

Successful development of a thin oil column using horizontal drilling in the Palas field, Malay Basin

ANG DUEN WOEI, ABDUL AZIZ ABD RAHIM AND MICHAEL D. CRUMLEY

Esso Production Malaysia Inc.

The Palas field is located in the 1995 PSC area and is approximately 215 km east of Kerteh, Terengganu. The Palas field was discovered in 1977 and six exploration wells were drilled to delineate the field over a period of 16 years. The initial development program began in 1985 after installation of the Palas A platform. The platform is a 32-conductor, unmanned satellite connected to the Gunting A platform, 12km to the west. The initial eighteen well development program primarily targeted the I-100/102 sands with minor completions in other I series sands (I-50, I-55, I-60, I-62, I-68, I-70, I-75, I-80, I-90 and I-95).

The last exploration well, Palas-6, was drilled in 1993 to delineate the undeveloped Group J sands. From the well's positive results, and supported by recent 3D seismic data, reservoir modeling and simulation work; an additional development drilling program was initiated in 2001. Thirteen horizontal wells and one conventional well are planned to develop reserves from a thin oil column within the J-20/21 and J-30/40 reservoirs. Twelve of the horizontal wells have been drilled thus far.

Early in the 2001 development program, two wells were drilled using pilot holes to determine the hydrocarbon contacts in the J-20/21 and J-18/19 reservoirs. The Palas A-20 well successfully delineated the J-20/21 G/O and O/W contacts, using a pipe conveyed formation test tool (MDT) in the high angle pilot hole. After plugging back, the information was used to optimally position the horizontal wellbore in the thin oil column within the J-20/21 reservoir. The Palas A-23 was successfully geosteered to stay within the thin, dipping J-18/19 reservoir, while penetrating both the G/O and O/W contacts. While the J-18/19 was deemed uneconomic to develop, the well was plugged back and drilled horizontally to the J-20/21 reservoir.

Subsequent horizontal wells have targeted the J-20/21 and J-30/40 reservoirs. Because of the thin oil column, these horizontal wells are geometrically steered at a specific depth, optimally positioned between the G/O and O/W contact. To reduce directional survey uncertainty below what can be obtained from MWD, gyro surveys are run at appropriate depths during the drilling operations. Additionally, recent wells have utilized rotary steerable drilling assemblies, making it possible to drill long horizontal sections that could not be drilled using conventional mud motor drilling assemblies. The rotary steerable assemblies also provide near bit inclination measurements, which reduce the survey to bit projection uncertainty. This in turn reduces the wellbore undulation, permitting the wellbore to remain optimally positioned between the contacts in the thin oil columns.

The Palas A-27 well was the eighth horizontal well drilled to develop the J-20/21 and J-30/40 reservoirs. Because of the well's position on the structural nose of the southeast flank and the low bed dip (1-2°), a long horizontal section was required to penetrate the complete reservoir section. Total measured depth of the Palas A-27 well is 5,817 m and the horizontal length set a new Malay Basin record of 2627m MD (45% of the total measured depth). The well path was optimized using seismic, to penetrate positive AVO responses, which correlate to sand development. Using a rotary steerable drilling system (RSS) with a near bit inclination sensor (~1.2 m from the bit), the well bore was maintained within a +/-1.4 m vertical window throughout the entire 2627m horizontal section. The wellbore intersected 970 m MD of net sand and was completed as a dual oil well, producing at a record rate of 12 kb/d, with no water and with gas volumes near the solution GOR.