Subsea - UK and Global Perspective

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Presentation Outline

- Post Deepwater Horizon Lessons Learned
- UK - Operations and Future Developments
- Global - Operations and Future Development
- Technology Challenges
Global Perspective: BP Since DW Horizon

Unprecedented Scale of Response

- 5-state response area
- ~48,000 responders
- 6,500+ vessels, 125 planes, 6 rigs
- Largest mobilization of boom (14 million ft)
- High pressure and low temperatures at source

Five Key Areas of Learning

1. Prevention & Drilling Safety
2. Containment
3. Relief Wells
4. Spill Response
5. Crisis Management

Sources of Learning

- Lessons Learned
- Learnings from DWH incident and response
- • BP internal investigation
  • Presidential Commission
- • DWH Joint Investigation (BOEM & USCG)
- • US Chemical Safety Board
- • National Academy of Engineers
- • Montara Commission
- • European Commission on Offshore Safety
- • API Task Forces

Sharing the Learnings

Sharing the Learnings across the globe.
Global Perspective: BP Since DW Horizon

Critical capabilities

Dedicated Safety & Operational Risk organization

- Drive process safety improvements and strengthen management of operational risk

Centralized global wells organization

- Implement consistent global drilling standards
- Elevated technical approvals to increase visibility of risk

Enhanced process safety through performance management

- Increased focus on well integrity and process safety as performance metrics
- Linked compensation to safety and compliance performance

Advance and Embed

Continuing to develop capabilities across the 5 critical areas. Focus on:

- Technology innovation
- Better standards in drilling safety
- Ensuring inventory of response equipment and consumables in global BP deepwater basins

Improving Equipment and Procedures

- Improving global standards for BOPs, cementing, integrity testing, and rig audits
- Establishing rigorous well checks
- Improving contractor oversight

Top to bottom changes to improve safety and risk management

- Added safety experts to board
- Empowering centralized Safety and Operational Risk group
- Creating centralized Global Wells Organization to drive standardization and consistent implementation
- Linking employee compensation to safety and compliance
UK Sector: BP in OSPRAG

OSPRAG = Oil Spill Prevention and Response Advisory Group

- Formed soon after Gulf of Mexico Deepwater Horizon incident by UK Oil & Gas
- Remit: Minimize oil spill risk and maximize the industry’s readiness to respond in the UK
- Scope: UKCS and future potential access areas; D&C, prod and transport operations

- Decision made by O&GUK to develop a valve based system capable of capping a leaking subsea well
  - Connection to an 18-3/4” subsea wellhead, BOP upper hub or riser adapter
- BP volunteered to act as PM for execution phase on behalf of industry Started Nov. 1st
- Notable Design Specs:
  - Water depth up to 5,500ft (1,670m)
  - Rating 15,000psi, 250F sour service
  - Handling upto 75,000lbs total fluids
  - Service life 1 year, design life 20 years
Infrastructure
- Largest Subsea portfolio in UK Sector
- c.50% of BP global subsea wellstock
- 178 subsea pipelines
- 5000KM of Pipeline & umbilicals
- 170 subsea wells (trees)

Assets
- Schiehallion (FPSO)
- Foinaven (FPSO)
- ETAP (tie-backs)
- Andrew/Cyrus (tie-backs)
- Magnus (tie-backs)
- Bruce (tie-backs)
- Harding
- Southern Gas (multiple tie-backs)

Production
- 50% of North Sea Production from Subsea Facilities (and growing)
• Water Depth @ FPSO - 368 m
• Templates - 5 off, total 24 slots
• Wells (Base Case) - 16 off, horizontal trees
• Flexible Risers - 10 off (inc. Export)
• Flowlines - 44 km, 316L clad
• Umbilicals - 21 Km static, 2 off control & 1 off power
• Direct Electrical Heating for Idun flowline
• Oil export by shuttle tanker
• Gas export via 80 Km 26” pipeline to ÅTS
• 2 well subsea tieback to East Brae
• Water Depth -
• HPHT Gas - 140 deg C / 580 barg
• Subsea Cooling Spool
• 13Cr flowlines and pipeline
• First Production 2012
Kinnoull development and pipeline system

- 3 no subsea trees / 4 slot manifold
- Bundle system design (x4)
- Separate umbilical system
- Goose necked riser caisson
- Tie-in point for Arundel future tie-in
- Oversized Andrew riser umbilical
Quad 204 Project - Infrastructure

- Replacement FPSO
- New topsides control system
- 5 new flowlines & risers
- 5 new fluids manifolds
- 4 new controls umbilicals
- Up to 25 new wells with
- CI & control upgrades
Angola; BP Operated Deep/Ultra Deepwater

Block 31
- BP 26.67% interest and operator
- Partners Exxon, Marathon, Sonangol, Statoil, TEPA (Total)
- 2002 first discovery
- 14 exploration successes
- >1bn bbl discovered (in pools 70-200mmb)
- 3 hubs (& more)
- Further E & A potential to exploit

Block 18
- 50% interest and operator
- Partner Sonangol Sinopec Int (SSI)
- 1999 first discovery (Platina)
- Greater Plutonio
- Remaining Western Area potential
- >200mmb recoverable
PSVM Summary
FPSO
Water Depth: 2000m
Up to 40 wells
15 manifolds
170km of flowlines
94km of umbilicals
Timing: Late 2011
Azerbaijan;
ACG, CC, SD2, & Shafag Asimon.

ACG - 13 Subsea Water Injectors.
• 99.7% availability.
• Additional 2 infill injectors;

Shah Deniz 2
• HP/HT Gas Producers - 26.
• Timing: - 2017

Future Potential Subsea Development
• Shafag Asimon
• 50 wells 1st Oil - 2025.
• 20K System.
Shah Deniz 2 Project

- Contracts to sell to EU
- Pipeline expansion in Azerbaijan / Georgia
- Two new platforms
- 26 x 15k subsea wells
- 125 kms of subsea flowlines
- New terminal at Sangachal
- BOTAS pipeline upgrade in Turkey
- To EU markets

MAP: Shah Deniz 1

- Caspian Sea
- Black Sea
- TURKEY
- ARMELEN
- AZERBAIJAN
- GEORGIA
- IRAN
- IRAQ
- SYRIA
- RUSSIA
Egypt. Taurt; Ph2 - Ha’py, West Nile Delta.

- Taurt / Ha’py Field Location (East Nile Delta)
- Approx. 70km offshore
West Nile Delta - Offshore Scope

- **Giza/ Fayoum**
  - 8 wells
  - 5 Manifolds & structures
  - 51 km x 24” Trunkline
  - 35 km x 10-16” Flowlines
  - MEG Lines
  - 94 km, Umbilical

- **Raven**
  - 8 wells
  - 3 Manifolds & structures
  - (2 HIPPPS)
  - 58 km x 20” Trunkline
  - 7 km x 16-20” Flowlines (CRA Clad)
  - MEG Lines
  - 65 km, Umbilical

- **Taurus/ Libra**
  - 8 wells
  - 6 Manifolds & structures
  - 60 km x 24” Trunkline
  - 52 km x 10-20” Flowlines
  - MEG Lines
  - 111 km, Umbilical
BP operates 8 deepwater facilities
Interests in 22 producing fields
Progressing 6 major projects
Subsea Technology Needs – New Projects

- **HP/HT** - > 15 KSI and 250 F
  - Required for global HP/HT developments.

- **Subsea Processing**
  - Boosted wet tree developments can deliver 5% to 20% higher recovery than dry tree developments.

- **Flow assurance**
  - Modelling, slug management, sand management

- **Deepwater Risers and Moorings**
  - Modelling and monitoring
Subsea Technology Needs - Operations

- **Integrity Management of Pipelines/Risers**
  - Significant % of subsea lines are not suitable for ILI
  - Need to further develop externally deployed technology which is equivalent to ILI in coverage and sensitivity. Techniques available, but not in a subsea environment

- **Equipment Reliability/ Availability**
  - Continued challenges with reliability, particularly with Subsea controls systems.
  - Smart systems required to maximise availability.

- **Sensors and meters**
  - Need for better, and more reliable meters and sensors.
  - Opportunities for retro-fit sensors and wireless technology

- **Condition Monitoring/ Data management**
  - Huge amounts of data available, but need to be able to condense this into useful information. Opportunity for smart systems.