Introduction

The Kikeh Field was discovered in August 2003 and was the first offshore deepwater development in Malaysia. The field’s first oil production commenced in August 2007, some 5 years after the commercial discovery of the block.

The Kikeh Field is located 110km off the north-west coast of Sabah, Malaysia in a water depth of approximately 1450m making the Kikeh gas pipeline the deepest rigid pipeline installed in the Asia Pacific region to date, and a major milestone for both SapuraAergy and Malaysia.

SapuraAergy was awarded the EPCI contract by Murphy Sabah Oil Company, Ltd. (the operator) for the Kikeh Gas Pipeline System for the Kikeh Development. The project was successfully completed in 2008 with minimum installation downtime.

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The final connection between the newly laid Kikeh pipeline and the existing Gas manifold was made using a subsea jumper spool. The spool was 45.5m in length and needed to be installed flooded with “Superdry” fluid. This fluid needed to be turned into a gel prior to deployment to prevent loss during connection operations.

The jumper spool was successfully fabricated and tested onboard the Sapura 3000 by the onboard team and then deployed and successfully connected using the two (2) units of work class ROVs. Once installed, the vertical connections were successfully tested followed by a subsea leak test on the jumper to confirm its integrity in-situ.

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The pre-commissioning services were completed successfully and without a lost time incident which was a magnificent result considering the challenges of 6600psig (445 barg) test pressure in such deepwater and with complex subsea architecture. Without the use of an innovative Gel isolation, the project would have been at risk of inducing hydrates immediately upon start up (which are expensive and difficult to correct) as well as causing potential delays to production.

Achievements/Results

The Kikeh field is the first deepwater development in Malaysia. In 2008, SapuraAergy successfully completed the works at a maximum depth of 1450m making the Kikeh gas export pipeline the deepest rigid pipeline installed in the Asia Pacific region to date and a major milestone for SapuraAergy.

Additionally, the PLET installation at 1450m water depth with a weight of 83MT, was the first of its kind in Malaysia, and a significant installation achievement for the Sapura 3000.

Kikeh Gas Pipeline System for Kikeh Development Project

Introduction

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Strength and Depth
Figure 1

Project Fact Sheet

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<th>Project Name</th>
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<td>Engineering, Procurement, Construction, Installation and Commissioning (EPCIC)</td>
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<td>Water Depth</td>
<td>From 0m (shore) to 1450m</td>
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<td>Vessel Utilised</td>
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<td>Scope of Work</td>
<td>Performance of offshore installation works at Kikeh Field - EPCIC - which includes: Deepwater tie-in to the Kikeh Field Tie-in jumper connecting the PLEM to the gas injection/export manifold (GIM) supplied/installed by others Shallow water tie-in flange located at the proposed Kabilalu Deep and East Platform location for future tie-in; Provision for deepwater tie-in for future tie-in at the Kikeh PLEM; 12” nominal diameter carbon steel pipeline from the PLEM to the onshore beach valve station at Labuan; Onshore maintenance valve; and Provision of operational pig launcher for operations/inspection/pigging</td>
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Figure 2

Project Challenges

The Kikeh export pipeline contract involves the complete EPCIC of a 138km, 12” diameter export pipeline installed in water depths from the beach (0m) out into the Kikeh field at 1450m. The contract included the line pipe procurement and coating, shore crossing works, the installation of pipeline end termination (PLET) in deepwater, the installation of a tie-in jumper spool and an in-line future tap tie-in at the Kinabalu East/Deep Platform.

Subsea completion work was performed utilising the two (2) permanently deployed ROVs on board the Sapura 3000 in 1450m water depth. This included a 50m long spool installation and pipeline pre-commissioning operations. The KGP project was completed with minimum downtime.

Challenge 1 – Shore Crossing

Shore crossing operations were performed by SapuraAercy from onboard the DLB Sea Horizon. The shore crossing consisted of a 750m section of pipe being pulled from the lay barge offshore into the beach. Loads recorded during the pull-in operation were up to 90Te in sections. The operation was completed successfully allowing the DLB Sea Horizon to continue with pipeline operation into a water depth of 20m. Three (3) units of existing pipelines required to be crossed requiring specific pipeline crossings were constructed during this pipelay section.

Figure 3

Challenge 2 – Hook-Up of Pipeline to LGAST

The installation of a pipeline and the connection of the pipeline at the existing LGAST terminal presented significant challenges. With limited access, SapuraAercy needed to construct an access from the main road in Labuan down to the pipeline pull-in location. This limited space also presented challenges for the pipeline testing, conditioning and testing operations. The final connection of the offshore pipeline to the land section as shown in Figure 2, required an open excavation over 2m in depth to be constructed in the tidal zone at the beach.

Figure 4

Challenge 3 – Future Tap Tee Installation

At a water depth of 60m, an in-line tee needed to be installed during the pipelay operation. The in-line, future tap tee (supplied by Olisates), was installed with an integrated protection frame making the total weight of the in-line joint 5MT. The future tap tee now sits upright on the seabed for future hook-up from the Kinabalu B platform that will utilise the pipeline to export sales gas to the LGAST facility.

Figure 5

Challenge 4 – Stinger Change-Out

Pipelay operations up to 120m WD were executed with a single section stinger (hinge section). However, to accommodate pipe laying operations in water depths beyond 120m, an additional section (section 2) needed to be installed as a stinger extension to enable a steeper departure angle for the pipeline to facilitate deeper water pipelay operations to 1450m WD. In full operation the total stinger weight is 700MT with an overall length of 90m.

Figure 6

Challenge 5 – Deepwater Pipe Laydown

Pipelay operations constructed into the Kikeh Field (1450m) where the pipeline needed to be laid into a 6m x 3m target box on the seabed. The pipe was laid down in an S-lay configuration, into the existing Kikeh field in an area that was already populated with subsea structures and flexible pipe. The Kikeh pipeline was laid-down successfully inside the target box and maximum pipelay lay down tensions were recorded at 10Te.

Figure 7

Challenge 6 – Deepwater Pipe Recovery and PLET Installation

For the installation of the deepwater Pipeline End Termination (PLET), the Sapura 3000 was mobilised with a project specific pipe hang-off platform that allowed the pipe to be recovered in a J-lay configuration and hang-off on the side of the vessel, a load of 84Te was experienced at the new hang-off clamp. Once the pipe lay down head was removed, the 83Te PLET was then up-ended and hung into its near vertical position for connection to the subsea pipeline. The PLET and pipeline were welded, tested and readied for subsea deployment.

Once all tests were complete, the pipeline and PLET were lifted (163Te) and successfully laid onto the seabed into a target box of 6m x 3m.

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Project Fact Sheet

Project Name: Kikeh Gas Pipeline System

Client: Murphy Sabah Oil Company Ltd

Contract Type: Engineering, Procurement, Construction, Installation and Commissioning (EPCIC)

Water Depth: From 0m (shore) to 1450m

Project Duration: 2006 – 2008

Kikeh Phase 1 – Gas Export Pipeline

Kikeh Phase 2 – PLET installation

Vessel Utilised: Sapura 3000

Scope of Work: Performance of offshore installation works at Kikeh Field - EPCIC - which includes:

- Deepwater tie-in to the Kikeh Field
- Tie-in jumper connecting the PLEM to the gas injection/export manifold (GIM) supplied/installed by others;
- Shallow water tie-in flange located at the proposed Kinabalu Deep and East Platform location for future tie-in;
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- 12” nominal diameter carbon steel pipeline from the PLEM to the onshore beach valve station at Labuan;
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Project Overview

The Kikeh Field was developed utilising dry tree wells located on a Dry Tree Unit (DTU) floating platform and subsea completions connected to a turret-moored Floating Production, Storage and Offloading (FPSO) vessel through a system of subsea manifolds, pipelines and risers.

Treated and stabilised crude oil will be periodically offloaded from the FPSO to shuttle tankers via tandem offloading.

Associated gas will initially be re-injected into the Kikeh reservoir until commissioning of the Kikeh Gas Pipeline System (KGP) project, after which the gas will be exported.

The project challenges were recorded at 10Te.

The Kikeh export pipeline contract involves the complete EPCIC of a 138km, 12” diameter export pipeline installed in water depths from the beach (0m) out into the Kikeh field at 1450m. The contract included the line pipe procurement and coating, shore crossing works, the installation of pipeline end termination (PLET) in deepwater, the installation of a tie-in jumper spool and an in-line future tap tie-in at the Kinabalu East/Deep Platform.

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