Oceaneering Life of Field Services

Justin Pizzitola
Intervention Service activities can be operated from most types of vessels of opportunity up to and including rigs

Lower Cost by 50%
Commitment to safe operations
Maximize savings when deployed from Vessel
Still Beneficial when deployed from Rig

<table>
<thead>
<tr>
<th>1st Rigless Stimulation System</th>
<th>1st Flowline Remediation System</th>
<th>Blue Ocean Acquisition</th>
<th>Riserless Coiled Tubing Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>2008</td>
<td>2012</td>
<td>2014</td>
</tr>
<tr>
<td>1st ROV Intervention Skid</td>
<td>Over 80 Total Hydraulic Intervention Projects</td>
<td>1st Mechanical Intervention Post Acquisition</td>
<td>Goal 500 Plus Intervention Projects</td>
</tr>
<tr>
<td>2016</td>
<td>2017</td>
<td>2019</td>
<td>2020</td>
</tr>
</tbody>
</table>
Intervention Skids

» More than 100 projects executed globally
» Adaptable to fit most all work class ROVs
» Currently operating in 9 different countries
» 10 skids in operation globally
» Application in repair, remediation, XT functioning, FIV operations, flushing, test, chemical injection, etc.
» Ideally suited for small volume hydrate remediation
» Skids can be configured for most any subsea operation required for Life of Field

» Intervention skids can be used to solve most any issue in the subsea infrastructure which can not otherwise be solved via the topsides control platform.
» Single vessel operation
» Dual or single ROV operation
» Up to 17,500 psi rated and flow up to 10 gpm
» Neutrally buoyant
» Depth rated to 10,000 ft (3,000 m)
» Failsafe actuators throughout skid to help maintain infrastructure integrity
» Proportional flow and pressure control
» Logging capability: Pressure & Flow, volume totalizer for precise fluid amounts
Intervention Skids

**ROV Mounting**
- Will mount to most types of ROVs of opportunity
- Requires 15-20 GPM @ 3,000 psi
- Requires either 24V @ 6amp or 110V @ 3amp service

**Controls**
- Fail close ISO valves
- Full control via laptop
- Pressure & flow monitoring
- Inline PRVs
- ESD functionality
- Control limits settable within software

**Tool**
- 17,500 psi rated
- 4-9 GPM flow rate
- 10,000 fsw rated
- 0 °F - 250 °F rated
- Weight in air: 2,100 lbs
- Weight in water: Neutrally Buoyant
- Dims: 8’x5’x2.5’

**Flow Path**
- Qty 3 – Duplex Pumps
- Qty 4 – 3 way directional control valves
- Qty 4 – Pressure transducers
- Qty 3 – Flow meters
- ¾” Autoclave tubing throughout

**Key Subsea Interfaces**
- Adaptable to use any hot stab required or other connection type
- ¾” Autoclave outlet fittings

**Remote Monitoring**
- HRS software is capable of sending real-time data back to the beach
- Pressures, system status, flow rates
- Allows clients and SME’s to analyze the data onshore, saving personnel costs

© Global Offshore Brazil Summit and Gulf Quest LLC
RWOCS is a solution designed to install, test, commission, and intervene in a subsea X-mas tree, but can also be used as a chemical delivery system to a manifold or PLET.

It can either be mounted to an ROV or deployed separately with a LARS.

With this unit, all pumping and testing pressure is contained subsea. There is no pressure provided at surface (no high-pressure exposure for technicians or others).

The system will be operated through a communication and power cable in the standalone mode (LARS) and through the ROV umbilical and tether in ROV mode.

It is capable of pumping multiple fluids subsea at 15,000 psi.

The modular design makes it flexible to customers needs.
Flowline Remediation

Flowline Remediation System

» Large scale Flowline remediation System
» Multi project campaigns
» Subsea pumping with liquid & gas separation at seabed
» With OII CT lines for conduits to surface
» Application in repair, remediation and decommissioning
» Smaller ROV mounted Hydrate remediation skids

Removes blockages (e.g. hydrates, asphalts, wax) to quickly and safely restore production in deep water flowlines. Allows the operator to restore production by de-pressurizing the pipeline blockage which allows the area to be treated.

Spread consists of:
» Subsea separator
» Subsea HPU (hydraulic power unit / pump)
» 2 coiled tubing downlines
» EQD System (Emergency Quick Disconnect)
» Topside fluid & gas handling equipment
» 30 campaigns globally since 2012.
# Flowline Remediation

## Vessel of Opportunity
- ~8,000 ft² Deck space required
- Moon-pool preferred
- 150T crane min with heave comp
- DP3 capable
- Dual ROVs

## Topsides
- Coiled Tubing
- Pumps
- Manifolds, Chokes & PRVs
- Gas Buster
- Fluid Storage
- Gas Vent Boom
- LARS System
- Control & Work Vans
- N2 Spread

## Subsea
- FRS
- Subsea Separator
- SHPU
- HRS
- ROVs
- HFLs
- EFLs
- Chemical Source

## Equipment Specs
- 5K rated
- 5K full differential
- Up to 25 gpm Flow
- ESD barrier valve
- Active & Passive EQD system

## Case History GOM
- W/D: 4,200 ft
- 26 mile x 8” Line
- Max Fluid Flow Rate: 12 gpm
- Max Gas Flow Rate: 10 SCFM
- Total Recovered Volume: 2,400 bbls

## Case History EG
- W/D: 1,500 ft
- 4.5 mile x 8” Line
- Max Fluid Flow Rate: 10 gpm
- Max Gas Flow Rate: 6 SCFM
- Total Recovered Volume: 1,600 bbls
Well Stimulation

Hydraulic Well Intervention

- More than 30 wells stimulated over a ten year span
- 7 different operators
- Two different regions
- 5 different tools in operation
- Average timeline for a 1 well campaign use to be 14-16 days dock to dock
- Average time for completion today 7-8 days
- Faster completion times directly related to operational excellence and vessel of opportunity

- Dual vessel solution in combination with stim boat, with LoF vessel acting as conduit to well.
- Single vessel solution, volume dependent
- 35 campaigns globally (300m – 2,400m)
- 15K rated up to 25 bpm.
- Proprietary Fatigue monitoring technology for Low and High Cycle (vessel motion feedback).
- Subsea Failsafe Barrier Package suitable for VXT & HXT access.
- Successful operation done 8,100fsw (2,470msw) water depth
- Multiple XT control options for both single and dual vessel solutions
  - Electrical and hydraulic from vessel
  - Hydraulic from vessel
- Active and passive EQD systems with full redundancy
Well Stimulation

**Dual Vessel**
- Average mob time 3 days
- Best used when doing a multi well campaign
- Capable of handling much higher chemical volumes

**Single Vessel**
- Average mob time 6 days
- Best used for single or double well project
- Chemical capacity ~6,000 bbls
- Multi well campaign possible depending on chemical volume required

**Subsea**
- Capable of both Horizontal and Vertical trees
- Multiple mounting configurations
- Numerous tree control options
- Subsea resettable EQD & ESD

**Equipment Specs**
- 15K rated system
- Up to 2-3/8” coil
- Up to 15 bpm
- Dual barrier ESD
- Active & passive EQD systems

**Case History Well Angola**
- W/D: 3,438 ft
- Max Flow Rate: 6 bpm
- Total Volume: 11,400 bbl
- Max Surface: 4,200 psi
- Max Tree: 2,500 psi

**Case History Well GOM**
- W/D: 4,294 ft
- Max Flow Rate: 6 bpm
- Total Volume: 3,796 bbl
- Max Surface: 11,500 psi
- Max Tree: 12,800 psi

Well Stimulation

**Case History Well Angola**
- W/D: 3,438 ft
- Max Flow Rate: 6 bpm
- Total Volume: 11,400 bbl
- Max Surface: 4,200 psi
- Max Tree: 2,500 psi

**Case History Well GOM**
- W/D: 4,294 ft
- Max Flow Rate: 6 bpm
- Total Volume: 3,796 bbl
- Max Surface: 11,500 psi
- Max Tree: 12,800 psi
Mechanical Well Intervention

» Full suite of intervention with the addition of Mechanical intervention
» Multiple intervention packages (IRIS/BORIS)
» Increasing production access capability (Slickline and E-line)
» Downhole tooling technology increasing overall riserless interventions
» Record depths of operations @ 8,200 fsw (2,560 msw)
» Effective, safe, reliable MSV-based

» Well integrity: TC/XT, tbg/annulus, etc
» Std slickline: DHSV lock outs, GLV change-outs, sleeve manipulation, etc
» Std E-line: production logging, perforating, WSO, etc
» E-line tractor services: conveyance, mechanical strokers, milling, clean-outs, etc
» P&A: well kill, suspensions, hydrocarbon removal, XT removal, MODU prep, etc
Mechanical Intervention Case Study

» First riserless wireline operations in-country; 1,250m and 2,060m water depths.
» All production enhancement.
» All well objectives, field production increases, and fiscals met.
» Vessel Quayside only for;
  - Initial mobilization for TRT, 3rd party tooling & chemicals.
  - Interim mobilization for TRT change-out.
» Regional support base provided for;
  - Vessel & Equipment Importation
  - Crewing
  - Mobilization Logistics
  - Explosives License
» 7 Months; 3 Jobs, 5 Services, 3 Countries, 3 Clients off the Single Vessel
Life of Field Case Study

Walvis Bay, Namibia
- Shipyard scope.
- Deck Handling equipment installation.
- Hydrate remediation equipment mobilized.

Equatorial Guinea
- Hydrate remediation of 2x flowlines
- Reduced LoF equipment specialist crew.

Angola
- 9 well LWI campaign.
- Same CT, topsides fluid handling kit.
- LWI equipment mobilized with TRT & campaign equipment.
Deepwater Mechanical and Hydraulic Interventions

- Extensive track record
  - All four services delivering enhanced production
- Hydraulic Intervention
  - >30 campaigns globally
- Hydrate Remediation
  - HRS around XT >30 campaigns globally
  - FRS flowlines >20 campaigns globally
- Mechanical Intervention
- Water depth records achieved
  - World records
    - 2010 – 915m/3000’ – GoM
    - 2012 – 280m/4200’ – GoM
    - 2014 – 2040m/6700’ – GoM
    - 2014 – 2560m/8200’ – GoM
  - Client world record
    - 2018 – 2030m/6660’ – Angola
  - West African regional record
    - 2018 – 2030m/6660’ – Angola

RLWI Wireline runs and counting

- 150+
- Projects and counting

- 50+

Riserless Hydraulic Well Intervention

- 2009 – Shell Mensa A-5
- 2010 – Shell Europa A1
- 2011 – Shell Deimos
- 2011 – Shell Europa EA1 & EA6
- 2012 – Shell Deimos DM1 & Europa A2
- 2012 – BP Naikika Seal-Tite Injection
- 2013 – Tullow Oil Ghana 5
- 2013 – Shell Crosby A-7
- 2015 – Chevron Tahiti 5
- 2015 – Anadarko Caesar Tonga
- 2015 – Hess Tubular Bells 2 wells
- 2016 – Hess Conger Lower Abandonment
- 2016 – Anadarko Caesar Tonga
- 2016 – Chevron Tahiti 3 Wells
- 2016 – Stone Energy Amethyst
- 2016 – Shell Princess
- 2017 – Chevron Tahiti Stimulation
- 2017 – Chevron Lianzi Stimulation
- 2018 – Chevron Tahiti Stimulation
- 2018 – Chevron Lianzi Stimulation
- 2018 – Hess Tubular Bells Stimulation
- 2019 – Shell Perdido Stimulation
- 2019 – Shell Kaikia 2 wells
- 2019 – Chevron Lianzi Stimulation

Riserless Flowline Hydrate Remediation

- 2006 – Operation Clean Sweep
- 2009 – SILS Shell Troika
- 2010 – SILS Mariner Bass Lite
- 2011 – IRIS ATP tubing cleanout & sleeve intervention
- 2011 – IRIS ATP tubing cleanout & sleeve intervention
- 2012 – IRIS Anadarko asphaltene cleanout
- 2013 – IRIS Apache P&A
- 2013 – IRIS W&I through tubing plugback
- 2013 – IRIS ENI sleeve shift verification
- 2014 – IRIS Apache bypass smart valves
- 2014 – IRIS Anadarko mechanical diagnostics & sleeve intervention
- 2014 – IRIS Anadarko sleeve intervention
- 2014 – IRIS Anadarko lease renewal
- 2015–16 – WWC Marubeni 9 Wells P&A
- 2017 – IRIS Hess Well Diagnostics
- 2018–19 – IRIS BP Angola 7 wells

Riserless Mechanical Light Well Intervention

- 2012 – Newfield Fastball Flowline
- 2012 – Marubeni Zia Flowline
- 2014-15 – ENI Goldfinger
- 2015 – Bennu Telemark Flowline
- 2015 – Murphy Thunder Hawk
- 2015 – LLOG Delta House
- 2015 – Marubeni Canyon Express
- 2016 – Bennu Telemark
- 2017 – Murphy Thunder Hawk
- 2017-18 – Exxon MICA
- 2017 – Apache Bass Lite
- 2017-18 – LLOG Son of Bluto
- 2018 – LLOG OTIS
- 2019 – Hess T-Bells
- 2019 – LLOG Niedermeyer

- 2006 – Operation Clean Sweep
- 2009 – SILS Shell Troika
- 2010 – SILS Mariner Bass Lite
- 2011 – IRIS ATP tubing cleanout & sleeve intervention
- 2011 – IRIS ATP tubing cleanout & sleeve intervention
- 2012 – IRIS Anadarko asphaltene cleanout
- 2013 – IRIS Apache P&A
- 2013 – IRIS W&I through tubing plugback
- 2013 – IRIS ENI sleeve shift verification
- 2014 – IRIS Apache bypass smart valves
- 2014 – IRIS Anadarko mechanical diagnostics & sleeve intervention
- 2014 – IRIS Anadarko sleeve intervention
- 2014 – IRIS Anadarko lease renewal
- 2015–16 – WWC Marubeni 9 Wells P&A
- 2017 – IRIS Hess Well Diagnostics
- 2018–19 – IRIS BP Angola 7 wells
CONNECTING WHAT’S NEEDED WITH WHAT’S NEXT™