TLO/SAPURACERGY

INSTALLATION OF DEEPWATER FACILITIES

By : Syed Jamil Fadaak, Deputy Project Director
Presentation Outline

- Corporate Structure
- Brief History
- Typical Deepwater Development
- Typical scope of work
- Key permanent subsea
- Key equipment in deepwater installation
- Key materials in Deepwater facilities
- Installation Engineering softwares
- Animation: Pile installation, Jlaying
Corporate Structure

ACERGY

SAPURACREST

50%

50%

100%

SAPURAACERGY

Joint Venture Company

TL OFFSHORE

Wholly owned and self operated
Contracting and Execution for deepwater works in Malaysia

PETRONAS PSC

TL OFFSHORE

SAPURAACERGY

DEEPWATER

SELF OPERATED

SHALLOW WATER

• PETRONAS LICENSE
• BIDDING ENTITY
• DOSH LICENSE
• CIDB

• DOSH LICENSE
• CIDB
## Brief History

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>TL Offshore was incorporated</td>
</tr>
<tr>
<td>2002</td>
<td>SapuraCrest Petroleum was established</td>
</tr>
<tr>
<td>2006</td>
<td>SapuraAcergy a joint Venture company with Acergy was incorporated – For Deepwater Works</td>
</tr>
<tr>
<td>2007</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Deepwater Installation works: Murphy-Kikeh</td>
</tr>
<tr>
<td>Nov 2008</td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Deepwater Installation contract: Gumusut-Kakap Project</td>
</tr>
</tbody>
</table>
DeepWater Subsea Development

- Stand alone field development
- Tie backs
- Subsea to shore
Subsea to shore deepwater field development
Stand alone deepwater field development
Tie Backs:

• To an existing:
  – Floating facilities
  – Shore facilities
  – Fixed platform
Subsea to shore
Typical Scope of works for Installation Contractors

- Engineering
- Survey
- Procedure development
- HSE
- QA
- SubContracting/Procurement
- Logistics
- Transportation
- Fabrication
- Factory acceptance test (FAT) & System Integration Test (SIT)
- Installation
- Pre-commissioning
Key Permanent Subsea Facilities

- Pipeline
- Flowline
- Risers
- PLET
- SLED
- Manifold
- Restraint piles and Initiation piles
- Mooring
- Jumpers
- Umbilical
Typical permanent subsea facilities
PLET
Jumper
Key Equipment in Deepwater Installation

- DP Barge
- J Lay tower
- DP Support Vessel
- ROV
- Pile guide frame
- ILT
- Underwater Hammers
- High speed deployment winches
- A & R Winch
- PLET handling frame
- LBL ARRAY
Barge and Vessels

Dynamic Positioning Vessel
Sapura3000

Typical dynamic Positioning ROV & Survey vessel
S-Lay – Steep and Normal

Stinger:
Steep Departure Configuration >
85° Departure angle capable)

Stinger:
Shallow Departure Configuration >
Single section can be used
Sapura 3000 – J Lay Tower
J Lay equipment

1. **Escalator**: Carries the pipe up from the storage racks to the erector.
2. **Erector**: Lifts the pipe into a vertical position and loads it into the Travelling Table.
3. **Work Station 1**: Pipe welding
4. **Work Station 2**: Field joint coating
5. **Bushing Table**: Pipe hangoff
6. **Stinger**: Gimballing jacks, Centraliser & rollers

**Table: J Lay Equipment Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>380t (Dynamic)</td>
</tr>
<tr>
<td>Gimbal angle</td>
<td>8/9 deg pitch/roll</td>
</tr>
<tr>
<td>Pipe size</td>
<td>4” - 20”, max 20t</td>
</tr>
<tr>
<td>Pipe length variation</td>
<td>22m - 24.9m, WS2 vertical stroke = 2m</td>
</tr>
<tr>
<td>A&amp;R system</td>
<td>360T for Saprua 3000</td>
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J-Laying

1. Escalator
2. Erector
3. Travelling Table
4. Work Station 1
5. Stinger
6. Work Station 2
Sapura 3000 ROV

- State of the Art
- High speed winches
- Heave compensated
- 100% redundancy
- 1500m tether
- 2 industry standard manipulators (5 and 7 functions)
- Perform touch down monitoring
- Fitted with navigation

Features
- New launch and recovery system (LARS)
- Intervention class ROV tooling suite
- Enhanced thrusters
- Improved maneuverability
- Latest HDTV systems
- Subsea dynamic positioning system
SYSTEM INTEGRATION TEST (SIT)

- IMPORTANT IN DEEPWATER INSTALLATION USING ROV
- CHECK ROV ACCESS
- TOOLING INTERVENTIONS
- CHECK POSSIBLE CLASH
- CLEANING TOOL
- SEAL REMOVAL TOOL
SYSTEM INTEGRATION TEST (SIT)
ROV Survey Equipment

ROV Positioning
• ROV Gyro: Octans 3000
• DVL: Workhorse Navigator

Bathymetry/Seabed Conditions
• ROV Bathy system and altimeter
• Multibeam: Reson 8125

Debris/Obstruction Detection
• OAS: Mesotech MS1000
• SSS: Edgetech 4200

Visual Recording
• Color zoom cameras
• Digital stills cameras
• Wheeled skid (boom cameras)
Pre-lop Survey Of Initiation Piles, PLET/Sled, DMA locations

• Purpose of the pre-lop survey is to identify and map seabed obstructions, anomalies or features that may hinder or pose a hazard to the installation works.

• Performed by ROV /Survey vessel

Overview Of Survey Equipment

- Vessel Equipment
  - USBL, Gyro, DGPS

- ROV Equipment
  - SSS, MBES, OAS, Cameras,

- Seabed Equipment
  - LBL MF Array
Typical LBL ARRAY FOR FLOWLINES J-LAY

- PLETS & In-line Sleds installation
- DMA installation
- Flowlines Initiation
- Jumpers Installation
- Cut to length calculations
## Typical survey accuracy and installation Tolerance

<table>
<thead>
<tr>
<th>Item</th>
<th>Positioning Method</th>
<th>Accuracy of LBL Array</th>
<th>Absolute Installation Tolerance</th>
<th>Accuracy Of Subsea Gyro</th>
<th>Heading Tolerance</th>
<th>Accuracy of Inclinometer</th>
<th>Inclination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driven Piles for Flowline initiation and restraint</td>
<td>MF LBL</td>
<td>+/- 0.25m</td>
<td>+/- 2m</td>
<td>+/- 0.5°</td>
<td>+/- 7.5°</td>
<td>+/- 0.05°</td>
<td>+/- 3° from true vertical</td>
</tr>
<tr>
<td>Driven Piles for Manifold foundation</td>
<td>MF LBL</td>
<td>+/- 0.25m</td>
<td>+/- 2m</td>
<td>+/- 0.5°</td>
<td>+/- 7.5°</td>
<td>+/- 0.05°</td>
<td>+/- 3° from true vertical</td>
</tr>
<tr>
<td>PLET</td>
<td>MF LBL</td>
<td>+/- 0.25m</td>
<td>+/- 1.5m</td>
<td>+/- 0.5°</td>
<td>+/- 2°</td>
<td>+/- 0.05°</td>
<td>+/- 2° from true vertical</td>
</tr>
<tr>
<td>DMA</td>
<td>MF LBL</td>
<td>+/- 0.25m</td>
<td>+/- 2m</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Flowline lay</td>
<td>MF LBL</td>
<td>+/- 0.25m</td>
<td>+/-2.5m corridor</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Key Materials in Deepwater facilities

- Stress Joints / Flex Joints
- Thickend pipes
- Mooring Chains and wires
- VIV fairings
Engineering Softwares

- **Pipeline and Riser Installation**
  - Offpipe – pipeline installation
  - Orcaflex – general purpose, marine riser program
  - Flexcom 3D – general purpose, marine riser program
  - MCS Pipelay – pipeline installation on window version

- **Manifold or Pile or Subsea Structure Lowering,**
  - Orcaflex
  - SIMO – specific for lowering
  - MOSES – motion study

- **Pile Driving**
  - GRLWeap – define hammer energy
  - Opile – define pile date

- **Mooring Installation**
  - Orcaflex
  - Moses
  - Ariane 3D – specific for mooring
Animation

- J Laying
- Pile installation
THANK YOU