Installation of Subsea Processing System in Deepwater

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Pazflor Project Overview

Subsea Separation Unit Information

Challenges and Outcomes:
1. IMF and SM Seafastening and Transportation
2. Limiting Sea States for SSU Deployment
3. Structure Installation
4. SSU Tie-In

Conclusions
Pazflor Project Overview

**PAZFLOR Field Layout Schematic**

- **BASE CASE**

First oil wells on Milestone:
- 8 production wells
- 6 water injection wells

3 x Subsea Separation Units

Installation by:
- TECHNIP
- ACERGY

First oil wells on Milestone:
- 5 production wells
- 2 water injection wells
- 2 gas injection wells

Based on General PAZFLOR Field layout schematic
Pazflor Project Overview

- Client: Total
- Contractor: Subsea 7 - Technip Consortium
- Contract: EPIC
- Scope:
  - Installation of 3 SSUs - the first ever to be deployed in deepwater fields
  - 54km of rigid pipelines
  - 10 flowline piles
  - 18 rigid jumpers
  - 87km of dynamic and static umbilicals
  - Three manifolds
  - 16 FPSO mooring lines and piles
  - Two flexible dynamic risers
Agenda

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Subsea Separation Unit Information

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Envelope Dimensions</th>
<th>In Air Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FBS</td>
<td>15m x 15m x 14m</td>
<td>205 Te</td>
</tr>
<tr>
<td>2</td>
<td>IMF</td>
<td>20m x 20m x 8m</td>
<td>264 Te</td>
</tr>
<tr>
<td>3</td>
<td>Separator Module (SM)</td>
<td>6m x 6m x 20m</td>
<td>440 Te</td>
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IMF and SM Seafastening and Transportation

• Grillage for structures sensitive to fatigue
• Grillage design for guiding for deployment & recovery offshore
• Grillage design for 2 journeys
  - Norway to Angola on a heavy lift vessel across Bay of Biscay in November
  - Luanda to field on a cargo barge
• Grillage design to enable lift with IMF/SM for
  - Load-out on heavy lift vessel
  - Transfer onto cargo barge in Luanda bay
  - Grillage clamped on each structure (no weld)
  - Additional stoppers for sea-fastening of SM/IMF on grillage
• Protruding and sensitive equipment
  - SM landing area on the IMF
  - Hubs for future connections
  - Piping and valves
IMF and SM Seafastening and Transportation
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IMF and SM Seafastening and Transportation

Structure Delivery in Luanda:
Structure Lifting and Installation

**Structure Lift Rigging:**

- **Very strict tolerance on structure inclination**
  - (± 0.5 degree)

- **Uncertainties with structure weight and CoG**
  - Estimated submerged weight
  - Estimated preservation fluids
  - Entrapped water

- **Adjustment of Rigging Lengths**
  - Schedule constraint
## SSU Tie-In

<table>
<thead>
<tr>
<th>Hurdle</th>
<th>Challenge</th>
<th>Mitigation</th>
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</thead>
</table>
| 1      | Stroking of such a large and heavy object  
- 300Te of downward force from the Separator Unit, 800mm stroking  
- Very high centre of gravity, resulting in eccentricity from the stroking location | SIT’s, SIT’s, and then more SIT’s  
- Use of 2 x stroking cylinders became the base case after onshore trials |
| 2      | Hub preparation prior to stroking  
- Extremely tight ROV working area  
- Impact of dropped objects | 3D ROV access simulation  
- Dry and wet trials with mock ROV |
| 3      | Hub alignment and tie-in  
- Alignment of 3 hubs in a single stroking operation  
- Double CAT tie-in and several flying leads | Good design, which was significantly challenged prior to getting to the testing phase  
- Checked during SIT |
| 4      | Interfacing with Company, SPS Contractor and Installation Contractor | The Client’s strong will |
SSU Tie-In - Stroking

Before

The vertical separator weight is 300Te

After

800mm

181kg Stroking Tool
SSU Tie-In – Hub Preparation

Dropped objects would prevent structure stroking, with no real proven contingency for retrieving them.
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1. What can be achieved in our projects is impressive

2. Interfaces are the key

3. Early Installation Contractor Involvement

4. Company Involvement and Follow-Up