Material Challenges for North Sea Oil & Gas Production
“A Well Engineer’s Perspective”

ITF Advanced Materials Workshop
Steve Bedford February 21st 2008
Material Challenges for North Sea Oil and Gas Production

Agenda

- Business Environment
- Operating Environment
- Opportunities for Advanced Materials?
- Conclusions
Global Energy Demand: 1970 to 2030

Source: IEA, 2005
99% of UK transport requires oil

UKCS could deliver another 27 bn boe

Potential investment of £300bn

Source: DTI, 2006

Source: UK Oil & Gas
• High global demand for oilfield equipment, people and services

• Offshore supply costs up c68% on 2000

• Production sharing agreements and windfall taxes

• Trend to divest mature fields/acreage to new entrants
Business Environment
Increasing Public Concern

Power, politics and pollution
The dirty fuel that's burning us

Measurement of environmental articles in the media
Source: Factive

Biodiesel puts on a suit
Fuel-heavy industries are turning to an alternative
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Operating Environment
Onshore Oilfield: Kimmeridge Bay, Dorset

- First Dorset exploration well drilled in 1934
- Field on stream in 1959
- Producing from the naturally fractured Cornbrash Limestone
- Production rate declined from 500 to current 80 bbl/day
- Beam pumped
- Sweet, light crude with very little gas
Operating Environment

Southern North Sea Gas

- Typically sandstone reservoirs, often hydraulically fractured to stimulate rates
- First fields on stream in the mid 1960’s
- As the larger fields were developed, smaller fields have been developed with subsea wells and unmanned small platforms. Move towards multi lateral wells, under balanced drilling and de-liquification technologies
Operating Environment
Large Integrated North Sea Oil Platforms

- Typically sandstone reservoirs with highly prolific wells and water flood
- Platforms typically accommodate 150 to 250 people with facilities for: drilling, primary processing, export and life support
- As fields age upgrades typically required to reduce discharges, artificially lift wells and access adjacent smaller fields e.g. subsea wells
Novel designs to reduce development costs and thereby access smaller Reservoirs.

Example is the Harding Field where a jack up on a concrete storage base is used for drilling, production, storage and export. Once the Field is exhausted the facility will be moved to the next field.
The image shows an oil rig in the ocean, representing the Post Piper Alpha Facilities. The text reads:

- **Operating Environment**
  - Post Piper Alpha Facilities

- **Move to separate living accommodation from process and drilling facilities**

- **Example is the Bruce Platform with three bridge linked structures:**
  - Quarters/Utilities: Drilling/Process and Export. Subsea wells tied back to the Drilling/Process platform.
Increasing subsea well count in the North Sea to reduce capital costs

Use of floating production systems and mobile drilling rigs, particularly in deep water areas e.g. Foinaven and Scheihallion Fields in 550m of water in the North East Atlantic.
Operating Environment
Supply Boat: Northern North Sea January 2007
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Opportunities for Advanced Materials?

**Corrosion / Erosion**

- Many miles of pipework in place – surface, subsea and downhole
- Corrosion/erosion may not be an issue until conditions change e.g. CO2 content increases
- Internal and external corrosion a major issue
- Coatings/materials to prevent or repair corrosion?
- “Intelligent” materials to provide information or react to change in condition?
Opportunities for Advanced Materials?

Material Deposition

- Organic scale, hydrocarbon deposits, sand, rust are major production issues
- “Non stick” coatings?
- Materials that destroy unwanted deposits?
Opportunities for Advanced Materials?

People

- Protective equipment?
- Location devices?
- Health monitoring?

- Lighter / stronger tools?
- Lighting?
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Conclusions

- Increasing demand for Oil and Gas with significant reserves remaining in the UK and multiple opportunities to export services/equipment internationally
- Pressure on margins, mature facilities, challenging geology and the emphasis on health, safety and environmental protection are driving operators to look for alternative materials in the UKCS
- Many possibilities for advanced materials
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