



OTC 17919

Development of Close-Moored Deepwater Systems: Kizomba A and B Projects

R.E. Sandström, J. Huang, and M.A. Danaczko, ExxonMobil Upstream Research Co., and W.C. Kan and R.K. Fry, ExxonMobil Development Co.

Copyright 2006, Offshore Technology Conference

This paper was prepared for presentation at the 2006 Offshore Technology Conference held in Houston, Texas, U.S.A., 1–4 May 2006.

This paper was selected for presentation by an OTC Program Committee following review of information contained in an abstract submitted by the author(s). Contents of the paper, as presented, have not been reviewed by the Offshore Technology Conference and are subject to correction by the author(s). The material, as presented, does not necessarily reflect any position of the Offshore Technology Conference, its officers, or members. Papers presented at OTC are subject to publication review by Sponsor Society Committees of the Offshore Technology Conference. Electronic reproduction, distribution, or storage of any part of this paper for commercial purposes without the written consent of the Offshore Technology Conference is prohibited. Permission to reproduce in print is restricted to an abstract of not more than 300 words; illustrations may not be copied. The abstract must contain conspicuous acknowledgment of where and by whom the paper was presented. Write Librarian, OTC, P.O. Box 833836, Richardson, TX 75083-3836, U.S.A., fax 01-972-952-9435.

Abstract

The Kizomba A and B projects, located on Block 15 offshore Angola, are world-scale production systems that set the pace for development of large, deepwater fields. The field layouts are unique in that they both combine a surface wellhead platform (SWHP) in close proximity to a spread-moored, floating production, storage, and offloading vessel (FPSO). This paper illustrates one of the many technical achievements that were essential to the success of Kizomba A and B projects: the integrated design of the close-moored system.

The design, construction, and installation of large floating vessels in close proximity presents challenges for managing interfaces between the major Engineering, Procurement, and Construction (EPC) contractors. Any change by one contractor to a key connecting system can affect the coupled motions and integrity of components designed by other contractors. Achieving the project targets for safe separation between the SWHP and FPSO required diligent coordination and an effective communication effort. This paper also discusses the project's approach for effective interface management and close coordination to achieve safe and successful installation of the Kizomba A and B SWHP and FPSO facilities.

Realizing the benefits of the Kizomba A and B field development architecture required establishing a confident basis for the separation distance and design of the fluid transfer lines (FTLs) between the SWHP and the FPSO. Because of the close proximity of the SWHP to the FPSO, establishing the separation distance and relative motions between the platforms through all load conditions was a key factor for design of the FTLs. Furthermore, the potential effects of hydrodynamic coupling, the subject of many technical papers on deepwater design, also warranted careful consideration. The design methodology outlined in this paper accounts for coupling between two floating vessels due to hydrodynamic interaction of the interconnecting systems.

Kizomba A and B Overview

The Kizomba A and B developments are located 370 km northwest of Luanda, Angola in water depths between 1,000 and 1,200 m. The developments each have estimated recoverable resources of 1 billion barrels of oil, and are based on virtually identical production systems, with peak capacities of 250,000 barrels of oil per day.

There are four major systems associated with the Kizomba A and B developments:

- The tension leg platform (TLP) was selected as the SWHP. The TLP supports the drilling and well workover system for developing and maintaining up to 36 production and injection wells. The TLP does not support any production facilities, except a manifold system to combine the wellstream from each well and to transfer the produced fluids to the FPSO via FTLs. These lines are suspended below water between the TLP and FPSO.
- The FPSO is spread-moored in close proximity (nominally 200 m) to the TLP. The FPSO supports oil and gas processing facilities and stores the oil until it can be offloaded onto shuttle tankers.
- Offloading to tankers takes place through a remotely located, catenary anchor leg mooring (CALM) buoy. The FPSO sends crude to the buoy through its oil offloading lines (OOLs), which are suspended below the water surface between the FPSO and the CALM buoy, never touching the sea floor.
- The fourth main component is a series of subsea wells. Unlike the surface wellheads on the TLP, these wells are located on the ocean floor. The subsea wells include injectors only for Kizomba A and both producers and injectors for Kizomba B. The injectors take water and gas that have been separated from the oil and pump them back downhole to maintain pressure in the oil-bearing reservoir. Most of these subsea wells are connected to the FPSO via single hybrid risers (SHRs).

Figures 1 and 2 illustrate the Kizomba A and B field architecture, including the TLP, the FPSO and the CALM buoy. Also shown are the FTLs, suspended between the TLP and the FPSO, and the other interconnecting systems. Table 1 summarizes the various interconnecting systems associated with the Kizomba A and B developments.