacceptable Action" on November 14, 1984, and issued the following Safety Recommendation M-84-48 to the Secretary of the U.S. Department of Transportation:

> Direct the Commandant of the U.S. Coast Guard to address immediately the early promulgation of personnel qualification and manning regulations for mobile offshore drilling units.

On October 16, 1987, the Coast Guard published interim final rules for the licensing and manning of MODUs with an effective date of April 1, 1989. As a result, the Safety Board on June 2, 1988, classified M-84-48 as "Closed--Acceptable Action." However, on February 28, 1989, the Coast Guard suspended the effective date of these interim rules indefinitely because comments on the Interim Final Rule indicated substantive revisions to the rule were necessary, and on May 17, 1989, issued a SNPRM.

On June 6, 1989, the Safety Board sent a letter to the Secretary of the U.S. Department of Transportation expressing its disappointment that it took the Coast Guard 10 years to publish an Interim Final Rule to implement these urgently needed regulations, and then to learn that the Coast Guard had suspended the rules indefinitely. As a result of the Coast Guard action, the Safety Board placed Recommendation M-84-48 in an "Open" status. The Safety Board believes that the lack of a qualified rig mover aboard the ROWAN GORILLA I again shows the need for MODU personnel qualification and manning standards and reiterates Safety Recommendations M-83-8, -9, and -10 to the U.S. Coast Guard and M-84-48 to the Secretary of the U.S. Department of Transportation. Because, as of the date of this report, the U.S. Coast Guard has not implemented personnel qualification and manning regulations for MODUs, Safety Recommendation M-84-48 has been classified "Open--Unacceptable Action."

The May 17, 1989 SNPRM will require an applicant for the offshore installation manager license with a bottom bearing unit underway endorsement to provide certification that he/she has witnessed 10 rig moves and directed 5 rig moves under the supervision of an experienced rig mover. However, the proposed regulations do not state what type of moves. The Safety Board does not believe that the experience gained from short field moves in protective waters is sufficient for supervising a long ocean tow where severe weather can be expected, and that the applicants for the offshore installation manager license with a bottom bearing unit underway endorsement should have had experience observing and directing both field and ocean moves.

The U.S. Coast Guard Certificate of Inspection for the ROWAN GORILLA I required that the rig be equipped with four survival capsules with a total capacity for 172 persons. Two of the capsules were required to be stowed on the port side and two on the starboard side. Additionally, the certificate of inspection required that the rig carry four inflatable liferafts with a total capacity for 100 persons. U.S. Coast Guard regulations required that the survival capsules and the liferafts be stowed in their U.S. Coast Guard approved launching equipment at all times and that the rig superintendent ensure that each item of lifesaving equipment was maintained in operative condition. However, contrary to these U.S. Coast Guard requirements, the Rowan alternate rig superintendent, under instructions from Rowan shoreside managers, removed the rig's four survival capsules and four inflatable liferafts from their U.S. Coast Guard approved launching equipment while preparing the rig for its tow across the North Atlantic Ocean. Rowan managers stated that the reason for removing the survival capsules and liferafts from their approved launching equipment was to protect the survival equipment from being washed overboard during the tow. The Rowan vice president was not aware of any Rowan policies regarding the stowage of U.S. Coast Guard required lifesaving equipment during ocean tows, and the ROWAN GORILLA I operations manual did not address the stowage of lifesaving equipment during ocean tows.

Fortuitously, Canadian Coast Guard inspectors boarded the ROWAN GORILLA I before the rig left Halifax and told the alternate rig superintendent that the survival capsules should not have been removed without U.S. Coast Guard approval. As a result, the two 36-person survival capsules were replaced in their launching equipment. Because there were only 27 persons on board the rig, the two 36-person survival capsules were probably sufficient for safety. However, Rowan managers never contacted the U.S. Coast Guard for permission to remove any of the survival capsules or liferafts from their launching equipment and none of the liferafts was replaced in approved launching equipment.

The Safety Board believes that the location of the ROWAN GORILLA I launching equipment for liferafts was inappropriate for an ocean tow. If the rig's liferafts had remained in their launching equipment on top of the rails near the edge of the main deck for the ocean tow, the hydrostatic releases for the liferafts would probably been activated and the liferafts would have been washed overboard during the severe storms encountered during the tow. The Safety Board believes that for the ocean tow, Rowan should have provided alternate U.S. Coast Guard approved liferaft launching equipment in locations on the ROWAN GORILLA I that would be protected from waves during severe weather. In addition, the Safety Board believes that Rowan should have provided explicit instructions in the rig's operations manual regarding the proper stowage of lifesaving equipment during ocean tows. Had the ROWAN GORILLA I proceeded to sea without any of its survival capsules or liferafts in their approved launching equipment, the Safety Board believes that there may have been serious injuries and loss of life when the rig capsized and sank on December 15, 1988, because the crew would not have been able to launch the survival capsules and liferafts. Although the crew's immersion suits would have provided them with thermal protection, they may not have been able to swim away from the rig before the rig capsized on top of them. If any of the crew were able to escape the sinking rig, they would probably have become separated in the high seas and darkness, and may not have been found by rescue aircraft or the SMIT LONDON. The Safety Board believes that the U.S. Coast Guard should examine the location of liferaft launching equipment on all U.S. self-elevating MODUs to ensure that the liferafts are protected from being washed overboard during storms while the rig is being towed. It may be necessary to require alternate liferaft launching equipment for ocean tows.

The ROWAN GORILLA I rig superintendent testified that the evacuation of the rig via the survival capsule "went just like the drills that we hold weekly." He stated that all crewmembers had donned their immersion suits, entered the capsule in an orderly manner, and secured their seat belts. All the rig crewmembers had attended the Canadian mandatory survival training course and the rig superintendent stated that he had put the senior barge engineer in charge of operating the capsule because the barge engineer had just completed a course in rescue craft operations. Once the survival capsule was underway, the crew relied on their survival training to minimize the physiological (hunger, dehydration), physical (sea sickness), and psychological stresses during their approximately 23-hour stay in the capsule. The rig mechanic stated that the survival training had saved his life, and the senior barge engineer stated that his training in rescue craft operations was "invaluable." Thus, the Safety Board believes that the ROWAN GORILLA I weekly abandon platform drills and the Canadian mandatory training contributed substantially to the orderly and safe rescue of all persons aboard the rig under the severe sea conditions.

The Rowan vice president stated that Rowan does not provide survival training similar to that provided in Canadian waters or the North Sea for MODU crews in the Gulf of Mexico, but relies on in-house training taught by their safety department and weekly abandon platform drills for MODU crews in the Gulf of Mexico. Furthermore, the U.S. Coast Guard does not require survival training for the crews of MODUs. The May 17, 1989 U.S. Coast Guard SNPRM for the licensing of officers and operators of MODUs would require the person in charge of the MODU to have completed U.S. Coast Guard approved immersion suit and survival craft training; however, this requirement would not apply to the other U.S. Coast Guard required crew or the industrial personnel aboard a MODU. The Safety Board believes that this accident shows the need for formal survival training for MODU crews who normally do not have a maritime background and that the U.S. Coast Guard should require that all MODU crewmembers attend a survival training course which includes donning of immersion suits, boarding liferafts from the water, and dealing with the stresses associated with abandoning a MODU under adverse conditions.

The incorrect position titles and the absence of names identifying the certificated lifeboatmen on the ROWAN GORILLA I fire and abandon platform bill did not affect the evacuation on December 15 because only one survival capsule was used and the rig superintendent took charge. However, if two survival capsules had been used, the Safety Board believes that there may have been confusion as to who was in charge of the second survival capsule and Rowan should revise any rig fire and abandon platform bills that have incorrect titles. Because MODU position titles do not identify the required U.S. Coast Guard Certificated lifeboatmen who should take charge of survival craft during an emergency, the Safety Board issued Safety Recommendation M-83-11 to the U.S. Coast Guard as a result of its investigation of the capsizing and sinking of the OCEAN RANGER:[5]

> Require that the station bill on mobile offshore drilling units identify by name the certificated lifeboatmen required by the U.S. Coast Guard Certificate of Inspection.

In a letter dated April 13, 1987, the U.S. Coast Guard stated:

> The Coast Guard concurs with the intent of this recommendation. The Coast Guard published Navigation and Inspection Circular No. 7-82 which revised station bill requirements to identify billets with emergency stations. Although the Board recommended identification by name, we believe our alternate action satisfies the intent of this recommendation. Therefore, no further action on this recommendation is anticipated.

On August 1, 1987, the Safety Board classified Safety Recommendation M-83-11 as "Closed--Unacceptable Action." The Safety Board believes that this accident again shows the confusion that can exist with MODU station bills if the U.S. Coast Guard certificated lifeboatmen are not identified and urges the U.S. Coast Guard to reconsider its position.

The tug master stated that he was not able to locate the position of the rig's survival capsule in the dark because it did not have an external light, and therefore, the SMIT LONDON had to stay some distance away to avoid colliding with the capsule. The officer in charge of the Halifax Rescue Coordination Center stated that because the survival capsule did not have an external light and it was made of fiberglass (a poor radar reflector), the Canadian aircraft pilots found the survival capsule very difficult to see at night and that they often lost contact with the capsule on radar. The 1983 amendments to the Safety of Life at Sea Convention (SOLAS 1974) require a light on the top of survival capsules visible for at least 2 miles and for an efficient radar reflector. However, these requirements only apply to vessels built after July 1, 1986 on international voyages and the U.S. Coast Guard has not implemented these requirements for U.S. vessels. The Safety Board believes that the circumstances of this accident show the need for lights and radar reflectors for all survival capsules on U.S. vessels and the need for the U.S. Coast Guard to implement the 1983 amendments to SOLAS 1974. As a

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[5] Marine Accident Report--"Capsizing and Sinking of the U.S. Mobile Offshore Drilling Unit OCEAN RANGER Off the East Coast of Canada, 166 Nautical Miles East of St. John's, Newfoundland, on February 15, 1982" (NTSB/MAR-83/2).

result of its investigation of the explosions and fires aboard the U.S. Tankship OMI YUKON[6] on October 28, 1986, the Safety Board issued the following Safety Recommendation M-87-32 to the U.S. Coast Guard:

> Implement for all U.S. vessels the second set of amendments to the 1974 Safety of Life at Seas Convention regarding improved lifesaving equipment which became effective internationally on July 1, 1986.

On October 6, 1988, the U.S. Coast Guard replied:

> A regulatory project now in progress will propose incorporation of the 1983 SOLAS Amendments into the Code of Federal Regulations, and will propose to extend appropriate new SOLAS requirement to U.S. ships not otherwise required to comply with SOLAS. ... Publication of a Notice of Proposed Rulemaking is now anticipated by the end of 1988.

On February 28, 1989, the Safety Board classified Safety Recommendation M-87-32 as "Open--Unacceptable Action," noting that the Notice of Proposed Rulemaking was not expected to be published until the summer of 1989. On April 21, 1989, the U.S. Coast Guard published a notice of proposed rulemaking to implement the lifesaving equipment carriage requirements of the 1983 amendments to SOLAS 1974 and stated that lifesaving equipment standards including lights on survival capsules would be the subject of a separate notice. Because the U.S. Coast Guard has not implemented the lifesaving equipment standards contained in the 1983 amendments to SOLAS 1974 as of the date of this report, the Safety Board reiterates Safety Recommendation M-87-32.

The rig superintendent and other survivors testified that the 36-person survival capsule was very crowded with 27 persons wearing immersion suits although 36 persons with lifejackets had sufficient room in the capsule during drills. Neither U.S. Coast Guard or SOLAS 1974 standards consider immersion suits in determining the capacity of survival craft. The Safety Board believes that both the U.S. Coast Guard and the International Maritime Organization should consider persons wearing immersion suits in the sizing of survival craft on vessels where immersion suits are required.

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

> Require remote gauging devices for all tanks on self-elevating mobile offshore drilling units. (Class II, Priority Action) (M-89-88)

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[6]Marine Accident Report--"Explosions and Fires Aboard the U.S. Tankship OMI YUKON in the Pacific Ocean about 1,000 miles west of Honolulu, Hawaii, October 28, 1986" (NTSB-MAR-87-6).

In conjunction with the American Bureau of Shipping, revise the structural design criteria for self-elevating mobile offshore drilling units under ocean tow to include a dynamic analysis which accurately reflects rig motions expected to be encountered. (Class II, Priority Action) (M-89-89)

Require applicants for the offshore installation manager license with a bottom bearing unit underway endorsement to provide certification of experience observing and directing both field and ocean moves. (Class II, Priority Action) (M-89-90)

Conduct a one-time inspection of the location of the launching equipment for inflatable liferafts on self-elevating mobile offshore drilling units (MODU) and, where necesssary, require that alternate launching equipment locations be provided to protect the liferafts from being washed overboard by waves when the MODU is being towed. (Class II, Priority Action) (M-89-91)

Require both the marine and industrial crews of mobile offshore drilling units (MODU) to attend a survival training course which includes donning of immersion suits, boarding of liferafts from the water, and dealing with the stresses associated with abandoning a MODU under adverse conditions. (Class II, Priority Action) (M-89-92)

Require that the station bill on mobile offshore drilling units identify by name the certificated lifeboatmen required by the U.S. Coast Guard Certificate of Inspection. (Class II, Priority Action) (M-89-93)

Require that all new and existing enclosed lifeboats or survival capsules be equipped with a light on the top visible for at least 2 miles and an efficient radar reflector. (Class II, Priority Action) (M-89-94)

Revise the capacity standards for survival craft required on board vessels required to carry immersion suits for all crewmembers to account for the wearing of immersion suits by all persons while in the survival craft. (Class II, Priority Action) (M-89-95)

Urge the International Maritime Organization to amend the capacity standards for survival craft to account for the wearing of immersion suits. (Class II, Priority Action) (M-89-96)

In addition, the Safety Board reiterates the following safety recommendations to the U.S. Coast Guard:

M-83-8

Expedite the promulgation of regulations regarding personnel qualifications and manning standards for mobile offshore drilling units.

M-83-9

Require that the master and the person-in-charge of a mobile offshore drilling unit be licensed and that their licenses be endorsed as qualified in mobile offshore drilling operations, including knowledge of U.S. Coast Guard regulations, stability characteristics of mobile offshore drilling units, the operation of ballast systems on mobile offshore drilling units, and the use of lifesaving equipment peculiar to mobile offshore drilling units.

M-83-10

Require that the person-in-charge of a mobile offshore drilling unit also be a certificated lifeboatman.

M-87-32

Implement for all U.S. vessels the second set of amendments to the 1974 Safety of Life at Sea Convention regarding improved lifesaving equipment which became effective internationally on July 1, 1986.

Also, the Safety Board issued Safety Recommendations M-89-97 through -104 to Rowan Companies, Inc.; M-89-105 to the American Bureau of Shipping; M-89-106 to Marathon LeTourneau Offshore Company; and M-89-107 through -110 to the International Association of Drilling Contractors. The Safety Board also reiterated M-84-48 to the Secretary of the U.S. Department of Transportation.

KOLSTAD, Acting Chairman, and BURNETT, NALL and DICKINSON, Members, concurred in these recommendations. LAUBER, Member, did not participate.

James L. Kolstad

By: James L. Kolstad
Acting Chairman