

ExxonMobil Subsea Developments

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ExxonMobil
Development

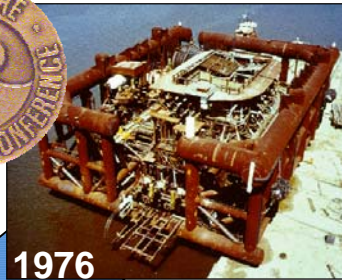
Presentation Outline

- Angola Block 15 video
- ExxonMobil offshore technology – a long term commitment
- The move to deeper water
- Subsea advantages
- ExxonMobil subsea business trends
- Subsea industry evolution
- Subsea challenges – operability, integrity, and reliability
- Subsea integrity – real life examples
- Increasing recovery with subsea technologies
- Subsea processing technologies
- Closing remarks

ExxonMobil Offshore Technology - A Long Term Commitment

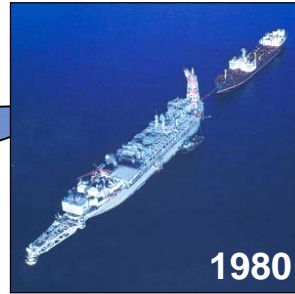


ExxonMobil's first major GBS



1976

Industry's first diverless subsea template



1980

ExxonMobil's first FPSO



1983

Industry's first compliant tower



ExxonMobil's first TLP



1992

- Track record for innovation in deepwater
- Focus on fundamentals to ensure integrity and cost effectiveness
- Ability to apply research and add value to deepwater developments

1960s - 1990s



Industry record deepwater drilling

Industry's first iceberg resistant GBS



1997

1940s - 1970s



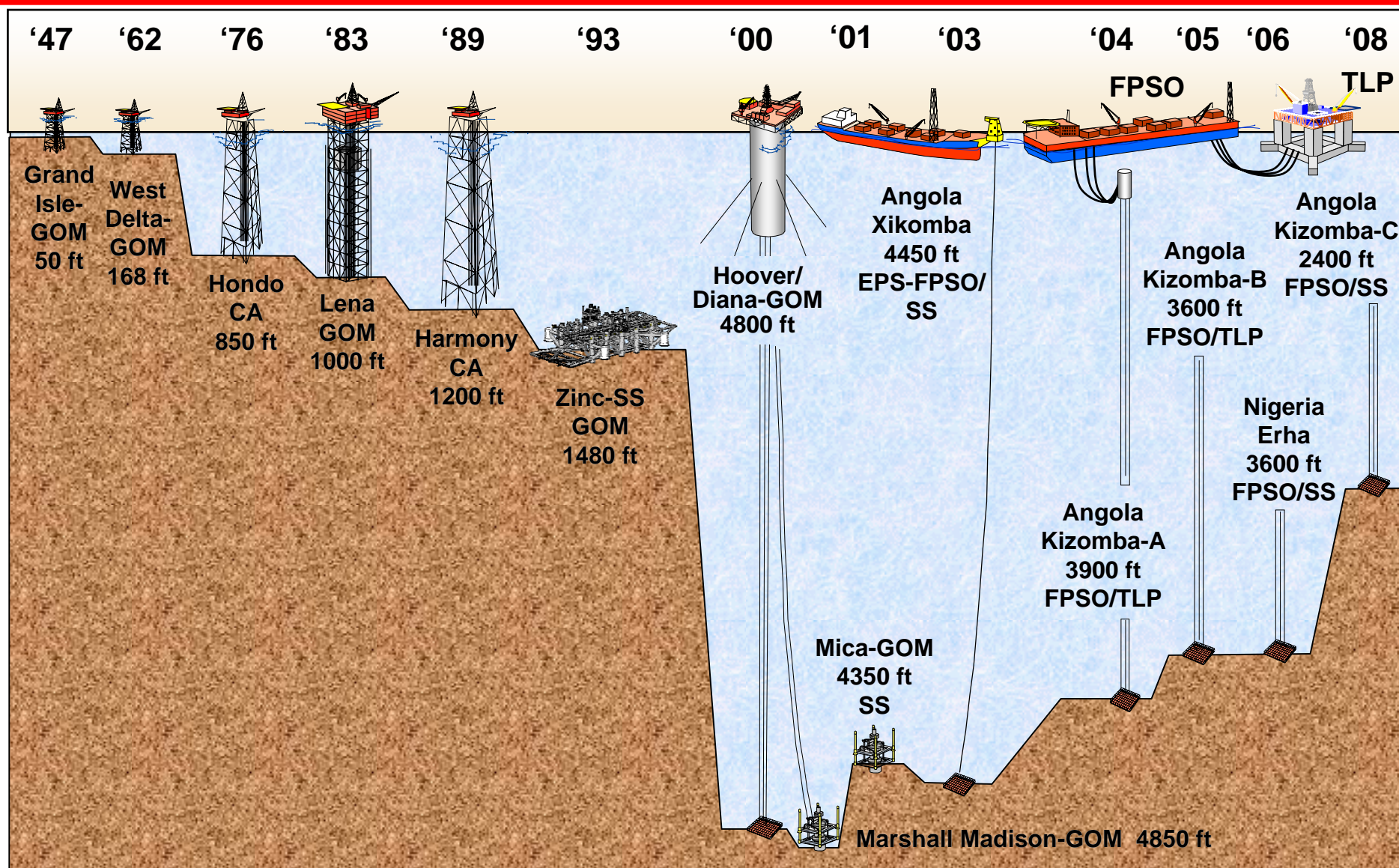
Platform design and wave force calibration



Industry's deepest water depth DDCV

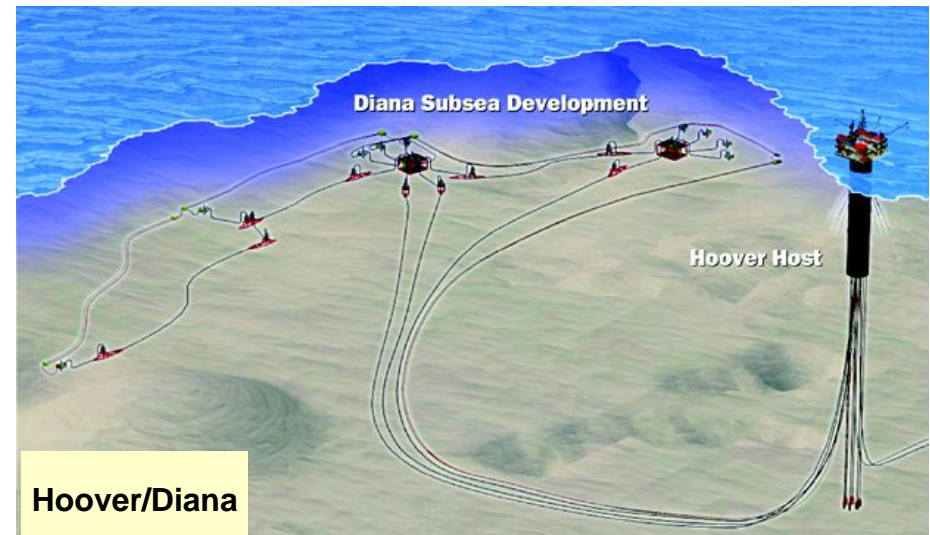
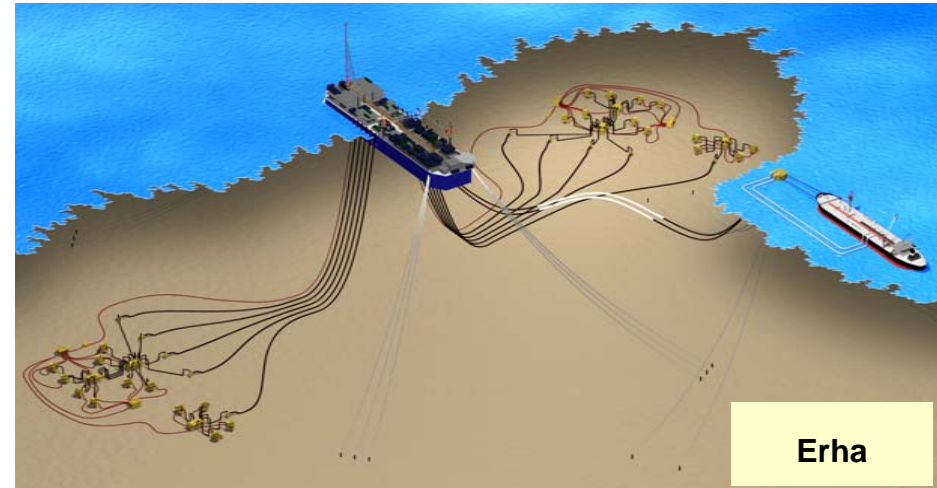


The Move to Deeper Water



Subsea Advantages

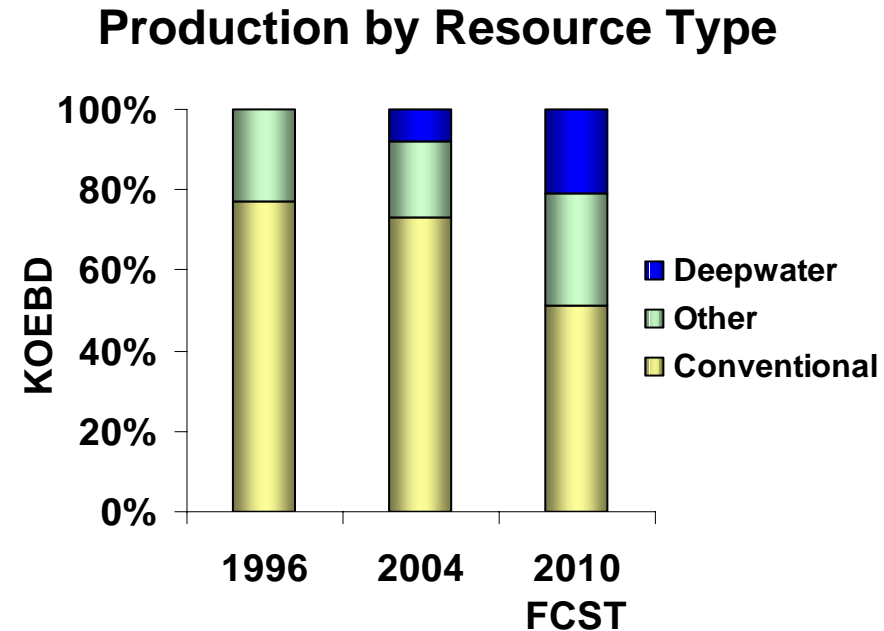
- Produce from satellite wells
- Decentralized resource will not support using surface platforms
- Extend field life of older platforms
- Faster development time
- Scaleable developments
- Economic viability
 - Water depth
 - Resource density



ExxonMobil Subsea Business Trends



World-wide portfolio of subsea projects



- Subsea portfolio (159 wells) is expected to double within the next 5 years
- Increasing dependence on subsea volumes, primarily from deepwater
- Field locations remote from infrastructure, operating requirements more severe
- Impacts of equipment failures becoming more significant

Subsea Industry Evolution

- **Technology migrating from R&D to supplier (commodity) mentality**
 - More commonality of product supply between oil company customers
 - Standardization of vendor interfaces
 - More reliance on vendor product development / qualification programs
- **Current subsea development focus is remote deepwater environments**
 - Market activity driving higher costs & lead-times
 - Value of production uptime is huge
 - Future fields likely to require new technology
- **Overall demand for subsea personnel increasing**
 - Vendor and 3rd party experience declining due to aging workforce
 - Emerging “local content” requirements
 - Recruiting, training and development of personnel is key industry focus

Subsea Challenges – Operability and Integrity

- Operability and integrity impact opex and downtime
- Flow assurance challenges
- Integrity of subsea and pipeline systems
- Subsea valve integrity
- Controls and distribution integrity
- Aging equipment

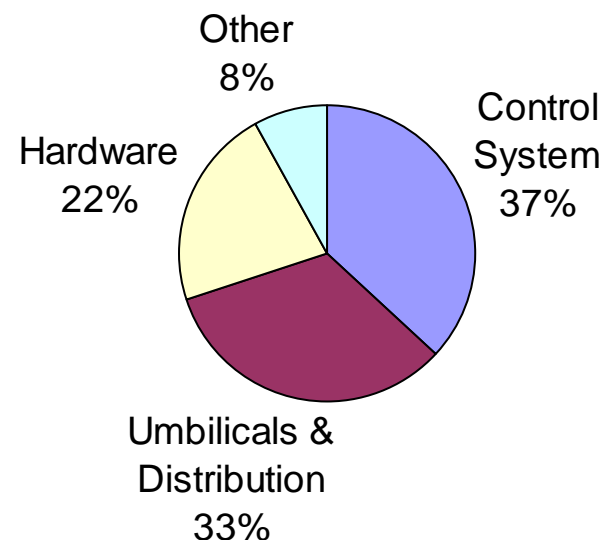
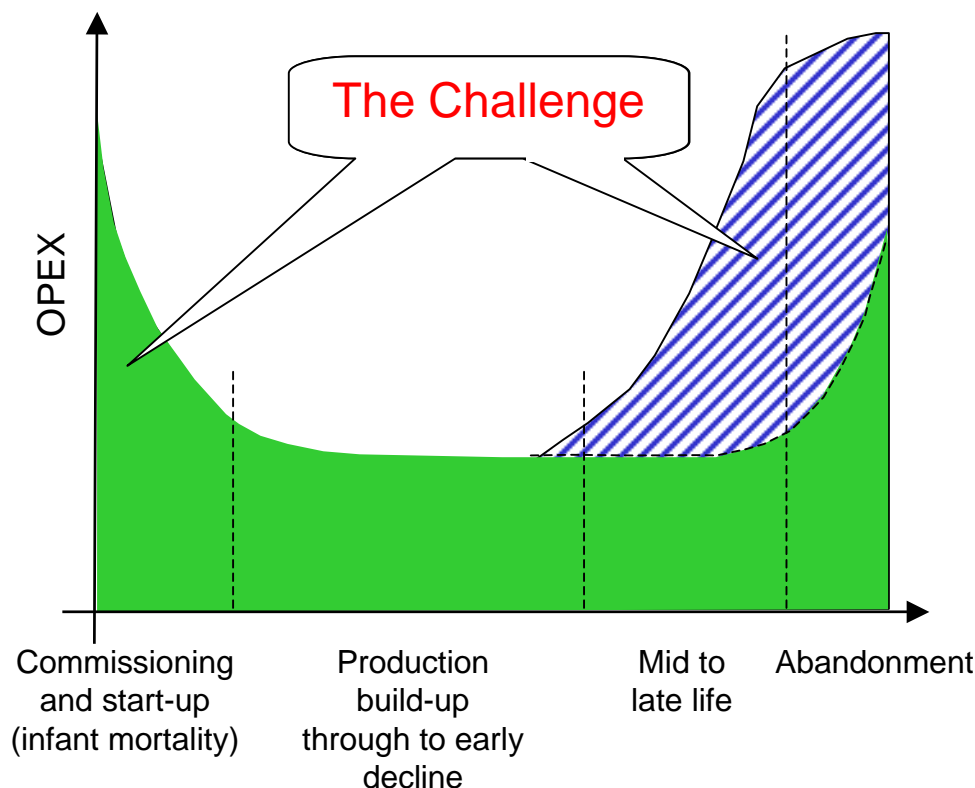


Subsea Production Choke Failure



Control Fluid Leak from Subsea Umbilical Termination Assembly

Subsea Challenges - Reliability



Subsea Equipment Failures

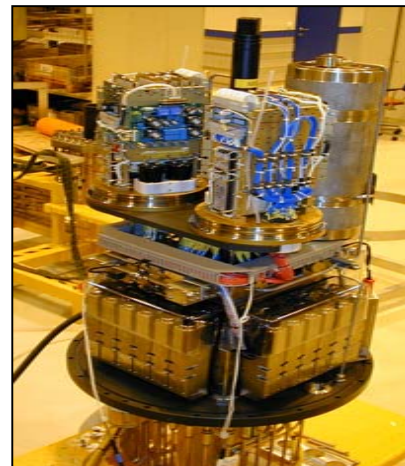
Need to flatten out the traditional reliability “bathtub curve”

- Well completion integrity (producers and injectors) - low cost subsea intervention
- Subsea equipment reliability - control systems, electric & hydraulic connections, flow assurance, QA/QC

Subsea Integrity – Real Life Examples



Smooth-Bore Flexible Riser Failure



Control Module – Electronics Failures



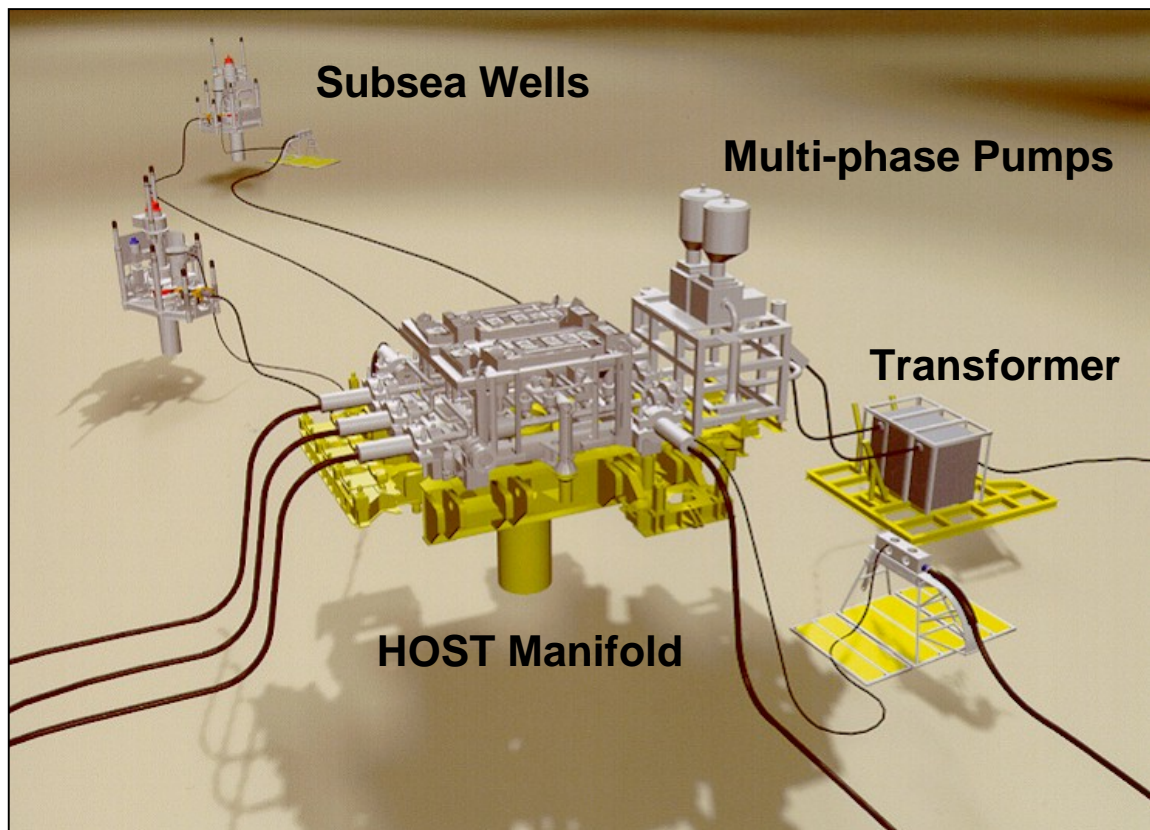
Hose Failure on Hydraulic Flying Lead



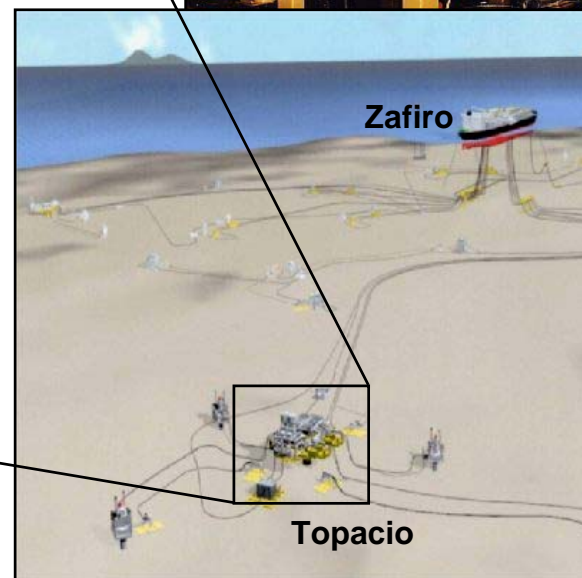
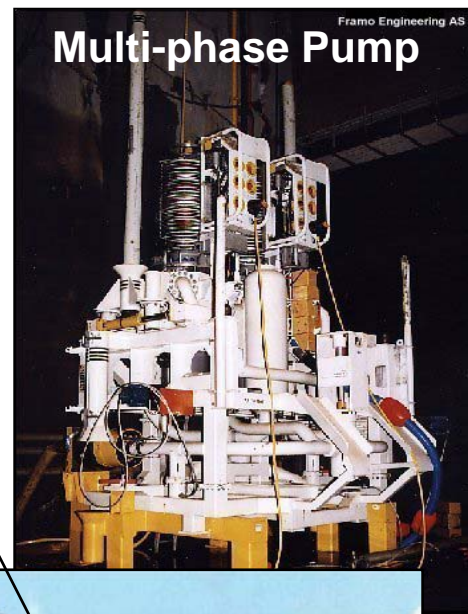
CO₂ Corrosion in Pipelines

Increasing Recovery with Subsea Technologies

- Record water depth
- Reliable performance since August 2000 installation
- EM Qualification program to extend design to 1700 m

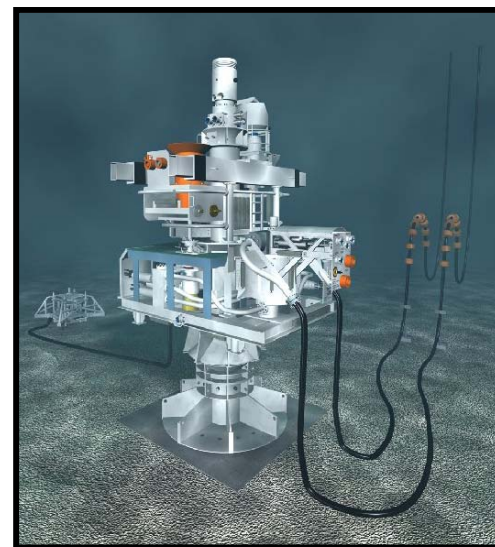


Topacio production increased 40% with addition of subsea multi-phase pumps



Subsea Processing Technologies

- Near-term technology applications
 - Multi-phase or liquid boosting
 - Gas-liquid or oil-water separation
- Emerging technologies
 - Three-phase separation
 - Compact separators and coalescers
 - Gas dehydration and compression
 - Water treating
 - Higher power pumps and motors
 - Longer-distance power transmission & distribution
 - Instruments & controls
- Complexity is an under-appreciated challenge
 - Reliability / operability / upset recovery
 - Performance prediction and testing
 - Solids management
 - Instrumentation and controls



Subsea Gas-Liquid Separation



Subsea Oil-Water Separation

Closing Remarks

- Subsea is an important tool in offshore development tool kit
- Subsea developments contribute significantly to ExxonMobil production volumes
- More subsea developments in future, more challenging than ever
- Operability, integrity, and reliability remain key concerns
- Equipment failures are extremely costly
- Subsea processing in the future, but many challenges remain to be solved