Jack / St. Malo
First 18 Months of Performance and the Journey Ahead

Travis Flowers – Chevron

API Delta Chapter
New Orleans, LA
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Introduction

Agenda

- Key Messages
- JSM Firsts
- Project Overview
- Early Performance & What’s Ahead
- Enabling Technologies
- Best Practices & Lessons Learned
- Q&A
Key Messages

• The Technology development and focused reservoir learnings early in the development are keys to success in Lower Tertiary

• Long-term relationships and collaboration with Service Providers and Co-owners enabled technology

• Robust design and reliable operations are paying dividends

• Favorable early-time performance, but still many learnings ahead
**JSM Firsts**

**Industry’s...**
- Largest Displacement Semi-Submersible
- First Deepwater ESTMZ Execution
- Largest & Deepest Subsea Boost Pumps

**Chevron’s...**
- First Deepwater Wilcox
- First Subsea Multi-Phase Meters
- First Subsea Sampling Skid
- Longest Subsea Tie-back in GoM
- Heaviest Casing String Run
- Highest Depletion Pressures
Project Overview

Jack / St. Malo Stage 1
- Floating Production Facility
- Located in WR 718
- Water Depth: 7,000’
- Capacity: 170,000 bopd
- 3 Drill Centers, 10 Wells
- Subsea Facilities
- Single-Phase Subsea Pumps
- 2 Export Lines (oil & gas)
- Expansion/Tie-Back Provisions for Julia & others
Walker Ridge Regional Host (FPU) Layout

Production Module (PM)

Oil Export: 4000 psi

Living Quarters: 159 POB

Gas Export: 3450 psi

Compression Module (CM)

Nameplate
- 170 MBOPD
- 42.5 MMSCFD
- 130 MBWPD
- 225 MBLPD

Generation Module (GM)
Power Capacity: 80 MW
Wilcox Reservoirs

Opportunity
- Thick Interval w/ Significant Oil in Place
- Substantial Reservoir Pressure

Challenges
- 26,000 – 29,000 Ft. TVD
- Low Permeability
- Heterogeneous, Vertical Flow Barriers
- Primary RF w/ Minimal Aquifer Support
- Low Bubble Point
- Extreme Borehole Depletion Stresses
- Challenging Subsalt Seismic Imaging
- 7000’ of water 200 miles offshore
Regional Geology

4-way salt-cored anticline structures in the Lower Tertiary Wilcox trend consisting of weakly confined to unconfined turbidite channel and fan complexes deposited in deep submarine setting

**JSM Stage 1 Development:**
- 4 Wells in Jack
- 5 Wells in St. Malo
- Centrally Located FPU
- Single-Phase Subsea Boost Pumps
Project Performance

On-time & under budget
8 wells producing over 100 MBOEPD
ESTMZ™** completions yielding better than forecasted well productivity
Excellent facility up-time; subsea pumps online
Incident free tie-back of Julia Field
Expect all Stage 1 wells online by 1Q17
Second stage of development in execution; Third stage in planning
OBN seismic influencing resource maturation

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*Shared in 4Q 2015 investor relations data
**ESTMZ™ system is a trademark of Halliburton
Operational Summary

- Many firsts with “serial #1” equipment
- Largest, most remote CVX GoM facility
  - 159 personnel-on-board, 200 miles offshore
  - Three drill centers & five manifolds w/ subsea sampling and subsea multiphase flowmeters on each well
  - 60+ miles of flowlines & risers
  - Largest & deepest seafloor boost pumps
  - 9 subsea JSM wells + 2 Julia wells (and growing)
  - Systematic H2S management & flow assurance
  - Successful tie-back and ramp-up of Julia Field
- World class safety, spill rate & reliability while managing new facility learnings & top-quartile operating expense
Ramp-Up Planning & Execution

- Detailed ramp-up plan executed smoothly
- Stable operations & regulatory alignment enabled data capture
- Calibrated multi-owner allocation process
- Tracers confirmed contribution from all zones
- Well performance exceeded expectations

<table>
<thead>
<tr>
<th>Well Performance</th>
<th>Flow Back</th>
<th>BU #1</th>
<th>BU #2</th>
<th>BU #3</th>
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<td>PTA KH (md-ft)</td>
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<tr>
<td>Total Skin</td>
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<td>Depletion (psi)</td>
<td>2800</td>
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Ramp-Up Deliverables
- Stable Ramp of “Clean” vs “Dirty” Wells ✓
- Calibrate Measurement & Allocation ✓
- Data at Initial Conditions ✓
- Establish kh and initial skin ✓
- Skin vs. drawdown/depletion ✓
- Completion integrity ✓
- Zonal contribution ✓
**Early-Life Signposts & What’s Ahead**

**Key Signposts**
- Well performance vs. Borehole depletion
- Reservoir connectivity
- Subsea pump performance
- Delineation results
- Depletion D&C effectiveness

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<tr>
<th>Negative</th>
<th>Signpost</th>
<th>Positive</th>
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<tr>
<td>Initial Productivity &amp; Well Performance</td>
<td>▲ Low initial skin</td>
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<tr>
<td>PI Degradation</td>
<td>▲ Within range of expectations</td>
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<td>8,500psi Borehole Depletion</td>
<td>▲ 1st three wells</td>
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<td>Effective Areal Connectivity</td>
<td>▲ New well MDT’s</td>
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<td>Faulting</td>
<td>▲ OBN interpretation</td>
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<td>▲ Simulation HM</td>
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<td>Subsea Pumps</td>
<td>▲ Pumps online</td>
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<td>Water Production</td>
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<td>Effective vertical drainage</td>
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<td>▲ RESMAN results</td>
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<td>OWCs</td>
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<td>10,000psi Borehole Depletion</td>
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<td>▼ 2015 step-out</td>
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<td>Undrilled Fault Blocks</td>
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<td>Depletion Drilling &amp; Completions</td>
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**Borehole Depletion vs. Cumulative Production**
- Full Depletion Level (10.5 kpsi)
- Subsea Pumps
- Potential Pore Deformation (8.5 kpsi)
- Hollow Cylinder Collapse Strength (7 kpsi)

Managing depletion pace through key stresses with sustained well productivity to 9,000 psi

Proceeding toward highest depletion levels in Chevron operated oil fields worldwide

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Enabling Technologies

- Enhanced Single Trip Multi-Zone (ESTMZ) Frac Pack
- RESMAN Production Tracers
- Subsea Boost Pumps (single-phase and multi-phase)
- Topsides & Subsea Multi-Phase Flow Meters
- Ocean Bottom Node Seismic (OBN)
Best Practices & Lessons Learned

- Consistency in Personnel, from Planning through Execution Enabled Success
- Co-Owner Collaboration Enabled Critical Technologies & Infrastructure
- Parallel Contingency Plans During Commissioning Kept Project on Schedule
- Early Regulator Engagement and Alignment Supported Execution
- Clear Ramp-Up Objectives Enabled Organizational Alignment & Execution
- ESTMZ FracPack Stimulations are Effective at Depletion Levels Seen to Date
- OBN Seismic Provides Improved Clarity and Potential for 4D monitoring

JSM is still very early in its life... With many exciting learnings ahead...
Optional Slides
Efficient Completions
Single-trip Multizone Frac Pack Technology

Enhanced Single-trip Multizone (ESTMZ™ system)
Designed for long lower tertiary completions

- High production rates enabled by frac pack completion
- Thick oil sand intervals require three to five frac packs for effective stimulation
- Reservoir pressures, interval lengths, and completion design require improved perforating gun to survive downhole conditions
- In a five zone completion, Single-trip Multizone technology saves 10 trips in the hole and reduces completion time by ~28 days per well

Conventional Completion (5 zone)
- 14 trips for completion installations including five perforation runs
- 64 days for sandface completion

ESTMZ™ System Completion (5 zone)
- 4 trips for completion installations including one perforation run
- 36 days for sandface completion

*ESTMZ™ system is a trademark of Halliburton
Seafloor Boosting
Increases Recovery and Improves Flow Rates

Artificial lift challenges:

- Improve production profiles by lowering wellhead pressure
- Enable long tie back distance
- Reliability of electric submersible pumps and fluid compatibility for gas lift

Design competition strategy:

- Extend water depth and power for subsea single phase pumps (SPP)

Solution:

- Collaborate with Co-owners & OneSubsea to develop the Single-phase Pump for JSM:
  - 3 MW motor power rating
  - 13,000 psi shut-in pressure rating
  - 60,000 BOPD capacity

*Photo courtesy of OneSubsea, a Schlumberger company*
Ocean Bottom Node Imaging Technology

- Technology extension for nodes with longer seabed endurance (1149 nodes/4 OCS blocks)
- Synergy of back-to-back surveys: On-time & budget
- Improved characterization of subsalt faults/compartments
- Baseline for potential 4D seismic
- Improved illumination impacting well placement
Jack / St. Malo Field History

Jack Field – 2010 vintage

St. Malo Field – 2005 vintage

Jack / St. Malo Activity

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- ⚫ Discovery date
- ⚬ Well test
- Exploration / Appraisal Drilling
- Development Drilling
- First Oil
Partnering Internally and Externally for Success
ESTMZ™ System Development

2006
- Technology Selection Workshop

2007
- Partnership with Halliburton to develop ESTMZ™ system
- System Integration Test at Halliburton’s Carrollton, TX

2008
- Erosion test at Halliburton’s Duncan, OK location
- Cased hole field trials at Chevron’s Rangely Field

2011
- Additional field trial at Chevron’s Lost Hills Field

2012
- Cased hole ESTMZ™ system
- (4 zone) with flow test

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