The Development of Cascade and Chinook Fields in Ultra Deep Waters in the Gulf of Mexico

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Walker Ridge Ridge Asset Manager
Petrobras

MARINE TECHNOLOGY SOCIETY
HOUSTON SECTION
March 26th, 2009
Agenda

1 - Introduction

2 - Cascade and Chinook Framework
   - Ownership and Well History
   - GoM Environment and Regulation

3 - Cascade and Chinook – Phase 1
   - Overview and Timeline
   - Reservoir and Wells
   - Subsea, FPSO and Export System

4 - Path Forward
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4 - Path Forward
**Petrobras Summary**

- **Proven Reserves (SPE): 15 bi boe**
- **Employees: 69,000**
- **O&G Production: 2.3 million boe/day**
- **Refining Throughput: 2.2 million boe/day**

**Employees:** 69,000

**Refining Throughput:** 2.2 million boe/day

**Map: World Presence**

- **Head Office:** Rio de Janeiro, Brazil
- **Trading:** USA, Europe, South America, Asia
- **Downstream:** Brazil, USA, South America, Asia
- **E&P:** Argentina, Brazil, Mexico, Nigeria, Venezuela
- **Gas & Power:** Brazil, Argentina, Uruguay, Brazil
- **Representative Office:** China, Japan, Singapore

**Regions:**
- Brazil
- Argentina
- Mexico
- Nigeria
- Venezuela
- USA
- Europe
- Asia

**Countries:**
- Brazil
- Argentina
- USA
- Mexico
- Nigeria
- Venezuela
- China
- Japan
- Singapore
- India
- Pakistan
- Iran
- Turkey
- Turkey
- Mozambique
- Senegal
- Portugal
- India
- Pakistan
- Iran
- Turkey
- Singapore
Petrobras as an Operator of Floating Production Systems

All Contracted Vessels (252 Vessels Total)

- Petrobras: 45 vessels
- Shell: 15 vessels
- StatoilHydro: 15 vessels
- ExxonMobil: 13 vessels
- BP: 12 vessels
- Chevron: 12 vessels
- Anadarko: 10 vessels
- Total: 9 vessels
- CNOOC: 8 vessels
- ConocoPhillips: 8 vessels
- ENI/Agip: 5 vessels
- Others: 100 vessels

Legend:
- FPSO
- Semi
- Spar
- TLP
- Other
Petrobras E&P Portfolio in Gulf of Mexico (259 Blocks)
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Cascade and Chinook Lease Holders

The Cascade Field

- Petrobras – 50%
- Devon – 50%

(Blocks WR205, 206,249 &250)

The Chinook Field

- Petrobras – 66.67%
- Total – 33.33%

(Blocks WR 425,426,469&470)
# Cascade and Chinook Field History

<table>
<thead>
<tr>
<th>Year</th>
<th>Cascade</th>
<th>Chinook</th>
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</thead>
<tbody>
<tr>
<td>2002</td>
<td>Discovery Well</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td>Discovery Well</td>
</tr>
<tr>
<td>2004</td>
<td></td>
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</tr>
<tr>
<td>2005</td>
<td>2 Appraisal Wells</td>
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<tr>
<td>2006</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>1 Well</td>
<td></td>
</tr>
</tbody>
</table>
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Lower Tertiary in GoM
Depositional Environment

( Badley Ashton )

Unconfined Distal Basin Floor Fans
Cascade & Chinook

Currents, Furrows and Hurricanes in Gulf of Mexico

~1 Football Field

Hurricane Katrina 2005
Oil and Gas Pipelines in Gulf of Mexico

Texas

Louisiana

Mississippi

Alabama

Mexico

Cascade & Chinook
# Regulatory Compliance

<table>
<thead>
<tr>
<th>MMS</th>
<th>USCG</th>
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</thead>
<tbody>
<tr>
<td>Exploration Plan</td>
<td>Certificate of Compliance (COC)</td>
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<tr>
<td>Application for permit to Drill</td>
<td>Foreign Flag Issues &amp; Equivalencies</td>
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<tr>
<td>Conservation Information Document</td>
<td>Design Document &amp; Plan Review</td>
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<tr>
<td>Downhole Commingling</td>
<td>Manning &amp; Licensing</td>
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<tr>
<td>D.W.O.P.</td>
<td>Security / Safety Zone</td>
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<tr>
<td>D.O.C.D.</td>
<td>Lightering Procedure</td>
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<tr>
<td>Pipeline Application / ROW &amp; LT</td>
<td>Oil Spill Management</td>
</tr>
<tr>
<td>Riser Verification (CVA – Risers)</td>
<td>Emergency Evacuation Plan / Vessel Response Plan</td>
</tr>
<tr>
<td>Structural verification (Structural CVA)</td>
<td>In-Service inspection plan</td>
</tr>
<tr>
<td>Production Safety System</td>
<td>USCG Inspections During Construction &amp; Installation</td>
</tr>
<tr>
<td>Surface Commingling &amp; Measurement</td>
<td>Pre-COI / COC Inspection</td>
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<tr>
<td>Well Control &amp; Production Training</td>
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<tr>
<td>In-Service Inspection Plans</td>
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<tr>
<td>Oil Spill Response</td>
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<td>NPDES</td>
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<tr>
<td>Departure Requests</td>
<td></td>
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<tr>
<td>MMS Inspections incl. Pre-Production Inspection</td>
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Cascade and Chinook
We Were Here in Aug2006

- Limited geological and well data;
- Lack of field analogs;
- Harsh environmental conditions;
- Ultra-deep waters;
- Lack of pipeline infrastructure;
- FPSO regulation under development;
- Tight SOP deadlines;
- Willingness to produce ASAP.
Cascade and Chinook Phase I
Walker Ridge
Gulf of Mexico
The Objective of Cascade and Chinook Phase 1 is to obtain data and information about the reservoirs and the well productivity in order to optimize the future phases focusing on the following aspects:

- Number and type of wells;
- Completion design;
- Production System Type and Capacity;
- Subsea Layout and Boosting System;
- Secondary Recovery Potential.
First Oil in Jun 2010 – As Planned

- Develop Conceptual Plan
- Design facilities bid packages
- Start procurement
- Define Development Plan
- Sanction the project
- Award facilities contracts
- Execute Facilities
- Regulatory Compliance
- Drill

- 3Q 2006
- 4Q 2006
- 1Q 2007
- 2Q 2007
- 3Q 2007
- 4Q 2007
- 1Q 2008
- 2Q 2008
- 3Q 2008
- 4Q 2008

First Oil in Jun 2010 – As Planned
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Reservoir Challenges
Well Drilling Challenges

Empire State Building ~1250 ft

Sea Level

8,000'

16,000'

24,000'

32,000'

40,000'

Suprasalt Sediment

Allochthonous Sigsbee Salt Canopy

Upper Tertiary Sediments

Lower Tertiary Cretaceous

Autochthonous Salt

Basement

Gulf of Mexico

Modified from Keith Couvillion, Chevron, 2008
Well Completion Challenges

STMZ – Single Trip Multi-Zone Frack Pack
Cascade and Chinook Rigs

2008

Ocean Endeavor - 10,000 ft WD
(Under Contract to Devon Energy)
Diamond Offshore Drilling

2008

West Sirius - 10,000 ft WD
(Under Contract to Devon Energy)
Seadrill Limited

2009

PetroRig 1 - 10,000 ft WD
(Under Construction – Singapore)
Larsen Oil & Gas
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FPSO Challenges
FPSO Conversion in Singapore
Shuttle Tanker Construction in Philadelphia
Gas Export Discovery Pipeline System
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Final Message

• The Cascade and Chinook project will pave the way for future ultra-deep water Lower Tertiary fields in the US GoM.
Path Forward !!
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in the Gulf of Mexico

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