

NATIONAL TRANSPORTATION SAFETY BOARD  
 WASHINGTON, D.C.

ISSUED: November 21, 1984

Forwarded to:

Admiral James S. Gracey  
 Commandant  
 U.S. Coast Guard  
 Washington, D. C. 20593

SAFETY RECOMMENDATION(S)

M-84-49 through -57

About 2355 on October 25, 1983, the 400-foot-long United States drillship GLOMAR JAVA SEA capsized and sank during Typhoon LEX in the South China Sea about 65 nautical miles south-southwest of Hainan Island, People's Republic of China (PRC). Of the 81 persons who were aboard, 35 bodies have been located, and the remaining 46 persons are missing and presumed dead. The GLOMAR JAVA SEA currently is resting on the bottom of the sea in an inverted position in about 315 feet of water; its estimated value was \$35 million. 1/

An underwater videotape survey of the wreck performed shortly after the accident showed a 40-foot-long transverse fracture in the starboard side and a separate longitudinal fracture in the deck plating of wing tanks Nos. 6 and 7. If the large transverse fracture occurred while the vessel was afloat on the surface, starboard wing tanks Nos. 6 and 7 would have flooded and could account for the undetermined 15° list reported at 2341 since the drillship's pumps would not have been able to overcome the subsequent rate of flooding. The Safety Board examined a number of factors which could have caused this fracture. A review of the videotapes did not show any evidence of an external explosion. Thus, sabotage by outside interests or a stray mine that had come adrift was ruled out. Because the hull plating was deformed inwardly, a deliberate or accidental internal explosion also was rejected. A deliberate ramming or accidental collision by another vessel was considered. The fracture showed no evidence of a collision with a steel vessel, and no vessel was reported as being in the area at the time of the accident. However, a wooden vessel such as a fishing vessel could have hit the GLOMAR JAVA SEA during the storm. The sharp blow of the wooden vessel striking the drillship could have initiated the fracture while not leaving any visible damage to the hull. However, the likelihood of a wooden vessel operating near the GLOMAR JAVA SEA during Typhoon LEX is remote.

The longitudinal fracture about 5 feet long and 8 inches wide in the main deck where the forward starboard leg of the derrick connected into the bulkhead at frame 91 also could account for the 15° list reported at 2341. The fracture was large enough to lead to

1/ For more detailed information, read 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-84/08).

rapid flooding of starboard wing tanks Nos. 6 and 7 with the waves washing over the deck. As the vessel heeled, the rate of flooding would have increased, and the drillship's pumps probably could not have kept up with the flooding. The Safety Board could not determine the cause of this structural failure. The failure could have occurred while the vessel was afloat on the surface or when it hit the ocean floor.

Under current U.S. Coast Guard (USCG), American Bureau of Shipping (ABS), and International Maritime Organization (IMO) standards, drillships similar to the GLOMAR JAVA SEA are required to be designed to withstand the accidental flooding of one wing tank. The October 25 accident illustrates the limitations of this standard. The structural failures at frame 91 resulted in the flooding of both wing tanks Nos. 6 and 7 and probably led to the capsizing and sinking of the drillship. If the GLOMAR JAVA SEA had been designed to withstand the flooding of two wing tanks or if an operational restriction had been placed on the vessel not to have two adjacent wing tanks empty, the GLOMAR JAVA SEA might not have capsized and sunk. There is a need for the USCG, the ABS, and the IMO to revise their stability standard for drillships to require drillships to withstand the flooding of two adjacent wing tanks.

Neither the operating manual approved by the ABS or the USCG gave the master of the GLOMAR JAVA SEA any guidance on the degree of survivability to which the drillship was designed. If the master had known that the GLOMAR JAVA SEA was designed only to withstand the flooding of one wing tank, he might not have permitted the chief engineer to have two adjacent wing tanks empty. The ABS no longer approves operating manuals and states that this is the responsibility of the owner. The Safety Board believes that the USCG should insure that the operating manuals of all mobile offshore drilling units (MODU's) contain information on the degree of survivability from flooding.

Since the metallurgical analyses of the transverse fracture showed no preexisting fractures or defects and the structural calculations showed moderate stress levels, there is a need for both the USCG and the ABS to review the structural design of the other five Global Marine drillships similar to the GLOMAR JAVA SEA. Drillships are required to be designed and built to withstand severe weather conditions. The GLOMAR JAVA SEA's structural failure indicates there may be a structural design problem that was not detected by the standard structural calculations performed by the ABS. There should be a comprehensive review of the structural design, including environmental assumptions, steel distribution in the hull plating near the derrick, and dynamic loads.

USCG lifeboat standards for drillships need to be improved. Federal regulations under which the GLOMAR JAVA SEA was certificated require sufficient lifeboat capacity on each side of the vessel for 100 percent of the persons onboard and liferafts of sufficient capacity for 50 percent of the persons on board. Similarly, the International Convention for the Safety of Life at Sea, 1974 (SOLAS 74), requires cargo ships to have sufficient lifeboat capacity on each side of the vessel for 100 percent of the persons onboard and liferafts for 50 percent of the persons onboard. One reason for 100 percent capacity on each side is that lifeboats are designed to be launched at a maximum list of 15°. With the typhoon at its peak and the GLOMAR JAVA SEA listing 15° or more, it was probably impossible to launch the port lifeboat. Therefore, only part of the crew evacuated in the starboard lifeboat which had a maximum capacity of 64 persons. There was a crew of 81 persons aboard, and the USCG Certificate of Inspection authorized up to 110 persons aboard while moored at the well location without any increase in lifeboat capacity above 64 per side. Since a drillship spends a large percentage of its time moored at the well location, the USCG regulations for MODU's should be amended to require 100 percent lifeboat capacity on each side at all times on drillships.

A radiotelegraphic distress transmission on 500 kHz (apparently from the GLOMAR JAVA SEA's lifeboat) was received on a passing cargo vessel at 1307 on October 27. Current regulations require a portable emergency radio only on one lifeboat on each vessel; however, most seagoing vessels have more than one lifeboat installed. Since lifeboats can become separated when a vessel is abandoned in severe weather and since lifeboat radios are not designed for operation in inflatable liferafts, the Safety Board believes that each lifeboat and each inflatable liferaft should be equipped with a device, such as an emergency position indicating radio beacon (EPIRB) to transmit distress signals automatically. An EPIRB would provide a means of detection by commercial aircraft or military aircraft which do not normally monitor the radio frequencies on which lifeboat radios transmit. Revisions to Chapters III and IV of SOLAS 74, which become effective July 1, 1986, include regulations requiring each survival craft to be provided with a manually activated survival craft EPIRB and a two-way radiotelephone unit and the general design requirements for each. The Federal Communications Commission (FCC) already has begun the process of implementing the revisions to Chapter IV by proposing new FCC rules for the general design requirements for a manually activated EPIRB on survival craft and a two-way radiotelephone unit. However, the USCG has not yet issued any proposed rulemaking to implement Chapter III or to apply the EPIRB requirements to U.S. vessels in domestic trade. The USCG should require EPIRB's on all U.S. survival craft as soon as possible.

The drydock inspection by the USCG inspector and ABS surveyor during November 1982 and the USCG inspector's and ABS surveyor's inspections during October 1983 were thorough and comprehensive. However, the USCG and the ABS could improve the thoroughness of their inspections and surveys of MODU's. The USCG overseas inspection program should emphasize the use of experienced personnel to conduct inspections of MODU's in remote areas, such as the South China Sea. The USCG inspector for the GLOMAR JAVA SEA had never inspected a MODU by himself or under the supervision of an experienced USCG inspector. The use of inexperienced personnel by the USCG in remote areas should not be permitted. The overseas inspection program is not temporary. There are a significant number of U.S. MODU's operating throughout the world, and the need for overseas inspectors will continue for a long time. The Safety Board believes the USCG should take the necessary steps to improve the experience level of the inspectors utilized in the overseas inspection program.

Although the metallurgical tests and examinations of the two fractures in starboard drill water wing tank No. 6 indicate that they could not have been anticipated by a visual inspection before the fracture, the internal examination of tanks could be improved. The investigation showed that neither the USCG nor the ABS entered starboard drill water wing tank No. 6 during either the November 1982 drydocking or the October 1983 inspections and survey. USCG policy does not require that USCG inspectors inspect a tank unless there is an outstanding ABS survey requirement or the USCG inspector suspects some problems. With the introduction of improved exterior hull coatings, an examination of the exterior hull of a vessel may no longer be an indication of the condition of the hull plating and internal framing. However, the internal structure of saltwater ballast tanks generally is not coated. Furthermore, an examination of the external hull plating does not indicate the condition of the internal plating. Recognizing the efficacy of improved hull coatings, the USCG is proposing to increase the drydock period for vessels in salt water from 24 to 30 months, and USCG regulations already permit MODU's to have a special underwater survey in lieu of drydocking.

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 drillships, or drill barges--vessels with conventional hulls. Self-elevating rigs and drill barges have to be towed from location to location, drillships 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 sea surface and, thus, are subject to the USCG manning and crew qualification laws and regulations. Since 1976, the Safety Board has investigated two other major marine accidents with a large loss of life involving vessels engaged in offshore oil exploration. On April 15, 1976, the self-elevating rig OCEAN EXPRESS 2/ capsized and sank with the loss of 13 lives, and on February 15, 1982, the column-stabilized OCEAN RANGER 3/ capsized and sank with the loss of 84 lives.

In 1978, the USCG published regulations for the inspection and certification of MODU's. However, it has not included personnel qualifications or manning standards for MODU's in the regulations, 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 Safety Recommendation M-79-43 on April 17, 1979, recommending that the USCG:

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.

On June 4, 1980, the USCG responded as follows:

The Coast Guard partially concurs with the recommendation. Manning and crew qualification standards are being applied to MODU's of the "bottom bearing" non-self-propelled type (such as the OCEAN EXPRESS) as these units come under the inspection process under 46 CFR I-A in the next several years. Manning standards will apply only when such units are in navigation. At this point it is contemplated that the standard manning for marine personnel, while in navigation, will consist of:

- 1 - Designated Person in Charge
- 2 - Able Seaman
- 1 - Ordinary Seaman
- Lifeboatman (number appropriate for the installed lifesaving equipment necessary to accommodate the number of persons on board).

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).

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).

Development of requirements for personnel on structures and MODU's not in navigation is being developed under the authority of the OCS [Outer Continental Shelf] Act. The Coast Guard believes that the OCS Act places limitations on the Coast Guard's ability to carry out the intent of this recommendation while the unit is in the bottom bearing mode. The OCS Act is applicable only to those activities on the United States Outer Continental Shelf. Accordingly, the application of a manning scale on units engaged in worldwide operations while in the bottom bearing mode is not possible under the provisions of the OCS Act.

On June 9, 1981, the USCG further replied:

We have attached an IMCO [International Maritime Consultative Organization] document entitled "Training Qualifications of Crews Serving on Mobile Offshore Units" (STW XIV/WP.4) dated 21 January 1981 (Enclosure (2)). This document deals with a variety of considerations affecting units such as the OCEAN EXPRESS. Various duties/training qualifications of the person-in-charge and other persons are covered. The working group preparing the document did not stipulate whether the person-in-charge should be drawn from seafarer or regularly assigned special personnel with responsibility for others (Appendix II, 3 and 4). This recognizes reality in that a mobile unit such as the OCEAN EXPRESS is a complex mixture of both industrial and marine considerations. The Coast Guard is of a similar opinion and believes a person qualified under either category could function in the position. Although this document is currently a working paper, it is scheduled to be formally reviewed at the 15th session of the Subcommittee on Standards of Training and Watchkeeping scheduled for February 1982. Due to the inherent limitations of the OCS Lands Act and the restrictions of the domestic statutes concerning vessel inspection and manning, the international agreement method appears the most viable initial approach. Although the resulting domestic regulations may be somewhat fragmented (due to the diverse statutory authority) and lacking when considering a bottom bearing unit on a foreign assignment, a foreign country which subscribes to the resolution could fill in this gap.

Insofar as the imposition of additional manning regulations specifically for MODU's, this appears to be generally unwarranted. Presently 46 CFR 157.20-15 addresses the Able Seaman/Ordinary Seaman question. The person-in-charge qualifications would be best delayed pending international action. As the STW working paper is almost a direct copy of a position paper presented at the 14th session of the STW in January 1981 by the International Association of Drilling Contractors (IADC), it can be reasonably assumed the industry will initiate compliance. Further, the MODU initial inspection program should be completed during the late summer or early fall of 1981, utilizing the manning scale noted in our letter of 4 June 1980.

The only statement in STW XIV/WP.4 concerning personnel qualifications and manning standards, other than emergency procedures and onboard training for group survival states:

3. RESPONSIBILITIES OF PERSON IN CHARGE CONCERNING MARITIME SAFETY TRAINING

- 3.1 The person in charge should be well acquainted with the characteristics, capabilities and limitations of the unit. This person should be fully cognizant of his responsibilities for emergency organization and action, for conducting emergency drills and training, and for keeping records of such drills.
- 3.2 The person in charge, or persons delegated by him, should possess the capability to operate and maintain on board the unit all fire-fighting equipment and life-saving appliances and be able to train others in these activities.

As a result of its investigation of the capsizing and sinking of the OCEAN RANGER, the Safety Board on February 28, 1983, issued Safety Recommendation M-83-8 to supersede Safety Recommendation M-79-43 and to call for similar regulations covering all types of MODU's. Safety Recommendation M-83-8 recommended that the USCG:

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

In a letter dated July 20, 1983, the USCG stated that:

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.

The Safety Board has classified Safety Recommendation M-83-8 as "Open--Unacceptable Action" pending further response from the USCG.

The Safety Board also issued Safety Recommendation M-83-9 on February 28, 1983:

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 response to Safety Recommendation M-83-9, the USCG stated that:

The Coast Guard concurs with this recommendation. The Coast Guard is initiating a regulatory project to revise 46 CFR Subchapter I-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. The need to endorse a conventional master's license has not been addressed in this regulatory proposal since the conventional master ocean licenses qualify a person to serve on mobile offshore units without further endorsement because of the similarity in examination topics and more extensive seagoing experience required for the conventional master's license. While we recognize that the industrial licensed masters must be familiar with unique equipment and operating conditions, it is our opinion and experience that the conventional masters will acquaint themselves with such equipment and conditions just as masters presently do with different types of cargo, freight or tank vessels. To emphasize this fact, a paragraph has been added to the revision of 46 CFR Part 10 which reads as follows: "With few exceptions, these regulations do not specify or restrict licenses to particular types of service such as tankships, freight vessels, or passenger vessels. However, it is incumbent on every licensed officer to become familiar with all unique characteristics of each vessel served upon as soon as possible after reporting aboard for duty. As appropriate for a deck or engineer license, this includes, but is not limited to: maneuvering characteristics of the vessel; proper operation of the installed navigation equipment; firefighting and lifesaving equipment; stability and loading characteristics; and main propulsion and auxiliary machinery.

The Safety Board has classified Safety Recommendation M-83-9 as "Open--Acceptable Action."

On August 8, 1983, the USCG published a Notice of Proposed Rulemaking (NPRM) to amend the regulations dealing with the licensing of merchant marine officers. Although the NPRM addressed the Safety Board's recommendations regarding personnel qualification standards in Safety Recommendations M-83-8 and -9, the NPRM did not address manning standards other than that the master shall be in charge. Moreover, the USCG is planning to issue a revised NPRM sometime in 1985 which will delay the actual promulgation of MODU personnel qualification standards. The capsizing and sinking of the OCEAN EXPRESS, a self-elevating MODU, the OCEAN RANGER, a column-stabilized MODU, and the drillship GLOMAR JAVA SEA all involved matters putatively under the cognizance of mariners and not industrial personnel. The Safety Board believes that the USCG has delayed too long the promulgation of MODU personnel qualification and manning standards and reiterates Safety Recommendations M-83-8 and -9.

As a result of its investigation of the capsizing and sinking of the OCEAN RANGER with the loss of all 84 persons aboard, the Safety Board issued Safety Recommendation M-83-20 on February 28, 1983, recommending that the USCG:

Require that a suitable vessel, capable of retrieving persons from the water under adverse weather conditions, be assigned to all U.S. mobile offshore drilling units at all times for the purpose of evacuating personnel from the unit in an emergency.

On July 20, 1983, the USCG replied:

The Coast Guard partially concurs with this recommendation. The nature of oil exploration operations is such that offshore supply vessels routinely operate in the vicinity of mobile offshore drilling units.

Offshore supply vessels typically have a low freeboard aft and can be readily used to recover persons from the water, provided that those persons are able to assist themselves. The vessels that tried to rescue the OCEAN RANGER victims were able to come close enough to toss lines to the victims but the persons in the water were unable to help themselves. If the persons in the water had been wearing exposure suits, they probably would have been capable of assisting themselves onto the rescue vessel.

On February 3, 1983, the Coast Guard published a Notice of Proposed Rulemaking (48 FR 4837) which would require exposure suits for personnel on mobile offshore drilling units and other types of vessels. As pointed out in your report NTSB-MAR-83-2, the requirements would pertain to vessels operating in areas where the water temperature may fall below 60° F. There are no lifesaving appliances or survival equipment systems that can guarantee the survival of all personnel on board a vessel involved in a casualty, especially in wind and sea conditions such as those encountered by the OCEAN RANGER. However, had the proposed requirement for exposure suits been in effect at the time of the OCEAN RANGER casualty, the number of lives lost could have been significantly reduced. The standby vessel for the OCEAN RANGER, the SEAFORTH HIGHLANDER, was on scene within one hour. Therefore, the problem was not one of getting a standby vessel on scene in a reasonable amount of time but rather one of rescuing victims who were rendered helpless by the effects of hypothermia.

We feel that the proposed regulations for exposure suits would effectively comply with the intent of this recommendation. In addition, the Coast Guard published an Advance Notice of Proposed Rulemaking for offshore supply vessels on 14 February 1983 (48 FR 6636). The proposed rules would require offshore supply vessels to be equipped with rescue boats that must be capable of taking an unconscious person on board from the sea. We believe that most of the rescue boats for offshore supply vessels will be of the inflatable or rigid-inflatable type, similar to boats now being utilized on Coast Guard cutters for rescue purpose. The only offshore supply vessels that would be exempt for the rescue boat requirement would be those that carry lifeboats or those offshore supply vessels that are designed or modified to be capable of recovering helpless persons directly from the sea.

The Safety Board has classified Safety Recommendation M-83-20 as "Open--Unacceptable Action" pending further consideration of this matter by the USCG.

Although no lives were saved by the GLOMAR JAVA SEA's standby boat, the NANHAI 205, the capsizing and sinking of the GLOMAR JAVA SEA again emphasizes the need for suitably equipped standby vessels. The USCG Advance Notice of Proposed Rulemaking of February 14, 1983, addresses U.S. offshore supply vessels but would not be applicable to the NANHAI 205 which was a PRC vessel. Canada, Norway, and the United Kingdom all require a standby boat for MODU's operating off their coasts. Since standby boats are already an integral part of drilling operations of a MODU, the USCG should require that a suitable vessel, properly equipped for ocean rescue, be assigned to all MODU's when moored over a drill site.

Therefore, in addition to reiterating Safety Recommendations M-83-8, -9, and -20, the National Transportation Safety Board recommends that the U. S. Coast Guard:



Revise the stability standards for drillships to include the capability of drillships to survive the flooding of any two adjacent compartments or tanks located within 5 feet of the hull. (Class II, Priority Action) (M-84-49)

Urge the International Maritime Organization to amend its 1979 Code for the Construction and Equipment of Mobile Offshore Drilling Units to include the capability of drillships to survive the flooding of any two adjacent compartments or tanks located within 5 feet of the hull. (Class II, Priority Action) (M-84-50)

Require that the operating manual for a drillship include guidance on the degree of survivability to which it is designed and the appropriate countermeasures to be taken in case of flooding. (Class II, Priority Action) (M-84-51)

Review the structural design, in conjunction with the American Bureau of Shipping, of the other five Global Marine drillships, similar in design to the GLOMAR JAVA SEA, and, if necessary, require design modifications to prevent a structural failure similar to that which occurred on the GLOMAR JAVA SEA. (Class II, Priority Action) (M-84-52)

Amend the U.S. Coast Guard regulations for mobile offshore drilling units (46 CFR 108.503) to require each drillship to have sufficient lifeboats on each side to accommodate all persons onboard. (Class II, Priority Action) (M-84-53)

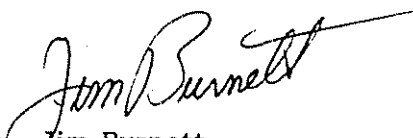
Require as soon as possible that all U.S. Coast Guard-approved survival craft be provided with a radio device capable of transmitting a distress signal. (Class II, Priority Action) (M-84-54)

Require every inspector (or the senior inspector if more than one) assigned to inspect U.S. mobile offshore drilling units in foreign waters to have had prior experience in the inspection of mobile offshore drilling units. (Class II, Priority Action) (M-84-55)

Require that a representative sample of nonfuel oil tanks on all U.S. vessels in saltwater service be inspected internally at least once every 30 months during drydock or biennial inspections and that the sample of tanks to be inspected be increased as the vessel gets older. (Class II, Priority Action) (M-84-56)

Require that a representative sample of fuel oil tanks on all U.S. vessels in saltwater service be inspected internally at least once every 5 years during drydock or biennial inspections and that the sample of tanks to be inspected be increased as the vessel gets older. (Class II, Priority Action) (M-84-57)

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

By:   
Jim Burnett  
Chairman