AKPO

A large Nigerian deep offshore development
A LARGE PROJECT OFFSHORE NIGERIA BY TOTAL

1400m water depth, 100 miles off Port Harcourt

44 wells, 10 manifolds, 14 SCR risers, 440 000 ton FPSO
A Complex Venture Arrangement

Managed through a PSA and a PSC, Partnerships differ in the 2 contracts, Total Operator for the OML
A Complex Venture but still a robust one

3 National Oil Companies!
AN HYBRID HIGH TECH SCHEME

Complex sand lobes and channels, critical fluid
Near high pressure / high temperature, gas export to LNG
TECHNOLOGY PULLED TO NEW FRONTIERS

7” SAS, Perforation/frac. pack in single run in 10 ⅞”, intelligent completions

118°C SPS, 588 bar SCR, FICSS, all electric 180 MW FPSO
QUALIFICATIONS FOR TECHNOLOGY RISKS

150 qualification programs

30% initial Test failure, zero Field failure
EXECUTION ON A GLOBAL SCALE

32 million man-hours, 14 million in Nigeria

Global IS/IT for central management in Nigeria
INNOVATIVE BIDDING SOLUTIONS

EPC reservation agreements signed 8 month ahead of uncertain FID

Currency & commodity hedging, asset reservation, schedule
## Contractual Strategy

<table>
<thead>
<tr>
<th>Management &amp; conceptual studies</th>
<th>DRILLING &amp; COMPLETION</th>
<th>SPS</th>
<th>UFR &amp; Offloading terminal</th>
<th>FPSO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TUPNI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEED Engineering</td>
<td>DRILLING TUPNI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detail Engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procurement</td>
<td></td>
<td></td>
<td>EPS CAMERON</td>
<td></td>
</tr>
<tr>
<td>Onshore fabrication</td>
<td></td>
<td></td>
<td>EPSCC SAIPEM</td>
<td></td>
</tr>
<tr>
<td>Offshore test &amp; com.</td>
<td></td>
<td></td>
<td>EPSCC Technip/HHI</td>
<td></td>
</tr>
<tr>
<td>Transportation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offshore installation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offshore H.U.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Offshore commissioning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start up &amp; operation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Drilling:
- Transocean

### Completion:
- Global Santa Fe

Defined during Basic phase,
Large & synchronized EPSCC
Selection approved at Project Sanction
Time Allowance for Record Nigerian Content

*Up to 18 month for capacity building, 50% for learning curve*

*Delivered quality meets international standards*
An Integrated Project Management

Fully integrated project management team till 1st oil

Unified IT tools & EDMS

Lessons learnt from TOTAL deep offshore projects
Complex under-saturated near-critical fluids

Significant amount of precipitated asphaltene sticking to the wall of the transparent cell

Light Oil (Up to 50°API) with High GOR,

Widespread impact on the AKPO development project
A Mandatory Meticulous Well Planning

Definition and freezing of the 22 start-up wells at Project Sanction, delivered as planned at Start-Up
Pre-production Interference Testing

A-2 and A-3 normalised pressure response during Interference test with A-1 (Pulser)

Subsea Well Intervention Monitoring System (SWIMS) used for pressure data recovery, storage and transmittal

2psi response consistent with test design
A Very Large Drilling Operation

4 drilling units, 2000 rig days, 3.6 Millions man hours

Two “flagship rigs”: Transocean Deepwater Discovery and Jack Ryan
Rig specialization to push the performance limit

Management decision to dedicate one rig for drilling, one rig for completion
Savings in rig upgrades and service costs, efficient specialized rig crew
Batch drilling helps for continuous improvement

Deep Water Discovery

Batch operations improved learning process
Sustained continuous progress for two years
Batch completions for quality & performance

Performance achieved, keeping high quality standards by batching operations of frac. pack, completions and X-trees
22 wells delivered ON TIME

AKPO strong management achieved a GREAT step in the efficiency of deep water well delivery.
Subsea Layout, a Key Feature of the Development

An Optimized Sub-Sea Layout with multi Drilling Centers, taking onboard SCR constraints and Flow Assurance requirements, frozen at FEED
Flow assurance influences field architecture, requires early definition
STANDARDIZED DRILL CENTRE LAYOUT

SUBSEA UMBILICAL TERMINATION

HYDRAULIC FLYING LEADS

HORIZONTAL CONNECTORS & DOGHOUSES

MANIFOLD MODULE

MANIFOLD PILE

WELLHEAD

XMAS TREE

SYSTEM DESIGNED FOR MAXIMUM AVAILABILITY
Akpo Subsea Production Facilities
Running Xmas Trees

50 tons at the end of the riser to be accurately positioned and connected to the wellhead
Jumper installation & Connection

150 line pipe subsea connections completed at First OIL

Connector Running Tool
One Riser Concept Selected at Pre-Basic Stage

Main Factors
- Water depth
- Flow Assurance
- No Gas lift
- Generic concept
- Local content
- Bidding process

SCR + wet insulation: best solution for AKPO
Flexible Joint Qualification

- Early maturity assessment during FEED
- Extensive qualification during detail engineering
  - Fluid compatibility testing
  - Hyper-Elastic law development for FEA
  - Resistance to explosive decompression
  - Ageing – stiffening and impact on design
  - Fatigue resistance under pressure cycles

*Early Maturity Assessment defined qualification scope for FJ design*

*Full scale test confirmed manufacturing process & design fitness for severe conditions*
SCR Pre-installed, Recovered & Transferred to FPSO

Step 1: FDS picks up FL Head

Step 2: FL head on FDS

Transfer wire passed to FDS from FPSO pulling rig

SCR laying

SCR transferred to FPSO
SCR load transfer from FDS to FPSO pulling rig
SCR including Flex-joint ready to transfer
AKPO FPSO

- Hull: 310m x 61m x 31m
- Living Quarter: 240 POB
- 2 million barrels storage
- Oil processing: 185,000 bbl/d
- Water injection: 420,000 bbl/d
- Produced water treatment: 150,000 bbl/d
- Gas treatment: 530 mmscfd
- Gas export: 290 mmscfd
- Gas injection: 210 mmscfd

110,000 tons fabricated & moored in 1400 m water depth,

14 Steel Catenary Risers
An Hybrid Gas Injection - Gas export FPSO

Flexibility to maintain liquid production

Gas export to LNG production
An all-electric FPSO

Single 160 Mw power generation plant, shorter commissioning & start-up

Higher availability & lower maintenance cost
E&I decentralized Technical Buildings

Easier and earlier commissioning before sail-away

Easier start-up of FPSO facilities
Field Integrated Control and Safety System

Global ICSS approach selected during FEED

No barrier to communication
Tow Opportunity between Korea and Nigeria

High state of readiness once on location

Team continuity between onshore and offshore
Simultaneous Operations Strategy

3 drilling rigs, 4 construction vessels, 1 flotel and FPSO

SCR installation, hook up, commissioning while producing
2 Years of Active People Development

Mobilise and train early - start production early
High Production Delivery Performance

Align project activities completion with production goals
AKPO Operations: the Keys to Success

- Integrated Project organisation
- Technological expertise
- Deep offshore operational experience
- Early operators mobilisation
- Focused Nigerians development
- Robust site organisation
- Personal Commitment

Operations success is the AKPO Project team's overall success