Gulf of Mexico Gas Well Intervention

Riserless Intervention Lessons Learned

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Agenda

- Background
- Intervention Objectives
- Why Riserless Light Well Intervention (RLWI)
- System Overview
- Challenges
- Lessons Learned
Background

- Performed an up hole recomplete on a gas well in 2,600 ft (~790 m) in Mississippi Canyon
- Produce through two stacked frac pack completions
- Each stacked assembly has a hydraulic valve operated with pressure
- Lower zone not contributing
Intervention Objectives

- With a riserless intervention package re-enter a live well.

- Open 2 MSV valves (circulating valves)

- Flow well to evaluate the contribution from the upper and lower zones

- Secure well and return control to the production platform
Why RLWI

- Wider fleet of suitable vessels, as compared to HP riser systems
- No anticipated need for coil tubing
- Increasing use and acceptance of deeper water riserless intervention in GoM
- Cost Savings
Cost Analysis to Access Well

- MODU ~ 8.5 Million
  - Avg. rate 500K/day
- HP Riser ~ 3 Million
  - Avg. Rate 380K/day
- Riserless ~ 1.5 Million
  - Avg. Rate 250K/Day

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<th>System</th>
<th>Cum Time Days</th>
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RLWI System Overview

- IRIS - Interchangeable Riserless Intervention System
- 10,000 PSI Rated Working Pressure
- 10,000 ft Water Depth Rating
- Slickline, Digital Slickline and E-line (5/16", 9/32" and 7/32")
RLWI System Overview

- **Pressure Control Head (Grease Head)**
  - Provide dynamic seal around wire and cable utilising concentric flow tubes
  - Redundant Pack Off assemblies to seal on static wire & cable in contingency
  - Bi directional ball check valves to facilitate an environmental seal on loss of wire

- **Lubricator Section**
  - Conduit For Tool Strings
  - Tool Trap to prevent loss of tools downhole

- **Well Control Package**
  - Dual Ram BOP c/w Wireline Blind & Fail Safe Shear Seal
  - 2 off Bi Directional gate valves
  - Pumping & Flush Return line interfaces c/w inline Fail Safe Valves
  - Lubricator & XT connectors
  - ROV override capability
Vessel Drive Off / Drift Off

- Vessel analysis established the green-yellow-red watch circles, dictating the shut down and quick disconnect ops

- Emergency Shut Down (ESD). Protection of personnel and the vessel and preservation of the well barriers

- Emergency Quick Disconnect (EQD) EQD closes well barriers and automatically disconnects all hardware associated with the EQD interface

- Ability to reconnect following a drive-off/drift-off event
Challenges

- Water Depth Concerns
- Inexperienced Crew
- Highly Deviated Wellbore ($63^\circ$)
- Hydrate Prevention
- Crown Plug Retrieval
Water Depth Concerns

- Water Column Analysis
  - Current Loading
  - Line Clashing
  - Stack Bending Moments

- Vessel Surface Study
  - RAOs
  - Wave Loading
  - Down Line Tensions
Inexperienced Crew

- Disadvantage of Using a Vessel of Opportunity
  - ROV crew was not used to working a Riserless system
  - Non Optimized vessel Arrangement
  - Hydraulic moon pool deck hatch
    - Wasted time using crane

- Wireline during Deployment and Retrieval of Lubricator
  - Matching deployment/retrieval speeds of the crane and wireline
  - Visual marking for wireline crew
  - Know Baseline weights
Highly Deviated Wellbore (63°)

- Modeled Each Tool String Deployment
  - Used computer modeling to optimize tool strings
    - No issues with wire friction or weight
    - Had to adjust bow-string centralizer
- Add rollers to all BHAs going below wellhead
- Modified the Gauge Ring
  - Added bevels to gauge ring
- Contingency
  - Run BHAs on E-line with Tractor
  - Performed successful horizontal (90°) test in shop
  - Not used offshore
Hydrate Prevention

- 4 Major Techniques to Prevent Hydrates
  - Remove the free and dissolved water from the system
  - Inject some inhibitor to prevent hydrate formation
  - Maintain high temperatures so that hydrates do not form
  - Maintain low pressures to keep all phases fluid
Hydrate Prevention

- Closed SCSSV and flushed tree with methanol from the platform prior to landing system

- Utilized Mono-Ethylene Glycol (MEG) as flushing fluid from the vessel

- Thoroughly flush system after each lubricator trip

- All flush line make/break connections required to be checked
Crown Plug Retrieval

- Difficulty to pull crown plugs in Dual plug hanger
- Primary BHA – Standard assembly with Jars
- Contingency BHA – Assembly with Stroker tool
  - BHA length consideration due to Stroker anchor section placement
  - Successfully used Stroker tool to pull both plugs
Other Considerations

- Ran actual slickline and E-line through grease head
  - Keep a log of tight spots
  - Tested beyond MASP and at different run speeds

- Used digital slickline to get real time data
  - Wire Tension
  - Pressure/Temperature
  - Casing Collar Log
  - Gamma Ray
  - Digital release
QUESTIONS?