Ultra-Deepwater Program
FACA Meeting
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C. Michael Ming
Washington, D.C.
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Secure Energy for America
A Small Organization, A Large Network

Well over 1,000 experts have participated in this process!

Secure Energy for America
Contents

• UDW situation update
• 2007 UDW program review and status
• 2008 UDW program review and status
• 2009 UDW Annual Plan
• Technology Transfer
Increasing Lag Between Discovery and Development

Proven Reserves Add Value

Number of deepwater field discoveries and new hydrocarbons found (MMS reserves, MMS resources, and industry-announced discoveries).


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Ultra-Deepwater Resources.— Awards from allocations under section 999H(d)(1) shall focus on the development and demonstration of individual exploration and production technologies as well as integrated systems technologies including new architectures for production in ultra-deepwater.
RPSEA Program Development Strategy

Year One

- Careful selection of key enabling and cross-cutting technologies that meet multiple objectives or enable the development of a suite of technologies
- Smaller more numerous awards towards the basic end of the research spectrum

Year Two

- Development of "low-hanging fruit" or technologies that provide incremental improvements in E&P economics, etc.

Years Five thru Ten

- Grand Challenges
- Down-selection, moving to demonstration

Science Themes  Enabling/Cross-cutting Themes  Enhancing Themes

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Significant Demand for UDW Technology Funding

April, 2007
- 120+ Project Ideas
  - $300 MM

June, 2007
- 70 Project Ideas
  - $175 MM

July, 2007
- 26 Project Ideas
  - $30 MM

RPSEA 2007 & 2008 Projects
## 2007 UDW projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Project Title</th>
<th>Number of bids</th>
<th>Selected</th>
<th>Award (RPSEA max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DW1201</td>
<td>Wax Control</td>
<td>3</td>
<td>University of Utah</td>
<td>$400,000</td>
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<tr>
<td>DW1301</td>
<td>Improvements to Deepwater subsea measurements</td>
<td>2</td>
<td>Letton Hall Group</td>
<td>$3,564,000</td>
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<tr>
<td>DW1302</td>
<td>High Conductivity Umbilicals</td>
<td>2</td>
<td>Technip</td>
<td>$448,000</td>
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<tr>
<td>DW1401</td>
<td>Composite Riser for UDW High Pressure Wells</td>
<td>3</td>
<td>Lincoln Composites</td>
<td>$1,680,000</td>
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<tr>
<td>DW1402</td>
<td>Deepwater dry tree system for drilling production</td>
<td>4</td>
<td>FloTec / Houston Offshore</td>
<td>$936,000</td>
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<tr>
<td>DW1403</td>
<td>Fatigue Performance of High Strength Riser Materials</td>
<td>2</td>
<td>SwRI</td>
<td>$800,000</td>
</tr>
<tr>
<td>DW1501</td>
<td>Extreme Reach Development</td>
<td>2</td>
<td>Tejas</td>
<td>$200,000</td>
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<tr>
<td>DW1603</td>
<td>Design investigation xHPHT, SSSV</td>
<td>6</td>
<td>Rice Univ.</td>
<td>$120,000</td>
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<tr>
<td>DW1603</td>
<td>Robotic MFL Sensor; monitoring &amp; inspecting risers</td>
<td></td>
<td>Rice Univ.</td>
<td>$120,000</td>
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<tr>
<td>DW1603</td>
<td>Hydrate Plugging Risk</td>
<td></td>
<td>Tulsa Univ.</td>
<td>$120,000</td>
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<tr>
<td>DW1603</td>
<td>Hydrate Characterization &amp; Dissociation Strategies</td>
<td></td>
<td>Tulsa Univ.</td>
<td>$120,000</td>
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<tr>
<td>DW1701</td>
<td>Improved Recovery</td>
<td>2</td>
<td>Knowledge Reservoir</td>
<td>$1,600,000</td>
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<tr>
<td>DW1801</td>
<td>Effect of Global Warming on Hurricane Activity</td>
<td>1</td>
<td>NCAR</td>
<td>$560,000</td>
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<tr>
<td>DW1901</td>
<td>Subsea processing System Integration</td>
<td>2</td>
<td>GE Research</td>
<td>$1,200,000</td>
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<tr>
<td>DW1902</td>
<td>Deep Sea Hybrid Power Systems:</td>
<td>1</td>
<td>HARC</td>
<td>$480,000</td>
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<tr>
<td>DW2001</td>
<td>Geophysical Modeling Methods</td>
<td>2</td>
<td>SEG</td>
<td>$2,000,000</td>
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</tbody>
</table>

Summary: 32 projects totaling $14,348,000
Ultra-Deep Water Project Selections

- DW 1801: Effect of Global Warming on Hurricane Activity
  - NCAR

- DW 1201: Wax Control
  - University of Utah

- DW 2001: Geophysical Modeling Methods
  - SEAM Corporation

- DW 1403: Fatigue Performance of High Strength Riser Materials Subjected to Sour Environments
  - SW Research Institute

- DW 1402: Deepwater dry tree system for drilling production in the GOM
  - Flo Tec & Houston Offshore

- DW 1301: Improvements to Deepwater Subsea Measurements
  - Letton-Hall Group

- DW 1603: Flow Phenomena in Jumpers
  - University of Tulsa

- DW 1603: Hydrate Characterization & Dissociation Strategies
  - University of Tulsa

- DW 1901: Subsea Processing System Integration
  - General Electric

- DW 1501: Extreme Reach Development
  - Tejas Research Institute

- DW 1902: Deep Sea Hybrid Power Systems
  - HARC

- DW 1603: Design Investigation - Extreme High Pressure, High Temperature, Subsurface Safety Valves
  - Rice University

- DW 1603: Robotic Magnetic Flux Leakage (MFL) Sensor for Monitoring and Inspection of Deepwater Risers
  - Rice University
## 2007 Selected Proposals

<table>
<thead>
<tr>
<th>Categories</th>
<th>UDW</th>
<th>Unconventional</th>
<th>Small Producers</th>
<th>Total</th>
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<tbody>
<tr>
<td>Universities</td>
<td>5</td>
<td>13</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>National Laboratories</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Nonprofit Corporation</td>
<td>4</td>
<td>1</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>For Profit Corporation</td>
<td>8</td>
<td>1</td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td>Geological Science</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>17</td>
<td>19</td>
<td>7</td>
<td>43</td>
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</table>
UDW 2007 RFPs

- 4 RFPs released November 5, 2007
  - 9 proposals received December 27, 2007
- 5 RFPs released November 28, 2007
  - 13 proposals received January 28, 2008
- 5 RFPs to be released February 11, 2008
  10 proposals received April 14, 2008
## 2008 UDW projects

<table>
<thead>
<tr>
<th>TAC Number</th>
<th>Impact</th>
<th>2008 RPSEA Max Share</th>
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<tbody>
<tr>
<td>DW2101</td>
<td>New Safety Barrier Testing Methods</td>
<td>$128,000</td>
</tr>
<tr>
<td>DW1202</td>
<td>EOS improvement for xHPHT</td>
<td>$1,600,000</td>
</tr>
<tr>
<td>DW2201</td>
<td>Viscous Oil PVT</td>
<td>$460,000</td>
</tr>
<tr>
<td>DW2301</td>
<td>Deepwater Riserless Light Well Intervention</td>
<td>$3,411,500</td>
</tr>
<tr>
<td>DW1502</td>
<td>Coil Tubing Drilling &amp; Intervention</td>
<td>$820,000</td>
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<tr>
<td>DW2501</td>
<td>Early Reservoir Appraisal, Utilizing a Low Cost Well Testing System - Phase 1</td>
<td>$880,000</td>
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<tr>
<td>DW2502</td>
<td>Modeling and Simulation; MPD</td>
<td>$384,000</td>
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<tr>
<td>DW2701</td>
<td>Resources to Reserves Development and Acceleration through Appraisal</td>
<td>$400,000</td>
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<tr>
<td>DW2801</td>
<td>Gulf 3-D Operational Current Model Pilot</td>
<td>$1,248,000</td>
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<tr>
<td>DW2901</td>
<td>power distribution &amp; components (Component Qualification)</td>
<td>$4,811,000</td>
</tr>
<tr>
<td></td>
<td><strong>Totals</strong></td>
<td><strong>$14,142,500</strong></td>
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</tbody>
</table>

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2008 RFP Release

• Modification of scope of work to reflect significant learnings from 2007 process – September 2008.

• Final review by Project Champions – October 2008.

• Final NETL review in late October.

• Approval by NETL to use multi-step contract and/or other contract form (?).

• Release of 2 to 3 RFP tranches.
2009 UDW Annual Plan

• Strategies:
  – Provide overview of each 2007 & 2008 project.
  – High level view of 2009 program direction.
  – Fewer, more general and integrated RFPs.
  – Include Environmental Issues
Annual Plan Strategy Development

- Portfolio of Opportunities (Canopy, Coyote, Gumout, Diablo)
- Field Development Scenarios (Dry Trees; Tiebacks, Produce to Beach)
- Technology Needs
- Initiatives (Programs)
- Projects
GOM Ultra-deepwater Activity

- **Walker Ridge / Keathley Canyon**
  - Sub-salt
  - Deeper wells
  - Tight formations

- **Alaminos Canyon**
  - Viscous crude
  - Lacking infrastructure

- **Eastern Gulf – Gas Independence Hub**
  - Higher pressure
  - Higher Temperature
  - CO₂ / H₂S

Higher Drilling Costs
Challenging Economics
Ultra Deepwater Needs

• Drilling, completion and intervention breakthroughs
• Appraisal & development geoscience and reservoir engineering
• Significantly extend subsea tieback distances & surface host elimination
• Dry trees/direct well intervention and risers in 10,000’ wd
• Continuous improvement / optimize field development
  – Per wellbore recovery
  – Cost reduction
  – Reliability improvements
  – Efficiency improvements
• Associated safety and environmental trade-offs
Ongoing Needs and Initiatives

• Need 1: Drilling, Completion and Intervention Breakthroughs
  – Initiative 1: Drilling and Completions
  – Initiative 2: Intervention (Downhole Services)
• Need 2: Appraisal and Development Geoscience and Reservoir Engineering
  – Initiative 1: Exploration and Appraisal
  – Initiative 2: Field Development
• Need 3: Significantly Extend Subsea Tieback Distances/Surface Host Elimination
  – Initiative 1: Stabilized Flow
  – Initiative 2: Subsea Power
  – Initiative 3: Subsea Processing
Ongoing Needs and Initiatives

• Need 4: Dry Trees/Direct Well Intervention and Risers in 10,000 foot Water Depths
  – Initiative 1: Dry Trees/Direct Well Intervention and Risers
• Need 5: Continuous Improvement/Optimize Field Development
  – Initiative 1: Improve Operating and Inspection Processes
  – Initiative 2: Graduate Student and Long Term Research and Development
• Need 6: Associated Safety and Environmental Concerns
2009 UDW Plan Strategy

- 4 to 7 Initiative-based RFPs (5 to 10 project awards)
- Unlike 2007 and 2008, however, the UDW TACs have not voted for individual projects. Rather, the TACs prioritized project ideas by initiatives.
- This input was evaluated by the PAC prior to decide the appropriate balance for the 2009 UDW program.
- UDW 2009 RFPs will consist of both specific projects (follow-on) and broader initiative-based requests. Anticipated 2009 RPSEA UDW initiatives and/or projects are listed below in the context of each UDW need.
- The actual 2009 RPSEA UDW may differ from the anticipated portfolio listed below. The actual 2009 UDW portfolio will be driven by further guidance from the UDW PAC and the timing associated with 2009 program funding.
2009 Anticipated Initiatives

Need 1: Drilling, Completion and Intervention Breakthroughs
- Proposals will be requested identifying novel ideas to reduce well construction and completion costs.

Need 2: Appraisal and Development Geoscience and Reservoir Engineering
- Proposals will be requested in the area of production and reservoir surveillance.

Need 3: Significantly Extend Subsea Tieback Distances/Surface Host Elimination
- Proposals may be requested in one or more of the following areas:
  - Ultra-deepwater flow assurance especially for the areas of solids (asphaltenes, hydrates, waxes, and scale) deposition and plug formation management
  - Pressure boosting
  - Autonomous underwater vehicles and intervention
  - Subsea processing/produced water treatment
2009 Anticipated Initiatives, cont’d

Need 4: Dry Trees/Direct Well Intervention and Risers in 10,000’ Water Depth
• Proposals in this area to be determined.

Need 5: Continuous Improvement/Optimize Field Development
• Proposals in this need area may include:
  – Advancing industry understanding of phenomena impacting ultra-deepwater operations such as vortex-induced vibration
  – Improvements in integrity management and reliability
  – Additional graduate student project funding
  – High risk, high reward ‘long-shot’ R&D opportunities

Need 6: Associated Safety and Environmental Concerns
• Ultra-deepwater efforts in this need area will involve the assessment of environmental and safety impact of RPSEA UDW funded technology development projects. This effort may take the form of individual solicitations or elements of more extensive project based solicitations. Areas of study may include:
  – Improved Metocean understanding
  – Discharge of produced water subsea – technology and regulatory aspects
## 2009 UDW PAC Recommended Funding

<table>
<thead>
<tr>
<th>RPSEA YR3 Funding Allocation (2009)</th>
<th>Funding Distribution ($k)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title / Description</strong></td>
<td>Low</td>
</tr>
<tr>
<td><strong>Need #1</strong> Drilling Completion and Intervention Breakthroughs</td>
<td></td>
</tr>
<tr>
<td>1 Drilling</td>
<td>2,000</td>
</tr>
<tr>
<td>2 Completions</td>
<td>1,000</td>
</tr>
<tr>
<td>3 Intervention (Downhole Services)</td>
<td>500</td>
</tr>
<tr>
<td>4 Intervention (In-Water IMR)</td>
<td>500</td>
</tr>
<tr>
<td>5 Extended Well Testing</td>
<td>-</td>
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<tr>
<td><strong>Need #2</strong> Appraisal &amp; development geosciences and reservoir engineering</td>
<td></td>
</tr>
<tr>
<td>6 Reservoir Surveillance</td>
<td>1,000</td>
</tr>
<tr>
<td><strong>Need #3</strong> Significantly extend subsea tieback distances / surface host elimination</td>
<td></td>
</tr>
<tr>
<td>7 Stabilized Flow</td>
<td>750</td>
</tr>
<tr>
<td>8 Subsea Power</td>
<td>-</td>
</tr>
<tr>
<td>9 Subsea Processing, Pressure Boosting, Instrumentation and Controls</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>Need #4</strong> Dry trees / Direct well intervention and risers in 10,000’ wd.</td>
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<tr>
<td>10 Riser Systems</td>
<td>-</td>
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<tr>
<td>11 Dry Tree Structures</td>
<td>-</td>
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<tr>
<td><strong>Need #5</strong> Continuous Improvement / Optimize field development</td>
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<tr>
<td>12 Long Term Research and Development and Graduate Student Program</td>
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<tr>
<td>13 Sensors, tools and Inspection Processes</td>
<td>1,000</td>
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<tr>
<td>Bridging and Contingency</td>
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<td><strong>Need #6</strong> Associated Safety and Environmental Concerns</td>
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<td>14 Environmental Issues</td>
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<td></td>
<td>10,000</td>
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2009 Annual Plan Process

Portfolio of Opportunities (Canopy, Coyote Gumout, Diablo)

Field Development Scenarios (Dry Trees; Tiebacks, Produce to Beach)

Tech Themes & Drivers

Technology Needs

Initiatives (Programs)

Tech Gaps & Solutions

Roadmap

RFPs

Bid Eval & Rec

PAC $ Allocation (Guideline)

PAC Funding Decision

TAC Input

TAC Working Committee

TAC Working Committee

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Technology Transfer Plans

2.5% Set-aside for Tech Transfer in each subcontract

- 1.5% Project Level
  - Preparing publications
  - Participating in conferences & workshops
- 1% Program Level
  - Support activities that impact multiple projects
  - Regional workshops, conferences
  - Topical conference
  - Directed publications
  - Newsletter
  - Website/Database creation & maintenance (Knowledge Database)
  - Technical support
  - Other novel approaches?
What Questions Can I Answer?

I HAVE A STUPID QUESTION.
THERE IS NO SUCH THING AS A STUPID QUESTION...

.... ONLY STUPID PEOPLE, ASKING QUESTIONS.

IS THAT ME?
DON'T BE STUPID.

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