



OTC 18541

## Dalia Subsea Production System: Presentation and Challenges

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### Abstract

Different from Girassol, the Dalia Subsea Production System was at the time, in 2002, the “largest subsea order” in offshore history, placed with a single contractor. With 71 wells, 71 drill through horizontal trees, nine six slot production manifolds, two work-over systems, flowline connection systems and a complex control and chemical injection system. Heat conservation and prevention of hydrates was paramount during the Subsea Production System detail design and construction.

This paper will focus on the selected design:

- Drill through horizontal trees for production, water and gas injection, where possible, installed by crane and cable from a service vessel. The production trees incorporate a retrievable Flow Control Module comprising a multiphase meter and the choke.
- Production manifolds with 6 well slots and pigging loops.
- Optimised insulation to meet production flow assurance requirements.
- Innovative Production Control System architecture and umbilical connections.
- Simplified horizontal tie-in systems with insulated boxes.
- Unique and extensive qualification & testing programme for all components, sub-assemblies and main modules, including shallow water testing.

Well work-over systems will also be examined as well as the issue of Hydrogen Induced Stress Cracking (HISC).

### Dalia Overview

Refer to Dalia Paper OTC 18538.

Figure 1 shows the general field layout with the 71 subsea wells, nine production manifolds, flowlines, risers and control

umbilicals, which all together cover a subsea footprint of around 100 km<sup>2</sup>.

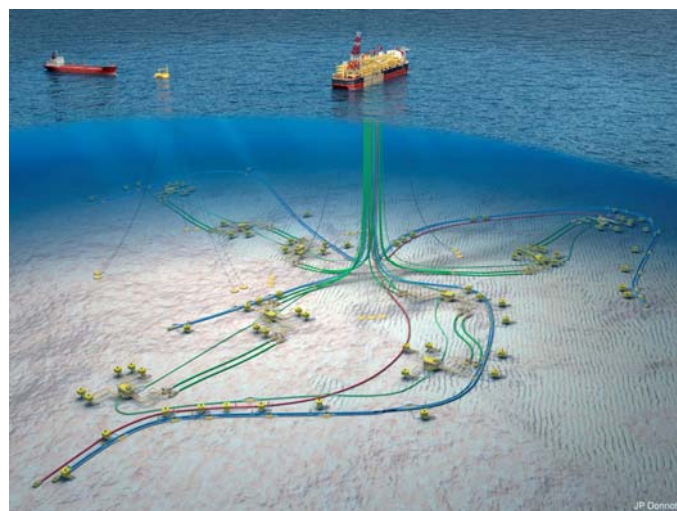


Figure 1 – Dalia General Field Layout with Subsea Wells, Manifolds and Flowlines

### Technical Requirements

The main requirements for the design and operation of the Subsea Production System are:

- Environment:
  - Deep water environment with an external pressure of up to 145 bars with soft soil conditions requiring installation of subsea equipment using suction piles.
- Pressures and Temperatures:
  1. Reservoir pressure: 215 to 235 bars
  2. Reservoir temperature: 46 to 56°C
  3. Well Head flowing temperature: 45°C
  4. Well production rate: 5,000 to 40,000 barrels per day
  5. Water injection pressure: 150 bars
  6. Water injection rate: 405,000 barrels per day
  7. Gas injection pressure: 260 bars
  8. Maximum operating temperature: 60°C
  9. Minimum operating temperature: -5°C
- Flow Assurance:
  - Hydrate prevention with Subsea Production System component temperatures remaining above 20°C for seven hours during production shutdown. Wells will be preserved with methanol injection after this time.