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Planning and Executing Deepwater Mooring in the GOM

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Abstract

In mid-2006 Noble Corporation's semisubmersible drilling unit *Noble Amos Runner* successfully established a new world record for the deepest "conventionally moored rig" by mooring in 7,650 ft of water in Green Canyon Block 955. The *Noble Amos Runner* is a Noble EVA-4000™ designed semisubmersible unit upgraded in 1999. Rated to operate in water depths up to 8,000 ft, the rig is equipped to drill wells up to 32,500 ft total depth. The *Noble Amos Runner* set this record using the rig's existing mooring system, as opposed to using pre-set mooring systems that require anchors or suction piles to be in place before the rig arrives. Using the rig's existing mooring system resulted in lower overall mooring costs and increased operational flexibility.

Conventional mooring at this depth required extensive project planning, beginning with a detailed mooring plan that considered site-specific winds, waves, and currents for the next six months. The rig was to be on site through the entire 2006 hurricane season, and the location is at the apex of the infamous GOM loop current that can produce surface currents of 3.5 knots for months.

Noble and Anadarko/Kerr-McGee commissioned numerous engineering studies by experts in mooring analysis and marine engineering to ensure the most optimum anchor pattern was used to combat strong currents, deep sea conditions, and anticipated hurricanes. Noble and Kerr-McGee held several pre-rig move meetings where their engineers, mooring and boat experts, rig personnel, and operational management teams discussed procedures, critiqued scenarios, and developed an optimum execution plan to address all issues that this deepwater location created.

This paper summarizes the planning and execution of conventional mooring in deep water in the GOM.

Introduction

The *Noble Amos Runner* is a semisubmersible drilling rig (Figure 1) currently outfitted for operations in water depths up to 8,000 ft. Its capacities and specifications are summarized in Table 1.

When originally constructed, the rig was a submersible designed drilling unit rated for 80 ft of water and set on bottom to drill. In 1997, the rig was converted to a semisubmersible unit. Several modifications were added including three additional columns, three pontoons with ten mud tanks, nine anchor winches, a new drill floor and derrick, five EMD generators with new SCR controls, three mud pumps rated for 7,500 psi, 160-kip tensioners, an 800-kip crown-mounted compensator, and a new 15-ksi BOP stack with fourth-generation MUX BOP controls. These upgrades provided the capability for the rig to drill in water as deep as 6,600 ft.

In 2006, the rig was upgraded again with the addition of longer and stronger anchor cables, longer MUX BOP control cables, and several upgrades to the riser and riser-tensioning systems. These additions further increased the rig's water depth rating to 8,000 ft.

The rig drilled 99,569 ft on six different wells in the GOM during 2006. On August 25, 2006, the *Noble Amos Runner* set a new world record for a conventionally moored vessel by successfully anchoring on location at Green Canyon Block 955 in 7,650 ft of water. This location is about 200 miles south of New Orleans, Louisiana. The previous depth record for conventionally mooring a semisubmersible rig was 5,920 ft set by Diamond Offshore in July 2006 with the *Ocean Victory* in the GOM at Mississippi Canyon.

In the first quarter of 2007, the *Noble Amos Runner* will be mobilized to a location with a water depth of 8,000 ft.

Mooring System. The rig is equipped with a nine-point mooring system. Traction winches are used to deploy a combination chain/wire anchor system. Each anchor point includes 10,500 ft of 3¼" anchor wire and 4,250 ft of 2¾" anchor chain (Table 2). With a total length of over 23 miles, the complete mooring system weighs more than 2,270 tons.

It is important to note that the mooring depth record described here was achieved using the rig's existing mooring system and anchors, as opposed to a pre-set mooring system based on preset anchors or suction piles. Pre-set systems require an anchor boat and crew to install anchors or suction piles before the rig arrives on location. This approach adds costs beyond conventional mooring, but can be advantageous where there is concern for protecting existing equipment