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Assessment of Storm Sea Fastenings for Drilling and Workover Rigs on Floating Production Systems During Hurricane Ivan: Phase 1

E.G. Ward, Offshore Technology Research Center, and J.M. Gebara, Technip Offshore Inc. (USA)

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Abstract

Drilling and workover rigs on Floating Production Systems (FPSs) are typically tied down or fastened to the decks of offshore structures by "sea fastenings" to prevent movement during hurricanes. During Hurricane Ivan, a number of drilling or workover rigs shifted. These movements are being assessed along with the current design philosophy and criteria for storm sea fastenings, rig and storm sea fastening installation practices, and onboard storm operational practices to ready FPSs for a hurricane. Results will provide information that can be used to assess any needs to revise tie-down criteria or practices to avoid future damage.

Project Description

Drilling and workover rigs on Floating Production Systems (FPSs) are typically tied down or fastened to the decks of offshore structures by "sea fastenings" to prevent movement during hurricanes. These sea fastenings can include large diameter bolts, weldments, braces, or other means.

During Hurricane Ivan, a number of drilling or workover rigs shifted. Possible factors that could contribute to these movements could include:

- adequacy of design criteria for the storm sea fastenings
- proper design and installation of storm sea fastenings
- operational practices to secure the rigs as a hurricane advances
- the intensity of hurricane Ivan loads on the storm sea fastenings significantly exceeding the design criteria

These movements are being assessed along with the current design philosophy and criteria for storm sea fastenings, rig and storm sea fastening installation practices, and onboard storm

operational practices to ready FPSs for a hurricane. Results will provide information that can be used to assess any needs to revise sea fastening criteria or practices to avoid future damage.

This project is being conducted in two Phases. Phase 1, being sponsored by the Minerals Management Service, is focusing on

- Collecting information and data on Floating Production Systems (FPSs) in the path of Hurricane Ivan that had platform drilling or workover rigs.
- Assessing this information to determine probable causes for the rig movements.
- Assessing success cases where rigs sustained Hurricane Ivan forces without movement.
- Completing an example case study comparing the actual behavior of a rig that moved during Hurricane Ivan with estimated rig loads and sea fastening capacities

Phase 2 is envisioned as a JIP that will focus on

- Completing case studies of failures and successes of rig sea fastening systems during hurricane Ivan
- Evaluate tie-down design options to prevent observed movements during storms
- Review practices for exchanging rig/floating system information needed for sea fastening design
- Document results and findings.

Phase 1 is now in progress. This paper will summarize the current project status and plans.

Data Gathering

Figure 1 shows the locations of FPSs that were exposed to Hurricane Ivan. Table 1 lists FPSs exposed during Ivan, and indicates whether rigs were on board and if there was movement. There were four instances reported in which drilling rigs or rig related equipment on FPSs moved. Movements were reported to have occurred on

- Ram Powell TLP
- Medusa Spar
- Horn Mountain Spar
- Devils Tower Spar

Figure 1 show the track of Ivan and the reported radius to maximum winds at the time Ivan was near the affected FPSs. Hurricane Ivan was an unusually severe storm and maximum