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Kikeh Development: Challenges in Implementing a Smart Field

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Abstract

Acquiring, accessing, and transforming real time data into useful information from which appropriate actions are taken is still, more often than not, an unrealized opportunity in the industry. Despite numerous papers in the literature, and many references to “the business case” and “value-add” of the “digital oilfield,” “smart field,” “i-field,” “e-field,” etc., the automation and conversion of real-time data into information in the oilfield remains an elusive goal. Why? *Because there is simply no single silver bullet.*

This paper describes the challenges and difficulties of actually implementing a successful, integrated, real-time production data monitoring and optimization system. In the opinion of the authors, the challenges are not so much cost issues as much as workflow and project ownership issues. The paper will describe the recipe followed in achieving the successful implementation of a production data management system (PDMS) for the optimization of production for the Kikeh Field—a large deep-water Spar, subsea, and floating production storage and offloading (FPSO) operation.

This paper is about the transformation and integration of massive amounts of digital data into information which is being used to optimize the production of a multi-billion dollar asset. The production estimates for Kikeh were exceeded by over 100,000 BOE for the first six weeks of operation. That additional production is being attributed to the Kikeh engineers’ and operations’ utilization of the PDMS to ramp up the production for the first five wells in *a third to one half* of the projected timeframes originally planned.

Background on the Kikeh Field

The Kikeh field is located northwest of the island of Labuan, offshore Sabah, East Malaysia in water depths of around 1,320m. Murphy Sabah Oil Co., Ltd. operates Kikeh on behalf of partner, Petronas Carigali Sdn Bhd (PCSB). The Kikeh development consists of a FPSO vessel receiving production from wells drilled from a Spar or Dry Tree Unit (DTU) platform and subsea well manifolds. The Spar has 25 slots. There are 3 subsea oil producers (one manifold), one gas injection well, and 12 water injection wells (three manifolds). Kikeh has a planned production plateau of 120,000 BOPD. Water injection will peak at 260,000 BWPD.

Dry Tree Unit (Spar). The Spar is 142m long and 32m in diameter. Murphy awarded the contract for the engineering, procurement, construction, installation and commissioning of the unit to Malaysian based EPCIC contractors. Construction and completion work was carried out in a Malaysian shipyard and engineering facility in Pasir Gudang, Johor, Malaysia. The Spar incorporates a tender assisted drilling rig to drill and complete the Kikeh wells. Eighteen wells (fourteen surface/dry tree production wells and four water injectors) will ultimately be drilled from the Spar. They are rated for a pressure of 5,000 psi and have 10-inch OD production riser systems.

The three each subsea producers are tied back over 4 km via looped 7-inch flexible pipelines and risers. All wells have downhole pressure and temperature gauges, methanol injection and wax inhibitor lines, and additional lines for future scale/corrosion inhibitor injection.

Floating Production Storage and Offloading. The FPSO has an overall length of 367m a beam of 54.6m and a dead-weight of 273,000 tons. The converted tanker was built in 1974. It has a storage capacity of 1.8 million barrels. The FPSO is designed to accommodate an oil production rate of 120,000 BOPD and water injection rate of 260,000 BWPD. It can compress gas at 150 million cubic feet a day. At the bow, is the external turret which can accommodate up to 17 flexible risers ranging from 8 inches to 10 inches in diameters.