DEEPWATER INTERVENTION FORUM

Coiled-Tubing Intervention and Drilling System Using Cost-Effective Vessels

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- Project Objectives
- Background
- System Configuration
- CT Capabilities
- Modeling Efforts to date
- Features & Advantages

Subsea Market is Exploding

- According to the BOEM (formerly known as MMS), a greater number of deep water wells in the GoM are being completed as subsea completions and tied back to production facilities.
  - Flow assurance advances coupled with the high cost of production facilities will increase the number of subsea completions.
  - Already 3,000 subsea wells exist, worldwide (400 GoM), and are growing at a rate of 300 to 400 wells per year.
- Artificial lift is essential for most deep water wells to maximize productivity and recovery.
- Current intervention is a costly reality.

Growing Realization

Cost Effective Intervention
Recovers More Oil
and
Reduces Field Operating Costs

- Ability to run ESPS and gas lift, cost effectively and on-time, i.e. when needed
- Ability to do mini-fracs, acid jobs, re-perforations, zonal isolation
- Fix wells “cheaply” that are broken, i.e., clean out, subsea safety valve management

Search for a Cost Effective Deep Water Intervention System has been Going on for Years

- Riserless intervention systems have evolved around a subsea lubricator for electric and wireline intervention
- Seafloor intervention systems for coiled tubing have been investigated, but found too complex and expensive
- Coiled tubing intervention from dry trees (for deep water) has been increasing
- Other deep water intervention, requiring circulation, is done using MODUs

Aker Oilfield Services Light Well Intervention Vessel

However…

The development of a safe and cost effective Self Standing Riser (SSR) introduces a new possibility for deep water intervention.

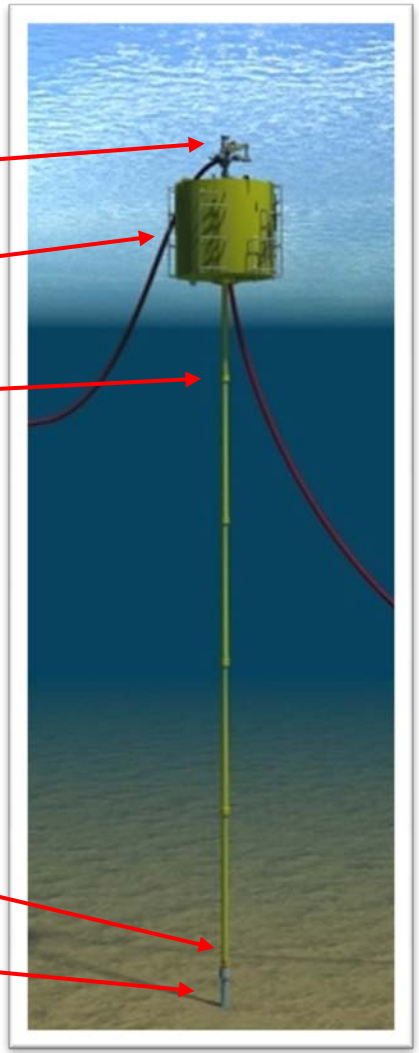
What is a SSR?

Adjustable Self Standing Riser (SSR)

Adjustable Depth to Surface

Adjustable Buoyancy

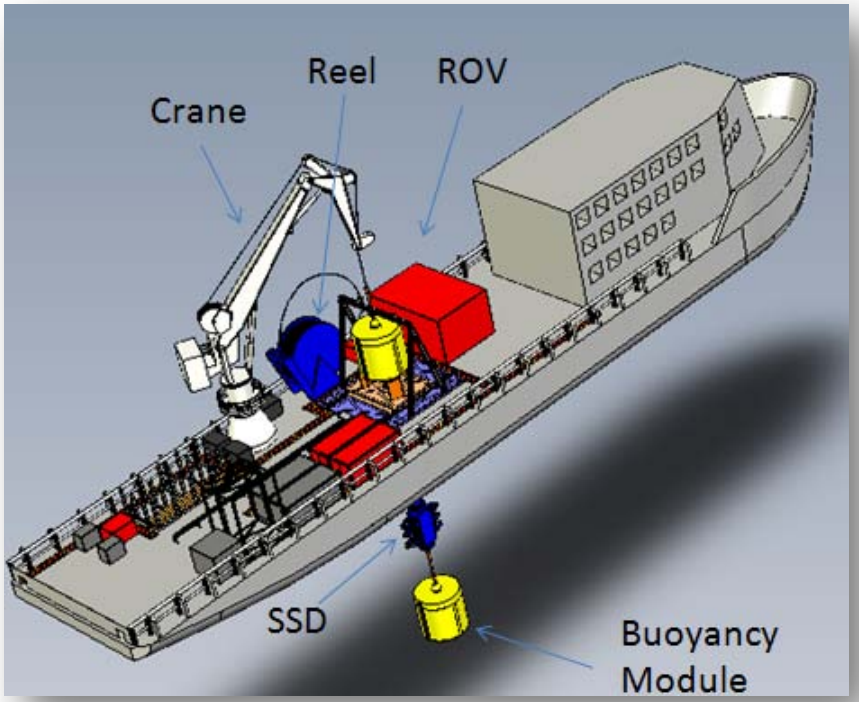
Keel joint



Stress joint

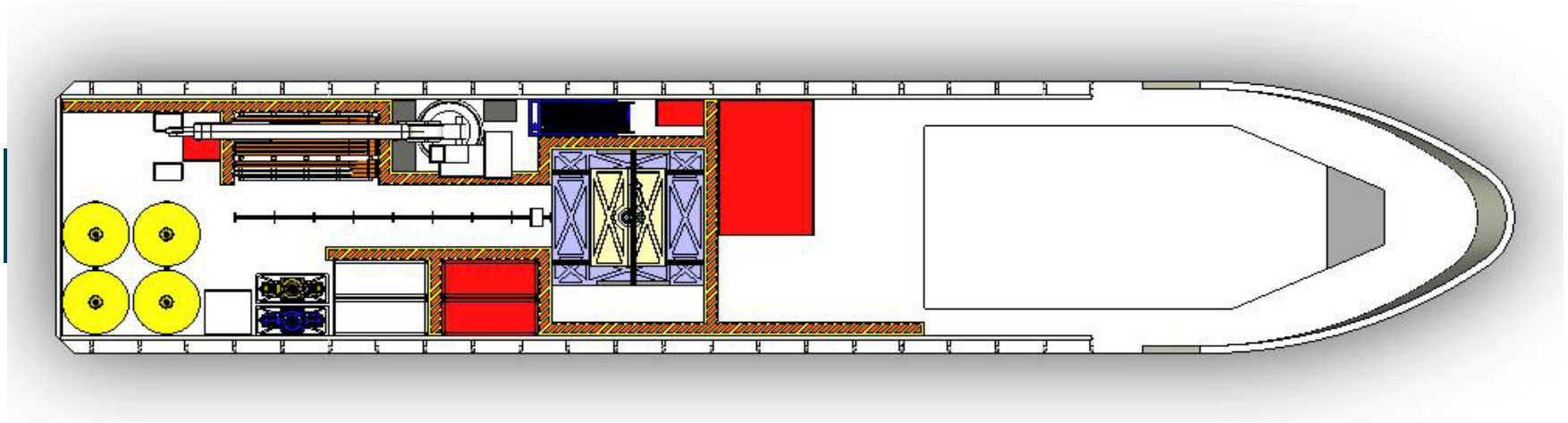
Wellhead

Examples of Cost Effective Vessels – i.e., Lengths Between 200 and 300 ft.

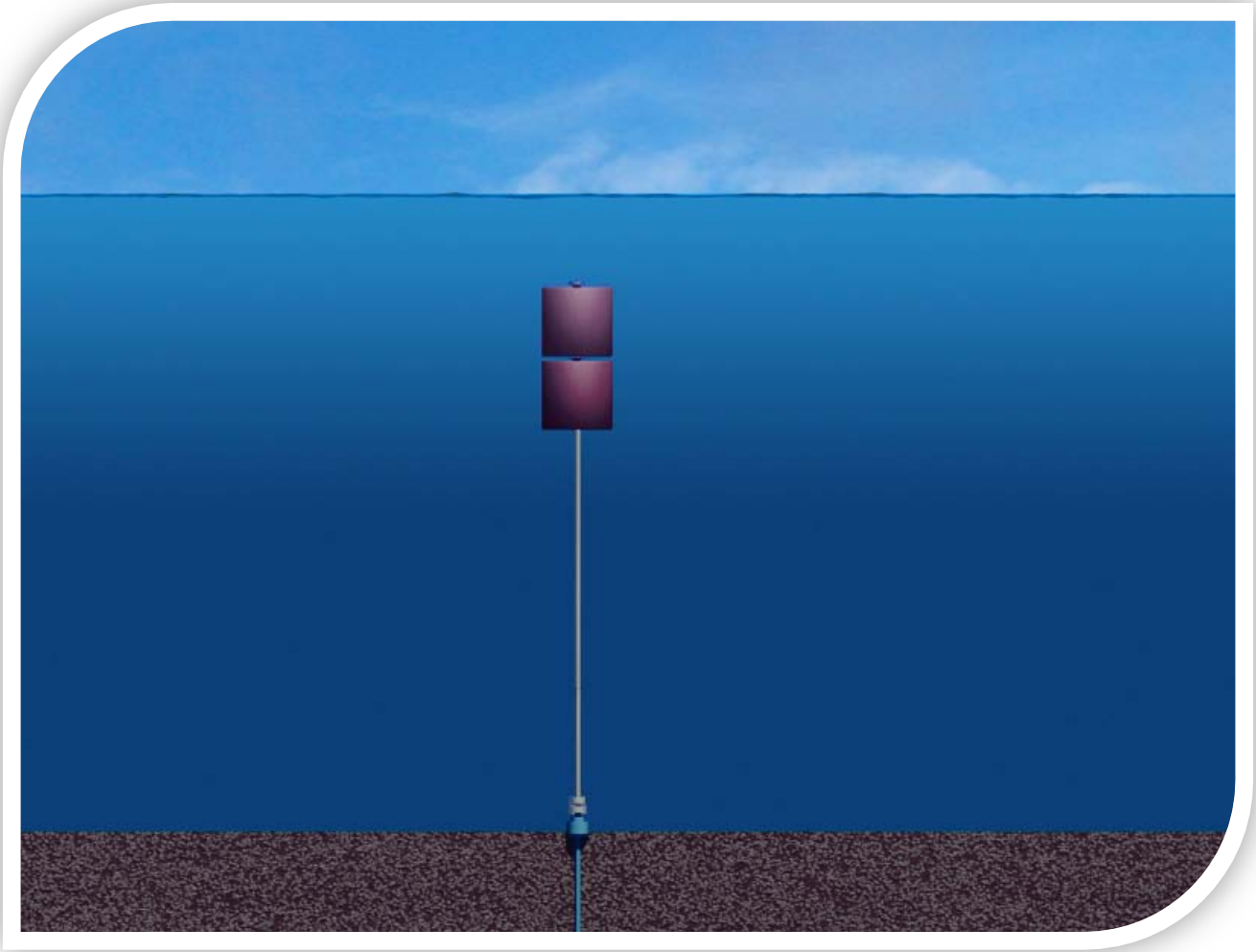


Typical SSR Installation Vessel

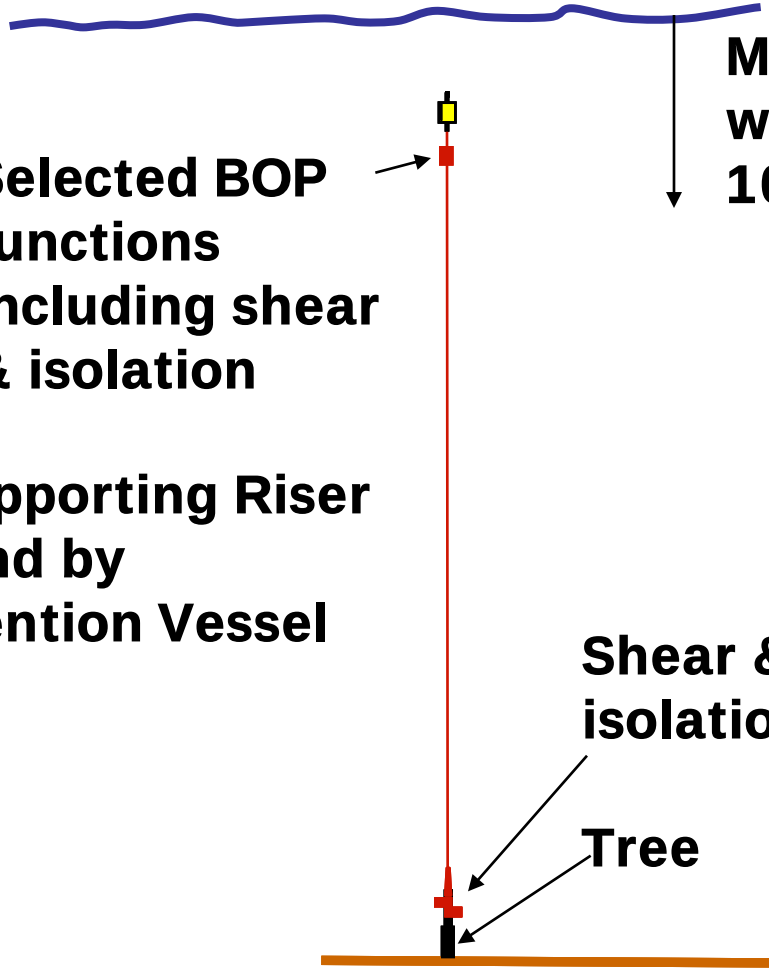
- 180 To 200 Feet Long
- DP 2
- 15 Ft Moon Pool
- 75 Ton Crane
- ROV

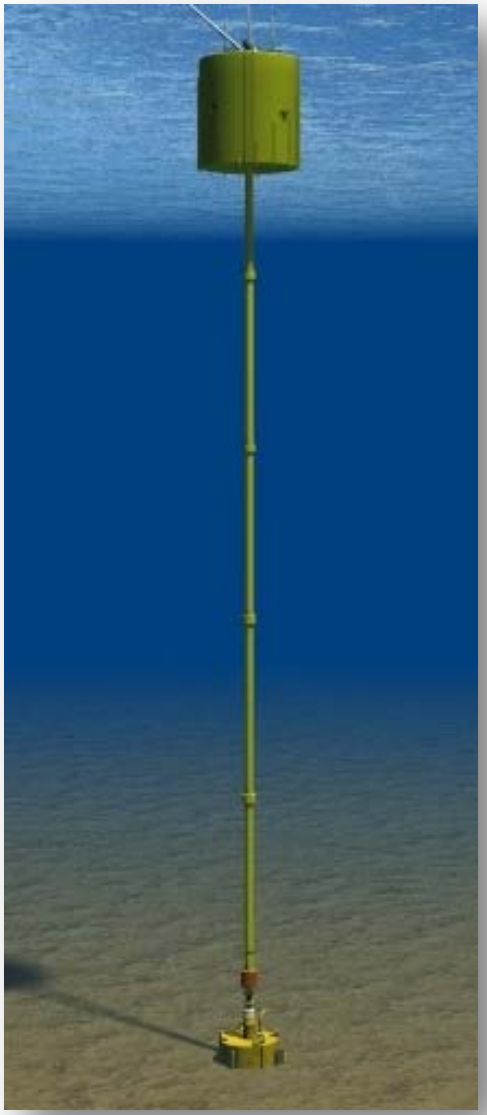


SSR Connected to the Subsea Tree Waiting for the Intervention Vessel



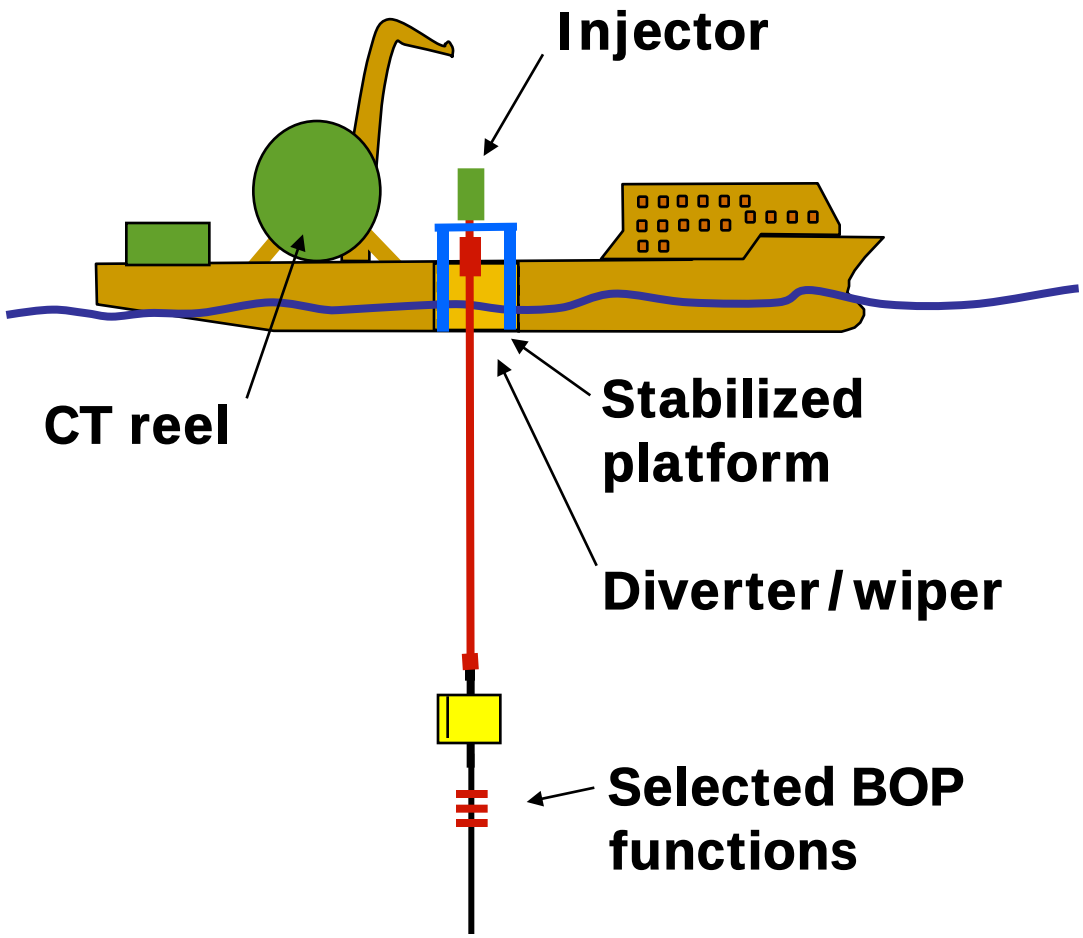
Riser Ready for Intervention Vessel



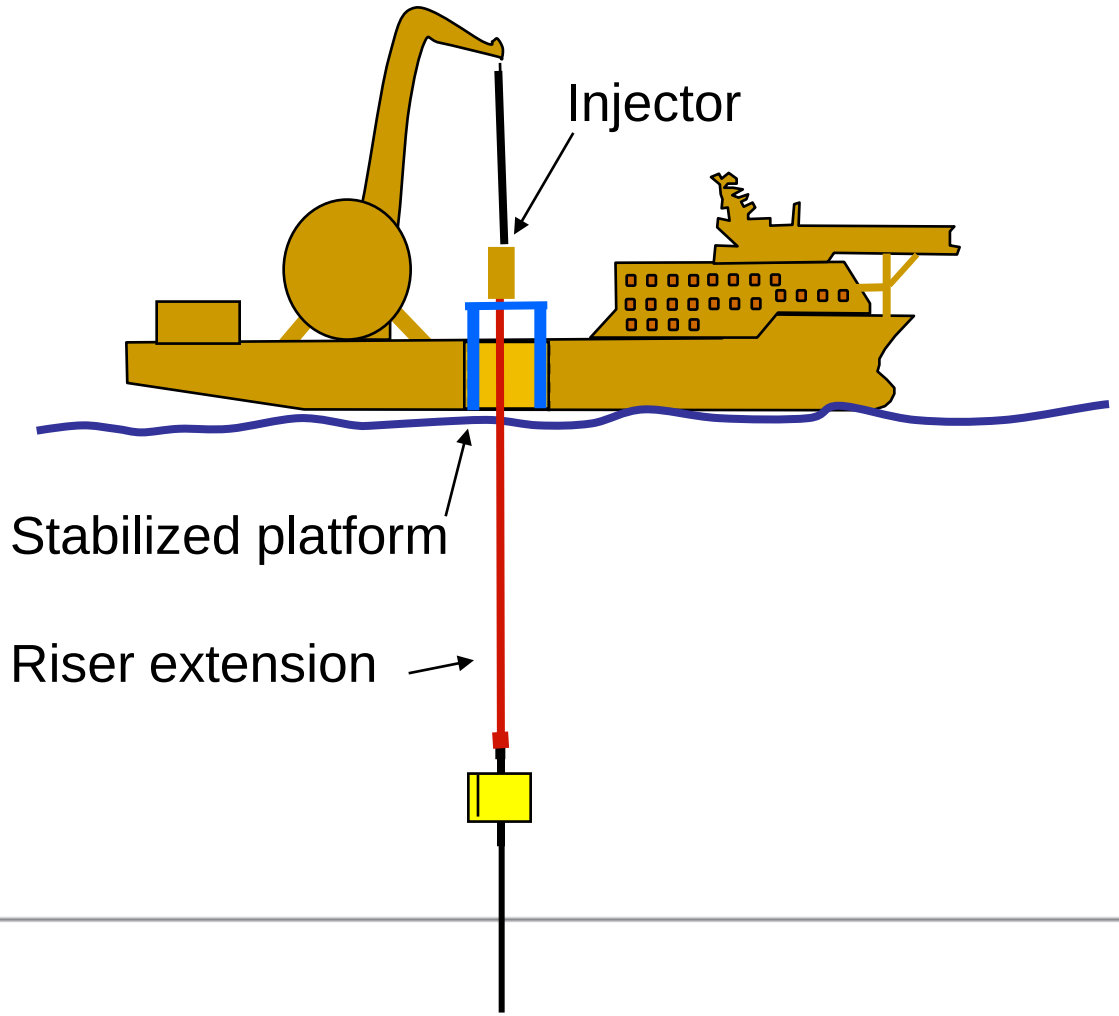


Typical Intervention Vessel

- 180 to 200 Feet Long
- DP 2
- 10 ft Moon Pool
- 10 Ton Crane for Tubing & Tools
- Rov
- Coiled tubing Contractor's Standard Ct Equipment



Riser Extension & Injector Supported by Stable Platform During Downhole Work



Understanding the Challenge
Subsea Intervention without a MODU

System would have:

1. Connection to existing subsea production or injection tree
2. Design of SSR that can be pre-installed and made ready for intervention
3. Safety devices to control the well and prevent failures
4. The CT design to operate from a non-MODU vessel
5. Vessel requirements to facilitate running and operating the CT to do the intervention

Probable Design to Operate Non-MODU Vessel for CT Operations

- Engineering designs of vessel to consider:
  - Weather and storms
  - Sea states
  - Deck space
  - Auxiliary equipment
  - Vessel motion - handle pitch and roll
  - Accommodate personnel
  - Safety
- Major modifications could include:
  - Making a moon pool
  - Strengthen hull structure for coiled tubing unit and riser
  - Dynamic positioning (DP-3)

SSR Test in the GoM

- Three years ago Anadarko Petroleum installed a SSR in the GoM in 1000 meters of water
- Invested substantially in engineering, wave tank tests, design, and a field trial
- Attempt to address the typical arguments for not using SSRs

SSR TECHNOLOGY – FIELD TRIAL

GoM Test 2006

- Location:
  - Port Isabel Block 921 Gulf of Mexico
  - Water depth ~3395 feet

RPSEA Project: Coil Tubing Drilling and Intervention System Using Cost Effective Vessels…

...is an approach that would go from conceptual feasibility, to the actual field test design and construction of necessary components, concluding a field test demonstration.

- Establish intervention systems to reduce cost by 50% compared to MODU intervention for GoM
- Establish reliable hardware and operating scenarios
- Optimize for work in 1500 to 2000 meters of water, suitable for 3000 meter
- Strong emphasis on safety and environmental safeguards
- RPSEA Project Phase I will be completed in 2010

If SSR is Proven Viable - Market Opportunity for Non-MODU Type Vessels and Auxiliary Equipment is Immense

The cost effectiveness of this approach will:

- Open up a market for CT units
- Increase market/share for intervention of subsea wells
- Provide an affordable way to install and service artificial lift
- Provide a new market for SSR related auxiliary equipment - production tees, safety systems, riser monitoring equipment
- Could provide another way for early well testing

Key CT Modeling Conclusions (By NOV CTES)

- CT Strings Can be Designed to Perform Interventions in Most Subsea Wells
- Straight-Wall String Designs can Reach > 33,000’ TD
  - With available 120kpsi material
- Tapered String Designs can Reach 40,000’+
  - Using reasonable buoyancy & pressures
- Optimum CT Size to Balance Pump Pressure and Fatigue Life is: 2-3/8” to 2-7/8”
- Total weight with 2 – 3/8” CT, spool and fluid (lb) + 229,585
- Simulated Both a 5” & 7” Wells

Planned Features

- No compromise in safety
  - Personnel safety
  - Asset protection
- Redundant reservoir isolation
- Risers on standby for callout
- Less than half the cost of MODU intervention

Acknowledgements

- This project is co-funded by Research Partnership to Secure Energy for America (RPSEA), contract # 08121-1502-01. Information on our project and others is posted on their website www.rpsea.org

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Project Steering Committee Companies

RPSEA Advisory Committee • Anadarko - Chevron • Shell • ConocoPhillips • Total

Project Team

Knowledge Reservoir LLC • IntecSea • Expro • University of Tulsa • General Marine Contractors Huisman • Tidewater • GE • Baker Hughes Inteq • Halliburton

Questions?

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