Reservoir Development, Surveillance and Management in Deepwater Slope Systems – Reservoir Architecture, Heterogeneity and Connectivity Learnings from the Zafiro Field, Equatorial Guinea

Dixon, Bret[1], Timothy Head[2], Michael B. Helgerud[3], Henry D. Bensmiller[1], David L. Mitchell[1], Gerrick N. Jensen[4], William J. Dunn[1], Sean C. Rochford[1], Brooks Clark[3], Alina Kalfsbeek[1], John Ardill[3], Ken Brantferger[5], James W. Barron[1], Mike Whitsett[3] (1) Equatorial Guinea Operations Technical, ExxonMobil Production Company, Houston, TX (2) Mobil North Sea Limited (3) ExxonMobil Exploration Company (4) ExxonMobil Development Company, (5) ExxonMobil Upstream Research Company

With long construction lead times, relatively short field life and the high cost of many deepwater field developments, ongoing multidisciplinary integration is essential for development plan implementation and continuous improvement of reservoir depletion plans. The phased development of the Zafiro Field provides an excellent example of how this can be achieved and demonstrates the impact of multiple, hierarchies of reservoir heterogeneity and connectivity on fluid flow over the productive life of a deepwater field.

The Zafiro Field, Equatorial Guinea, was discovered in 1995 and contains over 20 Pliocene age deepwater slope channel complexes. The field was developed using a staged approach and includes both subsea and platform wells. High-resolution 3-D, 4-D seismic log and pressure data from 100 reservoir penetrations, over 3500ft of conventional core and 10 years of production data have been integrated to create very accurate geologic and reservoir simulation models. In addition, staged development and continuous drilling has allowed the ongoing collection and integration of log and pressure data from stacked reservoirs. This has helped evaluate well interference/conformance, identify reservoir baffles and barriers, confirm relative permeability differences, and allowed differentiation of primary from secondary gas caps, and perched water from zones swept by injection. When integrated with reservoir surveillance data, the high resolution hierarchical seismic stratigraphic framework, combined with detailed depositional environment interpretation and 4-D seismic analysis has allowed a more complete understanding of the spatial and temporal changes in fluid saturation, reservoir pressure and the movement of fluid contacts.