FACA review
RPSEA; 2010 Annual Plan Overview

C. Michael Ming
Hani Sadek; VP, UDW
September 16/17, 2009
2010 Draft Annual Plan & Program Updates

- Continued aggressive engagement of the private sector and research communities to enhance the value of the public/private model created by EPACT Section 999
- Focus on building, maintaining, and managing an optimal and integrated portfolio
- Transition from program planning to program execution
- The 2010 Draft Annual Plan (dAP) is an evolutionary product of the 2007 through 2009 dAPs which laid the foundation for the current R&D portfolio
- Significant increase in proposals from 2007 to 2008
- 2009 UNG & SP RFPs posting is imminent
## 2007 Portfolio Overview

<table>
<thead>
<tr>
<th></th>
<th>Small Producer</th>
<th>Unconventional Resources</th>
<th>Ultra-Deepwater</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universities</td>
<td>6</td>
<td>13</td>
<td>5</td>
<td>24</td>
</tr>
<tr>
<td>For Profits</td>
<td>0</td>
<td>1</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Non-Profits</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>National Labs</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>State Agencies</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total Selected</strong></td>
<td><strong>7</strong></td>
<td><strong>19</strong></td>
<td><strong>17</strong></td>
<td><strong>43</strong></td>
</tr>
</tbody>
</table>

* 42 of 43 awarded
### 2008 Ultra Deepwater Program Solicitation

#### Number of Proposals

<table>
<thead>
<tr>
<th></th>
<th>For Profits</th>
<th>National Labs</th>
<th>Non Profits</th>
<th>State Agencies</th>
<th>Universities</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received</td>
<td>15</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td>Selected</td>
<td>8</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>11*</td>
</tr>
<tr>
<td>Awarded</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

* 2 additional selections pending

#### Proposal Value ($000)

<table>
<thead>
<tr>
<th></th>
<th>Total Value</th>
<th>RPSEA Share</th>
<th>Cost Share</th>
<th>Cost Share %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received</td>
<td>32,713</td>
<td>24,529</td>
<td>8,184</td>
<td>25</td>
</tr>
<tr>
<td>Selected</td>
<td>13,540</td>
<td>10,748</td>
<td>2,790</td>
<td>21</td>
</tr>
</tbody>
</table>
### Number of Proposals

<table>
<thead>
<tr>
<th></th>
<th>For Profits</th>
<th>National Labs</th>
<th>Non Profits</th>
<th>State Agencies</th>
<th>Universities</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received</td>
<td>22</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>35</td>
<td>69</td>
</tr>
<tr>
<td>Selected</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Awarded</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

### Proposal Value ($000)

<table>
<thead>
<tr>
<th></th>
<th>Total Value</th>
<th>RPSEA Share</th>
<th>Cost Share</th>
<th>Cost Share %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received</td>
<td>103,892</td>
<td>49,941</td>
<td>53,951</td>
<td>52</td>
</tr>
<tr>
<td>Selected</td>
<td>28,592</td>
<td>18,361</td>
<td>10,231</td>
<td>36</td>
</tr>
</tbody>
</table>
# 2008 Small Producer Program Solicitation

## Number of Proposals

<table>
<thead>
<tr>
<th></th>
<th>For Profits</th>
<th>National Labs</th>
<th>Non Profits</th>
<th>State Agencies</th>
<th>Universities</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>17</td>
</tr>
<tr>
<td>Selected</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Awarded</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

## Proposal Value ($000)

<table>
<thead>
<tr>
<th></th>
<th>Total Value</th>
<th>RPSEA Share</th>
<th>Cost Share</th>
<th>Cost Share %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Received</td>
<td>17,059</td>
<td>8,993</td>
<td>8,066</td>
<td>47</td>
</tr>
<tr>
<td>Selected</td>
<td>6,847</td>
<td>3,141</td>
<td>3,706</td>
<td>54</td>
</tr>
</tbody>
</table>
RPSEA 2010 dAP Stakeholder Involvement

- Since inception
  - 75 advisory committee and other meetings with:
    - 1,838 participants
    - 6,800 hours
  - 25 RPSEA member forums with:
    - 1,335 attendees
  - Total 11,800 hours
RPSEA Members

Current Members

Pending Members

Member list by state on back

Updated 6/23/09
RPSEA 2010 dAP Objectives

• Meet EPACT 2005 objectives
• Enhance the traditional iterative industry process by:
  • Developing a time scaled R&D process
  • Identifying and enabling the relevant scientific overlay not feasible with pure market driven efforts
  • Facilitate collaboration among industry and researchers through integrated projects in a well designed integrated portfolio
RPSEA 2010 dAP Process Flow

- SAC Guidance
  - Member Forums (includes non-members)
  - Research Community, Other Innovators
  - Technical Literature/Research Papers
- RPSEA Members
- Resource Target Identification
- PAC Input on Resource Targets
- RPSEA Finalized Resources Target Priority List
  - TAC's and EAG
  - Research Community
  - Other Stakeholders
  - RPSEA Members
- Program Needs Identification
- PAC/RAG Input on Research Priority Needs
- RPSEA Finalized Research Priorities
- DRAFT ANNUAL PLAN
RPSEA 2010 dAP Portfolio Guidance

Grand Challenges

Year One
Science Themes
Smaller, more numerous awards towards the basic end of the research spectrum

Year Three
Enabling/Cross-cutting Themes
Careful selection of key enabling and cross-cutting technologies that meet multiple objectives or enable the development of a suite of technologies

Year Five through Ten
Enhancing Themes
Development of "low-hanging fruit" or technologies that provide incremental improvements in E&P economics, etc.

Down-selection, moving to Demonstration
RPSEA 2010 FACA Presentation Outline

- Environmental emphasis for the overall program
  - Environmental Advisory Group (EAG) description by Rich Haut
- Individual program presentations will include:
  - Resource drivers
  - Portfolio development specific to each program
  - Program status
  - 2010 R&D plan
  - Technology transfer
Executive Summary
1. Background
2. Overall Implementation Scheme
   2.1 Ultra-Deepwater Program Element
   2.2 Unconventional Natural Gas
   2.3 Small Producer Program Element
   2.4 Solicitation Process
   2.5 Project Management
   2.6 Technology Transfer
   2.7 Performance Metrics and Program Benefits Assessment

Appendix A: Title IX, Subtitle J of EPAct 2005 Sections 999A through 999H
Appendix B: RPSEA Membership and Committee List
Appendix C: RPSEA 2010 Draft Annual Plan
RPSEA Organization and Advisory Committees

- Strategic Advisory Committee (SAC)
  - Strategic direction/long range planning advice/identifies metric areas

- Board of Directors
  - President

- VP Operations
  - Operations Team Support from SAC

- VP Ultra-Deepwater
  - Ultra-Deepwater Team Support from Chevron

- VP Unconventional Resources
  - Unconventional Team Support from GTI
  - Unconventional Resources Program Advisory Committee (PAC)
    - Recommendations on elements of draft Annual Plan and selection of proposals

- Small Producer Research Advisory Group (RAG)
  - Recommendations on elements of draft Annual Plan, technical review and selection of proposals

- Small Producer Team Lead
  - Small Producer Team Support from NMS

- Ultra-Deepwater Technical Advisory Committees (TAC)
  - Includes experts who study and apply technologies in real field situations, identify current technology gaps and define the specific N&D efforts needed

- Environmental Advisory Group (EAG)
  - Provides input to all programs regarding environmental issues

- Unconventional Resources Technical Advisory Committee (TAC)
  - Includes experts in a range of technical disciplines that provide technical reviews of proposals submitted to RPSEA

Secure Energy for America
RPSEA UDW Structure
PAC and TACs

Resource of >700 SMEs from industry, academia and government!

Program Advisory Committee
“PAC”

- Regulatory TAC (X100)
  51 Active Members

- Subsea Systems TAC (X300)
  138 Active Members

- Drilling & Completions TAC (X500)
  66 Active Members

- Met Ocean TAC (X800)
  55 Active Members

- Flow Assurance TAC (X200)
  100 Active Members

- Floating Systems TAC (X400)
  150 Active Members

- Reservoir Engineering TAC (X700)
  44 Active Members

- Systems Engineering TAC (X900)
  76 Active Members

- Geoscience TAC (X000)
  15 Active Members
International Collaboration
UDW Program Input

International
- DEMO 2000
- PROCAP 3000
- itf - Growing technology
- DEEPSTAR - Technology Development for Deepwater Research

Regional and local
- Houston Technology Center
- RICE Alliance
- Texas A&M University
- LSU

Professional Societies
- SPE International
- SEG - Society of Exploration Geophysicists
- Offshore Technology Conference

Universities
- MIT - Massachusetts Institute of Technology
- The University of Tulsa

RPSEA; Invited Organization

Secure Energy for America
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.
UDW Program Approach

Four base-case field development scenarios

The Challenges

Walker Ridge/Keathley Canyon
- subsalt
- deeper wells
- tight formations

Alaminos Canyon
- viscous crude
- lacking infrastructure

Eastern Gulf – Gas Independence Hub
- higher pressure & temperature
- CO₂/H₂S

Overall
- higher drilling costs
- challenging economics
Increasing Lag Between Discovery and Development

Proven Reserves Add Value

Figure 22. Number and volume of deepwater discoveries. Volumes include MMS reserves, MMS resources, and industry-announced discoveries.

Need to reduce costs

Figure L.9. Total Upstream Costs per BOE for FRS Companies, 1981-1983 to 2004-2006

Figure 5. Cost per Barrel of Oil Equivalent (BoE) per US Department of Energy, Energy Information Agency (EIA) January 2008, for companies reporting to EIA's Financial Reporting System (FRS). It does not include state-owned oil companies. http://www.eia.doe.gov/ieic/infosheets/crudeproduction.html
UDW Program Goal

The goal of the UDW is to exploit the ultra-deepwater resource base and to convert currently identified (discovered) resources into economic recoverable (proven) reserves, while protecting the environment, thereby providing the U.S. consumer with secure and affordable petroleum supplies.

This goal will be achieved by:

• Increasing production of ultra-deepwater oil and gas resources
• Reducing costs & cycle time to find, develop, and produce such resources
• Increasing the efficiency of exploitation of such resources
• Increasing production efficiency and ultimate recovery of such resources
• Improving safety and environmental performance by minimizing environmental impacts associated with ultra-deepwater exploration and production
UDW Program Objectives

Near Term

Objective 1: Ongoing Identification of Technology UDW Needs

Objective 2: Technology Research & Development, & Applied Science

Objective 3: Awareness and Cost-Share Development.

Longer Term

Objective 4: Technical Development and Field Qualified

Objective 5: Environmental & Safety Technology Development & Deployment

Objective 6: Technology Demonstration.

Objective 7: Technology Commercialization and Industry Deployment
UDW Program ‘Needs’

1. Drilling, completion and intervention breakthroughs

2. Appraisal & development geoscience and reservoir engineering

3. Significantly extend subsea tieback distances & surface host elimination

4. Dry trees/direct well intervention and risers in 10,000’ wd

5. Continuous improvement / optimize field development
   - Per wellbore recovery
   - Cost reduction
   - Reliability improvements
   - Efficiency improvements

6. Associated safety and environmental trade-offs
UDW Program Approach

UDW Program Flowchart

UDW Projects
- Well Construction Cost Reduction
- Completion Cost Reduction
- Intervention (down-hole) Services
- Reservoir Characterization and Appraisal
- Improve Recovery
- Subsea Processing and Boosting
- Power Generation, Transmission and Distribution
- Stabilization Flow
- Intervention (in-water)
- Dry Trees/Direct Well Intervention
- Risers
- Innovative/Novel Concepts
- Emerging Tech/Grad Students
- Health, Safety and Environment Concerns with Emerging Facilities

Initiatives

Program Needs

1. Drilling, Completion and Intervention Breakthroughs
2. Appraisal and Development Geoscience and Reservoir Engineering
3. Significantly Extend Satellite Well Tie-Back/Host Elimination
4. Dry Trees and Risers in 10,000 foot water depth
5. Continuous Improvement and Innovation
6. Health, Safety and Environment Concerns

UDW Resources to Reserves with New Technologies

Program Goal

Secure Energy for America
Programmatic approach
“Need 1” (drilling) Example

Need 1: Drilling, Completion, and Intervention Breakthroughs

Benefit: Drilling, completion, and intervention costs now represent 50 to 70 percent of the total capital expenditures on UDW projects. With ultra-deepwater drilling spread cost exceeding $1 million per day, significant cost reduction is required for UDW project viability.

Initiative 1: Well Construction Cost Reduction

Target: Reduce ultra-deepwater drilling costs by 30 percent

DW1501 (2007): Extreme Reach Development (not awarded – to be re-bid in 2010)
This project will conceptualize the tools and service capabilities required to safely drill, complete, produce, maintain, and at end of life abandon reservoirs located up to 20 miles away from the surface facilities and well access point.

DW2501 (2008): Early Reservoir Appraisal Utilizing a Low Cost Well Testing System (Note: This project also supports Need #2, Initiative 1: Reservoir Characterization and Appraisal)

DW2502 (2008): Modeling and Simulation of Managed Pressure Drilling (MPD)
This project will expand existing capabilities for analysis and simulation of MPD ultra-deepwater well design and operations.

DW35xx (2009): Drilling
Proposals under this drilling initiative are expected to have the potential to significantly reduce the cost of UDW well drilling operations.
Concepts addressed may include:
• To reduce the single MODU spread cost ....
• To reduce the total well count ...
• A longer-term approach may be to develop a seafloor based drilling rig .....

DW45xx (2010): Extreme Reach Development

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

15 awarded $14,148,000
## 2008 UDW Projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Project Title</th>
<th>Selected; lead</th>
<th>Approx. RPSEA share</th>
</tr>
</thead>
<tbody>
<tr>
<td>DW 2101</td>
<td>New Safety Barrier Testing Methods</td>
<td>Southwest Research Institute</td>
<td>$128,000</td>
</tr>
<tr>
<td>DW 1202</td>
<td>EOS improvement for xHPHT</td>
<td>NETL ($1,600, 00)</td>
<td></td>
</tr>
<tr>
<td>DW 2201</td>
<td>Heavy Viscous Oils PVT for Ultra-Deepwater</td>
<td>Schlumberger Limited</td>
<td>$460,000</td>
</tr>
<tr>
<td>DW 2301</td>
<td>Riserless Intervention System (RIS)</td>
<td>DTC International</td>
<td>$3,411,500</td>
</tr>
<tr>
<td>DW 1502</td>
<td>Coil Tubing, Drilling and Intervention Systems Using Cost Effective Vessel</td>
<td>Nautilus International, LLC</td>
<td>$820,000</td>
</tr>
<tr>
<td>DW 2501</td>
<td>Early Reservoir Appraisal, Utilizing a Well Testing System</td>
<td>Nautilus International, LLC</td>
<td>$880,000</td>
</tr>
<tr>
<td>DW 2502</td>
<td>MPD; Advanced Steady-State and Transient, Three-Dimensional, Single and</td>
<td>Stratamagnetic Software, LLC</td>
<td>$384,000</td>
</tr>
<tr>
<td></td>
<td>Multiphase, Non-Newtonian Simulation System for Managed Pressure Drilling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DW 2701</td>
<td>Resources to Reserves Development and Acceleration through Appraisal</td>
<td>TBA</td>
<td>$400,000</td>
</tr>
<tr>
<td>DW 2801</td>
<td>Gulf 3-D Operational Current Model Pilot</td>
<td>TBA</td>
<td>$1,248,000</td>
</tr>
<tr>
<td>DW 2901</td>
<td>Ultra-Reliable Deepwater Electrical Power Distribution System and Power</td>
<td>GE Global Research</td>
<td>$4,811,000</td>
</tr>
<tr>
<td></td>
<td>Components</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DW2902-02</td>
<td>Technologies of the Future for Pipeline Monitoring and Inspection</td>
<td>University of Tulsa</td>
<td>~ $150,000</td>
</tr>
<tr>
<td>DW2902-03</td>
<td>Wireless Subsea Communications Systems</td>
<td>GE Global Research</td>
<td>~ $150,000</td>
</tr>
<tr>
<td>DW2902-04</td>
<td>Replacing Chemical Biocides with Targeted Bacteriophages in Deepwater Pipelines and Reservoirs</td>
<td>Phage Biocontrol, LLC</td>
<td>~ $150,000</td>
</tr>
<tr>
<td>DW2902-06</td>
<td>Enumerating Bacteria in Deepwater Pipelines in Real-Time at a Negligible Marginal Cost Per Analysis: A Proof of Concept Study</td>
<td>Livermore Instruments, Inc.</td>
<td>~ $150,000</td>
</tr>
<tr>
<td>DW2902-07</td>
<td>Fiber Containing Sweep Fluids for Ultra-Deepwater Drilling Applications</td>
<td>University of Oklahoma</td>
<td>~ $150,000</td>
</tr>
</tbody>
</table>

- **Projects Total**: 15 Projects
- **Selected Projects**: 13 selected
- **Total RPSEA Share**: $12,542,500
2009 UDW Plan Strategy

- 6 Initiative-based RFPs (6 to 10 project awards)
- Unlike 2007 and 2008, UDW TACs have not voted for individual projects. Rather, the TACs prioritized project ideas by initiatives.
- This input was evaluated by the PAC to decide appropriate balance for 2009 UDW program.
- UDW 2009 RFPs will consist of both specific projects and broader initiative-based requests.
- Timing; anticipate release of RFPs September 2009 with 60 day clock, selection 1Q2010 and awards 2Q2010
## 2009 UDW Funding

### RPSEA YR3 Funding Allocation (2009)

<table>
<thead>
<tr>
<th>Need #</th>
<th>Title / Description</th>
<th>Low</th>
<th>High</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need #1</td>
<td>Drilling Completion and Intervention Breakthroughs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Drilling</td>
<td>2,000</td>
<td>5,000</td>
<td>3,500</td>
</tr>
<tr>
<td>2</td>
<td>Completions</td>
<td>1,000</td>
<td>3,000</td>
<td>2,000</td>
</tr>
<tr>
<td>3</td>
<td>Intervention (Downhole Services)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Intervention (In-Water IMR)</td>
<td>500</td>
<td>1,000</td>
<td>750</td>
</tr>
<tr>
<td>5</td>
<td>Extended Well Testing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need #2</td>
<td>Appraisal &amp; development geosciences and reservoir engineering</td>
<td></td>
<td></td>
<td>1,500</td>
</tr>
<tr>
<td>6</td>
<td>Reservoir Surveillance</td>
<td>1,000</td>
<td>2,000</td>
<td>1,500</td>
</tr>
<tr>
<td>Need #3</td>
<td>Significantly extend subsea tieback distances / surface host elimination</td>
<td></td>
<td></td>
<td>3,625</td>
</tr>
<tr>
<td>7</td>
<td>Stabilized Flow</td>
<td>750</td>
<td>1,500</td>
<td>1,125</td>
</tr>
<tr>
<td>8</td>
<td>Subsea Power</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Subsea Processing, Pressure Boosting, Instrumentation and Controls</td>
<td>2,000</td>
<td>3,000</td>
<td>2,500</td>
</tr>
<tr>
<td>Need #4</td>
<td>Dry trees / Direct well intervention and risers in 10,000’ wd.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Riser Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Dry Tree Structures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need #5</td>
<td>Continuous Improvement / Optimize field development</td>
<td></td>
<td></td>
<td>3,000</td>
</tr>
<tr>
<td>12</td>
<td>Long Term Research and Development and Graduate Student Program</td>
<td>1,000</td>
<td>2,000</td>
<td>1,500</td>
</tr>
<tr>
<td>13</td>
<td>Sensors, tools and Inspection Processes</td>
<td>1,000</td>
<td>2,000</td>
<td>1,500</td>
</tr>
<tr>
<td>14</td>
<td>Bridging and Contingency</td>
<td>500</td>
<td>750</td>
<td>625</td>
</tr>
<tr>
<td>Need #6</td>
<td>Associated Safety and Environmental Concerns</td>
<td></td>
<td></td>
<td>500</td>
</tr>
<tr>
<td>15</td>
<td>Environmental Issues</td>
<td>250</td>
<td>750</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>21,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14,875</td>
</tr>
</tbody>
</table>
2010 UDW RFPs

• ~ $15 million (RPSEA) + cost share available for project awards.

• Target funding of three to five large projects, with a value of $1 million to $5 million / project.
  • Additionally, a number of smaller awards averaging $150 - $300K thousand under Need 5: Continuous Improvement and Innovation.
  • Each project will have a duration of one to three years.

• Projects will be aligned with the six UDW needs.

• Project integration across multiple disciplines will be encouraged (e.g. geoscience, reservoir and drilling, or flow assurance and subsea).

• Proposed UDW 2010 RFPs can be categorized into three types:
  1. Next phase projects based on completed projects from the 2007 and 2008 program
  2. Specific project ideas to fill-in identified technical gaps
  3. Graduate student and innovative /novel projects
2010 UDW Activities

- Project management & technology transfer; 2007 and 2008 projects.

- Bid, review, select, negotiate & award 2009 projects

- Bid, review, select, negotiate & award 2010 projects

- Gather input, review and adjust as appropriate Program objectives and technology needs

- Prepare 2011 draft Annual Plan

- Collaborate with NETL Complementary and Metrics Program

- Address input & issues from FACA and government agencies (MMS, USCG, GAO, etc.) and NGOs
Technology Transfer Approaches

- Engagement of PAC and TAC Members
  - Project selection and review
  - Participation in field tests as “early adopters”
  - Quarterly TAC meetings are an important aspect of ongoing tech transfer
  - Working Committee (cost share partners)
- Active Coordination with NETL on Knowledge Management Database (KMD)
- RPSEA Website Enhancement
  - Project information
  - Program direction
- 2.5% set-aside for each subcontract
  - 1.5% Project Level
  - 1% Program Level
Project-Level Technology Transfer

- Funded by 1.5% Set-aside
- Managed by subcontractors (with RPSEA final approval)
  - Project-specific websites
  - Participation in conferences, workshops
  - Preparation of articles for journals, trade publications
Program-Level Technology Transfer

- Funded by 1% Set-aside
- Managed by RPSEA
  - Website Enhancements
  - Coordination with NETL KMD,
  - Events at Major Technical Conferences (SPE, OTC, SEG, etc.)
Questions?
Back-ups
### 2010 Consortium Process Timeline

<table>
<thead>
<tr>
<th>Month</th>
<th>-2</th>
<th>-1</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 Draft Plan Submitted (August 3, 2009)</td>
<td>♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan Published</td>
<td>♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plan Approved</td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obtain DOE Approval of Solicitation</td>
<td></td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solicitation Open Period</td>
<td></td>
<td></td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proposal Evaluation and Selection</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DOE Approval</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contract Negotiation and Award</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manage 2010 Awards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manage 2007, 2008 &amp; 2009 Awards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Report Program Deliverables</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduct Technology Transfer Workshops &amp; Activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Establish 2011 R&amp;D Priorities &amp; Annual Plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>♦</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## UDW Program status

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Universities</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>National Laboratories</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonprofit Corporation</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>For Profit Corporation</td>
<td>8</td>
<td>7</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geological Science</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>15</td>
<td>13 (+ 2 more pending)</td>
<td>0</td>
<td>RFP release 9/09</td>
</tr>
<tr>
<td>RPSEA approx. totals</td>
<td>$14.1MM</td>
<td>$12.5MM</td>
<td></td>
<td>$15MM</td>
<td></td>
</tr>
</tbody>
</table>

Secure Energy for America
UDW Program Process

Portfolio of Opportunities (Canopy, Coyote Gumout, Diablo)

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

Tech Themes & Drivers

Technology Needs

Tech Gaps & Solutions

Initiatives (Programs)

Roadmap

RFPs

Bid Eval & Rec

Projects

PAC $ Allocation (Guideline)

PAC Funding Decision

TAC Input

TAC Working Committee

TAC Working Committee

Secure Energy for America
Need 1: Drilling, Completion, and Intervention Breakthroughs
Proposals may be requested identifying novel ideas to reduce well construction and completion costs and funding follow-on recommendations from 2007 and 2008 projects.

Need 2: Appraisal and Development Geoscience and Reservoir Engineering
Proposals will be requested in the area of formation and reservoir characterization and/or surveillance. The goal of this effort is to reduce the amount of unproduced hydrocarbons upon well or field abandonment, contributing to increased recovery.

Need 3: Significantly Extend Subsea Tieback Distances/Surface Host Elimination
Proposals may be requested addressing follow-on recommendations from 2007 and 2008 projects. New 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
- AUV and intervention
- Subsea processing/produced water treatment
2010 UDW

Need 4: Dry Trees/Direct Well Intervention and Risers in 10,000 foot Water Depth
This need area was addressed in the 2007 and 2008 UDW. Next phase proposals may be requested addressing recommendations from the 2007 and 2008 projects

Need 5: Continuous Improvement and Innovation
Proposals in this need area may include:
- Advancing industry understanding of phenomena and science impacting ultra-deepwater operations
- Improvements in integrity management and reliability
- Additional graduate student and project funding
- Innovative technology high risk, high reward “long-shot” opportunities
Need 6: Associated Safety and Environmental Concerns

There is a tremendous amount of environmental research funded by the federal and state governments as well as private foundations. RPSEA will reach out to the environmental researchers and safety professionals, enabling them to understand the importance of their efforts with respect to U.S. domestic energy production. **RPSEA’s focus is on technology development** and, as such, RPSEA will be focusing efforts to ensure new technology developed within the program takes environmental impact and safety considerations into account. In accomplishing this, RPSEA will be seeking to leverage ongoing research efforts, and collaborate within existing forums and venues, and where possible integrate with ongoing UDW projects.

Areas of study may include:

- Discharge of produced water subsea – technology and regulatory aspects
- Environmental impacts associated with technologies addressed under other UDW needs
RPSEA DW 2001- Synthetic Benchmark Models of Complex Salt

**Description:** Develop one or more synthetic data models to be used to benchmark new processing methods and tools to image reservoirs under complex salt structures.

**Application:** This data set will enable the quality verification and testing of imaging tools with a known result.

**Objectives:**
This project will contribute to geophysical imaging technology evolution. It will provide realistic benchmark geological models and associated synthetic seismic together with potential field data.

**Value / Impact:**
These models will allow industry to effectively and efficiently assess seismic (and other) acquisition and processing techniques for generating images of hydrocarbon reservoirs beneath massive, complex salt bodies.

**Results / Accomplishment:** The deliverables include this benchmark data set to be used by the developers of complex seismic processing tools.

**Champion:** P Williamson (Total) & C. Meeder (Marathon)  
**Contractor:** SEAM  
**Budget:** $2,500,000  
**RPSEA:** $2,000,000
**Description:** Develop wax management technologies for use in cold slurry flow scenarios.

**Application:** Deepwater flowline tie-backs over long distances

**Objectives:** Evaluate and improve wax management technologies to:
- Minimize wall wax deposition rates.
- Improve techniques to effectively remove deposition.
- Improve cold slurry flow technologies as they apply to hydrates and waxes.

**Value / Impact:**
Will enable long distance tie-backs with bare steel flowlines with improved operational performance. Will not need expensive insulation or external heating.

**Results / Accomplishment**
Expect resulting technologies to deliver a true comprehensive cold flow strategy without pipe insulation.

Champion: G. Shoup (BP)  
Contractor: University of Utah  
Budget: $500,000  
RPSEA: $400,000
# RPSEA DW 1301- Improvements to Deepwater Subsea Measurement

<table>
<thead>
<tr>
<th>Description:</th>
<th>Perform six related tasks to improve subsea sensors and multiphase meter measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application:</td>
<td>Multiphase measurements are required for reservoir management and for fiscal allocation among various stakeholders.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objectives:</th>
<th>Improve reliable performance through:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Deepwater Sampling</td>
</tr>
<tr>
<td></td>
<td>• ROV-Assisted Metering (Check meter service)</td>
</tr>
<tr>
<td></td>
<td>• HP/HT Sensor Qualification</td>
</tr>
<tr>
<td></td>
<td>• Meter Alteration Effects</td>
</tr>
<tr>
<td></td>
<td>• Metering System Uncertainty</td>
</tr>
<tr>
<td></td>
<td>• Evaluation of Flow Modeling</td>
</tr>
</tbody>
</table>

| Value / Impact: | Improved monitoring enables greater reservoir recovery. |

| Results / Accomplishment: | A set of standards and designs will be produced and qualified to improve overall meter and sensor service. |

<table>
<thead>
<tr>
<th>Champion:</th>
<th>Robert Webb (BP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contractor:</td>
<td>Letton Hall Group</td>
</tr>
<tr>
<td>Budget:</td>
<td>$4,455,000</td>
</tr>
<tr>
<td>RPSEA:</td>
<td>$3,564,000</td>
</tr>
</tbody>
</table>
### RPSEA DW 1302- Ultra-High Conductivity Umbilicals

**Description:** Develop concepts and a plan-forward for deepwater power umbilicals

**Application:** Required to deliver large amounts of power subsea for major deepwater field developments.

<table>
<thead>
<tr>
<th><strong>Objectives:</strong></th>
<th>Conceptualize power umbilical technologies to increase power capacity and decrease size and weight of umbilicals. Technologies may include nano-tubes and other promising alternatives.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Value / Impact:</strong></td>
<td>Efficient delivery of subsea power is required for major deepwater developments.</td>
</tr>
</tbody>
</table>

**Results / Accomplishment:** Various technologies will be evaluated and a plan forward established to develop these efficient power umbilicals

<table>
<thead>
<tr>
<th>Champion: Akin Oke (CVX)</th>
<th>Contractor: Nano Ridge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget: $560,000</td>
<td>RPSEA: $448,000</td>
</tr>
</tbody>
</table>

Secure Energy for America
# RPSEA DW 1401- Composite Riser for Ultra-Deepwater High Pressure Wells

<table>
<thead>
<tr>
<th>Description:</th>
<th>Develop and qualify fiber reinforced XHP riser tubulars. Build prototypes for field trials in the GOM.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application:</td>
<td>Light weight tubulars for use in drilling and production service.</td>
</tr>
<tr>
<td>Objectives:</td>
<td>Determine, through large scale tests, if carbon fiber wrapped steel riser pipe (steel /composite hybrid) is suitable for long-term use in the harsh environment of deep water offshore</td>
</tr>
</tbody>
</table>
| Value / Impact: | Composite Risers expected to:  
- Water depth capability in excess of 10,000 feet  
- Operating pressure rating beyond 15,000 psia  
- Provide a 50% reduction in the in-water weight of a comparable steel riser |
| Results / Accomplishment: | Qualify design, fabrication and testing methodologies. Deliver some prototypes for field service in next phase. |

Champion: Roy Shilling (BP) & Tom Walsh (Shell)  
Contractor: Lincoln Composites  
Budget: $2,100,000  
RPSEA: $1,680,000
### RPSEA DW 1402- Ultra-deepwater Dry Tree System for Drilling and Production in GOM, Phase 1

**Description:** Conceptually design and evaluate 2 hulls and 2 payloads for dry-tree ultra-deepwater structures.

**Application:** Ultra-deepwater field developments with lower costs

**Objectives:** Define the potential and gaps for developing a dry tree semi or similar hull to a feasible and competitive floater solution for GOM in 8,000 ft water depth with moderate to large payloads

**Value / Impact:** The market is currently limited to a single concept. A competitive alternative will spur improvement and cost reduction in current dry tree hosts for ultra deep water.

**Results / Accomplishment:** Designs, trade-offs, cost estimates, model tests, workshops and Phase 1 project documentation will be produced.

**Champion:** Paul Devlin (CVX); Shell & Statoil

**Contractor:** FloTech/ Houston Offshore

**Budget:** $1,170,000

**RPSEA:** $936,000
# RPSEA DW 1403- Fatigue Performance of High Strength Riser Materials

## Description:
Measure fatigue and crack growth properties for high strength steels and newer materials to qualify them for deepwater riser service.

## Application:
Ultra-deepwater Riser service optimized for weight and strength

## Objectives:
Address fracture toughness, crack growth and S-N curve tests on strip specimens of riser materials. Stress corrosion cracking (SCC) and HEE would also be conducted for simulated service conditions.

## Value / Impact:
Prequalification of high strength materials for risers will enable deepwater riser development and reduce the risk for use of such materials.

## Results / Accomplishment:
Design information detailing fatigue crack growth rates and SN curves for the materials tested.

Champion: Himanshu Gupta and Steven Shademan (BP)  
Contractor: SwRI  
Budget: $1,000,000  
RPSEA: $ 800,000
<table>
<thead>
<tr>
<th>Description:</th>
<th>Conceptualize new integrated drilling, completion and production technologies which are capable up to a 20 mile offset reservoir development.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application:</td>
<td>Any location where vertical surface reservoir access may be limited.</td>
</tr>
<tr>
<td>Objectives:</td>
<td>Start with “clean” paper, establish a design basis and then conceptualize and document the required facilities and all operating procedures for reservoir development scenarios having offsets up to 20 miles</td>
</tr>
<tr>
<td>Value / Impact:</td>
<td>Grand Challenge programs focus innovative (out-of-the-box) thinking having potential to enable some field developments or to reduce the cost of existing methods.</td>
</tr>
<tr>
<td>Results / Accomplishment:</td>
<td>A conceptual design defining new (breakthrough) technologies offering alternative methods for satellite marginal field developments.</td>
</tr>
<tr>
<td>Champion:</td>
<td>Phil V. Clark (CVX)</td>
</tr>
<tr>
<td>Contractor:</td>
<td>Tejas</td>
</tr>
<tr>
<td>Budget:</td>
<td>$250,000</td>
</tr>
<tr>
<td>RPSEA:</td>
<td>$200,000</td>
</tr>
</tbody>
</table>
RPSEA; Graduate Student Design Projects

DW 1603 – Design investigation xHPHT, SSSV; Rice University

DW 1603 b – Robotic MFL Sensor; monitoring & inspecting risers; Rice University

DW 1603 c – Hydrate Plugging Risk; Tulsa University

DW 1603 d – Hydrate Characterization & Dissociation Strategies; Tulsa University
## RPSEA DW 1701-Improved Recovery (Reservoir)

**Description:** Systematically determine the potential and technical gaps to the application of improved reservoir recovery technologies to deepwater GOM.

**Application:** Improve recovery factors from the 15-25% currently achieved in these GOM reservoirs.

| Objectives | Perform initial 2 phases of a 5 phase program to improve recovery factors. Document the incentives and technical needs for improving recovery. Establish baseline information. High grade applicable recovery techniques through analogue studies and lab tests. |
| Value / Impact | Determining effective recovery techniques early allows field developments to be configured to implement the technologies. |

**Results / Accomplishment:** Characterize reservoirs by category, reserves, and recovery factor and estimate improved recovery potential. Identify the causes of trapped reserves and techniques (with gaps) to improve recovery. Plan next phases to close gaps and validate effectiveness of IOR.

| Champion: Anadarko/Chevron/Total/BP | Contractor: Knowledge Reservoir |
| Budget: $2,000,000 | RPSEA: $1,600,000 |
**Description:** Using recent models hindcast hurricane activity and then under different scenarios forecast hurricane impact and compare to GOM facility design criteria.

**Application:** Determine if GOM facility design criteria is adequate for different weather scenarios.

**Objectives:** Assess the threat that global warming will increase Gulf hurricane activity. Perform a sensitivity study to better understand the factors governing wave generation in very severe hurricanes.

**Value / Impact:** Most hurricane impacts could be mitigated with proper planning provided we know far enough in advance what to expect.

**Results / Accomplishment:** Two reports, one documenting the climate modeling and the other, the wave modeling.

**Champion:** C Cooper (CVX) & D Driver (BP)

**Contractor:** UCAR

**Budget:** $700,000

**RPSEA:** $560,000
# RPSEA DW 1901- Subsea Processing System Integration Engineering

**Description:** Identify and address the technologies and any gaps for the Coyote field development using subsea production technology.

**Application:** Risk reduction through facility Design for Reliability will improve SS processing field development utilization.

| Objectives: | Through field development studies demonstrate the facility arrangements and technical readiness levels of SS production systems. Determine field economics and how future expansion of SS system would enhance development. |
| Value / Impact: | Integrates existing SS Processing work to demonstrate readiness and risk levels. Areas needing further work will be identified. |

**Results / Accomplishment:** SS Processing field development studies using Design for Reliability techniques will quickly demonstrate the technology readiness and directions for any more work.

Champion: C Haver (CVX)  
Contractor: GE  
Budget: $1,500,000  
RPSEA: $1,200,000
# RPSEA DW 1902- Deep Sea Hybrid Power Systems (Initial Study)

**Description:** Evaluate various seafloor based power production facilities to support field developments.

**Application:** SS power generation may power SS production facilities and has potential to produce environmentally friendly power for surface facilities.

**Objectives:** Perform a feasibility assessment of various SS based generation and energy storage devices capable of providing power as required by production facilities.

**Value / Impact:** Improves potential for standalone SS developments. May provide environmentally friendly power to surface facilities. Such seabed facilities would reduce facility topside loads.

**Results / Accomplishment:** A technical screening of alternative power systems complete with a risk assessment will recommend a suitable system. Further development plans will be prepared.

<table>
<thead>
<tr>
<th>Champion</th>
<th>Contractor</th>
<th>Budget</th>
<th>RPSEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>C Haver (CVX)</td>
<td>HARC</td>
<td>$600,000</td>
<td>$480,000</td>
</tr>
</tbody>
</table>