Subsea Technology Vision

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Subsea Driven

- $6.2 Billion Revenue in 2012
- 18,900 Employees Worldwide
- 30 Production Facilities in 16 Countries
- 3 Major Technology Centers
Technology Drives Operator Value

Operator Success

Access reserves

- High Pressure / High Temperature
- Ultra-deepwater
- Arctic
- Long offsets

Accelerate production

- Shorten system lead times
- Production optimization / flow assurance
- Reliability/System availability

Increase reservoir recovery

- Economic wellbore access
- Subsea separation / processing

Reduce total cost of ownership

- Optimized field layout
- Standardization
- Low-cost installation methods

Safety and reliability

- Quality and safety culture
- Product integrity
- Operational excellence
Early Collaboration Unlocks Value

- Early involvement
- Participation in system design
- Visibility
- Trust
- Sharing best practices
- Working efficiently

Early collaboration impact

Target for collaboration

Traditional bid phase

Project Timing
The Future of Offshore Energy:  
*All Subsea*
Extreme Environments
Lower Tertiary Trend in the Gulf of Mexico

Challenges:
- Material Compatibility
- Sealing Systems Survivability
- Electronics MTBF
- Control Fluid Compatibility
- Fatigue
- Seabed Boosting
- Power Systems
- Safety and Environmental

The Prize: Over 15Bboe Reserves to Access!

- Water Depths >10,000’
- Well Depths >30,000’
- Pressures up to or >20,000psi
- Temperatures up to or >400F
- Cost to drill one well > $100M
Extreme Environments

Arctic

- Ice Coverage > 6 months/year
- Iceberg Scour
- Remote from Process Facilities
- Strict Environmental Regulations
- Cost to drill one well > $200M

Challenges:
- Foundation Design
- Flow Assurance
- Reliability and Maintainability
- Seabed Boosting & Compression
- Power Systems
- Material Compatibility

The Prize: 90 Billion Barrels of Undiscovered Oil and 1,700 TCF of Gas!
Condition and Performance Monitoring: Proactive Maintenance Maximizes Uptime

- Early warnings enable system repair before functional and production losses occur
- Advanced indications—made possible by the system’s fault condition reporting—reduce refurbishment turn-around time

![Diagram of Condition and Performance Monitoring Process]

- Planned Production
- Planned Stop
- Functional Loss
- Resume Production

CPM Early Warning: Continue Producing

Planned Production • Planned Shutdown • Planned Production
Achieving the Vision:  
*Further Challenges.....*

- **Economics**: operator margin squeeze
- **New technologies**: who will try serial #1?
- **Industry conservatism**
- **Field performance feedback**: imperative for improvement
- **Converging technologies**: robotics, automation, nanotechnology, simulation, composite materials, electro-magnetics
- **Product integrity and reliability**
- **Imagination**
The Vision Realized