



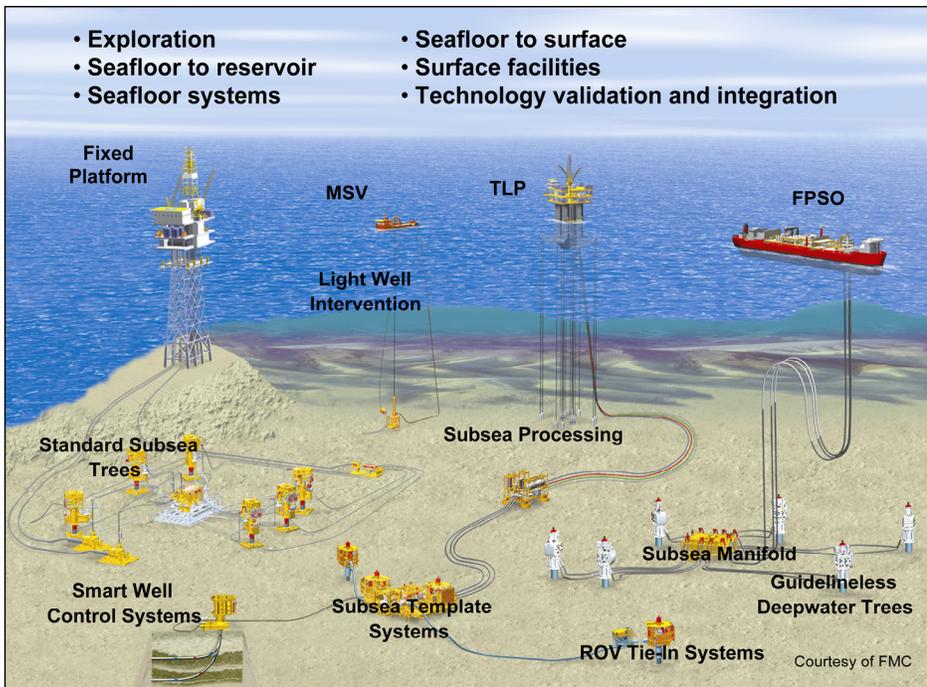
the **ENERGY** lab
PROGRAM FACTS

Strategic Center for
Natural Gas & Oil

Offshore Research Program

The Department of Energy's (DOE) Office of Fossil Energy (FE) supports research and policy options to ensure clean, reliable, and affordable supplies of oil and natural gas for American consumers. The National Energy Technology Laboratory's Strategic Center for Natural Gas and Oil (NETL/SCNGO) implements a portfolio of FE research & development (R&D) programs aimed at protecting the environment while enhancing domestic oil and gas exploration and production. These R&D portfolios include research conducted by NETL-ORD as well as extra-mural projects awarded through competitive solicitations.

Natural gas and crude oil provide approximately two-thirds of our Nation's primary energy supply and will continue to do so for at least the next several decades as the Nation transitions to a more sustainable energy future. The oil and gas resource estimated to exist within the United States (U.S.) has expanded significantly, but because much of this off-shore resource is increasingly harder to locate and produce, such as the current subsalt lower tertiary play, new technologies are required to safely extract it. Challenges associated with this play, such as high temperature and high pressure (HPHT) conditions, geohazards and the need for sophisticated subsalt seismic imaging, are just part of what causes the resource to be increasingly difficult to discover and develop with existing technology, even at current prices.



Offshore Operations: High Risk/Complexity

CONTACTS

Roy Long

Offshore Technology Manager
Strategic Center for Natural Gas & Oil
281-494-2520
roy.long@netl.doe.gov

Kelly Rose

Offshore Technical Portfolio Lead
Office of Research and Development
541-967-5883
kelly.rose@netl.doe.gov

William Fincham

Project Manager
Natural Gas & Oil Project Management
Division
304-285-4268
william.fincham@netl.doe.gov

Jared Ciferno

Director
Strategic Center for Natural Gas & Oil
412-386-5862
jared.ciferno@netl.doe.gov

Elena Melchert

Division Director
Office of Oil & Gas
202-586-5095
elena.melchert@hq.doe.gov

NATIONAL ENERGY TECHNOLOGY LABORATORY

Albany, OR • Anchorage, AK • Morgantown, WV • Pittsburgh, PA • Sugar Land, TX

Website: www.netl.doe.gov

Customer Service: 1-800-553-7681



U.S. DEPARTMENT OF
ENERGY

The current Offshore Program builds on the *Ultra-Deepwater and Unconventional Natural Gas and Other Petroleum Resources Research (UDW) Program* launched in 2007 by EPOA 2005. This public/private partnership was designed to benefit consumers by developing environmentally-friendly technologies to increase America's domestic oil and gas production while reducing the nation's dependency on foreign imports. Subsequent to the Macondo incident, the UDW Program became focused on safety and environmental sustainability. This mission and synergistic research to support the DOE/ Bureau of Safety and Environmental Enforcement's (BSEE) Memorandum of Collaboration (MOC) form the basis of the new Offshore Program.

Contracted Research

Although the Title IX, Subtitle J, Section 999 of the Energy Policy Act of 2005 (Sec.999) was rescinded by Congress with passage of the FY14 budget, projects will continue through September 2016. The Offshore Program is organized under the following four technology areas that support a Safety and Environmental Sustainability focus:

1. Geologic Uncertainty

- Providing prediction and early detection of subsurface conditions and geohazards

2. Drilling & Completion Systems

- Reducing operations risk and supporting informed decision-making

3. Surface Facilities & Umbilicals

- Improving systems and performance for extreme environments

4. Subsea Systems Reliability

- Improving systems reliability through automation and advanced technology

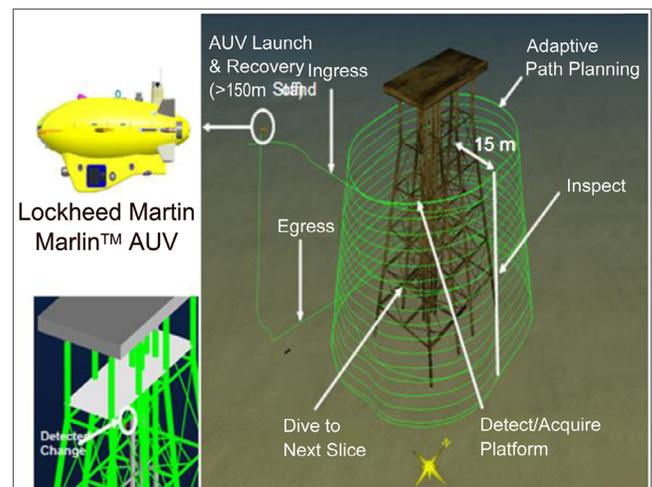
During the Sec. 999 Program, the bulk of the projects dealt with the two facility-focused areas: (1) Surface Facilities & Umbilicals and (2) Subsea Systems Reliability. Going forward, the Program expects to increase and emphasize focus on the two operation-focused topic areas: (1) Geologic Uncertainty and Drilling and (2) Completion Systems.

The current contracted portfolio has approximately 39 projects total distributed by project year as follows:

2008	2009	2010	2011	2012	Total
4	3	18	6	8	39

Approximately one-third of these are expected to continue until September 2016. The entire portfolio over all the years represents a DOE investment of almost \$114 million.

Numerous projects have achieved commercialization and made an impact on industry. Most notably, Lockheed Martin's Autonomous Utility Vehicle (AUV), in combination with 3D at Depth's laser imaging system, is providing next generation capabilities in underwater metrology. Continuous measurements to the millimeter scale suitable for engineering as-built drawings and detailed change analyses are now possible.



Lockheed Martin's Marlin™ AUV: Next Generation Subsea Metrology

In-house Research

The in-house Offshore R&D Program is implemented by NETL-ORD as directed by the DOE-FE in support of the DOE/BSEE MOC for offshore R&D collaboration. Following the Macondo incident, the program focused on reducing uncertainty and defining technology gaps related to extreme offshore activities. This includes developing tools, approaches, and data needed to provide a robust foundation for risk assessments to support scientifically based decision making, such as regulatory and future R&D decision making.

The current in-house Offshore R&D Program portfolio is divided into the following topic areas and projects:

• Wellbore Integrity – Improved Science Base of Materials:

- Characterizing the Behavior of Metal-Based Systems Used for Control Devices in Extreme Environments
- Improving Science-Base for Wellbore Integrity, Foam Cements
- Evaluation of Wellbore Integrity in Extreme Offshore Systems

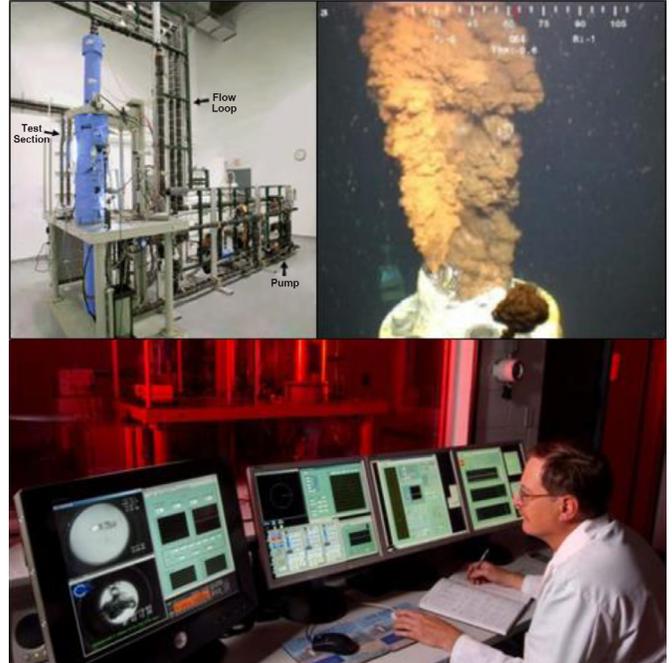
- **Risk Reduction – Mitigating Knowledge & Knowledge Gaps in Offshore Systems:**
 - Quantifying Complex Fluid-Phase Properties at HPHT
 - Assessing Risks and the Potential for Environmental Impacts Associated with Offshore Hydrocarbon Resource Development
- **Rapid Detection and In Situ Characterization – Improving Safety:**
 - Improving deepwater drilling safety through enhanced understanding of multiphase flow dynamics of hydrocarbon mixtures
 - Kick Detection at the Drill Bit – Adaptation of Existing Technology to Reduce Risks Associated with Offshore Drilling

Looking Ahead

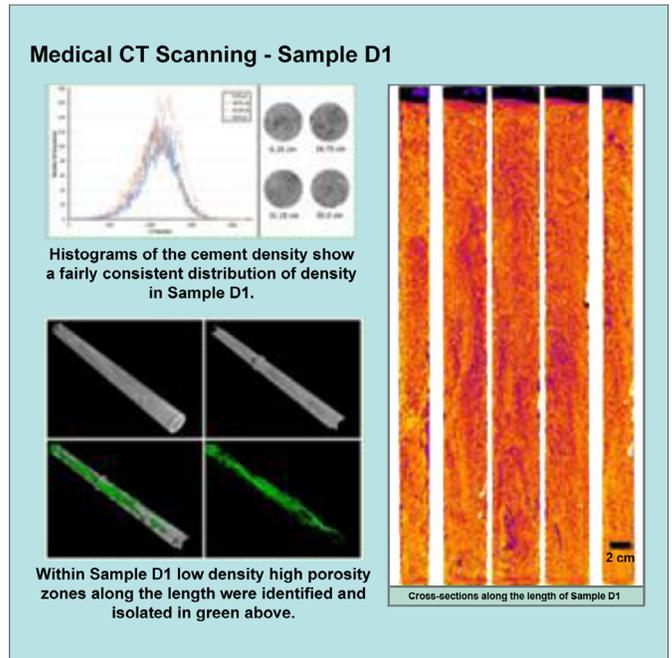
As previously noted going forward, the Program is increasing its focus on two operations topic areas: (1) Geologic Uncertainty and (2) Drilling and Completion Systems.

In-house R&D is expected to take a strong lead in this research, building upon the work ongoing in their current suite of projects, and leveraging areas of mutual interest between DOE and other agencies, such as the existing coordination between DOE and BSEE. The projects will continue to support risk reduction through a focus on spill prevention (e.g., ORD’s Integrated Risk Assessment Modeling study).

It is anticipated that the Program will also leverage the resources of NETL’s coordination-collaboration system, the Energy Data Exchange (EDX). EDX is a data curation system, tool to rapidly search and find authoritative data from key outside sources, and coordination/collaboration system. Research data, analytical tools, and other results from the Program’s Offshore R&D are made available via EDX when ready for public dissemination. The data, tools and capabilities of EDX are gaining increased use and interest from DOE users and collaborators of DOE. It is expected that the risk assessment modeling tools, approaches, and datasets, which include connections to authoritative datasets from other agencies (e.g., BSEE and BOEM) will be utilized by the Offshore Program and other stakeholders to reduce knowledge gaps, identify technology needs, and guide science-based decision making. The modeling system includes tools and data spanning the subsurface, wellbore, and water column systems, allowing for individual systems evaluation, and in the future, is staged to support integrated system assessments for a variety of needs.



Lab and field resources related to quantification and characterization of hydrocarbon plumes



Offshore foam cement integrity research results, including CT images of samples analyzed by ORD

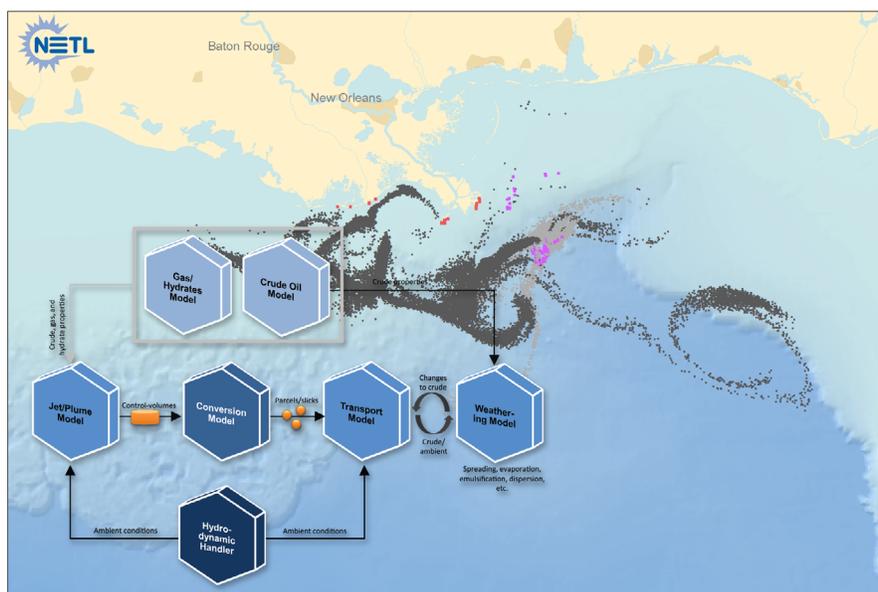
In addition to the data from DOE and other authoritative government sources, the water column portion of this system will be enhanced by the Metocean JIP Projects.

Another significant growth area in the Program going forward will be expansion of the Foam Cement JIP and additional cement studies focused on minimizing risk involved with developing these essential barriers. The outputs from all of these studies are incorporated in the Integrated Risk Assessment Model.

This model is graphically shown in the Geocube GIS System. Additional information on these projects is available on NETL's Energy Data Exchange (EDX) website <https://edx.netl.doe.gov/offshore/>.



EDX homepage, <https://edx.netl.doe.gov>



Map of hypothetical spill simulation and trajectory analyses in support of risk modeling for spill prevention