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Special issue on the offshore drilling industry

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Cover Photo
Dual purpose jack-up New Orleans removes old fixed platform.
Photo courtesy of Terminator, Inc., a subsidiary of Rowan Companies.

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Special issue on offshore drilling

Domestic features

Departments

Overseas features

MODU is shown with attending vessels in the Gulf of Mexico.

Photo by LT Thomas Favreau.

Offshore drilling industry generates safety

By RADM A. E. "Gene" Henn

In the midst of difficult economic times for offshore drilling and production companies, it is heartening for the Coast Guard to highlight an industry with such a fine record in accident-prevention and pollution-free operation. Compared with other marine industries, offshore drilling, and oil and gas production, is fraught with hazards that invite accidents to happen. Yet this industry's record in conducting clean, safe operations is second to none.

- In the 10 year period of 1980 to 1990, the offshore drilling industry improved its safety record by 342 percent, from an incident rate of 24.96 to 5.65 accidents per 200,000 work hours.
- During the 20 years between 1971 and 1990, the industry drilled 20,550 wells on the United States outer continental shelf, producing 6.8 billion barrels of oil, with an infinitesimally small oil spill of only 908 barrels or 0.0000134 percent.

Accidents causing injury to personnel or the environment are being reduced through advancements in drilling and production technology, such as the use of redundant systems, sealing features to protect against the loss of well control, and automation in drilling and pipehandling equipment. Even in this bleak economy, the industry has not backed off from its firm commitment to constantly keep improving its accident and oil-spill prevention techniques.

Statistics show that the United States produces about half of its total oil demand. To increase this figure, more new oil must be discovered, particularly offshore. Now, 80 percent of all new oil in the United States is discovered offshore. This is likely to increase in the future.

Recently, I met with members of the board of directors of the International Association of Drilling Contractors, and I was extremely impressed with their safety and environmental protection record. However, the general public is not really aware of this achievement. We must strive to get this positive message to the people to generate their support for the industry.

The Coast Guard has emphasized for some time the need to address human factors in the fight for accident and pollution prevention. We know that the offshore industry supports this philosophy wholeheartedly.

It is increasingly important that the Coast Guard and the drilling and production industry work together to keep the offshore safe and pollution free. We must not let down our guard. Even though the record is good, it can be better. And we must constantly strive for improvement.

As economic conditions influence the drilling and service industry to seek markets overseas, we can all gain from the experience of international competition. The United States supports efforts at the International Maritime Organization (IMO) to develop international codes concerning human factors and quality management principles.

The offshore drilling industry provides an excellent example of how such principles, when embraced by top management and carried out throughout the work place, can provide a safer, cleaner environment.

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Offshore drilling

Henry Goodrich, a semi-submersible drilling unit is under tow.

Photo courtesy of Sonat Offshore Drilling Inc.

Here and Now

By Mr. Marshall Ballard

Down side

Offshore drilling and related industries are currently experiencing their 11th year of decline and/or depression in varying degrees. As those in the industry well know, the United States market has been particularly battered since 1991 by consistently ebbing demands brought on by very low prices for natural gas, and moderate prices for oil on the one hand, and restrictions, moratoriums and increased costs of operation due to the growing number of state and federal regulatory actions, on the other.

There are now only two mobile offshore drilling units (MODUs) operating in the United States outside of the central and western Gulf of Mexico, the main area for offshore operations.

According to *Offshore Data Services*, some 42 MODUs were removed from the Gulf of Mexico during the past year. This was about 22 percent of the fleet. Most of these units still work in other parts of the world as MODUs, although about 18 were retired due to a lack of work in the Gulf of Mexico, combined with a limited world-wide market. A small number were converted to other uses, including accommodation units or production platforms. The remaining Gulf of Mexico fleet of about 151 MODUs currently suffers from less than 50 percent utilization.

It should be noted that the United States oil and gas industry as a whole, including the producers -- major and independent -- service and other related companies have lost from 450,000 to 475,000 jobs since 1981. Reportedly, this is more than the automobile and steel industries combined, and there are additional reductions and restructurings still taking place.

Oil imports are up an unprecedented 50 percent and growing as domestic production declines. In 1973 and 1978, when oil shortages, gas lines and rationing were taking place, the United States was importing only one-third or less of its needs.

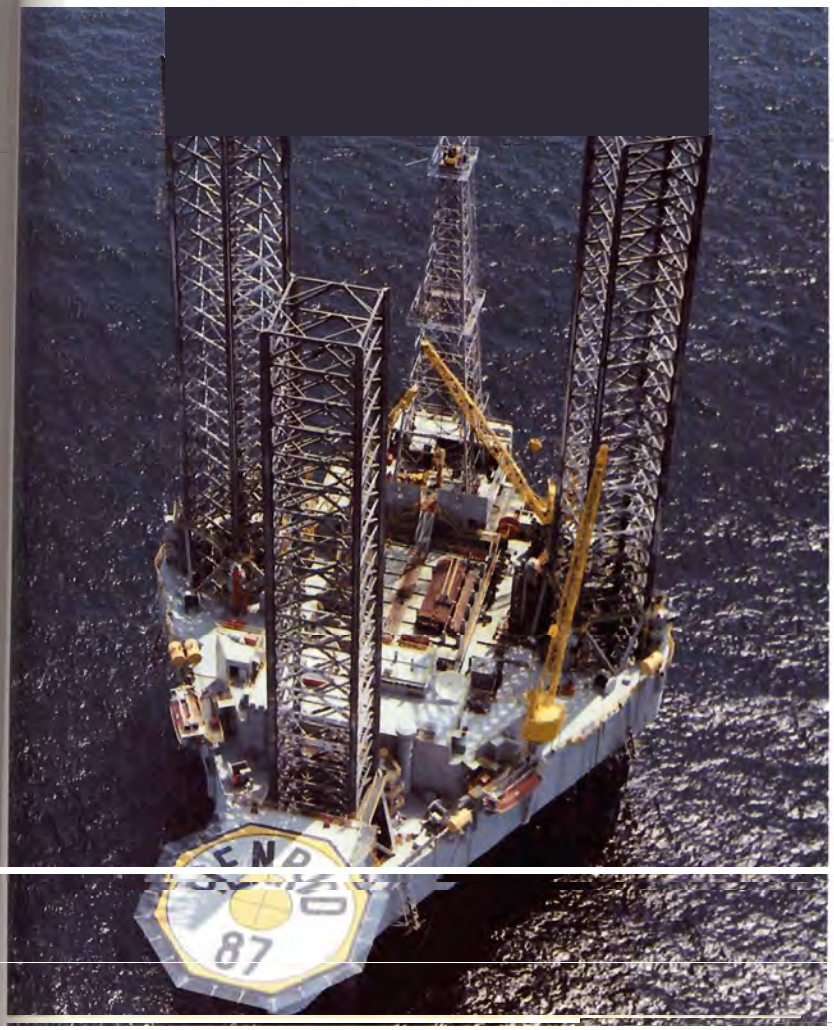
Up side

Despite these reversals, the drilling industry has achieved remarkable advances in technology both in regard to equipment and drilling techniques. Examples include top and side drives, and directional drilling. The drilling process has become much more efficient.

The best news is that these advances have been accompanied by remarkable improvements in safety and environmental protection. This is clearly demonstrated by Admiral Henn's statistics. (See page 1.)

The environmental record with regard to oil spills speaks for itself. No expenses, except for administration, have ever been paid out of the fund created by the Outer Continental Shelf Lands Act Amendments of 1978, which is now part of the Oil Pollution Act of 1990 (OPA 90). This fund was set up to take care of spills resulting from offshore exploration and production on the United States outer continental shelf.

The drilling industry's safety record has improved dramatically, due largely to a growing realization that safety is "everybody's business," starting at the helper-roustabout level up



Penrod 87 jack-up unit is drilling in the Gulf of Mexico.

Photo courtesy of Penrod Drilling Corp.

through each trade and supervisory level to the company president. Many oil company lease operators have also recognized the necessity for strong safety initiatives, including the need to change company "cultures" to incorporate strong training programs and safety awareness as a way of life. The most dramatic improvements occur when an oil company lease operator and the drilling contractor have similar aggressive approaches toward safety, health and the environment. Motivated personnel at all levels are bound to create a safe, efficient and environmentally sound operation.

MODUs are, for the most part, well maintained, well equipped with modern safety systems, and generally meet or exceed all federal, state and classification society requirements.

The establishment in 1988 of the National Offshore Safety Advisory Committee (NOSAC) to the Coast Guard is also a positive factor for the country and the industry. (See page 42 for detailed information on NOSAC.)

Conclusion

Relatively low cost foreign sources of oil and gas continue to find favor in our political processes. Clearly, fossil fuels will continue to provide the great majority of our energy needs well into the next century, so there has to be a future for the drilling contractors who survive.

When there will be a recognizable sustained recovery for the contract drilling business and related industries, and in what part of the world, remain "$64 questions," which are very difficult to answer.

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Auger is on the way . . . WAY DOWN

By Ms. Elizabeth B. Bollich

In late 1993 or early 1994, a fully equipped tension-leg platform will be placed in the Gulf of Mexico in a water depth of 2,860 feet, the world's deepest offshore production installation. Operations on the Auger project of Shell Offshore Inc. should begin shortly thereafter.

The Auger tension-leg platform will be placed on Garden Banks block 426, about 214 miles southwest of New Orleans, Louisiana.

Design

The *Auger* will be the first tension-leg platform in the Gulf of Mexico to support a drilling rig and a complete complement of production facilities. It will consist of a superstructure (hull and deck), foundation templates, tendons, production risers and a lateral mooring system.

The total cost for the entire project is $1.3 billion, which includes the construction and installation of the tension-leg platform and a drilling rig, process facilities, pipelines, and material and services for drilling and production.

As would be expected for a project of this magnitude, there have been many design challenges. They have provided impetus for the use of computer-aided design software to an extent not previously used within Shell. The primary software, Plant Design Management System, was designed in Cambridge, England, and was used before on other major Shell projects.

Among other things, this software was used on *Auger* to detect interferences on the tension-leg platform. This included determining (1) "hard-hard" clashes where piping or other structural components physically interfered, (2) "hard-soft" clashes where physical components impinged on reserved spaces (e.g., piping running right across a stairway and blocking egress) and (3) "soft-soft" clashes where maintenance activities on modules would be impeded. The software identified more than 2,200 clashes and permitted their elimination before construction.

Additionally, Shell wrote an in-house program to work with the Plant Design Management System package. This allowed for the calculation of the weight and center of gravity for any and all components on the tension-leg platform. This development reflected the relatively unique considerations in the design of a floating versus a fixed structure.

Background

The discovery well for the *Auger* was drilled in 1987. In December 1989, Shell announced plans to install the tension-leg platform, and, in 1990, contracts were awarded to McDermott Inc. in Morgan City, Louisiana, for deck fabrication, mating of the deck and hull, and installation of the structure; to Belleli of Taranto, Italy, for hull fabrication; and to Sonat in

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Constructed in Taranto, Italy, in July 1992, column sections connected by pontoons form the Auger hull.

(Left) Foundation templates for steel tethers will be anchored to the sea floor in the Gulf of Mexico this winter.

(Above) Crane lifts process vessel module to set it on the deck at far left. Various other modules await placement in the Louisiana shipyard.

(Left) Computerized representation of Auger tension-leg platform.

(Below) Power module contains turbine-driven generators.

(Left) Scaffolds shroud construction work on the Auger deck.

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Houston, Texas, for initial development drilling. In addition, more than 771 companies thus far have received contracts for work segments, the majority of which are located along the Gulf of Mexico coast.

Certification

The *Auger* was designed by Shell engineers in Houston and New Orleans, who worked closely with the Coast Guard to assure that the design met appropriate regulations. The Coast Guard also reviewed and approved construction plans, which was not an easy undertaking in that different segments of construction were performed by 14 companies located in the Gulf of Mexico and Italy.

Spreading construction and fabrication activities over such a large number of sites was relatively unique for the Gulf of Mexico petroleum industry. Typically, the structures for offshore platforms have been built in one location, such as Corpus Christi, Texas, or Morgan City, Louisiana. Likewise, the process modules have been constructed in another, such as the Harvey Canal near New Orleans, Louisiana. *Auger*'s construction in multiple locations is more typical of North Sea projects of similar magnitude, and, therefore, presented significantly greater management challenges.

The Coast Guard and Shell devised a unique arrangement to facilitate this potential coordination nightmare. The Officer in Charge of Marine Inspection at Port Arthur, Texas, was named focal point to monitor and coordinate all inspections at the many fabrication sites.

Progress

Development drilling began in May 1990 using Sonat's semi-submersible rig, *George Richardson*. Ten development wells have been drilled and cased, and the structure has been designed to accommodate up to 22 more wells once the tension-leg platform is installed.

Once the deck and hull are fabricated, the hull will be transported from Italy to the Gulf of Mexico coast, where it will be mated with the deck in the open seas. After the mating, the hull and deck structure will be transported to Freeport, Texas, where the final hookup and commissioning will take place. The structure will then be towed to the installation site.

Production

The total gross ultimate recovery is estimated to be more than 220 million barrels of oil and gas equivalent. Production is expected to peak at 40,000 barrels of oil and 150 million cubic feet of gas per day. The expected life of the field is more than 20 years. Currently, *Auger's* field is among the largest in the Gulf of Mexico.

"The Auger tension-leg platform represents another giant step toward narrowing the industry's ability to explore and its ability to produce," said Frank Richardson, president of Shell Oil Company.

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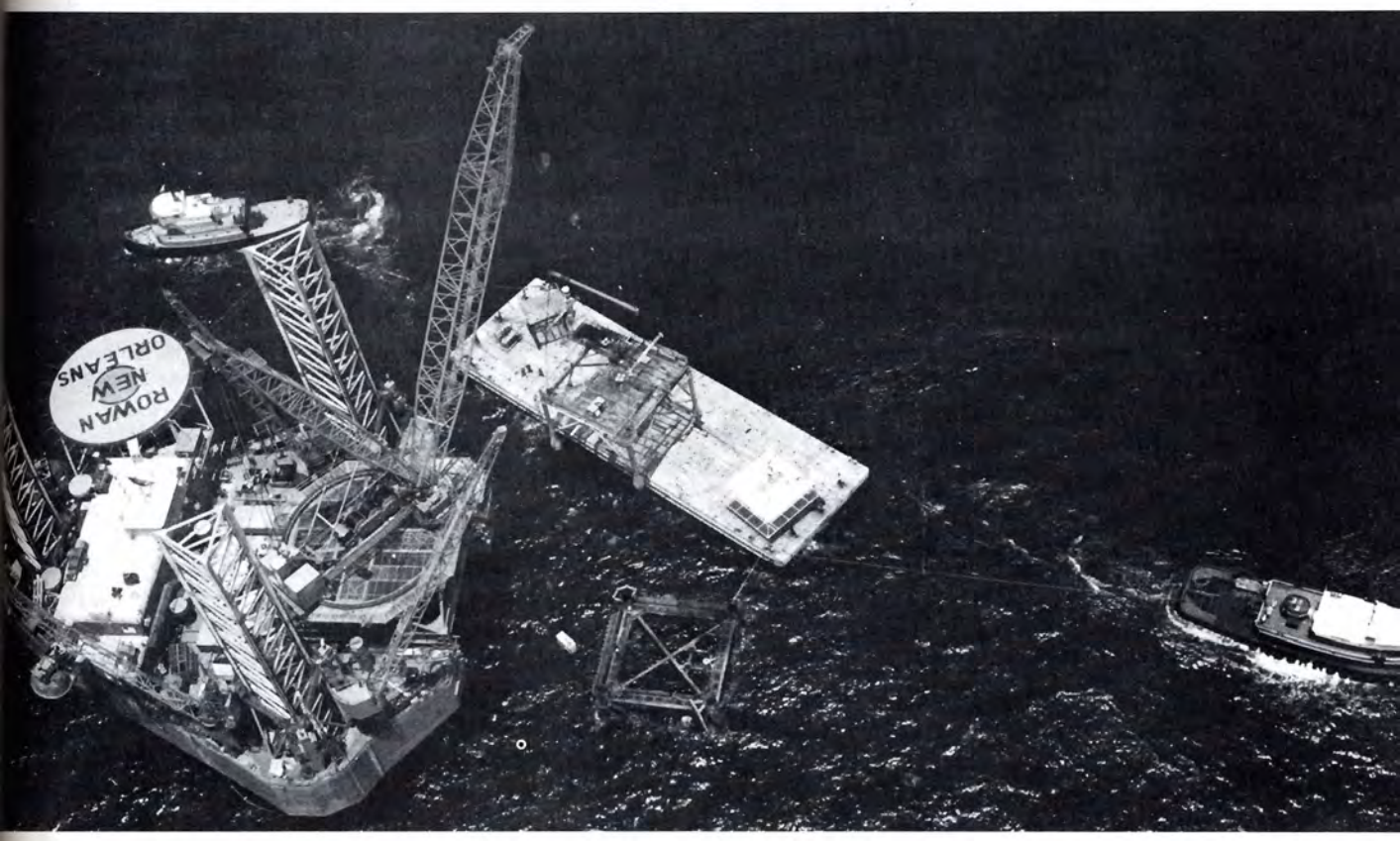
Hull column section is under construction in foreground with pontoon shown in left rear in Taranto, Italy, shipyard. Note: cylinder at center of pontoon is used for passage between all four columns.

Photographs accompanying this article are courtesy of Shell Offshore Inc.

Rowan "the terminator"



New Orleans, Rowan's dual purpose jack-up, lifts top portion of old fixed platform onto barge to be towed off for disposal.

gives new life to idle rigs

By LCDR Ruben H. Arredondo

Who says necessity is not the mother of invention? With oil prices declining and the offshore drilling business on the down swing, an enterprising drilling company used some common sense with imagination and developed a new use for idle offshore rigs.

Rowan Companies began exploring new opportunities to maximize their resources after seeing their rigs and those of many other companies stacked along the shores of the Gulf of Mexico. Their efforts produced a slot jack-up rig capable of sliding off the present drilling package and replacing it with a 550-ton crane aimed at platform removal.

Dual option

Operated by Terminator, Inc., a subsidiary of Rowan Companies, the new rig can be used either for drilling or for a crane barge/platform tender. The option depends on customer need and industry demand.

Presently the rig is in its "crane mode," being used to plug and abandon 16 pipelines, plug 23 abandoned wells, and dispose of five wells and 14 single-well structures.

In addition, the rig is designed to perform drilling operations over a fixed platform by sliding a portable skid-base on top of the capping beams. The rig's drilling package, including

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subbase, substructure and drill floor, is then slid over the skidbase to allow the platform to conduct drilling operations. The rest of the rig can be used as a tender.

Rowan maintains that the process offers operators an economical alternative to operating standard platform rigs.

Why?

The idea for the dual option rig was inspired partly by the state and federal government's designation of many platforms in the Gulf of Mexico as obsolete due to aging. The May 1992 issue of *Texas Parks & Wildlife Magazine* reported that by the year 2,000, operators will have to mark for removal approximately 40 percent of the 4,000 United States offshore platforms, 95 percent of which are in the Gulf of Mexico. The Mineral Management Service estimates that the removal of these platforms may cost as much as $3 million for those in shallow water and up to $15 million for those operating in depths greater than 400 feet.

The new bottom-supported jack-up crane offers companies a more economical way of disposing of the platforms than by derrick barges. Owners can further save millions of dollars in disposal costs if the states accept the platforms as artificial reefs for the protection of marine life. The costs of placing the dismantled pieces in barges, towing them ashore and disposing of them would be completely eliminated.

Added benefits

There are other large derrick barges with 2,000-ton capacity cranes in the business. However, they are used mainly in deep water platform operations and in pipeline laying. The first in a series of the dual option rigs, the Rowan *New Orleans*, can operate in water depths under 250 feet or in any location along the shoreline. Their expenses are less due to employing smaller crews than for drilling work, and shorter time on site. Other jack-up rigs capable of the same dual performance are the *Juneau, Odessa, Alaska* and *Louisiana*.

Rowan claims a weather window to be an additional advantage of the dual rig over the derrick barges. The company maintains that their rigs only require a 48-hour window verses two weeks for derrick barges. The rig also can operate year-round with very little downtime during the winter.

Future plans include exploration and development in extremely remote areas. The rig will drill the exploratory well and the development wells in the MODU mode, then convert to a derrick barge, set all the platform equipment, rig it up, and convert to a drill rig again to do all the tie-backs and completions. If necessary, they will be able to exchange the drilling package for the crane, go back and install the structures, get the drilling package back, skid it onto the platform and place it into oil or gas production.

Inspection

The *New Orleans* underwent conversion in Fourchon, Louisiana, where the crane was installed and subjected to intense weight testing. An additional 42 tons of steel was added to the hull and keyway for reinforcement to support the added weight of the crane package. Operating manual procedures had to be modified to comply with new stability requirements.

Since the rig retains its drilling function and will operate in United States waters, it had to undergo a complete Coast Guard inspection by MSO Morgan City. And because the rig is registered in Panama, it received a Letter of Compliance instead of a Certificate of Inspection. The rig must undergo a Coast Guard inspection every time it changes back to the drilling mode to ensure that it meets the Letter of Compliance requirements. Areas of concern include: life-saving equipment, firefighting equipment and other safety items related to machinery and auxiliary equipment.

Summary

Rowan estimates that 2,000 platforms and other offshore structures will go out of commission in the next eight years. Approximately 1,500 of them will be located in the Gulf of Mexico -- enough to keep the dual option rigs busy for a long time to come.

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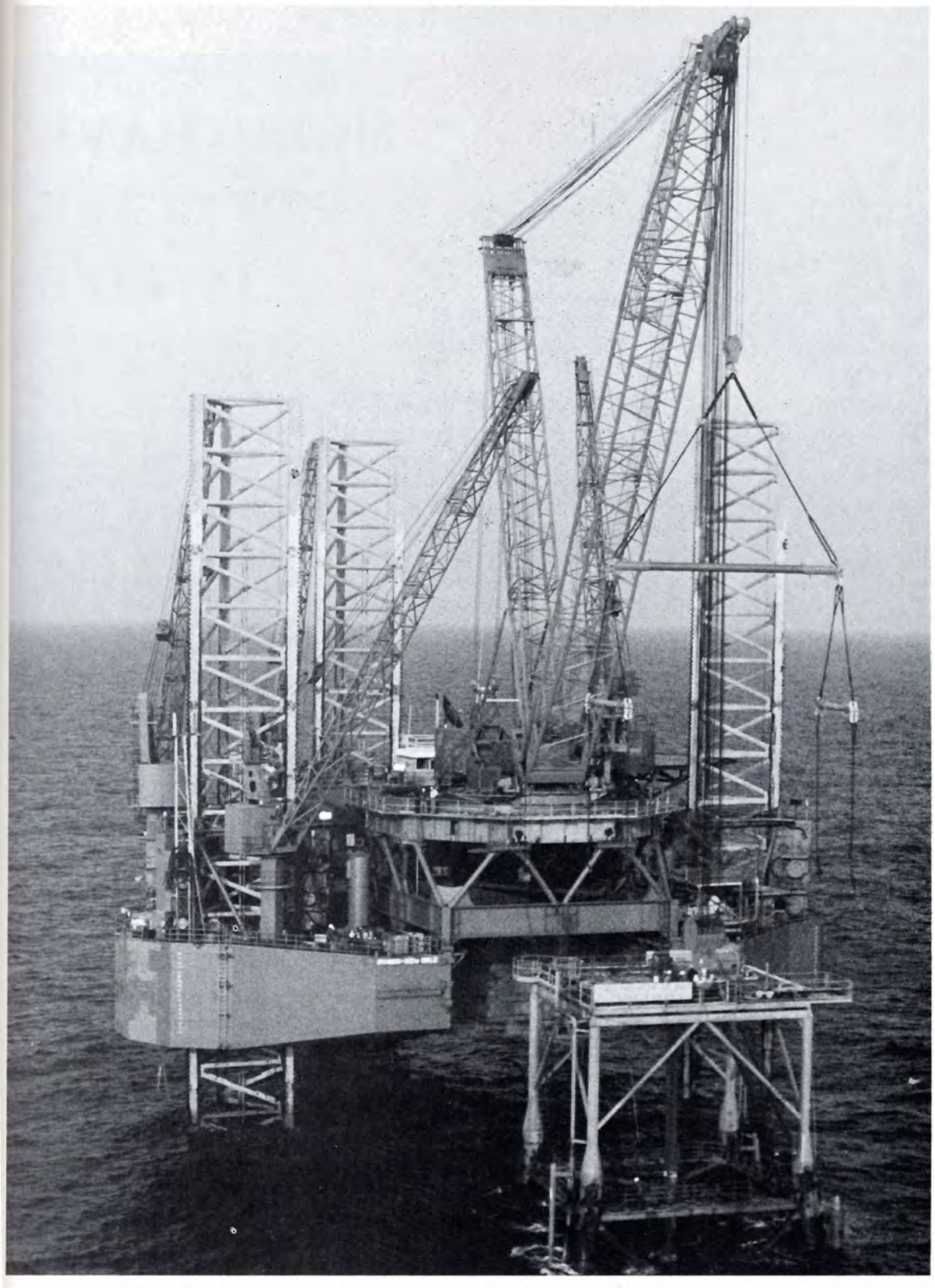
Photographs accompanying this article are courtesy of Terminator, Inc., a subsidiary of Rowan Companies.



New Orleans' crane lifting gear is being positioned to raise another old fixed platform.

MODUs HAVE NEW LEASE ON LIFE

By Mr. Robert Bowie

Introduction

During the past ten years, the offshore industry has been confronted with unique situations which have forced oil companies, drilling contractors and related industries to develop innovative solutions to continue offshore drilling and production activities. They include:

- accelerated worldwide offshore exploration, resulting in the discovery of oil and gas in geographical areas where refineries, pipelines, transportation facilities etc., typical in the Gulf of Mexico and North Sea, were not available;
- depressed crude oil prices, providing little incentive for developing costly offshore projects; and
- the discovery of significant reserves in water depths exceeding the limits of conventional fixed platforms.

These three actualities highlight the dilemma faced by the offshore industry. In short, why should exploration for additional reserves continue when newly discovered supplies were already too costly to develop? One solution is the use of a floating production system. The industry today is creating numerous types of floating production systems, and converting existing MODUs for use in production service.

The American Bureau of Shipping (ABS) has developed specific criteria for the conversion of MODUs to production systems, based on experience gained in working with the offshore oil industry in the Gulf of Mexico, the Coast Guard and Mineral Management Service (MMS).

Criteria

When a MODU is identified for conversion to production service, the design review work, fabrication records and survey reports over the unit's life help determine its adequacy for site-specific use. ABS has devised a system of four production categories, recognizing different operating scenarios and indicating applicable requirements and the extent of ABS involvement.

Category A
Well or drill stem testing

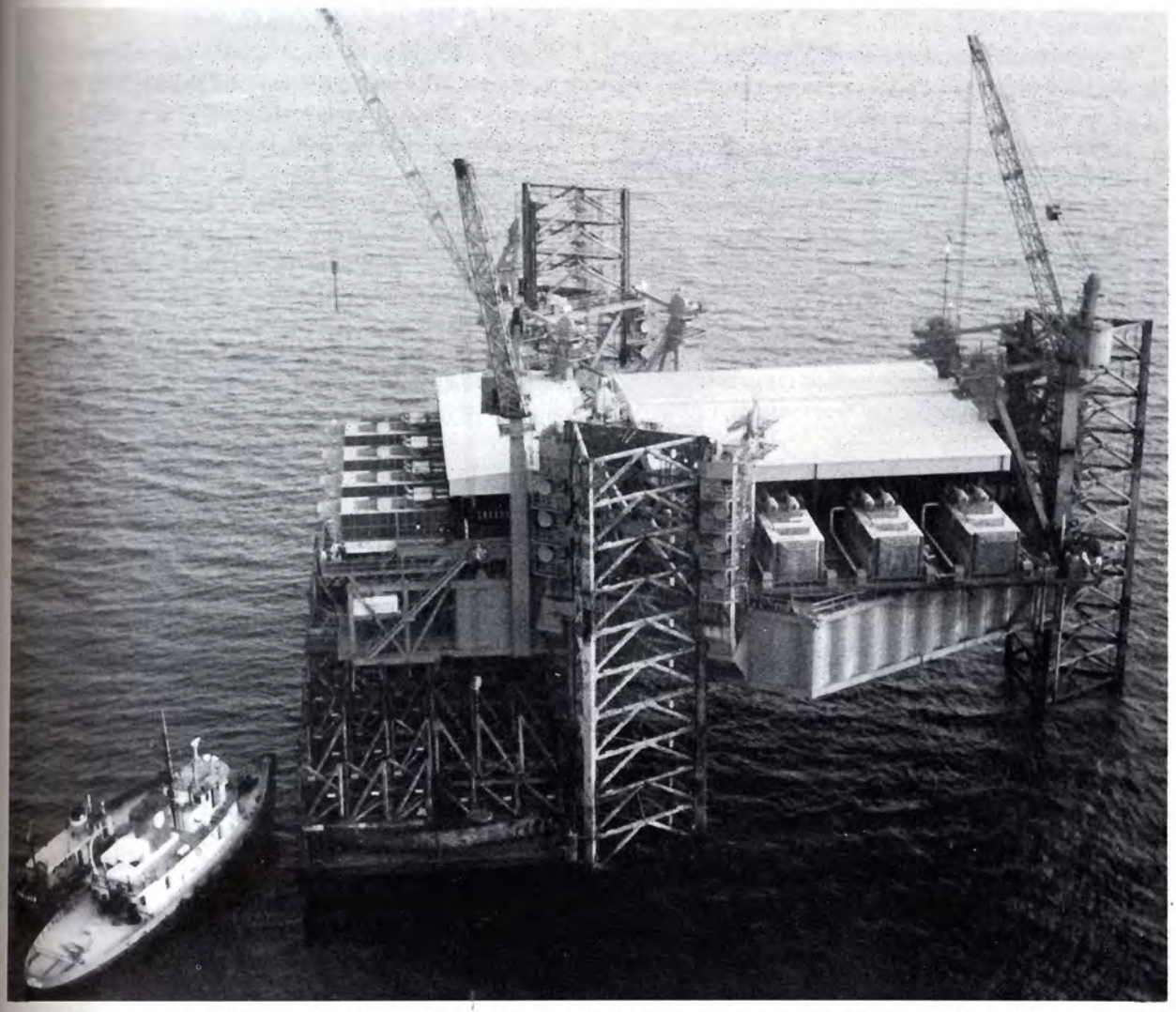
This is a short-term test using portable equipment brought on board a drilling unit. The test is conducted as part of drilling or work-over operations.

ABS requires the description of the locations where the equipment may be temporarily placed on the unit and any actions necessary to safely accommodate it. The MODU retains its class designation, requiring no additional ABS involvement. (No production can be exported.)

Category B
Dedicated well testing

This testing is conducted on permanently arranged units primarily dedicated to well testing. Such units do not have drilling systems, and typically move from site to site, connecting to the drillstring to conduct their operations from alongside the rig.

The major concern of ABS for these units centers on arrangement and equipment installations. Design details of the installation must be submitted for review, and components must be either certified by ABS or by other recognized authorities, such as the American Society of Mechanical Engineers for pressure vessels or the Underwriters Laboratories Inc. for electrical



This former jack-up drilling unit was converted to a production platform for operation in Lake Maracaibo, Venezuela.

equipment. In addition, the fabrication and installation of equipment must be inspected by ABS. It is also subject to periodic inspection by ABS surveyors. (No product can be exported.)

Category C
Short-term production

Vessels, barges and MODUs outfitted for temporary or early hydrocarbon production of marginal fields or for extended well test operations fall under this category. The product may be stored on board, and is exported by flexible hose either to a storage vessel, a single-point mooring, a subsea pipeline or manifold center. In some cases, the units may be arranged for simultaneous drilling and production. ABS considers production to be short-term when its duration does not exceed two and one-half years at a site.

A detailed design review of the arrangements, systems and components of the production facility is conducted to assure compliance with ABS "Guidelines for Building and Classing Hydrocarbon Production Facilities on Offshore Installations." ABS surveys are carried out during fabrication of critical process components, as well as on board installation and testing. Surveyors are in attendance during initial start-up and commissioning offshore. In retrofitted units, structural fire protection of accommodation spaces may have to be upgraded if production equipment is placed nearby.

ABS does not review the site-specific adequacy of the system, such as environmental, mooring or foundation considerations, as a mandatory condition of classification. It is up to the

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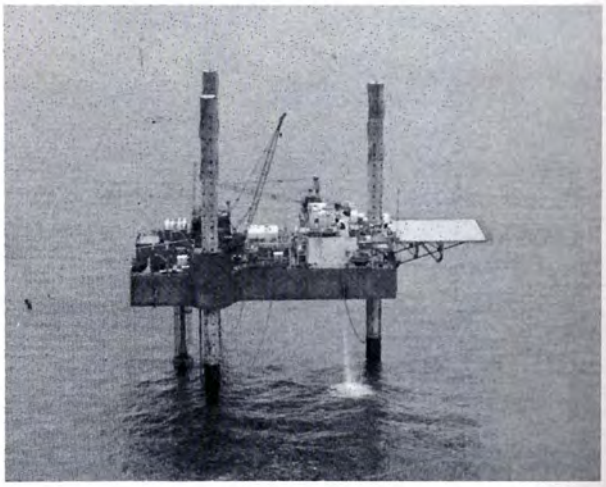
owner to address these considerations to ensure that the system is not exposed to conditions disallowed by classification criteria. The owner also should decide when and what operational changes are required to withstand severe storms, such as "cut and run," shut-in wells, retract cantilever, deballast or weathervane on mooring etc. This is also true for MODUs used for normal drilling.

Gulf ABS considerations

ABS's approach to MODUs converted to site-specific production service is based on the premise that the owner chooses to maintain classification of the unit as a MODU in addition to the site-specific designation, "A-1 offshore installation production platform." However, in the special case of a self-elevating drilling unit converted to production service, another approach is to treat it as a fixed platform.



Once a drilling unit, the Marlin IV now operates in the Gulf of Mexico as a production platform.

Category D
Hydrocarbon production installations

These are permanent installations where provisions have been made for extended on-site deployment without drydocking. The installations include fixed platforms, tension leg platforms, compliant towers, floating production systems and MODUs used for long-term site-specific production.

ABS classification requires plan review and survey of topside facilities similar to installation for Category C. In addition, the site-specific adequacy of the entire system and station-keeping capabilities are reviewed for compliance with the ABS Rules for Building and Classing Offshore Installations, part 1- Structures.

An important difference between Categories C and D is the duration of production service contemplated. The two and one-half-year production limit was selected based primarily on ABS requirements for drydocking, and the policy that a unit is drydocked before going on location.

Successful review and acceptance according to the rules leads to naming the unit as an "A-1 offshore installation production platform."

This approach involves the following actions:

- owner requests that the MODU classification designation be dropped;
- owner requests ABS to reclassify the unit as an "A-1 offshore installation production platform";
- ABS approves the unit for suitability to its offshore installation rules, consistent with the MMS requirement for utilizing 100-year return period environmental conditions for proving structural adequacy; and
- ABS does not require review and classification of production facilities.

This procedure has been afforded to operators in the Gulf of Mexico only. It accommodates the MMS requirements and procedures for platforms installed in United States waters. MMS requires that all fixed installations be shown by

the operator to meet their requirements for structural adequacy of a design. The owner is allowed to submit process facility design information to MMS for approval.

In meeting its requirements, MMS has advised owners that ABS classification of the converted MODU is acceptable as demonstrating the structural adequacy of the unit. However, MMS does not recognize ABS classification as a replacement or substitute for its own requirements for approval of the production facility.

In most cases, owners have chosen the option provided by ABS to classify only the structural adequacy of the unit as if it were a fixed platform. ABS believes that this one exception for conversion of MODUs to production service is justified, since a jack-up approved for site-specific applications (with jacking capability removed once the unit is elevated, is, in fact, a fixed platform).

Coast Guard requirements

MODU owners must also comply with the following Coast Guard requirements:

- surrender the existing Certificate of Inspection for the MODU,
- disable the drilling capability of the unit, and
- disable the jacking gear (after elevating the unit) so that the unit cannot easily or inadvertently be lowered.

The unit must be operated in accordance with 33 CFR, subchapter N for fixed outer continental shelf activities, and it is not subject to Coast Guard in-service inspection requirements for MODUs. Furthermore, if any of the above Coast Guard requirements are not met, then the unit is considered a vessel under either 46 CFR, subchapter I or I-A, depending on whether drilling capability is maintained. In either case, ABS requires a full review of the production facilities, since either application is subject to the MODU rules requirements and Category C- or D-type production service requirements.

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Former drilling unit, Penrod 72, was converted to a floating production system for operation in the Gulf of Mexico.

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One exception

One exception provided in the classification of self-elevating drilling units to site-specific production applications in the Gulf of Mexico has not been extended to column stabilized drilling units for the following reasons:

- in maintaining active control of the column stabilized drilling unit, the ability to provide power to adjust ballast, mooring tension and other operational controls is of critical importance to ensure the safety of personnel and the unit during all phases of operations, including potentially hazardous conditions;
- the introduction of production facilities requires significant linkage with marine systems which are needed to provide the active control of the column stabilized drilling unit. ABS cannot be assured that this unit could be appropriately modified to counteract any adverse conditions without also reviewing the production system to ensure that necessary marine capabilities are not compromised.

This involvement by ABS has proven quite helpful in providing a vital linkage between marine personnel responsible for the column stabilized drilling unit operations and the production personnel responsible for the hydrocarbon process facilities. ABS realized early in its involvement with MODU conversions that, due to the nature of the engineering efforts, the marine and production aspects normally involve different expertise, and the parties are not completely aware of each other's objectives or limits. Thus ABS ensures it is capable to help determine the applicable limits of the marine and production systems regarding safe operating practices, and also to ensure that applicable requirements of both the Coast Guard and MMS are met.

A self-elevating drilling unit converted to site-specific production application (as a fixed platform without MODU designation) is not required to be reviewed by the Coast Guard. But a column stabilized drilling unit is always reviewed by the Coast Guard and must meet the requirements for MODUs under 46 CFR subchapter I-A, as well as any additional requirements of MMS. This was the case in the conversion of Placid's *Penrod 72*.

Conclusion

Requirements for MODUs converted to site-specific application are based on a combination of ABS rules, IMO safety standards, Coast Guard and MMS requirements to provide a rational framework within which ABS and the offshore owner/operator can work. This framework has proven effective in providing extended life and /or use for the MODUs.

"... MODUs of all ages can be successfully operated as production units for extended periods of time ..."

Service experience has demonstrated that MODUs of all ages can be successfully operated as production units for extended periods of time when site conditions are within the unit's design capabilities. ABS is committed to help ensure a level of safety equivalent to that for conventional fixed installations.

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Photographs accompanying this article are courtesy of ABS.

"Dynamic positioning" for deep ocean drilling

By Mr. John Rouse

Background

Mobile offshore drilling units generally fall into two distinct categories: (1) jack-ups and other bottom-supported units, and (2) drillships or semisubmersibles.

As offshore drilling progressed to deeper waters, new types of units had to be designed. Bottom-supported units only have a water depth capability of up to 400 feet.

Floating drilling vessels were introduced in the early 1970s, which overcame the water depth restrictions of jack-ups, but they necessitated the deployment of multi-anchor spread mooring systems to keep the vessel in position during drilling operations.

Later, as potential oil reserves were identified in ultra-deep waters (5,000 feet and above), conventional mooring systems became unfeasible. In the mid-1970s, drilling vessels with dynamic position systems were introduced. Thrusters controlled by computers hold the vessel heading and the position, instead of conventional anchors and chains.

The primary task of a drilling vessel is to safely drill for potential oil reserves. This requires strict and reliable stationkeeping performance to maintain the vessel as closely as possible over the center of the well. Usually this means that the vessel must be maintained in a position range of better than two to three percent of water depth. For example, in 5,000 feet of water, the horizontal excursion of the vessel in relation to the well center should be no more than 100 to 150 feet.

This is not a factor for conventional mooring systems during normal drill operations due to the fact that the mooring lines passively restrict vessel movement. Failure of mooring lines, except during severe storm conditions when drilling has ceased, is rare.

In operations involving dynamic position systems, however, stationkeeping is dependent on the computer-based controls and power-propulsion systems. Therefore, design, redundancy and safety systems play major roles in the development of a reliable dynamic position system.

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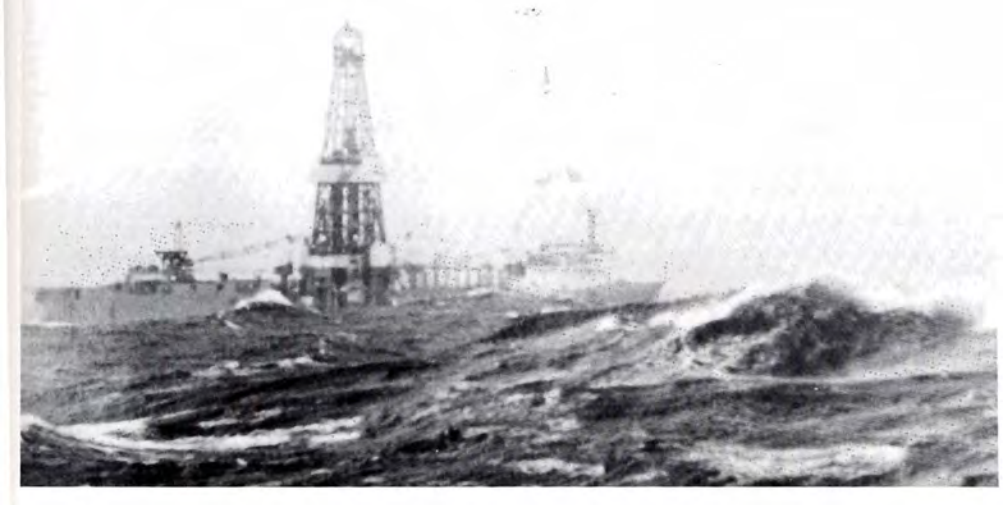

MODU uses dynamic position system for deep water drilling.

Dynamic position systems use state of the art computer equipment.

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Basic features

The fundamental features of any dynamic position system are:

- **Thrusters/propulsion** -- The environment (wind, waves, currents, etc.) all act upon the vessel and produce external forces that attempt to move it from a selected position. Thrusters, in combination with the vessel's main propulsion screws, must counteract these forces with equal strength to maintain station and vessel heading.
  There are several different types of thrusters, but the functions are identical in them all. Currently in use are fixed and azimuthing (rotatable), variable and fixed pitch propeller types. These combinations are designed to provide variable thrust in a selected direction to counteract the effects of the environmental forces.

- **Position reference system** -- Several technologies are normally used to provide position data to the dynamic position control system. Satellite position systems combined with differential information from land-based reference stations has produced an effective position reference system. In fact a standard deviation accuracy of about five feet is possible.
  Another type of position information system is based on the deployment of beacons on the sea bed and transducers on the vessel. Periodic acoustic transmissions between these devices yield position information of the vessel relative to equipment on the sea bed. There are several types of equipment, which offer performance from standard deviation accuracy of one foot to about one percent of water depth. Another position reference system that can be used is the measurement of the absolute angle of the drilling riser pipe connecting the vessel to the sea bed.

- **Environmental measurement systems** -- Wind speed and direction; vessel pitch, roll and heave; and vessel heading are monitored by vessel mounted electronic sensors. The sensors provide raw data to the computers for processing. This data is used to calculate the resultant external forces on the vessel.

- **Power system** -- This system supplies electrical power to the thrusters, sensors and dynamic position control system. Power is supplied by diesel/electric generator sets. Total generating capacity for a typical dynamic position drilling vessel is 20,000 to 30,000 kilowatts or 30,000 to 40,000 horsepower.

Since power requirements and fuel consumption are enormous, they are key factors for any dynamically positioned vessel. It is therefore necessary to optimize power demand versus availability. This is normally accomplished by a computer-based power management system which monitors peak power demands and automatically starts or stops engine generator sets to meet anticipated demands.

waters and harsh environments require special equipment and personnel. The development of dynamic position systems has been accomplished in a cost effective and extremely reliable fashion.

The bridge control center resembles that of a sophisticated military vessel.

- **Dynamic position system controller --** The control system processes environmental data with position information and data about how the vessel responds to external forces to determine the forces acting on it. This data is used to direct the thrusters and propulsion to provide an equal and opposing force to keep the vessel steady on its heading and position.

Summary

Dynamic position systems as they exist today use state of the art computer technology. Highly trained operators and technicians are required to operate and maintain the system. Exploration drilling offshore in ultra deep

About 90 percent of all wells drilled using dynamic positioning have been drilled by United States contractors. Most of the wells have been in United States waters. In this high-tech arena, American drilling contractor's expertise and experience is second to none.

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Photographs accompanying this article are courtesy of Sonat Offshore Drilling, Inc.

What is in store for offshore service vessels?

By Mr. Robert J. Alario

The boat industry serving the domestic offshore market, which operates almost exclusively in the western and central Gulf of Mexico, is DOWN. "Davey Jones" deep down! However, one dares to hope, not out!

Offshore boat owners and operators saw the domestic offshore oil and gas market -- their industry -- unravel in 1991, continuing its downward spiral in the first half of 1992. The supply/demand ratio performed a furious filp-flop, which left many stomachs in the boat market unsettled and unsure about where to look for a cure.

Today, supply boats; tugs; utility and geophysical vessels; crewboats; liftboats; diving support vessels, pipelay, derrick and deck barges, and other special purpose offshore vessels are struggling with an ebbing market. Their clients are leaving the Gulf of Mexico in increasing numbers, their operating and construction capital are increasingly scarce, and their insurance costs and tax assessments are skyrocketing.

Foreign exodus

During the past 18 months, the major oil companies and many independents have significantly shifted their attention and budgets to foreign exploration and development.

The financial impetus for the exodus of exploration companies and their entourages into foreign markets lies in much higher projected economic returns on investments: 20 to 25 percent from international prospects compared with four to six percent in the United States domestic market.

Naturally, offshore vessel operators that can, have been obliged to follow their customers into international waters.

The primary overseas markets are the North Sea, West Africa, Brazil, the Middle East and Southeast Asia, with considerable attention being directed lately on Mexico, Venezuela and Argentina.

A 200-foot tug and supply boat.

Offshore supply-anchor handling vessels.

Domestic scene

The offshore marine service vessel industry was born in the United States. American boat operators were the acknowledged leaders. They owned and exported the technology. They led the pack that soon followed. Today, they are "exporting" once again, with a fury. But this time, commercial moves are often defensive. And, at the rate things are going, unless business, government and environmental forces come together with some kind of balanced perspective, the future looks mighty bleak.

The price of gas in the Gulf of Mexico recently dropped unexpectedly and precipitously to $.90 per thousand cubic feet (mcf). Many drilling leases are expiring -- 285 are expected to expire in 1992, and 2,800 between 1993 and 1996.

The offshore rig utilization rate, just over 40 percent today, is at the lowest level of activity in 40 years. United States offshore drilling and construction budgets have been cut drastically. Consequently, a significant number of service vessels have been adversely affected. Many have been deactivated.

Domestic vessel utilization rates recently slumped below 60 percent. Day rates for active units are generally at break-even, with some slight exceptions in specialty markets. Many jobs have been lost on- and off-shore. Some companies have failed and others are threatened.

For example, in the offshore supply vessel sector, an estimated 286 out of 316 supply boats were active at the end of 1990, reflecting a 91 percent fleet utilization. Day rates averaged between $2,800 to $3,000 a day. In mid 1992, occupancy was between 60 and 65 percent, with day rates averaging between $1,400 and $1,700, perilously close to or below break-even.

Perversely, Hurricane Andrew briefly "helped" utilization and day rates with the flurry of activity cleaning up damage to platforms and piplines in the Gulf of Mexico. However, this spurt is expected to be short lived. By January, the industry will again rely on natural gas exploration efforts for revenues.

Meanwhile, companies fortunate enough to have vessels in the international market places enjoy stronger revenues and higher utilization rates than in their domestic operations. However, the overseas markets are not "friendly" to all, and particularly not to small operators. Furthermore, these markets are showing signs of softening and, naturally, competition is intensifying as more and more companies search for homes for their inactive vessels.

Through adversity, owners have recognized the need for more efficient service intensive operations and for expanded, diversified markets. The companies and equipment still afloat in 1993 will be of the "survivor" class.

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A 100-foot crewboat.

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Long term views

What can be expected in 1993 and beyond? Are there any positive signs with respect to domestic offshore operations that will affect boat operations? While the overall outlook might not be bright, there are interesting and hopeful blips on the screen for the more rugged, enterprising operators, beyond hurricanes.

Recently, speculation is growing that the gas bubble is about to pop (again). Industry analysts who were bemoaning the future of natural gas are now commenting about the possibility of a shortage in the not too distant future. Prices have risen from $.90 per mcf in February to more than $1.60 per mcf today. This, they say, is due to unseasonably cool weather in the north and an unseasonably warm summer in the south.

In any event, rising prices (if they stay upwardly mobile), declining supplies (less drilling going on) and increased use of environmentally preferred fuels to generate electricity are making the still gas rich Gulf of Mexico more attractive, particularly to active independents, who have purchased proven oil field reserves from major companies. Assuming that these independents can raise the capital to generate serious exploration programs, all will not be lost. *World Oil* magazine, in fact, is predicting a small upturn in oil and gas exploration in the coming months.

Furthermore, the companies that hold deep water prospects have announced that they fully expect to pursue their projects. Development work, they say, has been rescheduled, not abandoned.

Also, some boat companies are scrambling to position and/or convert vessels to service the oil spill clean-up market, when OPA 90 requirements become definitive.

Immediate prospects

Of more immediate significance, on the positive side, the offshore platform salvage and removal market, and the federally-required pipeline inspection program, both supervised by the Mineral Management Service (MMS), appear to be firming up.

Non-producing or abandoned platforms must be removed within one year after the cessation of operations. MMS estimates that more than 2,000 platforms will have to be removed on the outer continental shelf by the year 2,000.

Therefore, site clearance requirements, platform removal and pipeline inspection programs should engage equipment that is presently inactive, taking up some slack in the oversupplied market. Offshore vessel contractors are hopeful, but understandably cautious.

Conclusion

Whether or not the domestic offshore market will rebound soon or even in the long term, depends upon many truly unpredictable factors. The migration of the major oil and gas players overseas appears to be a serious, permanent change in direction. Last year, for example, it was reported that 77 percent of the total earnings of the six major international companies came from outside the United States. Current returns on investments are highly disproportionate and unfavorable toward United States investment. Accordingly, one major investment banking firm estimates that more than $20 billion in capital has gone overseas during the past six years. There is every indication that this will continue until the economics of exploration and production in the Gulf of Mexico change drastically.

For the most part, however, the major oil and gas producers have come to regard the Gulf of Mexico as a "mature" province with limited future prospects. In addition, they assert that highly restrictive domestic regulations and a stunning moratoria on offshore drilling applicable beyond the year 2000 will effectively inhibit future offshore exploration in the United States. At the same time the energy policies of many foreign countries are designed to attract offshore exploration.

As the pendulum of activity swings back and forth, oil field service companies, such as the offshore boat industry, are locked on for the ride, hanging on for dear life. Some analysts say that they have "seen the trough" -- that the worst is over and they can now expect an upturn in their fortunes.

However, many analysts continue to paint a relatively grim picture for the long-term future of the domestic offshore industry. As far as the Gulf of Mexico is concerned, much will depend on what happens to gas futures.

Until the future becomes the present, however, and the truth is finally revealed, the offshore vessel industry and its tough, resilient population will simply "look death in the eye" (again), "call his bluff" (again) "and hope he blinks" (again).

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Photographs accompanying this article are courtesy of Offshore Marine Service Association.

Oceanographic research vessel shown scanning the depths for oil and gas.

United Kingdom will require safety assessments for all North Sea platforms.

Piper Alpha disaster prompts new offshore safety initiatives

By Mr. Alan Spackman

The July-August 1992 issue of Proceedings described various management safety initiatives affecting traditional shipping industries. Though the risks facing the offshore energy exploration and production industry differ extensively from those of the traditional industries, similar initiatives are being pursued.

United Kingdom

On July 6, 1988, the *Piper Alpha*, a fixed production platform located in the northern North Sea was destroyed by a series of fires and explosions, causing 167 fatalities.

Prompted by recommendations arising from the public inquiry into this disaster, the United Kingdom embarked on one of the most massive regulatory reform programs in history -- one that will fundamentally alter the multi-billion dollar North Sea oil and gas industry. The inquiry resulted in 106 detailed recommendations in 24 broad categories.

There are considerable differences in the risks associated with a production platform such as the *Piper Alpha* with its large inventory of flammable liquids/gasses coexisting with a large workplace population, and the typical MODU which only has fuel on board and a relatively small population.

Nevertheless, it became evident early on that MODUs would be swept up in the regulatory reform effort. Recognizing the challenge this would present, members of the International Association of Drilling Contractors with operations in the United Kingdom joined together to develop guidelines for the necessary safety steps to comply with requirements of the forthcoming regulations. These guidelines provide a disciplined approach for drilling contractors to undertake safety assessments and develop safety management systems.

Potential hazards believed to be relevant to MODU operations in the United Kingdom

sector of the North Sea include: blowouts, explosions, dropped objects, loss of stability, vessel collisions, helicopter crashes, structural failures, fires, major mechanical failures, towing incidents and toxic/radioactive releases.

The government of the United Kingdom remains committed to sustaining the development of its offshore energy resources. The market stability resulting from this policy promotes a long-term investment on the part of industry to implement the mandated safety programs. The costs associated with the regulations are substantial, with estimates of up to two man-years to prepare a single safety assessment for drilling operations.

Similar safety regimes are established in Norway and the Netherlands.

United States

While the United Kingdom moves toward a single regulatory authority for offshore safety, these functions are shared among three federal and many state and local regulatory bodies in the United States. The federal agencies are the Minerals Management Service (MMS) of the Department of the Interior, the Coast Guard and the Occupational Safety and Health Administration.

MMS activities

In 1989, MMS formed a task force to assess its outer continental shelf inspection and enforcement program. The task force found that the service's inspection strategy relied too heavily on checking the operation of devices and not enough on stimulating safety consciousness among offshore operators. Noting the completion of recommended practice 750, "Management of Process Hazards," by the American Petroleum Institute in May 1991, MMS wrote to the institute requesting consideration for expanding its scope to include outer continental shelf oil and gas operations and facilities.

The American Petroleum Institute and the International Association of Drilling Contractors, had embarked on a joint effort to comply when MMS published a notice of proposed rulemaking in the *Federal Register* requesting comments and recommendations on a concept under which the service would require outer continental shelf lessees and/or operators to develop and establish a safety and environmental management program similar to the United Kingdom's.

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Drilling operations by the cantilever jack-up will require a safety assessment of potential hazards.

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Concurrently, the institute is revising its recommended practice (14J) for design and hazards analysis for offshore production facilities. Both proposals are nearing completion.

Like the United Kingdom's proposed safety regulations, those of the American Petroleum Institute are objective-based, providing a framework for a company to establish an effective safety management system and complete a disciplined assessment of the potential hazards associated with its activities. The same principles of management and risk control that govern safety also apply to environmental concerns.

Most oil companies have national and/or regional operating divisions, and can be relatively unconcerned about differences between national requirements because their production platforms are rarely moved across national boundaries. On the other hand, most drilling contractors market their MODUs internationally and are vitally concerned with the possibility that differing regulations will add unnecessary costs to moving a MODU across national boundaries. (One famous example is the case of the MODU helideck that had to be repainted when moved across a national boundary, even though the rig was to be serviced by the same aircraft.)

Coast Guard activities

Since August 1990, the Coast Guard, along with a special working group of the National Offshore Safety Advisory Committee, has been developing a proposal for major revisions in its outer continental shelf activities regulations in 33 CFR subchapter N. Much of the working group's effort is focused on updating regulations pertaining to fixed facilities, which have remained relatively the same since 1956.

Other issues being addressed by the Coast Guard include the development of standards for tension-leg platforms, mobile inland drilling units working in shallow waters of the outer continental shelf, and for foreign vessels, other than MODUs, engaging in offshore activities.

OSHA activities

OSHA has largely left the regulation of offshore safety to MMS and the Coast Guard. The agency recently completed a comprehensive rulemaking on process safety management of highly hazardous chemicals, explosives and blasting agents (57 FR 6365, *et. seq.*), which exhibits many elements contained in the United Kingdom's and MMS safety proposals.

OSHA excluded oil and gas well drilling and servicing operations from its final rule based on its belief that such operations should be covered in a standard designed to address the uniqueness of that industry.

International guidelines

IMO's "Guidelines on Management and Safe Operation of Ships and for Pollution Prevention" were drafted for application to traditional shipping, and may not be wholly appropriate guidance for the management of offshore energy exploration and development activities.

There is recognition that the development of common guidelines by industry representatives would enhance safe performance. Consequently, the Oil Industry International Exploration and Production Forum, and the International Association of Drilling Contractors have formed a joint working group to complete a critical review of all existing regulations and regulatory initiatives, existing and proposed industry standards and related documents concerning the preparation of safety management systems, hazard analyses and risk assessments.

The goal of this working group is to develop model guidelines for worldwide exploration, development and production activities of MODUs. Special emphasis is given to the connection and coordination between operator, contractor and subcontractor management and safety systems, as well as their development and implementation.

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Photographs accompanying this article are courtesy of the International Association of Drilling Contractors.

Conoco's tension-leg platform is piggyback towed from Singapore to the Gulf of Mexico.

Evolution
of the tension-leg platform

By Mr. Andrew Hunter

With the current low oil prices, the offshore industry can no longer afford to build permanent deep water structures that can be used only one time.

During the past 25 years, the most important development in offshore technology has been the MODU. It was the exploration tool that was needed for the rapid expansion of the offshore drilling industry from the 1950s through the 1980s. Deep water exploration activities are expensive, and exploratory (wildcat) drilling is a major part of the cost. Unless the MODU is capable of being used over again and again (more than 100 times in its 25-year working life), the industry couldn't afford to build it.

During the next 25 years, the most important technological development will be the mobile offshore production unit. This tool will be needed for its easy redeployment capability. It can be used perhaps three or four times in its 25 or more years of working life. (Mobile offshore production units must stay on production wells for ten or more years, while MODUs remain only about the three-months' time required to drill an exploration well.)

Tension-leg platform

The tension-leg platform is the best alternative to fixed deepwater structures. It is a floating vessel, whose buoyancy is restrained by vertical "tendons" or "tethers" anchored to the sea floor. Unlike a ship or semi-submersible drilling unit, this platform with its vertical tensioned mooring, does not exhibit perceptible heave motions in rough seas.

In layperson's terms, the tension-leg platform works like an inverted pendulum. Each well can be piped back to its deck with a certain degree of flex at the top and bottom to account for lateral movement caused by wind, wave and current.

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Economics

The tension-leg principle, as applied to deepwater offshore development, is the best means of supporting the production well tie-backs to the surface. This "production well tie-back" is merely an extension of the well bore, adapted to specific operating conditions.

In shallow water, the best way to support this "tie-back" obviously is a fixed rigid framework to prevent the well-bore casing from buckling under its own weight. This is what a fixed platform does. However, as one goes deeper, the costs of such structures outweigh the basic economics of hydrocarbon production. If oil sold for $200 a barrel, fixed platforms would again be viable options for deepwater development. This is not the case.

Furthermore, one simply does not drill a well, open a valve and then sit back and watch the oil flow for the next 20 years. Just like an automobile, wells require care, attention and regular maintenance. Well maintenance is the one most important feature of long-term oil production, and the most costly aspect of operations.

The prime responsibility of the offshore structures designer is to provide the most economical well access possible. The successful tension-leg platform is one which accomplishes this cheaper than a fixed platform, a guyed tower, a buoyant tower or a subsea alternative.

On the other hand, the tension-leg platform, along with the tower, are the most expensive ways to support oil and gas processing equipment, utilities, personnel accommodations and drilling equipment. In these areas, the tension-leg platform will never compete with the second-hand semi-submersible or tanker.

To reduce expenses, one must remove every extraneous system, component or feature from the basic design. The overall system must be geared to the specific needs of the reservoir. The bigger the reservoir, the more money that can be allocated for development. However, in striving for excellence, one may produce designs that turn "elephant" reservoirs into "white elephants" in terms of profitable ventures.

This can happen because the actual amount of oil or gas that can be recovered from the reservoir and its daily production rate is unknown. In evaluating an oil field, one usually has a low, base or medium and a high oil estimate. In most developments, the designers take the "blue sky" route and design for maximum production, recovery and wells (with spares), along with the attending maximum support structures.

The inclination is to build superb structures, which, if they are well maintained, have far longer lives than the oil fields to which they are dedicated. To realize their full potential, tension-leg platforms must be redeployed as they become available.

"If oil sold for $200 a barrel, fixed platforms would again be viable options for deepwater development. This is not the case."

Existing tension-leg platforms can be redeployed over a wide range of water depths and conditions, reducing subsequent operational costs. The secret is to build in the mobility and redeployment features without incurring cost penalties to the primary development.

Design

The absolute minimum size for a tension-leg platform is determined by the clearance from the outer perimeter riser to the nearest pontoon or column shell, at extreme offset. The rest of the dimensions are arbitrary, depending on the amount of the payload.

It is at this point when the designers spread out in all directions. Design spirals go into reverse, schedules extend and costs rise, leading to the creation of a "monster" and a "black hole" in which much money is poured.

The initial design sweeps should be done without relation to space and weight contingency factors. There is a good reason for this. The normal design progression from well system to well-bay on to process facilities, to deck size and weight, to hull size and displacement, to tendons and foundations can result in a tension-leg platform twice as large as necessary.

If each subsystem inserts a 20 percent weight or size contingency, by the time one reaches the displacement, it has grown to 200 percent of the base estimate. To avoid this, take the base estimate displacement, add 20 percent, and make each system designer toe the line.

Construction and installation

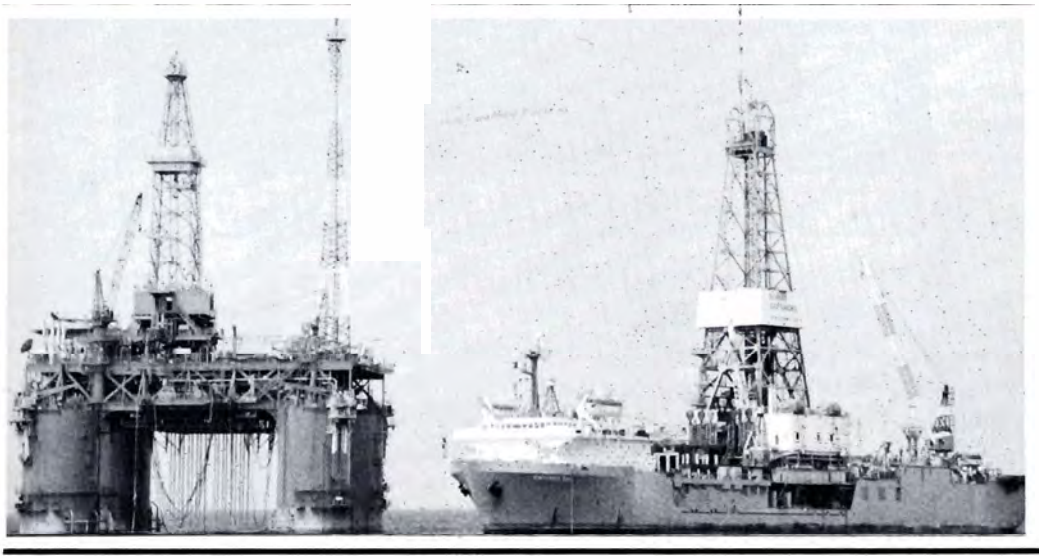
The transition from engineering design to construction and installation is not easy. Experienced designers produce practical designs, minimizing construction and installation costs. Sometimes the installation costs are three times as much as construction. In these instances, installability governs design.

If an individual is injured in a fall inside a 30-foot high pontoon, can he or she be gotten out? Can he or she be raised up the column gently? These things should be taken into consideration early in the design process.

Summary

The tension-leg platform has established itself as a primary tool for deepwater oil and gas production. It can be built small, medium, large and jumbo -- depending upon the site needs of the oil field and its environment.

With sound construction, quality control and good maintenance, the tension-leg platform can outlast its initial oil field and be reused many times. The newest designs can be demobilized, docked, refurbished and reinstalled at a new location. This mobility will pay big dividends over the next 25 years for United States offshore oil production.



Conoco's tension-leg platform with Sonat's dynamically positioned drilling vessel, Discoverer 534.

Post-installation inspections (maintenance and repair) are critical. Good designers can walk their way through a design to ensure that the operators can gain access to the structure for inspection, especially for nondestructive testing activities. One should think twice about an internal coating system, if it has to be blasted off for an inspection every four years.

One must also plan for adequate hull compartment access. Extra large tension-leg platforms may require scaffolding for close-up inspections. With personnel in the compartment, the manhole should be large enough so that access is not blocked with ventilation ducts, power leads or other paraphernalia.

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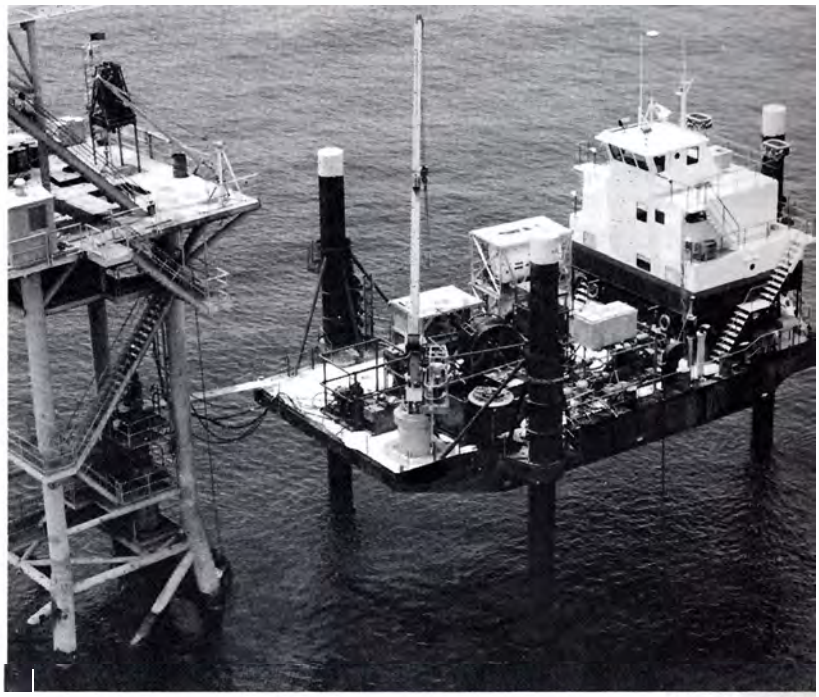
Photographs accompanying this article are courtesy of Conoco, Inc.

LIFTBOATS...



Liftboat services a fixed platform in the Gulf of Mexico.

UNIQUE VERSATILE VESSELS

By Mr. Bil Stewart

Liftboats have been in use in the United States for 25 years by the offshore oil and gas industry, but outside of the Gulf of Mexico, few people know what they are.

Essentially, liftboats are self-propelled barges with accommodations for crew and other offshore industry personnel. They range from just over 50 to more than 400 gross tons, and from 74 to 130 feet in length. They have a relatively large, open flat deck and three or four legs.

The legs are undoubtedly their most distinguishing feature. Attached to the hull through jacking towers, liftboat legs generally range from 110 to 140 feet in height, and more than 200 feet on some. Large pads on the bottoms of the legs broaden the base of support and prevent the legs from sinking far into soft sea beds. The legs are raised and lowered by rack and pinion systems in the jacking towers. When liftboats are at their target destination offshore, they lower their legs down to the sea bed and jack their hulls up out of the water in the same way as a jack-up drilling rig raises its hull.

Activities

Unlike their big brothers, jack-up drilling rigs, liftboats rarely stay in the same location for many days, and often return to port at night. About half the fleet of approximately 250 liftboats operate only in bayous and bays where the water is less than 40 feet deep. The largest liftboats can operate offshore in water depths of more than 120 feet.

Our offshore industry relies heavily on liftboats to service production platforms, especially in the Gulf of Mexico. They have proven to be more economical and practical than other available vessels. Their principal advantage is their stable work platforms above water, from which a variety of operations may be conducted. Liftboats are used for construction, maintenance, well service, temporary accommodations, diving support, salvage operations and oil exploration.

Design

As the vessels have grown in size and number, there has not been a consistent ap-

proach to their design. Many design improvements came about through trial and error. Vessels often operated well for a period of time after modifications were made to correct problems. Then similar problems cropped up again and further modifications had to be made.

As operations moved into deeper waters and more hazardous locations, larger, sturdier liftboats were built. Water depth capabilities increased with longer legs and larger hulls.

With a goal of achieving some consistency in design and analysis methods, the Coast Guard has sponsored research projects to enhance the industry's understanding of liftboat strength and survivability against the forces of nature. The Coast Guard also participates with industry associations concerned with liftboats.

Association efforts

Most liftboat operators are members of the Offshore Marine Services Association headquartered in New Orleans, Louisiana. This association has worked with the Coast Guard for several years to achieve a balanced set of regulations governing the design and operation of existing liftboats. Coast Guard regulations for new liftboats will be a part of 46 CFR subchapter L, which addresses offshore supply vessels.

The Society of Naval Architects and Marine Engineers is involved in technical areas of liftboat design and operations. It has a liftboat committee which intends to produce a technical and research bulletin to address liftboat design and operation. The Coast Guard, the American

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Liftboat uses its crane to set a helicopter deck on a platform.

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Bureau of Shipping and the National Transportation Safety Board are active participants of the liftboat committee.

Operating precautions

Liftboat operations are unique -- completely different from those of any other vessel in the Gulf of Mexico. Liftboats are not and cannot be designed to operate in heavy seas. Typically, they are restricted to wave heights of four to five feet when jacking up or down.

Operational instructions for liftboat captains leaving port usually require them to assess weather conditions at the offshore destination and en route. If seas are predicted to be above the maximum safe limit for the vessel, the captain will stay in port. If seas are encountered en route approaching the safe limit for jacking, the captain will either stop and jack up the vessel, or return to port.

If a liftboat is jacked up on location and is preparing to return to port, a similar weather evaluation is made. If conditions are predicted to be rougher than the vessel can tolerate afloat, the captain will keep it elevated. Because a liftboat when elevated offshore usually encounters more turbulent seas than those in which it can jack up or down in safety, it must be designed to be able to operate while jacked up in rougher weather conditions than if it were afloat.

A typical liftboat spends about 90 percent of its life in service elevated offshore. Although many liftboats have been toppled by hurricanes when elevated, there are also many cases where they have survived. Their survivability when elevated is directly related to the water depth at their elevated location. The Coast Guard requires that existing boats demonstrate their ability to survive in 100-knot winds in shallow water when elevated.

Existing liftboats must satisfy afloat stability standards similar to, but not quite as stringent as those for mobile offshore drilling rigs (MODUs). They must comply with the Coast Guard's 1.4 area ratio (often presented in terms of an allowable center of gravity location curve) for a 50-knot wind speed. Existing boats are required to have a range of positive stability of just 10 degrees.

Liftboats generally have much lower freeboards than MODUs (often less than three feet), and cannot safely travel in seas more than six feet high. In higher seas, there is danger of capsizing after taking large amounts of green water on their open forward decks.

The industry is now trying to determine maximum safe conditions for liftboat operations based upon vessel design parameters. The practical experience of many years of liftboat operation is being combined with modern naval architectural science to achieve this goal.

The future

The liftboat market is less affected by the current downturn in the United States offshore industry than the drilling rig and supply boat market. This is partly because liftboats are still the best vessels for maintaining many existing offshore production platforms.

However, liftboats are beginning to leave United States waters and go to overseas markets in the Middle East, Africa and the Mediterranean, decreasing the number of available boats in the Gulf of Mexico.

The recent introduction of inspection requirements also affects the market. The new regulations have resulted in water depth restrictions being imposed on vessels that were previously limited only by leg lengths.

These two new occurrences are both helping to keep the liftboat market from collapse. Several new vessels have been built on the Gulf Coast in the last three years. With more emphasis on analysis, clear design targets and modern computer design aids, these new vessels are setting higher standards for liftboat safety and efficiency. It is hoped that the market will continue to support new liftboat construction.

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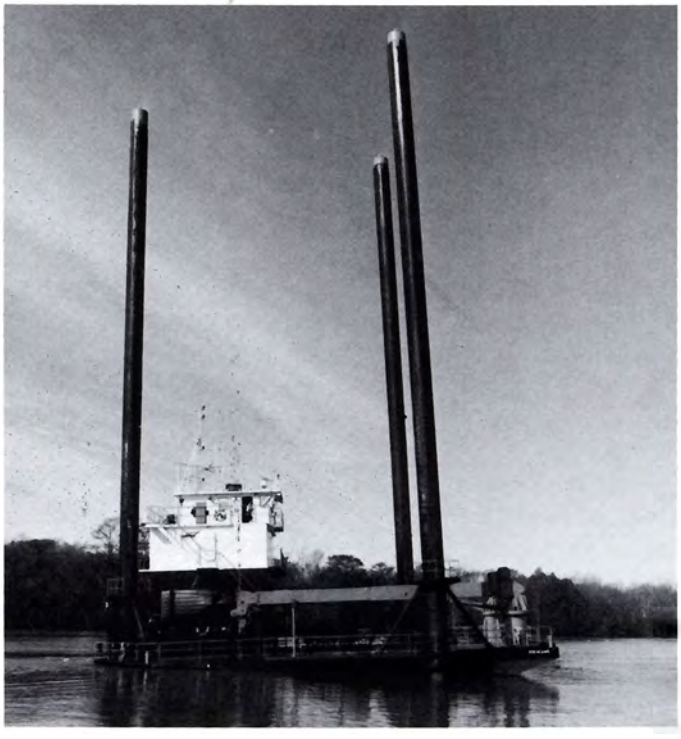
Photographs accompanying this article are courtesy of Stewart Technology Associates.

Why and how **liftboats** **are inspected**



Liftboat is underway from Morgan City enroute to the oil field.

BY LT Timothy M. Close

Between 1980 and 1987, 46 liftboats were involved in accidents resulting in 57 deaths and injuries, and more than $20 million in damages. Well over half of the accidents were caused by failure of the legs, pads or jacking equipment. Operator error and inadequate stability accounted for most of the remaining accidents.

This accident record prompted liftboats to become Coast Guard-inspected vessels in the late 1980s. They are inspected under Coast Guard regulations for cargo and miscellaneous vessels, except for liftboats under 100 gross tons, which may be inspected under small passenger vessel regulations.

Liftboat inspections for certification, focus on safety features, including lifesaving and firefighting equipment, propulsion and auxiliary machinery, the electrical system, pollution prevention, licensing and documentation, hull and closure condition, and fire hazards.

Because they can elevate their hulls out of the water, liftboats carry their own drydocks with them, and rarely need the services of an actual drydock.

Inspection of the legs, support structure and jacking mechanisms are an important part of their hull examinations. For example, the straightness of the legs must be checked, because even slight deflections can result in catastrophic accidents. In addition, the welded connections between pads and legs need to be closely inspected to ensure they are sound.

Stability

Because liftboats operate both in afloat and elevated modes, their stability calculations are more involved than for standard vessels and must be carefully reviewed.

Adequate stability is absolutely vital to control wind and wave forces. Without it, liftboats are in danger of being flipped upside down.

When a liftboat is afloat, traveling between jobs, its legs are up, extending high above the deck. Large waves can wash across the main deck and momentarily push the vessel down in the water, damaging cargo or the vessel. Big waves can cause a liftboat to "rock and roll" severly, because of the high center of gravity.

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To improve stability, some companies permit their operators to lower the legs several feet to reduce the center of gravity and smooth out the ride. This can be disastrous, however, in shallow water or near shoals where the lowered legs could contact the bottom and get damaged, or even cause the liftboat to capsize.

When a liftboat is elevated, winds are of primary concern. Picture a liftboat with its pads on dry land and its hull jacked up almost to the tops of its legs. Besides looking scary, it is obvious that the hull can act like a sail. Such is the case even when a liftboat is in 100 feet of water and only elevated 25 feet above it. It is very important that it be able to withstand high winds without toppling over.

Since large waves frequently accompany high winds, a liftboat must be high enough out of the water so as not to get hit by the waves. When the vessel is elevated, big waves can actually lift it up off the sea floor and slam it back down again. Obviously, this can damage the legs and jacking machinery, but if the vessel is slammed down unevenly, it can be toppled. Since the length of the legs prevent liftboats from being jacked up indefinitely, there are limits to the depth of water in which liftboats can operate.

The ability of liftboats to withstand wind and waves determines the operating restrictions placed on them by the Coast Guard.

Operational guides

Liftboat operation methods have contributed to numerous casualties over the years. (See *Proceedings*, April 1982, November/December 1986, September 1987 and July/ August 1992 for liftboat casualty cases.) Consequently, formal operations manuals are required for each liftboat. These manuals contain simple instructions for routine and emergency operations, and for maintaining stability.

Probably the riskiest of all liftboat operations is jacking up and down. A vessel is most susceptible to damage when its pads have just made contact with or are near the sea floor. If the seas unexpectedly cause the vessel to pitch or roll, or the sea floor is uneven, the load on one or more of the legs can be greater than it or they are designed to handle. Consequently, wave heights and sea condition limits are contained in all operations manuals.

Guidance for emergency situations is absolutely necessary in liftboat operations, as illustrated by the sinking of the *Avco V* on July 31, 1989. This vessel was attempting to get into port in severe weather when it was overcome by the seas and capsized, killing ten people. One of the causes cited was the company's failure to recall the liftboat into port early enough to avoid the heavy weather. Also contributing to the accident was the master's decision to lower the liftboat into heavy seas from a relatively safe elevated position. Since this incident, operations manuals have had to provide guidance for such difficult decisions as when to leave the area and head for safe refuge, when to evacuate the vessel and when to jack it down.

Operational manuals provide additional guidance such as warnings not to submerge the main deck to attempt to free a leg that is stuck in the mud, and not to rock or twist the vessel to break legs free from mud. There also are instructions for liftboat personnel to wear life preservers during jacking operations. These lessons were all learned the hard way.

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Liftboats will be around offshore oil fields for a long time to come. Possessing qualities of both the MODUs and OSVs, the unique vessels have proven their value to the oil industry many times over. The recent increase in safety awareness and improvements should guarantee their continued productivity.

Coast Guard-inspected Otis liftboat works near oil production platforms.

Who regulates the offshore industry

nationwide?
in Alabama?

By LT Thomas Favreau

A number of federal and state government agencies regulate the offshore drilling and production industry to safeguard life and property, protect and preserve the marine environment, and to manage mineral resources.

Federally, the Coast Guard, the Office of Pipeline Safety of the Department of Transportation, MMS and the Army Corps of Engineers of the Department of Defense all play important roles in managing the offshore industry.

Coast Guard and MMS

Under the Outer Continental Shelf Lands Act of 1953 (43 U.S.C. 1331 *et seq.*), the Coast Guard and MMS share responsibilities for the safety of personnel, activities and facilities on the outer continental shelf, which is defined by the act as "all submerged lands lying seaward and outside the area of lands beneath navigable waters." (Lands beneath navigable waters are essentially those under waters within individual state boundaries out to three miles from shore.)

To minimize duplication of effort, and to promote consistent, coordinated and less burdensome regulation of offshore activities, the Coast Guard and MMS signed a memorandum of understanding on August 29, 1989. This document outlines each agency's responsibilities under the act and establishes procedures for sharing enforcement authority.

The Coast Guard regulates for the safety of life and property on offshore facilities and vessels engaged in outer continental shelf activities, and to ensure the safety of navigation. Its marine inspectors inspect oil industry vessels, MODUs and certain fixed platforms to ensure that structures, stability, firefighting equipment, life-saving equipment, pollution prevention equipment and manning meet minimum required standards.

MMS is responsible for managing mineral leasing on the outer continental shelf and regulating all mineral exploration, drilling, well completion and workover, and production activities on leased or leasable land. As such, it is primarily concerned with drilling and production equipment, and associated activities.

MMS also approves and monitors pipeline installation, and annually inspects all above-water components of pipelines. It verifies product quantity from each well and collects royalties on behalf of the federal government. Production platforms are inspected annually, while drilling rigs are inspected at least once a month.

A fixed production platform in Mobile Bay collects natural gas to send ashore via an underwater pipeline.

Crane barge buries underwater pipeline in Mobile Bay.

Office of Pipeline Safety

The Office of Pipeline Safety issues the rules for the design, construction, operation and maintenance of gas and liquid pipelines both on the outer continental shelf and in navigable waters out to three miles from shore. It conducts detailed inspections during pipeline construction and, every two to three years, it examines maintenance records, repair procedures and pipeline overflight logs. The Office of Pipeline Safety works closely with MMS and appropriate state agencies.

Army Corps of Engineers

A wide range of responsibilities of the Army Corps of Engineers includes issuing permits for all construction and dredging work in the navigable waters of the United States. The corps works closely with the Coast Guard to notify mariners of dredge and platform locations, and to enforce navigation aid requirements on capped well heads awaiting the construction of production platforms.

Alabama

Individual states with offshore activities have their own requirements, which typically mirror or expand upon federal regulations. For example, in Alabama, the State Oil and Gas Board, the Public Service Commission and the Department of Environmental Management have established regulations governing drilling and production activities in state waters extending out to three miles from shore.

The Alabama State Oil and Gas Board regulates drilling and the production of oil and gas in state waters. It reviews structure and equipment plans, and issues drill permits. It ensures sound management and fair distribution

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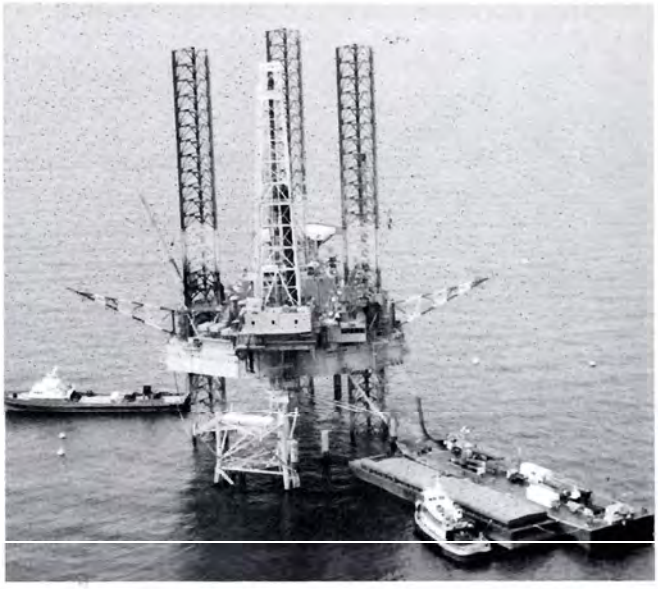
of resources, and the protection of the rights of owners of the minerals produced. It conducts periodic inspections of safety and emergency gear, as well as witnesses the calibration of production metering equipment to account for all material produced.

The Alabama Public Service Commission regulates all pipeline installation and construction in state waters.

Drill rig and platform modifications include superstructure coamings, drain curbs and gutters, and a manifold system, all of which are designed to collect rain water and channel it to a collection tank. Waste drill cuttings and mud are pumped to a separate collection tank (usually a hopper barge approved by the Coast Guard for the carriage of such wastes). Containment is installed under all machinery, and fuel and oil tanks.



MODU with attending barges collects contaminated water and waste solids in Mobile Bay.

The Alabama Department of Environmental Management exercises authority over the marine environment within state waters. Of particular note, this department has been enforcing a "zero discharge" law in the state waters since 1972. Only uncontaminated rain water, ballast water and treated sewage may be discharged into Alabama waters. Prohibited from discharge are drill cuttings, drill mud, oil and all other solid and liquid wastes (untreated sewage, garbage and food).

This law is enforced through a letter of commitment required by the state agency from the offshore industry each time a permit to drill is granted. The law applies to drill rigs and platforms in waters out to three miles from shore, and has led to the development of structural modifications for the containment of solid and liquid waste.

Conclusion

Although there are considerable costs associated with the various federal and state regulations, there is a certain pride within the industry for meeting the challenge and, in some cases, exceeding the requirements. With the passage of the Oil Pollution Act of 1990, an even closer working relationship is developing among federal and state government agencies and the industry.

A safe workplace, a clean environment and carefully managed resources are the goals. Through cooperation, they can be met.

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Inspectors attend MODU U

By LCDR Ken Parris

Inspectors take water survival training at MODU U.

Editor's Note:
Due to the approach of Hurricane Andrew toward Louisiana early in the week of August 24, the 1992 course was cancelled before the offshore hands-on-training segment was to have started.

Every year since 1979, a new crop of inspectors in the Eighth Coast Guard District receives comprehensive instruction on the unique industry at work on the outer continental shelf. They learn how to inspect mobile offshore drilling units, and support vessels and equipment from stem to stern in a course commonly referred to as "MODU U."

MODUs and platforms are inspected by the Coast Guard under the authority of the Outer Continental Shelf Lands Act and various other vessel inspection laws. Applicable regulations are found in 33 CFR 67 and 140-144; and 46 CFR 41-69, 107-113, 147 and 159-164.

The four-week MODU U course is divided into three sections: drilling activities, inspection and hands-on-training. The first two sections are each covered in one week. The third portion is allotted two weeks.

Drilling

MODUs are equipped with a complex mixture of shipboard systems and industrial equipment. Inspectors are familiarized with these systems, their uses and dangers, and the unique terminology of offshore operations. They are also informed about various industry standards incorporated into the regulations.

Inspection

The rules, regulations, laws and policies relating to Coast Guard inspections are thoroughly covered in this section. In 1992, for the first time, the entire class was to have lived offshore for three days on a Penrod Drilling Company rig, receiving classroom instruction in the dayroom, followed by actual "on-the-job training," inspecting and examining rig equipment.

Hands-on-training

The course has always emphasized the need for hands-on-training of inspectors, especially in water survival, helicopter egress, hydrogen sulfide escape and self-contained breathing apparatus use. They also visit a survival craft manufacturer.

Each student spends time on a working platform and drilling rig to gain first-hand experience of life offshore.

During the three-part course, industry experts provide technical information on various drilling and platform systems, explaining their functions, maintenance, and potential problems and dangers.

The industrial portion of MODU U was contracted through the Petroleum Extension Service of the University of Texas.

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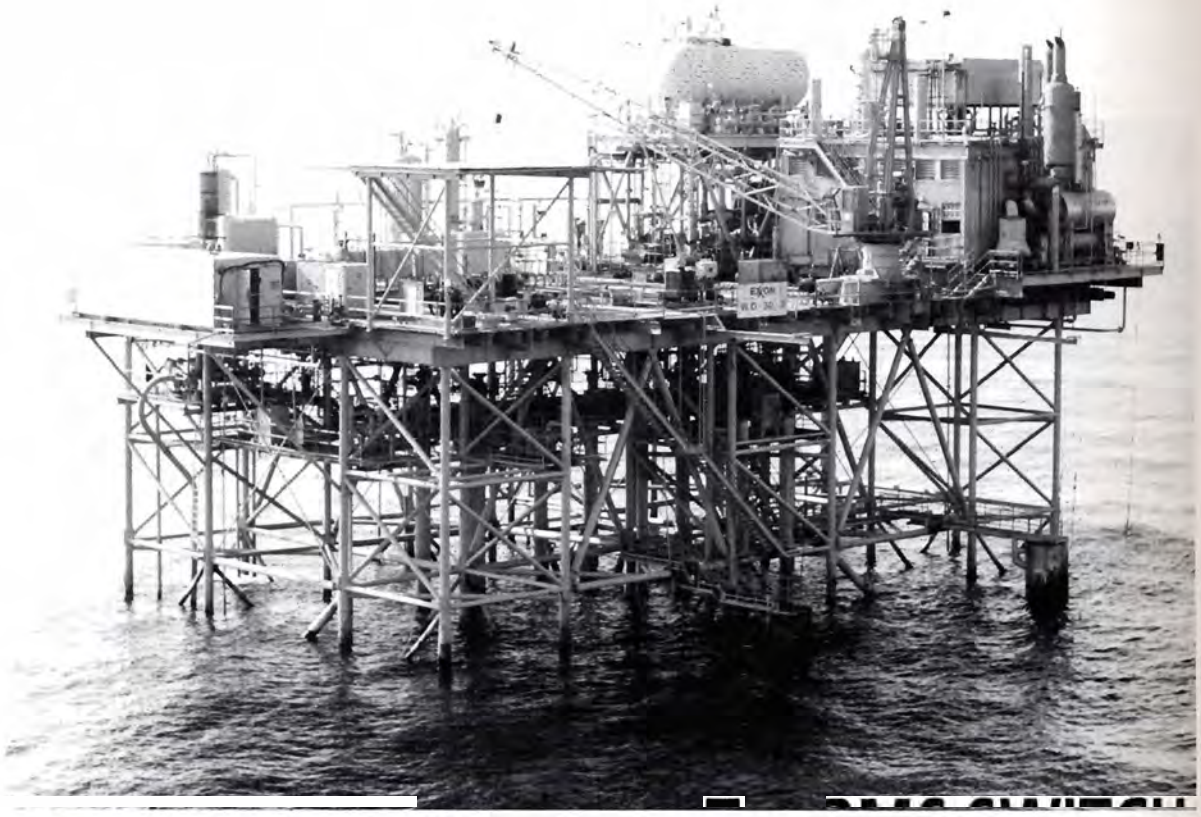

FIXED PLATFORMS SWITCH TO SELF-INSPECTION

BY LT MARK HAMILTON

Background

A fixed platform is any bottom-based facility permanently attached to the sea bed or subsoil of the outer continental shelf. The first fixed platform was installed in the Gulf of Mexico in a water depth of 20 feet in 1947.

At the present time, there are approximately 3,852 fixed platforms in the Gulf of Mexico, about two-thirds of the total number in the entire world.

Regulations

On August 29, 1989, the Coast Guard and the Minerals Management Service of the Department of Interior entered into a memorandum of understanding establishing guidelines for overseeing facility design, construction, systems and equipment, and operations on the outer continental shelf associated with the exploration, development and production of mineral resources.

On July 7, 1987, the Coast Guard published a notice of proposed rulemaking in the *Federal Register*, requiring owners and/or operators to conduct annual inspections of their facilities, and report their results to their local MSOs. These regulations were published as a final rule on May 26, 1988, becoming effective June 27, 1988. This final rule amended existing inspection regulations in 33 CFR subchapter N, parts 140-145. Before implementing the self-inspection regulations, the Coast Guard verified compliance with annual on-site inspections of outer continental shelf facilities.

Coast Guard role

The Coast Guard has a three-fold role in the self-inspection program:

1. to ensure owners/operators submit within 30 days, a completed form CG-5432 to an Officer in Charge, Marine Inspection at a local MSO; (The forms are reviewed for completion, and the extent of outstanding deficiencies and hazards.)

2. to conduct an initial inspection of each fixed platform to determine whether it is in compliance with the requirements of 33 CFR, parts 140-145; and

3. to conduct annual oversight inspections of approximately 25 percent of all fixed platforms engaged in outer continental shelf activities to ensure the self-inspections are in compliance with applicable requirements. (These inspections are conducted at any time, with or without advanced notice.)

Summary

Previous regulations required that owners and/or operators of fixed platforms be given advance notice and scheduling of inspections. This tended to produce a false picture of the year-round condition of a platform. It cost the Coast Guard $760,000 to inspect platforms under these old regulations.

Alternatively, it is estimated that only $190,000 is expended annually to complete the 25 percent oversight inspections, which are unannounced, assuring a more candid view of operations. The major goal of the fixed platform self-inspection program however, is not money saved, but safety first.

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Photographs of fixed platforms accompanying this article are by Don Allen, courtesy of Exxon Company, U.S.A.

"Andrew" puts evacuation plan to test

By Mr. James M. Magill

Hurricane Andrew

During the last week of August, 1992, Hurricane Andrew cut a large swath in a north westerly course through many fixed platforms and a few MODUs in the Gulf of Mexico. Some platforms were destroyed and others damaged. However, no individuals involved in offshore activities were lost or injured.

Background

Before May 1989, the only requirements for the escape of personnel from manned fixed platforms in the United States were for two primary means of escape (either a ladder or stairway), and for one secondary means of escape (a knotted rope) for each ten people. These means got individuals to lifefloats in the water, the only survival craft required. Lifefloats, however are only intended for temporary flotation, not as a means of protection from burning oil, heavy seas or hypothermia.

In response to legislation concerning inadequate evacuation procedures for United States offshore facilities, the Coast Guard developed new emergency evacuation regulations, which require contingency planning for the evacuation of personnel in emergency conditions, such as hurricanes, blowouts and major fires.

Regulations

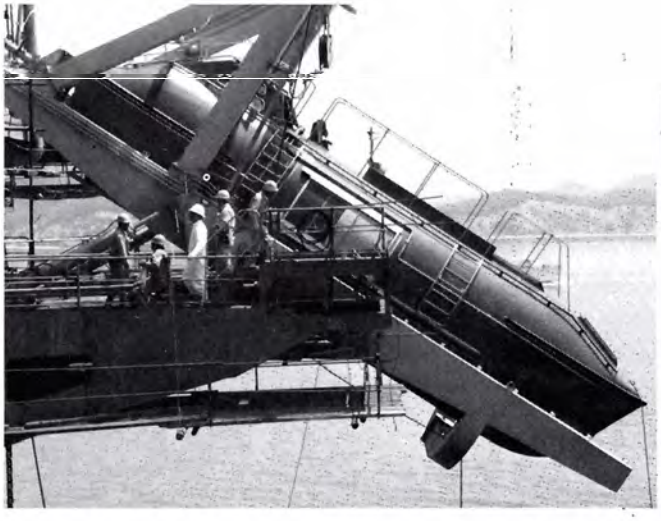
On May 18, 1989, the Coast Guard published a final rule concerning emergency evacuation plans for manned outer continental shelf facilities. A comprehensive site-specific contingency plan is required for the emergency evacuation of all personnel from manned fixed facilities and MODUs.

The regulations require that the owner or lessee submit such a plan to the Coast Guard for approval. This plan must address the evacuation of each facility, however, it may apply to more than one facility if they are in the same general area and all evacuation needs are taken into consideration.

The emergency evacuation plans are reviewed by the appropriate Officer in Charge Marine Inspection, and approved or returned for revision. Approval must be obtained before drilling or production on a new site begins.

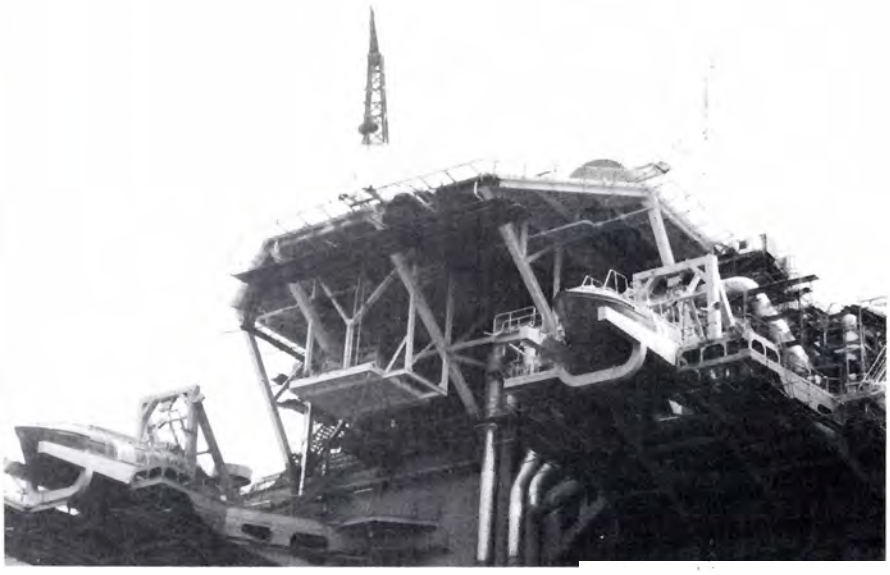
Evacuation equipment

Evacuation technology has advanced over the past twenty years to include such equipment as helicopters, freefall lifeboats and survival capsules, along with standby vessels to rescue survivors. Since helicopters are widely used for transporting offshore personnel to and from fixed



(Left) Freefall lifeboat is ready to launch.

(Below) It splashes down, free and clear of rig.



Two of the four 75-person freefall lifeboats on the drilling unit ~~Henry Goodrich~~ rest on launch pads, ready for use.

Photographs accompanying this article are by Mr. James M. Magill.

platforms and MODUs, they are the main means of evacuation in the Gulf of Mexico before a hurricane. Emergency evacuation plans normally stipulate that all personnel are to be taken on shore two to three days before a hurricane approaches a platform or drilling unit.

Lifeboats

The conventional davit-launched lifeboat has been used as a means of escape from ships since long before the *Titanic* disaster in 1912. With the advent of the offshore industry in the late 1950s, the open lifeboat design was modified to accommodate certain unique circumstances.

Open lifeboats do not afford adequate protection for individuals trying to escape a blowout with massive oil and gas fires on the water. A totally enclosed lifeboat with a water spray system and oxygen breathing apparatus was developed to enable personnel to survive such circumstances.

Furthermore, most davit-launched lifeboat accidents occur during and after the craft is lowered into rough seas and high winds. It is miraculous if such a lifeboat survives launching and emerges unscathed after being buffeted into the sharp projecting sides of a typical rig. The vulnerable craft still has the difficult task of getting away while heavy seas and wind batter it into the sides of the distressed rig.

The freefall lifeboat was designed to circumvent the risks that plague conventional davit-launched craft. Sliding down an inclined ramp and falling unencumbered into the sea, the freefall lifeboat is carried by kinetic energy away from the distressed rig into safe waters.

While the objective in the Gulf of Mexico is to evacuate drilling platforms before a hurricane approaches, this is not always possible in areas such as the North Sea or the east coast of Canada where winter storms quickly erupt and can produce winds of more than 60-knots.

The freefall lifeboat, which can hold up to 75 people, is often the only safe means of evacuating personnel from high marine structures, such as fixed platforms or semi-submersibles, when threatened with severe wind and waves.

Summary

Freefall lifeboats, along with other advanced evacuation equipment, are now being used successfully in many offshore drilling and production areas of the world.

The excellent safety record during hurricane seasons in the Gulf of Mexico is attributed mostly to the advanced planning now required by the new emergency evacuation regulations, along with the offshore industry's smooth implementation of the required plans.

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The National Offshore Safety Advisory Committee

How it works

By CDR Michael Ashdown

Since the late 1970s, the Coast Guard has taken on increasing responsibilities concerning the safety of individuals involved in the exploration and development of mineral and energy resources lying beneath the United States outer continental shelf. These responsibilities have been generated by congressional mandates necessitating numerous regulatory initiatives affecting all segments of the offshore industry. Such initiatives must be carefully coordinated to ensure that all these individuals are afforded the highest level of safety without creating unwarranted economic burdens on an industry that recently has undergone significant economic reversals.

To maintain open lines of communication between the Coast Guard and the offshore industry, the National Offshore Advisory Committee (NOSAC) was established in 1988. Besides providing useful information to the Office of Marine Safety, Security and Environmental Protection, NOSAC helps generate effective and efficient safety regulations on major issues of mutual concern. NOSAC also serves as a public forum for discussion and advice on safety matters and other offshore industry concerns.

Membership

NOSAC members are drawn from the broad population directly or indirectly affected by outer continental shelf activities. There are 14 regular members with particular expertise, knowledge and experience in exploration for and recovery of offshore mineral resources. NOSAC members are as follows:

- two members representing companies engaged or specializing in each of the following:
  - production of petroleum,
  - offshore drilling,
  - offshore operations and
  - support of offshore operations by offshore supply vessels or other vessels.
- one member representing enterprises or interests engaged or specializing in each of the following:
  - construction of offshore exploration and recovery facilities;
  - diving services related to offshore construction, inspection and maintenance;
  - geophysical services related to offshore exploration and construction;
  - pipelaying services related to offshore construction;
  - environmental interests and
  - the general public.

In addition, the commandant of the Coast Guard may request MMS, the Environmental Protection Agency and the Occupational Safety and Health Administration to each designate a representative to participate as an observer. Members are appointed by the commandant, subject to approval by the secretary of the Department of Transportation, to serve a term of three years or until a replacement is appointed. Membership terms are staggered with approximately one-third expiring each year. To provide some turnover without disrupting continuity, not more than half of the members with expiring terms may be reappointed.

Meetings

Committee meetings are held biannually in February or March and again in August or September, usually at Coast Guard headquarters in Washington, D.C. Notice of each meeting is published in the *Federal Register*. All meetings are open to the public.

Issues

Through subcommittees, NOSAC provides valuable recommendations on rulemaking projects, safety issues and other concerns related to offshore activities. The Coast Guard has received cogent advice on such topics as:

- vessel tonnage;
- proposed rules for drug testing;
- licensing rules for MODUs and the IMO convention on standards, training, certification and watchkeeping;
- crane inspection intervals;
- ocean tow of jack-up MODUs;
- revisions to regulations for outer continental shelf activities (33 CFR subchapter N);
- proposed rules for lifesaving equipment and
- revisions to subchapter I-A for MODUs.

In addition, NOSAC provides a vital forum for public discussions of issues related to OPA 90 and its considerable impact on the offshore industry. Other recent issues on the agenda include the 1990 Clean Air Act Amendment, IMO activities and workplace safety initiatives.

One notable product of NOSAC efforts was the publication of Navigation and Vessel Inspection Circular (NVIC 11-91) concerning the towing of jack-ups (See *Proceedings*, vol 49, no. 4). These guidelines were submitted to the IMO Subcommittee on Stability and Loadlines, and on Fishing Vessel Safety in early 1992. This subcommittee recommended that IMO member governments circulate the guidelines to marine industry members, drilling contractors, owners and operators, and classification societies.

Conclusion

The Coast Guard performs a wide variety of functions to enhance the safety of the maritime community. NOSAC provides an important forum in which to discuss the relationships of various initiatives with respect to their impact on the offshore industry. Active participation by committee members has resulted in a positive working relationship between the Coast Guard and the offshore industry at all levels of management.

CDR Michael Ashdown is the executive director of NOSAC and chief of the Fishing Vessel and Offshore Safety Branch of the Merchant Vessel Inspection and Documentation Division, Office of Marine Safety, Security and Environmental Protection.

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Chemical of the month *4/C Kevin Gavin*

Diesel fuel 2-D

Since diesel-powered automobiles usually achieve better fuel economy than gasoline-powered ones, the desire for cars driven by diesel fuel 2-D has increased in recent years.

The diesel engine was developed by Rudolf Diesel, who used the heat of compression to ignite the fuel instead of a spark, as in a gasoline engine. When the piston in the cylinder of an engine compresses the air inside of it, injectors spray diesel fuel into the compressed air, which has reached a temperature of about 932°F (500°C), igniting the fuel and driving the piston through another cycle.

Diesel engines are used extensively by heavy transport vehicles, construction equipment, the military, railroad locomotives and as a mosquito-control agent (coating on breeding waters).

Found only in liquid form, number 2-D diesel fuel is a yellow-brown color with a characteristic lube or fuel oil odor.

Physical dangers

Diesel fuel is harmful if swallowed, causing irritation of the stomach and intestines followed by nausea, vomiting and cramping. Symptoms of kidney and liver damage may be delayed.

The best first-aid treatment for ingestion of the liquid is to have the victim drink plenty of water. A physician should be contacted immediately. One should NOT induce vomiting, because aspiration causes severe lung irritation with coughing, gagging, dyspnea, substernal (under the sternam) distress and rapidly developing pulmonary edema. In the event of aspiration, enforce bed rest, administer oxygen and seek medical attention immediately.

Inhalation of high concentrations of vapor can cause headache and stupor. If diesel fuel contacts skin or eyes, flush the area with plenty of water.

Avoid harmful effects from the fuel by wearing protective clothing, avoiding ingestion and excessive skin contact.

Environmental threats

Large spills can cause serious long-term problems to aquatic life, marine environment and shorelines. In the event of a spill, local health and wildlife officials and nearby water intake operators should be notified immediately.

Control

A spill is best controlled by mechanical containment. Once the fuel has been isolated, chemical and physical treatment can begin. Spotting a leak is easy, because diesel fuel and water do not mix, causing the fuel to float to the top of the surface.

The best way to control a fire is with dry chemicals, foam or carbon dioxide. Water is usually ineffective in putting out a fire. The use of water in fire fighting should be limited to cooling surfaces of threatened containers.

Shipping rules

Shipping requirements call for an ambient temperature and open ventilation. The fuel is stable under normal conditions. Exposure to flame or heat is what creates a hazard.

Federal regulations for shipping diesel fuel in bulk can be found in 46 CFR subchapter D. When shipping in break bulk, the necessary guidelines can be found in 49 CFR section 172.101.

Diesel fuel oil 2-D

Chemical name:	Diesel fuel oil 2-D
Formula:	Petroleum distillate; mostly unbranched paraffins
Synonyms:	Fuel oil 2-D
Physical description:	Yellow-brown color with lube or fuel oil odor
Physical properties:	
Boiling point:	540 to 640°F (282 to 338°C)
Freezing point:	0 to 30 °F (-18 to -34°C)
Vapor pressure:	Varies
Threshold limit value:	
Time weighted average:	Unassigned
Short-term exposure limit:	Unassigned
Flammability limits in air:	
Lower flammability limit:	1.3% by volume
Upper flammability limit:	6.0% by volume
Combustion properties:	
Flashpoint:	125°F minimum
Autoignition temperature:	491 to 545°F
Densities:	
Vapor (air = 1):	Approx. 4.5
Specific gravity (at 20°C):	0.87 to 0.90
Identifiers:	
CHRIS code:	OTD/ODS
Cargo compatibility group:	33 (Misc. hydrocarbon mix.)
CAS registry number:	68334-30-5
DOT number (NA):	1993
U.N. number:	1268
U.N. class:	3, Flammable liquid
NFPA:	
Health hazard:	0
Flammability:	2
Reactivity:	0

Kevin Gavin was a fourth class cadet at the Coast Guard Academy when this article was written as a special chemistry project for LCDR Thomas Chuba.

This article was reviewed by the Hazardous Materials Branch of the Marine Technical and Hazardous Materials Division of the Coast Guard's Office of Marine Safety, Security and Environmental Protection. Telephone: (202) 267-1577.

Nautical queries

The following items are examples of questions included in the third assistant engineer through chief engineer examinations and the third mate through master examinations.

Engineer

1. An advantage of electromagnetic slip couplings is _____.

A. torsional vibrations are reduced
B. torque increases with a decrease in excitation current
C. the coupling rapidly responds to sudden changes of load
D. excitation and induction power losses appear as a change in torque instead of rotational speed between the primary and secondary elements

2. When supplying emergency lighting loads, the storage battery initial voltage must not exceed the standard system voltage by more than _____.

A. two percent
B. three percent
C. five percent
D. ten percent

3. In an automation system, increasing or decreasing a loading pressure by a set amount is known as _____.

A. positioning
B. proportioning
C. biasing
D. controlling

4. Mist detectors, as installed on large low-speed diesel propulsion engines, are typically used to detect the presence of _____.

A. fuel oil vapors at the sludge tank vent
B. unburned fuel vapors in the scavenge air receiver
C. lube oil vapors in the crank case
D. lube oil vapors in air intake manifold

5. In a pneumatic automation system, a unit which will produce a signal to govern the position of the controller of the measured variable relative to the value of the measured variable is said to have _____.

A. reset action
B. proportional action
C. proportional band
D. rate action

6. Warping of superheater screen tubes could be caused by _____.

A. high superheater temperatures
B. high furnace temperatures
C. installing baffles of excessive length
D. sudden cooling of tubes after being overheated

7. In the operation of a lube oil centrifuge, operated as a clarifier, the position of the oil-water interface should be _____.

A. maintained by the ring dam
B. maintained by the number of disks
C. nonexistent
D. maintained by the diaphragm/weir flow control valve

8. On most diesel engines, the governor controls the speed by _____.

A. controlling the amount of fuel injected into the cylinders
B. varying the speed of the turbocharger
C. changing the injection camshaft timing
D. changing fuel injection camshaf

9. The highest viscosity of lube oil in an operating system under normal load should occur _____.

A. just before entering the lube oil cooler
B. at the lube oil cooler outlet
C. at the main lube oil pump discharge
D. at narrowest point of hydro-dynamic wedge

Deck

1. The calling and distress frequency on a single-side band marine radio telephone is?

A. 1492 kHz.
B. 1892 kHz.
C. 2082 kHz.
D. 2182 kHz.

2. How should you signal the crane operator to stop?

A. Place both fists in front of your body with the thumbs pointing outward.
B. With both arms extended out and palms down, move arms back and forth.
C. Extend arm with the palm down and hold this position rigidly.
D. Clasp hands in front of your body.

3. Which statement is correct concerning the carriage of coal in bulk?

A. Coal should be vented with surface ventilation only.
B. Because of its inherent vice, coal should not be loaded wet.
C. Dunnage should be placed against ship's sides and around stanchions.
D. Through ventilation, as well as surface ventilation, should be provided whenever possible.

4. BOTH INTERNATIONAL AND INLAND-- An inconspicuous, partly submerged vessel or object being towed, where the length of tow is 100 meters, shall show _____.

A. yellow lights at each end
B. two red lights in a vertical line
C. a black ball
D. a diamond shape

5. While assisting a victim of an epileptic seizure, it is most important to_____

A. move the patient to a comfortable bed
B. get professional medical advice for further medical care
C. keep the patient awake and make him or her walk, if necessary, to keep awake
D. remove any soiled clothing and put the patient in a clean bed

6. When daylight savings time is kept, the times of tide and current calculations must be adjusted. One way of doing this is to ____.

A. subtract one hour from the times listed under the reference stations
B. add one hour to the times listed under the reference stations
C. apply no correction, as the times in the reference stations are adjusted for daylight savings time
D. add 15° to the standard meridian when calculating the time difference

7. You hear on the radiotelephone the word "securite" spoken three times. This indicates that _____

A. a message about the safety of navigation will follow
B. a message of an urgent nature about the safety of a ship will follow
C. the sender is in distress and requests immediate assistance
D. you should secure your radiotelephone

8. One major advantage of the load-on-top system is that _____

A. oil that was previously lost is recovered
B. discharge time is significantly reduced
C. corrosion within cargo tanks is reduced
D. multiple-product ships can use it without contamination problems

9. The dividing meridian between zone descriptions minus four and minus five is _____

A. 60 degrees E
B. 67 degrees 30' E
C. 75 degrees E
D. 60 degrees W

Answers

Engineer
1-A, 2-C, 3-C, 4-C, 5-B, 6-D, 7-C, 8-A, 9-D.

Deck
1-D, 2-C, 3-A, 4-D, 5-B, 6-B, 7-A, 8-A, 9-B.

If you have any questions concerning "Nautical Queries," please contact U.S. Coast Guard (G-MVP-5), 2100 Second St., S.W., Washington, D.C. 20593-0001. Telephone: (202) 267-2705.

Notice of withdrawal

CGD 77-115, Defect notification and first purchaser information (33 CFR part 179) RIN 2115-AA16 (August 12).

On December 29, 1980, the Coast Guard published a notice of proposed rulemaking in the *Federal Register* proposing amendments to the regulations covering defect notification.

The purpose of the proposed rulemaking was to increase the numbers of owners of recreational boats and associated equipment (inboard engines, outboard motors and sterndrive units), who are successfully notified by manufacturers of a failure to comply with an applicable Coast Guard safety standard, or of the existence of a defect which creates a substantial risk of personal injury to the public. Because of government-wide constraints on regulations involving information collection and Coast Guard concern about the anticipated reporting and recordkeeping burdens, consideration of comments and publication of a final rule were delayed.

On May 29, 1987, the Coast Guard published a supplementary notice of proposed rulemaking in the *Federal Register* because more than six years had elapsed since publication of the notice of proposed rulemaking. Once adopted as a final rule, this proposal would have required boat and engine manufacturers to establish and maintain first purchaser lists, and would have required marine dealers to furnish the manufacturers with the information necessary to establish those lists: the serial numbers of new boats and engines sold and the names and addresses of retail first purchasers of those products. However, this supplementary notice of proposed rulemaking never proceeded to final rule stage. Again, the primary reason for not pursuing the proposed amendments was a concern that the proposed information collection requirements would impose an undue paperwork burden upon recreational boat manufacturers and dealers.

The Coast Guard has since investigated other approaches for increasing the availability of first purchaser information for manufacturers. It has examined the availability of other sources for retail purchaser information. Section 12308 of chapter I of title 46, U.S. Code, allows a person, including a manufacturer, to request from vessel numbering system records, numbering and registration information for a vessel, when the numbering authority is satisfied that the request is reasonable and related to a boating safety purpose.

The proposed rulemaking is being withdrawn because state vessel numbering and registering information is available to boat manufacturers from most issuing authorities, and it contains retail purchase information which can be used for defect notification -- a boating safety purpose. The Coast Guard will continue to work with the National Boating Safety Advisory Council, Boating Safety Officers of State Boating Law Administrators towards making purchaser information readily available to boat manufacturers from all vessel numbering and issuing authorities. This approach will allow existing records to be utilized instead of increasing information collection, recordkeeping and other paperwork burdens for boat and engine manufacturers and marine dealers.

DATE: This rule was effective August 12, 1992.

For further information, contact: Mr. Alston Colihan, Recreational Boating Product Assurance Branch, Telephone: (202) 267-0981.

Interim final rule

CGD 90-051, Double-hull standards for vessels carrying oil in bulk (33 CFR parts 155 and 157; 46 CFR parts 30, 32, 70, 90 and 172) RIN 2115-AD61 (August 12).

Pursuant to the Oil Pollution Act of 1990, the Coast Guard is adopting standards for double hulls on vessels carrying oil in bulk as cargo or cargo residue that are constructed or undergo a major conversion under contracts awarded on June 30, 1990 or later. The Coast Guard is also issuing standards for double hulls on vessels carrying oil in bulk as cargo or cargo residue that

have been constructed or have undergone a major conversion under earlier contracts. The act requires these vessels to have double hulls according to a timetable commencing in 1995. This rule provides the shipping and shipbuilding industries with interim standards in order to meet the double-hull requirement.

DATE: This interim final rule was effective on September 11, 1992. Comments must have been received on or before October 13, 1992.

ADDRESS: Comments may be mailed to the executive secretary, Marine Safety Council (G-LRA/3406) (CGD 90-051), Coast Guard headquarters, 2100 Second Street, S.W., Washington, D.C. 20593-0001 or may be delivered to room 3406 between 8 a.m. and 3 p.m., Monday through Friday, except federal holidays. Telephone: (202) 267-1477.

The executive secretary maintains the public docket for this rulemaking. Comments will become part of this docket and will be available for inspection or copying at room 3406, Coast Guard headquarters.

For further information, contact: Mr. Stephen M. Shapiro, Merchant Vessel Inspection and Documentation Division (G-MVI-2). Telephone: (202) 267-1181.

Interim rule with request for comments

CGD 91-035, Claims under the Oil Pollution Act of 1990 (33 CFR parts 135, 136 and 137) RIN 2115-AD90 (August 12).

This interim rule implements the provisions of the Oil Pollution Act of 1990 concerning the filing of claims for uncompensated removal costs or damages resulting from the discharge of oil, designation of the source of the discharge and advertisement of where claims are to be filed. This action is an interim measure needed primarily to explain how eligible claimants may file a claim against the Oil Spill Liability Trust Fund. In response to comments received regarding this rule, a more comprehensive rule may be developed and published for public comment. This rule will facilitate the presentation, filing, processing, settlement and adjudication of claims against the fund.

DATE: The rule was effective on August 12, 1992. Comments on this rule must be received by December 10, 1992.

ADDRESS: Comments may be mailed to the executive secretary, Marine Safety Council (G-LRA-3406) (CGD 91-035), Coast Guard headquarters, or may be delivered to room 3406 between 8 a.m. and 3 p.m., Monday through Friday, except federal holidays. Telephone: (202) 267-1477.

Comments on collection of information requirements also must be mailed to the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th Street, N.W. Washington, D.C. 20503, ATTN: Desk Officer, U.S. Coast Guard.

The executive secretary maintains the public docket for this rulemaking. Comments will become part of this docket and will be available for inspection or copying at room 3406, Coast Guard headquarters.

For further information, contact: Ms. L. E. Burgess, project manager, National Pollution Funds Center. Telephone: (703) 235-4795.

Final rule

CGD 89-037, Stability design and operational regulations (46 CFR parts 30, 32, 35, 70, 78, 90, 97, 107, 108, 109, 167, 169, 170, 171, 184, 185, 188 and 196) RIN 2115-AD33 (September 11).

The Coast Guard is amending the stability design and operational regulations for inspected vessels to incorporate requirements of recently adopted amendments to the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended. With certain exceptions, the requirements in this final rule will apply to all new and existing vessels. These regulations are intended to minimize the potential for vessel capsizing caused by inadequate damage stability and related operational considerations.

DATE: This final rule is effective on December 10, 1992.

For further information, contact: Ms. P. L. Carrigan, Marine Technical and Hazardous Materials Division. Telephone: (202) 267-2988.

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Final rule

CGD 91-031, Hazards to navigation (33 CFR part 64) RIN 2115-AD83 (September 21).

Recent statutory amendments mandate the establishment of standards for what constitutes a hazard to navigation. The Coast Guard is amending 33 CFR part 64 to include a definition for such a hazard and a list of factors which are to be considered when determining whether any obstruction constitutes a hazard to navigation. Providing a list of factors and a definition will assist the owners of obstructions when evaluating whether an obstruction is a hazard to navigation which requires marking.

DATE: The rule was effective October 21, 1992.

For further information, contact: Mr. Frank Parker, Navigation Rules and Information Branch. Telephone: (202) 267-0357.

Advance notice of proposed rulemaking

CGD 88-031a, Documentation of vessels; controlling interest (46 CFR part 67) RIN 2115-AE25 (September 21).

The Coast Guard is publishing this advance notice to solicit information concerning implementation of the ownership grandfather or savings provision of the Commercial Fishing Industry Anti-Reflagging Act of 1987. The Coast Guard's current rules for the citizenship savings provision, published at 46 CFR 67.03-15, have been the subject of litigation: *Southeast Shipyard Assn. v. United States*, No. 90-1142 (D.D.C). On April 30, 1991, the District Court decided that the Coast Guard's interpretation of the citizenship savings provision of the Act was incorrect. The court did not provide the Coast Guard with a new interpretation. Although this decision is being appealed, the Coast Guard seeks additional data to use in developing a new interpretation.

DATE: Comments must be received on or before December 21, 1992.

ADDRESS: Comments must be in writing and may be mailed to the executive secretary, Marine Safety Council (G-LRA/3406) (CGD 88-031a), Coast Guard headquarters, or may be delivered to room 3406 between 8 a.m. and 3 p.m., weekdays, except holidays. Telephone: (202) 267-1477.

The executive secretary maintains the public docket for this rulemaking. Comments will become part of this docket and will be available for inspection or copying at room 3406, Coast Guard headquarters.

For further information, contact: LCDR Don M. Wrye, Vessel Documentation and Tonnage Survey Branch. Telephone: (202) 267-1492.

Final rule

CGD 89-007b, Documentation of vessels; recording of instruments; citizenship declarations (46 CFR part 67) RIN 2115-AD60 (September 24).

The Coast Guard is issuing this final rule to amend its regulations requiring the filing of a Declaration of Citizenship (MA-899) in connection with the filing and recording of certain instruments affecting the title to documented vessels. The purpose of this change is to conform Coast Guard regulations to those of the Maritime Administration, to reduce uncertainty as to the validity of those instruments, and to reduce the paperwork burden upon the public.

DATE: The rule was effective Sept. 24, 1992.

For further information, contact: Mr. Thomas L. Willis, chief, Vessel Documentation and Tonnage Survey Branch. Telephone: (202) 267-1492.

Correction

The July-August 1992 *Proceedings* contained a photograph on page 6 of two inspectors standing on scaffolding as they examine damage to a vessel. After publication, we learned that there are a number of violations of OSHA standards in the photograph, the most serious being the life threatening position of one inspector standing on an extended portion of board outside the scaffold. The conditions clearly visible in the photograph are serious violations of 29 CFR 1915.71. We regret this oversight very much.

From the North Sea to West Africa . . .

An angry North Sea in a winter storm batters a standby boat alongside a drilling unit.

Photo by Mr. James M. Magill.

Rig inspectors cope with hardships

By LT James Whitehead

From the harsh cold climate of the North Sea to the hot, politically volatile environment of West Africa, the Marine Inspection Office of New York conducts inspections of offshore activity equipment, including jack-up and semi-submersible MODUs, standby vessels and offshore supply vessels.

North Sea operations

A MODU in the North Sea must be prepared for extreme weather conditions, such as those experienced by the *Glomar Arctic III*, a United States-flagged semi-submersible MODU operating in the northern sectors of the United Kingdom.

The author's first experience traveling out to a North Sea MODU was to the *Glomar Arctic III* in May 1991, which was regarded as a "calm" weather period. As the helicopter pilot neared the MODU's landing platform, he announced to his passengers that they exersize caution because the winds were at 60 knots. At the same time, the waves were between 20 and 30 feet.

In January 1991, the *Arctic III* was hit by a rogue wave estimated between 70 and 100 feet high. It damaged the accommodation house and tore the two lifeboats apart. (All that was left of one lifeboat was the fore and aft ends that were still attached to the hooks, and all that remained of the other was the bottom quarter, also still attached to its hooks.) Fortunately, no loss of life occurred, however, several crew members were quite shaken by their windows being blown out and water gushing into their rooms.

There have been other similar occurrences in the North Sea, but the single event which has had the biggest impact on all MODUs in the waters of the United Kingdom is the *Piper Alpha* explosions on July 6, 1988. (See page 22.)

A public inquiry into the *Piper Alpha* incident was chaired by the honorable Lord W. Douglas Cullen, who completed a report in October

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Nigerian boatman maneuvers alongside a supply boat in the hot, calm waters of the mid-Atlantic Ocean.
Photo by CWO Doug Eggleston.

Winter North Sea waves crash against Sonat's semi-submersible drilling unit Chris Chenery.

Photo by Mr. James M. Magill.

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1990. The two volumes, known as the Lord Cullen Report, dealt with the incident and its causes, and also made recommendations on how to improve safety on North Sea MODUs and platforms. The recommendations were adopted almost in their entirety by the British government. The revised regulations probably will not conflict to any measurable degree with United States regulations, but will produce certain changes in MODU equipment.

While the burden of safety remains with the MODU operator, additional safety equipment may be required on board, including smoke hoods, extra lifeboats and a temporary safe refuge. Some items, such as the lifeboats, must be approved by the Coast Guard for use aboard United States-flagged rigs, thereby increasing the operator's cost of doing business in the United Kingdom's portion of the North Sea.

West African hardships

Compared to that of the North Sea, the weather of West Africa is hot and relatively calm, but the developing areas present other occupational hazards for MODU and supply boat operators, and Coast Guard marine inspectors. They include malaria, political unrest, unsafe food and water, and sporadic violence.

Malaria is one of the most serious hazards. Medication is constantly changing and being updated as new strains of the disease develop. Also travelers in West African countries, as in many developing nations, must watch what they eat and drink as bacteria of various viruses are found in food and water. People are urged to use bottled water for drinking and washing teeth.

The political upheavals and ever changing governments in many developing nations frequently cause frustrating delays. Necessary

It is hot and still in downtown Abidjan, capital of Ivory Coast.

Photo by LT Lamberto Sazon.

The supply boat Moon Tide languishes in the heat off the coast of Warri, Nigeria.

Photo by CWO Doug Eggleston.

parts and equipment for MODUs and supply vessels take up to six months to be shipped from the United States.

Some of the towns in West Africa visited by inspectors are in extremely remote areas, accessible only by plane or boat. For example, there are several United States-flag MODUs and offshore supply vessels located off the town of Port Gentil, Gabon. Mangoes grow wild there and can be picked off trees on the side of the road. Surrounding the town are thick swamps and dense jungles, where one of the largest concentrated populations of elephants call home. Fortunately, the animals tend to keep their distance from populated areas.

Local wildlife frequently roam the towns, and are even spotted at airports. On one occasion, a Coast Guard inspector was waiting for a helicopter to take him offshore when a groundskeeper suddenly jumped backwards and grabbed his machete. The inspector was relieved when the poisonous snake that slithered out of the grass was taken care of in short order.

In Walvis Bay, South Africa, one can drive out of town and, within a few minutes, arrive in Namibia, a country with great desert areas where baboons, antelope and other animals greet travelers along the road. One wonders how the wildlife survives in such an arid environment.

Overall

Overall, the Coast Guard Marine Inspection Office of New York has been fortunate when conducting inspections of MODUs, supply and standby vessels overseas. The offshore industry has supported the inspectors, helping them through the hazards of the North Sea and the hardships in West Africa, whether by providing helicopters to MODUs in the former or transportation through isolated roads in the latter.

Despite cruel weather, threats of malaria and the many inconveniences of overseas life, the marine inspectors appreciate the priceless opportunity of traveling to places and seeing things that most people never experience in their lifetimes.

LT James Whitehead is the foreign inspections supervisor at the Marine Inspection Office, New York Battery Park Building, New York City, NY 10004-1466.

Telephone: (212) 668-7494.

Traffic snarls at "confusion junction" in the town of Warri, Nigeria.

Photo by CWO Doug Eggleston.

"Eating house" in Singapore.

Photo by LCDR Edward J. McCauley.

"Honolulu means more than Singapore"

What it's like to be an inspector attached to MSO Honolulu

By LCDR Edward J. McCauley

In the 1970s, when the offshore oil boom reached Southeast Asia, many oil companies, rig operators, supply and construction vessel operators opened offices in Singapore. United States offshore company activities continued in Asia on through the 1980s, with projects taking place anywhere from Korea to Bombay.

During the 1980s, more major United States-flag inspected vessels were constructed in the Honolulu zone than in any other single Coast Guard marine inspection zone anywhere in the world, bar none. The Singapore zone was fast becoming the world center for shipbuilding activity. Singapore's inexpensive labor and quality work force acted like a magnet, attracting construction and repair contracts from all over.

Shipyards in the region constructed everything from sewage sludge barges for the city of New York to sophisticated floating offshore oil production platforms. Passenger, container, tank, bulk and offshore oil rigs were produced in quantity. One particular order included 12 of the then largest container ships in the world.

An inspector's MSO

All this construction and repair activity means a lot of work for MSO Honolulu, which is responsible for periodic inspections of all United States vessels on location and in shipyards in its zone. This means constant scrambling for inspectors to meet the demanding workload.

Many of these inspections have been conducted by volunteer inspectors from other marine safety offices. MSO Honolulu, however, bears the brunt of the work, which is often under conditions unlike any stateside. More than one new lieutenant is a little surprised to learn what MSO Honolulu really means.

Don't expect to see much of Waikiki, when you report for inspection duties at MSO Honolulu. The insides of cargo tanks and spud cans will be your "home away from home," not the beach. You will inspect cargo tanks in Singapore in 100°F with equivalent humidity, and spud cans in Bombay, which don't smell at all like Eastern spices.

If you are at all interested in knowing what kind of damage an Excocet missile can do to a very large crude carrier, or how to install 400 tons of new steel into a 20-year-old tanker, or how to conduct an inclining experiment in Labuan, Malaysia, MSO Honolulu is your port of call.

Be prepared for the unexpected --

Get your rest on the airplane. You won't want to miss out on the action. You depart Honolulu at 11 a.m. and arrive in Singapore two days later at 1 a.m. after crossing the dateline.

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Conoco's 180-foot tension-leg platform is loaded on ~~Mighty Servant 3~~, a heavy lift vessel bound from Singapore to the Gulf of Mexico in 1989.

Photo courtesy of Conoco Inc.

Coast Guard and offshore industry in Southeast Asia

Southeast Asia is one of the busiest areas for offshore drilling in the world, although conditions are far from the boom days of the early 1980s. Today, there are 17 active United States-registered MODUs operated by Diamond M-Odcco, Reading & Bates, Global Marine Drilling and Atwood Oceanics with drilling operations in waters off Australia, India, Indonesia, Brunei, Malaysia and Thailand.

At this time, there are no new United States-registered MODUs being constructed in Southeast Asia. Construction of foreign-flag MODUs is also at an all-time low in the depressed world market conditions. In Singapore, Far East Levingston Shipyard is building two foreign-flag jack-up MODUs. Once completed, there will be no MODU construction in Southeast Asia for the first time in many years.

The Coast Guard's MSO Honolulu, Hawaii, is responsible for conducting safety inspections of all United States-registered MODUs operating in the Southeast Asian area. The MSO recently opened an inspection department in Singapore, the regional headquarters for the area's offshore drilling industry, as well as a major center for drydock and repair of United States-registered cargo vessels and tankers.

The Coast Guard, along with other international safety regulating agencies, requires a higher level of safety for MODUs. All United States-registered MODUs must meet minimum manning and training requirements of 46 CFR subchapter 1-A to receive Coast Guard Certificates of Inspection. In addition, self-propelled MODUs of 500 gross tons or more, engaged in international voyages, are also subject to the requirements of SOLAS 74/78.

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After adjusting your watch, you are quickly seduced by fragrant blossoms throughout the airport area, and assailed with humidity thick enough to cut with a knife. Less than an hour's drive from the airport are some of the largest ship construction and repair yards in the world.

For some inspectors, after a night's rest it's off to another exotic, or more often, remote location. A lucky few work in Singapore, becoming known as "the Coast Guard." All at once, you are an inspector, investigator and all-around troubleshooter all rolled in one. You are on call 24 hours a day. While the schedule could get tiring, the vitality of the industry, the constant activity and newness keep the juices flowing.

It means the South China Sea where fate can be kind if you are a dog treading water. During the towing of the semi-submersible drilling rig Jim Cunningham from Hong Kong to the Pearl River Basin in China, I awakened in the middle of the night to the sound of a dog barking. No dogs had been put aboard when we left Hong Kong, but the barking was coming from the water, not on deck. Apparently, during the night the dog must have fallen off another vessel and when it saw the Jim Cunningham approaching, it decided to climb aboard a pontoon and hitch a ride. It was a wise decision for the dog.

Sea snakes and squid abound in Indonesian waters. Off duty roustabouts and rough-necks try to keep the snakes in the water and the squirting squid on deck. On most occasions, they succeed in catching large quantities of squid, which is later dried and taken home. This is a fringe benefit of working in Southeast Asia.

The very old and the very new in Kuching, a commercial hub on the Island of Borneo, Malaysia.

Photo by LCDR Edward J. McCauley.

MSO Honolulu means more than Singapore.

It means Madras, India, where at the Connemara Hotel you can listen to 1960s sitar music while cooling your recently curry-singed pallet with a tonic (never drink the water). Or you can sit by the pool and read Gunga Din while waiting for your ship to come in (usually three days late). If you feel adventurous, you might like to grab a helmet and drive around town on the back of a shipping agent's motor scooter to obtain the proper port clearance papers so that when your ship docks, you can board without delay.

It means offshore in the Bombay High oil field, where helicopter service is scheduled once a week in Russian helicopters flown by Indian pilots. However, a normal inspection takes only three or four days. You want to go home when the job is done? Simply hail a chopper headed for shore, connect at the Oil and Natural Gas Commission platform, and if you're lucky, you won't get stranded there for the next three days. If you do, relax and enjoy the sunsets.

Working in Southeast Asia is exhilarating. At the same time, living in any developing area requires resourcefulness, patience and a sense of humor. Life can be very frustrating until you learn to adjust to unfamiliar cultures. Once you relax and begin to accept new attitudes and activities in stride, you will appreciate and enjoy a whole new way of life.

LCDR Edward J. McCauley is the chief of the Fishing Vessel Safety Section, Fishing Vessel-Offshore Activities Branch, Merchant Vessel Inspection and Documentation Division, Office of Marine Safety, Security and Environmental Protection. He was stationed in the Honolulu zone from 1984 to 1989.

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Henry Goodrich, a semi-submersible drilling unit, is enroute from Japan's Mitsui shipyard to offshore Norway.