

Subsea Workshop 26th November 2012

Welcome and Introduction

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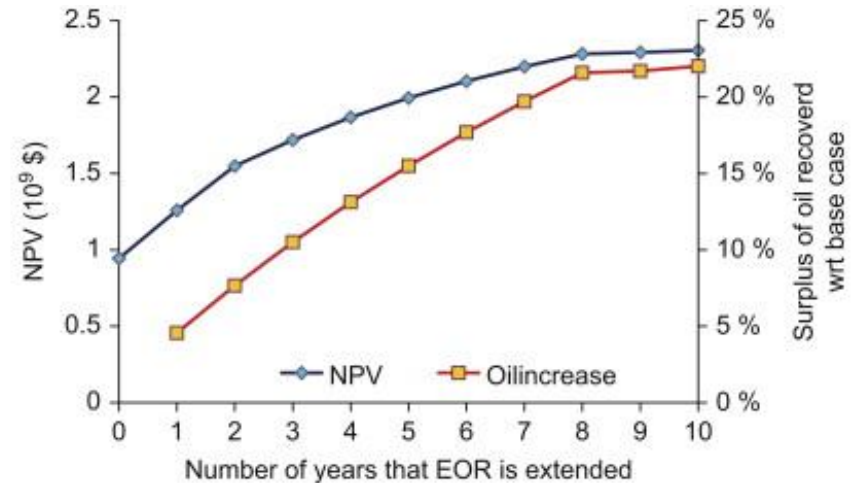
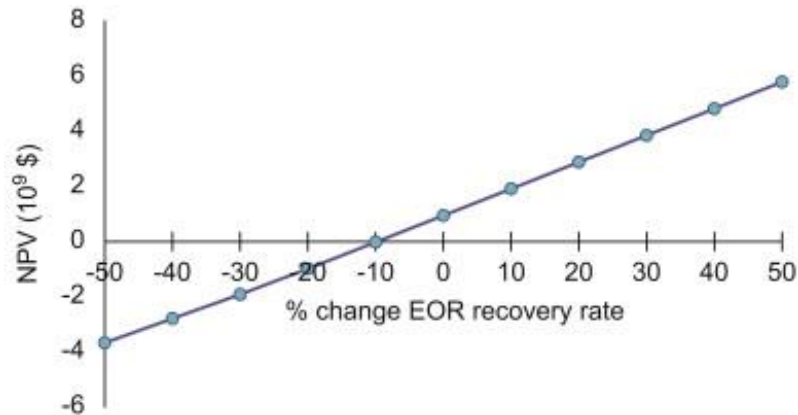
Visiting Professor, NUS

Date/Time	Activity
0830 – 0900	Registration
0900 – 0905	Opening Remarks
0905 – 1005	Segment 1: Subsea Production Systems – Current and Future Trends <ol style="list-style-type: none"> 1. NUS –Subsea Systems Evolution & Influences 2. FMC – Advances in Subsea Processing Systems 3. NUS – Trends in Subsea Water Management 4. INTECSEA, WorleyParsons Group
1005 – 1045	Panel Discussion (40 min)
1045 – 1105	Coffee/Tea Break
1105 – 1150	Segment 2: Subsea Asset Management, Life Extension and Integrity <ol style="list-style-type: none"> 1. NUS – Mid-life Asset Transformation, Life Extension 2. Schlumberger – Reservoir Management 3. Lloyd’s Register, Global Technology Centre
1150 – 1230	Panel Discussion (40 min)
1230 - 1255	Aligning Education Curriculum to Meet Industry Needs
1255 – 1300	Closing Remarks
1300 – 1400	Lunch
1400 – 1500	(Optional) Tour of NUS Multi-phase Flow Loop Facility

Segment 2

Subsea Asset Management Life Extension and Integrity

Extended Oil Recovery Economics



Source: NUST Trondheim

Extended oil recovery concerns both the rate of additional oil recovery and the amount of oil recovered.

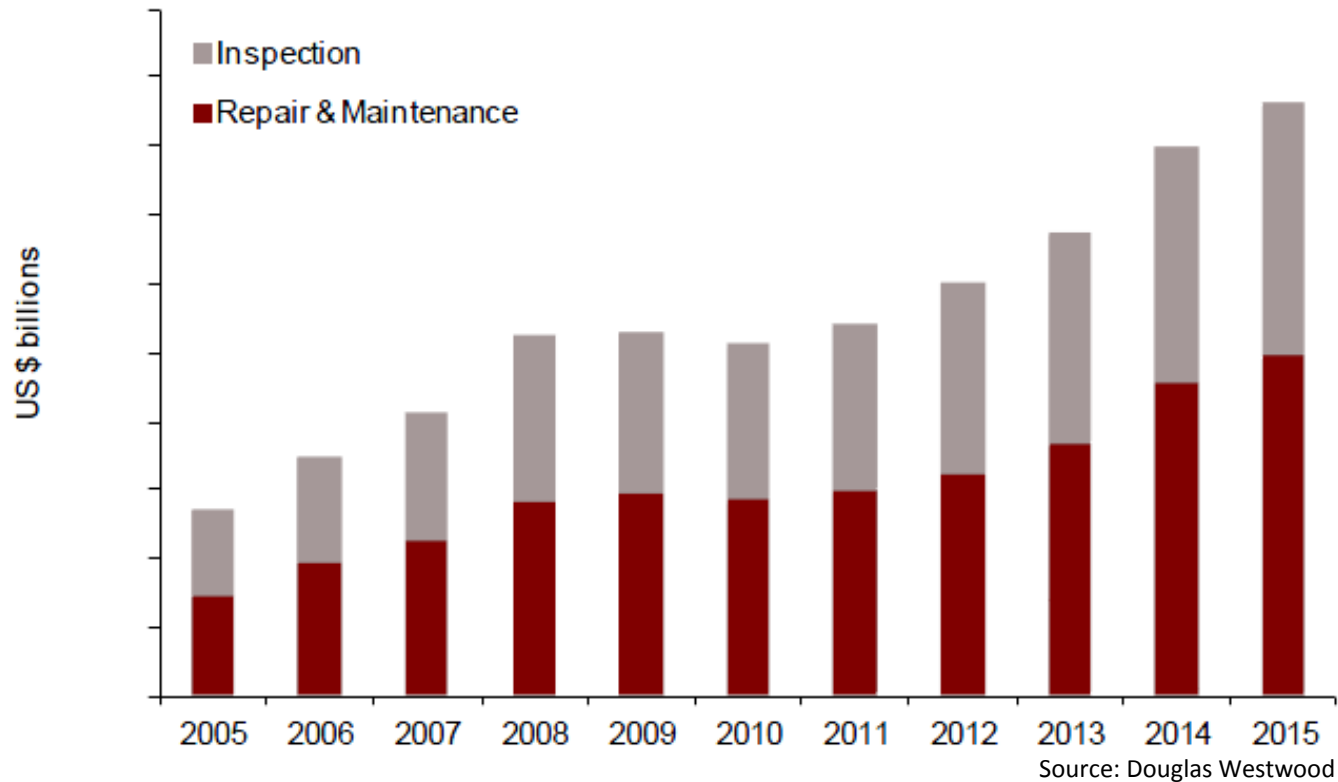
Both influence the profitability of the field and unless the net profitability increases significantly, it may not be commercially viable to risk additional cost as the equipment will deteriorate and would be an on-going operational risk.

Subsea Well Intervention

- Well maintenance and stimulation work is an important part of managing assets to maintain maximum productivity
- Large field developments tend to implement different well designs and materials to reduce well intervention requirements
- New generation of light intervention vessels designed to displace heavyweight rigs for some applications
- Tooling for these vessels must be light weight and allow for extended operations to reduce rig requirements
- Market has been somewhat apprehensive in this area

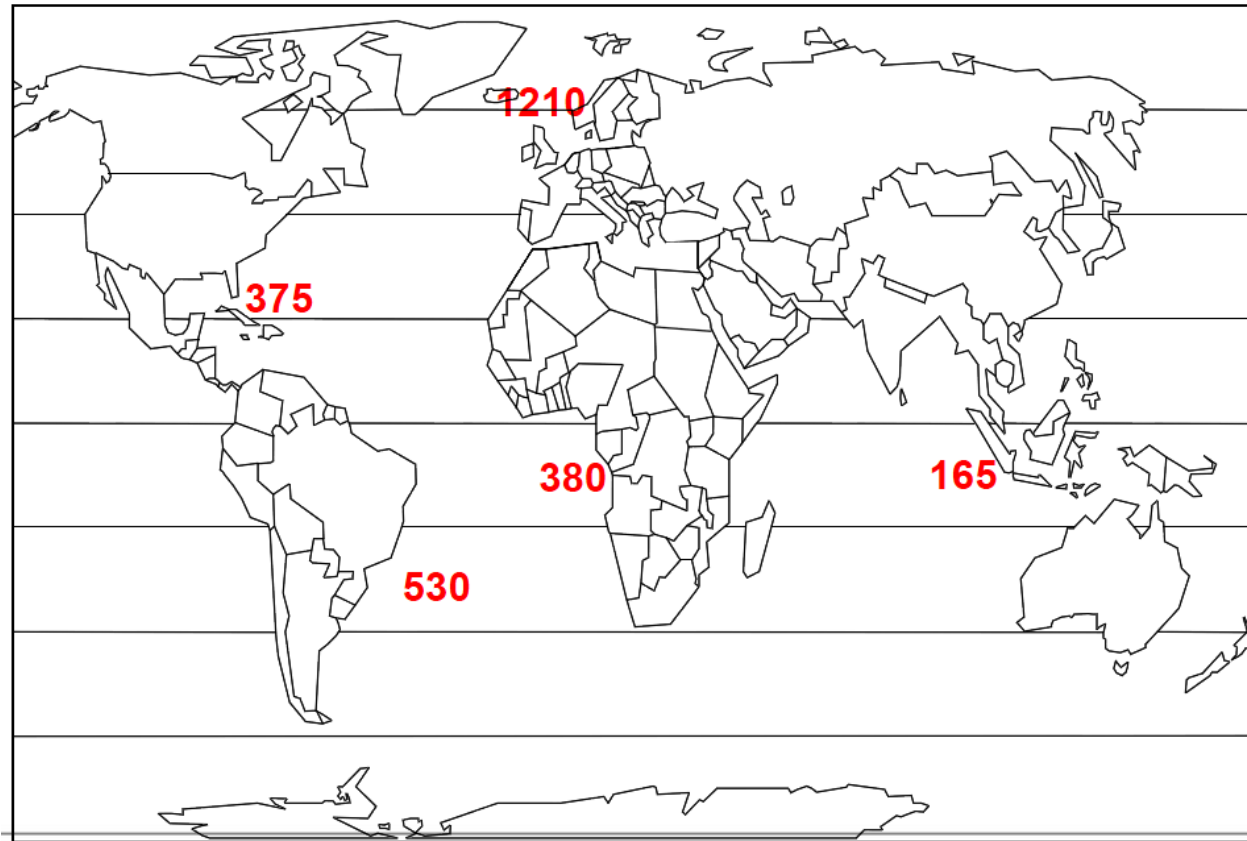


Image: Aker Olifield Services



Global Subsea Operational Expenditure Forecast (2012)

Each year installed subsea systems get older, and more infrastructure is installed. The total amount of subsea equipment increases each year and integrity requires increasing management. Global subsea OPEX is now equal to the CAPEX.



Source: FMC Technologies

Number of Subsea Wells less than 5 years old (2012)

Inspection, Repair and Maintenance

The subsea environment is highly hostile

- Corrosion
- Fatigue
- Erosion

Average lifespan extension beyond initial planned operational life is over 12 years

Life extension brings significant issues in terms of risk management, asset integrity management and repair processes

Inspection methods are currently via ROV systems – generally requires ROV Support vessel

AUVs are being used for some IRM tasks, but acceptance is still in early days



Image: SMD



Image: Subsea 7

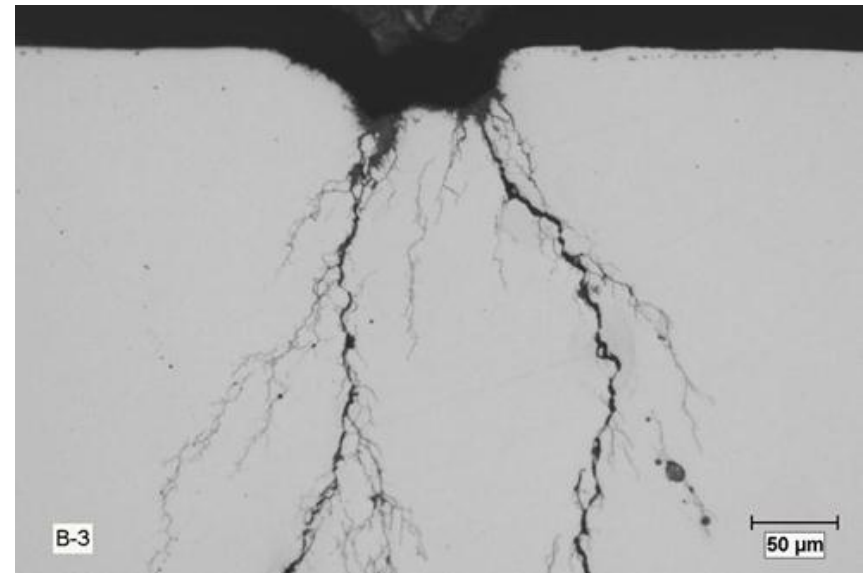
Subsea Materials and Fatigue

Material fatigue is a major consideration, particularly in risers, flow-lines, mooring systems and other highly stressed components

Crack detection methods are available for shallow water (mainly diver deployed) but do not extend well currently into deeper water

New deployment technologies are entering the market and this is an area that is expected to expand significantly

Is the technology mature, or do we need a new form of technology for the newer subsea systems entering the market



Some Possible Areas to Explore:

- Field life extension methods (IOR/EOR)
- Integrity management
- Subsea system extension
- Obsolescence management
- Predictive failure analysis
- Subsea power, distribution and controls
- New concepts in ROV/AIV/AUV systems
- Real time risk management
- Integrity sensing and deployment methods
- integrity intelligence
- Barrier management
- Subsea reliability based maintenance
- Reduced operational cost
- Intelligent decision support and visualization
- Integrated environmental management
- Subsea leak detection

