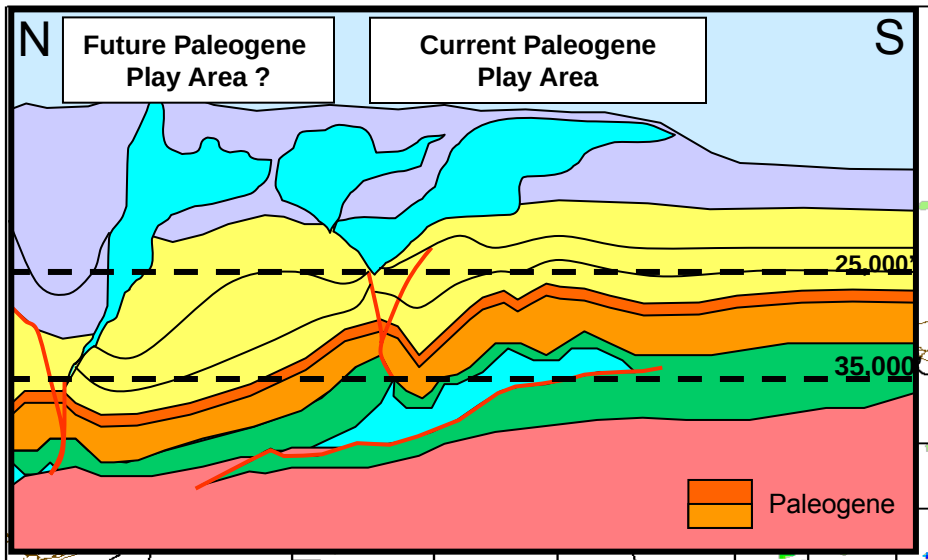
MMS Workshop

Unlocking Technology and Geologic Challenges in the GoM

January 2008

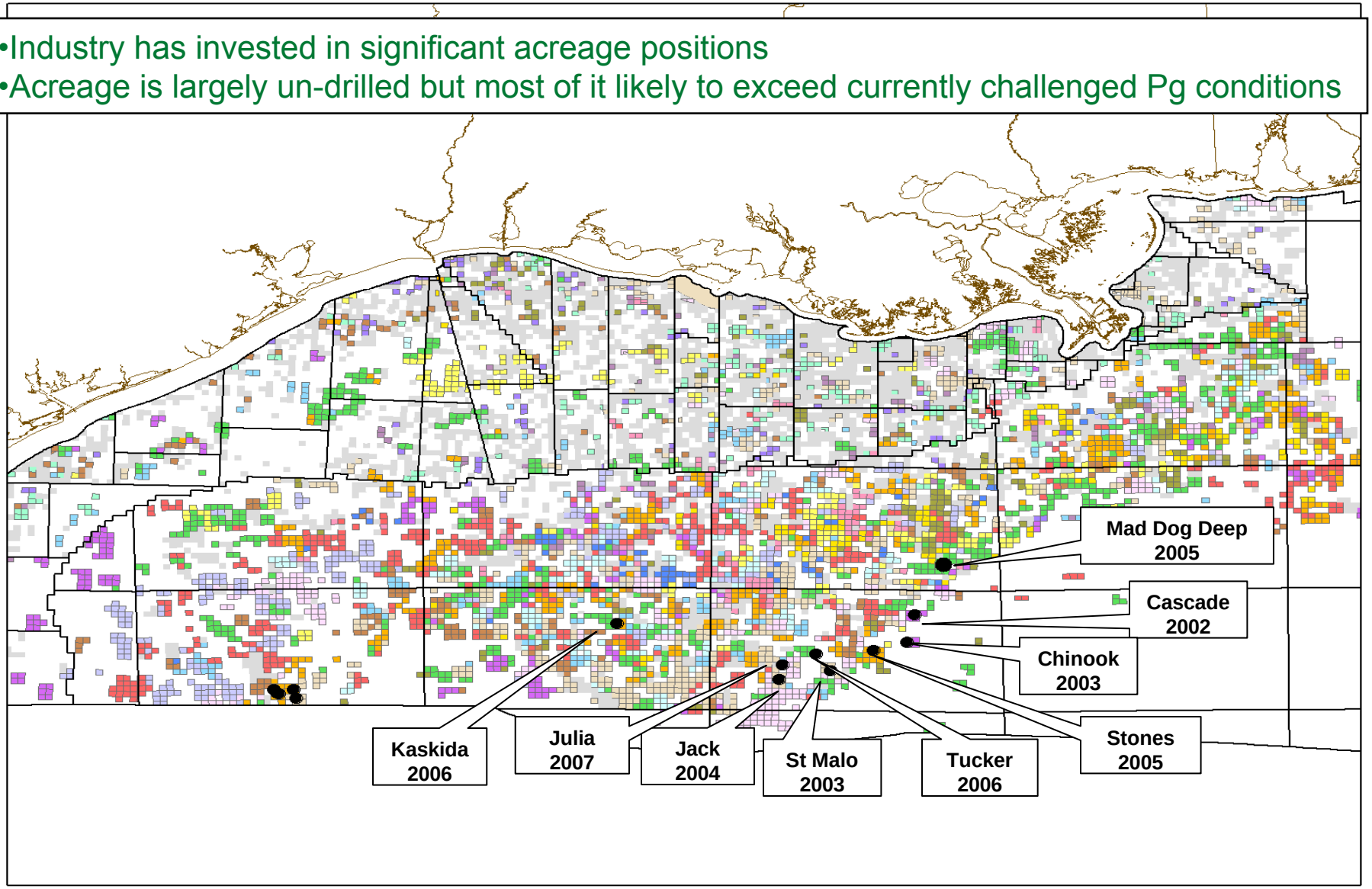
MMS Questions: Is this Concept Warranted?
Paleogene: A Challenging Opportunity



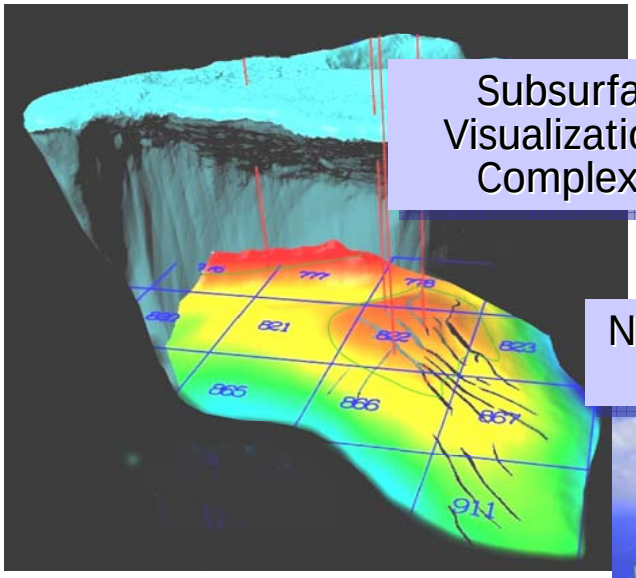
- Most activity and discoveries are along the southern extent of the Paleogene Trend
- Moving to the North it will be potentially Deeper, hotter and higher pressure more difficult seismic imaging, more structurally complex

MMS Questions: Is this Concept Warranted?
Paleogene: A Challenging Opportunity

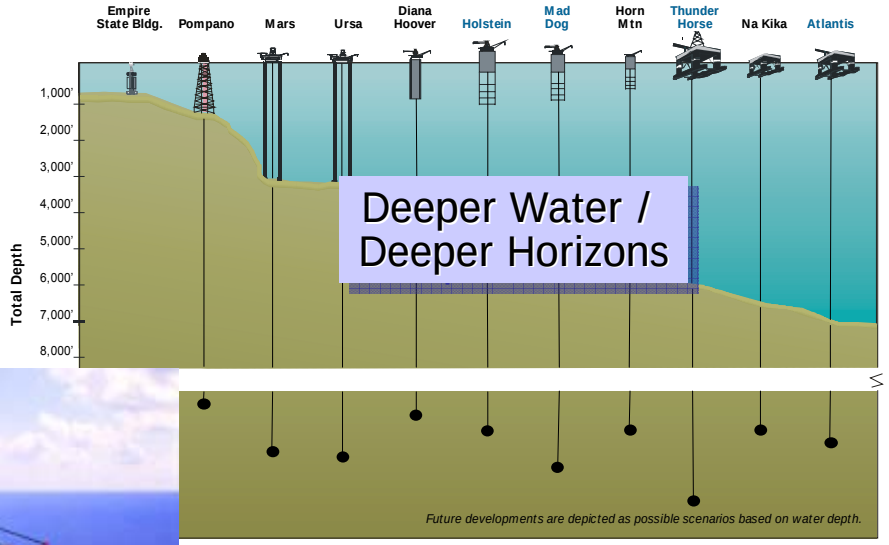
- Industry has invested in significant acreage positions
- Acreage is largely un-drilled but most of it likely to exceed currently challenged Pg conditions



The Future Portfolio: Technology Drivers

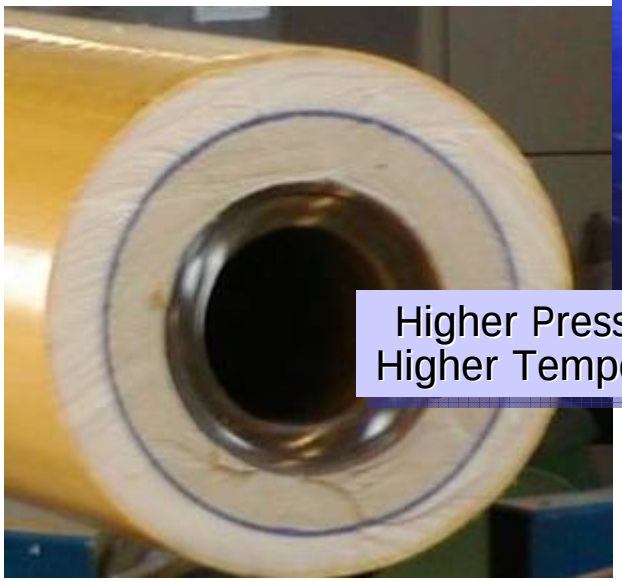


Subsurface Visualization & Complexity

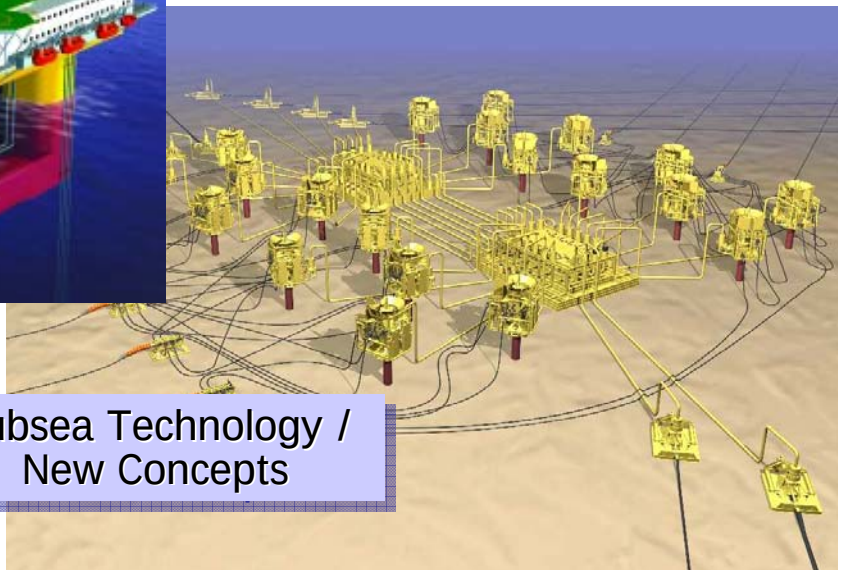


Deeper Water / Deeper Horizons

New Generation Rigs



Higher Pressures / Higher Temperatures



Subsea Technology / New Concepts

How would MMS define “Technological Challenge”?
Emerging Technology Themes for the Paleogene

Theme	Condition	Concerns and Gaps
Reservoir Depth & Pressure	>20k psi @ reservoir 15k psi @ seafloor >25-35k ft TVD	Completion technologies Intervention techniques
		Subsea Equipment & Dry tree riser & rig loads
Seismic Imaging	Subsalt	Advanced seismic techniques, limited capabilities, timeliness
Fluid & Rock Properties	Viscous fluids & low perm: Requires - High drawdown, downhole artificial lift, WF/EOR	Completion design & integrity, Zonal isolation, Artificial Lift integration, Injection pressures
Remoteness	Lack of export infrastructure	Crude Pipeline challenges, tankering, gas balance.
Temperature	<300° F @ Reservoir	Existing Technology
Water Depth	6,000 - 9000 ft.	Existing Technology

+

No Existing Production Analogs

Key Focus Appraisal Areas:

- Static - Wells & Advanced Seismic
- Dynamic Flow Testing - Rate/Recovery
- Appraisal & Development Technology

How would MMS define "Technological Challenge"?
Emerging Technology Themes for the Paleogene

Lessee must demonstrate that project requirements are beyond traditional appraisal /development.

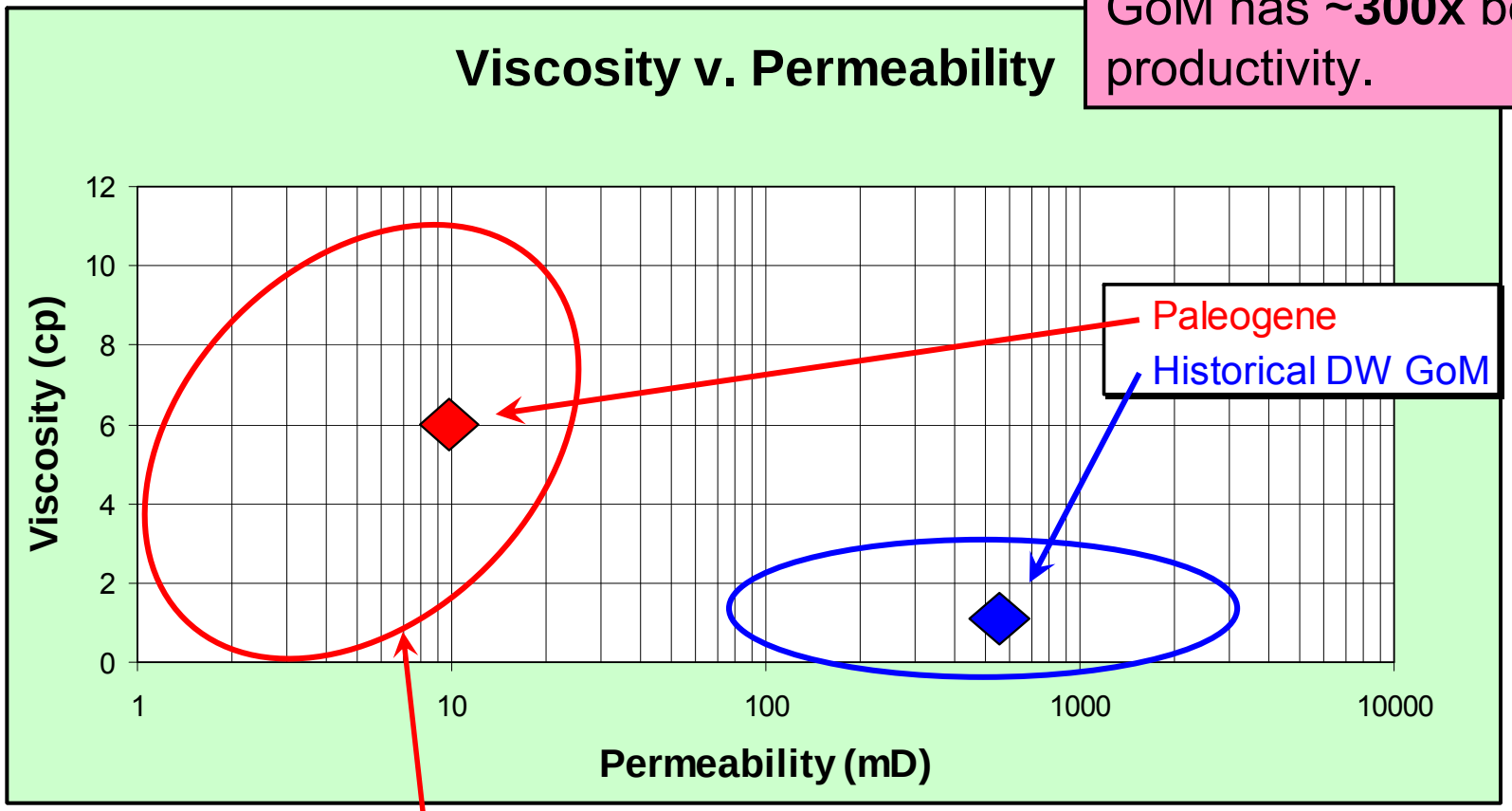
One or more of these 5 technical challenges creates the need for regulatory flexibility:

- Quantitative – Beyond current industry capability
  - HP – High Pressure > 15k psi @ seafloor or > 20k psi @ reservoir
  - HT – High Temperature > 350° F
  - Extreme Depth >25,000' subsea
- Qualitative
  - Rate/Recovery Challenges – Rock & Fluid Properties
  - Severe Seismic Imaging Challenges

How would MMS define "Technological Challenge"?
Emerging Technology Themes for the Paleogene

Rate and Recovery

Current Producing DW GoM has **~300x** better productivity.

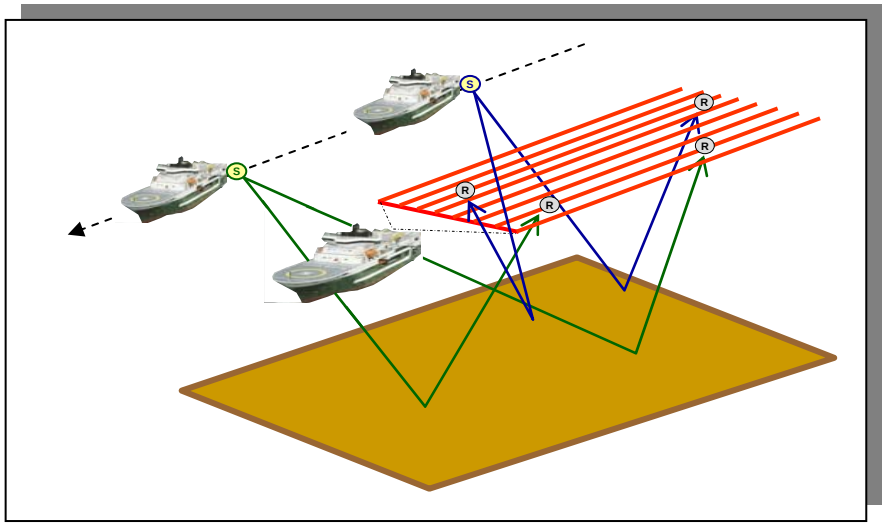


There are no production analogs for these conditions!

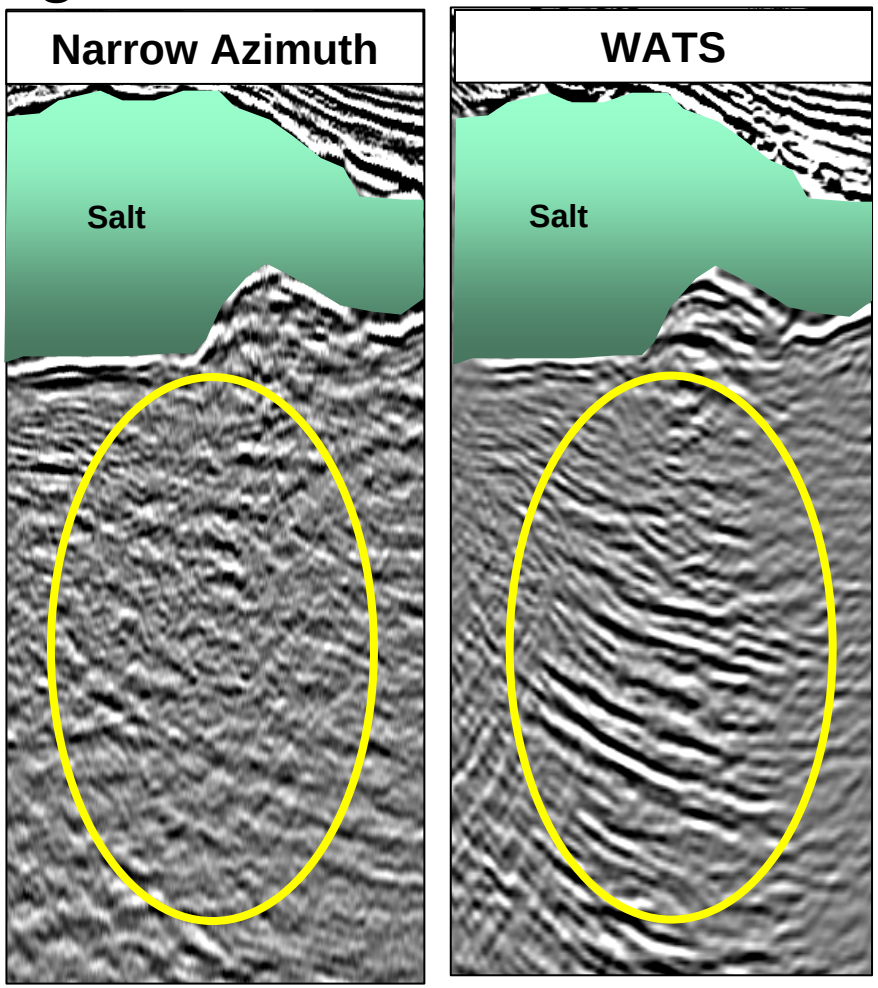
How would MMS define “Technological Challenge”?

Emerging Technology Themes for the Paleogene

Seismic Imaging



To address the challenging imaging issues, a Wide Azimuth Towed Streamer (WATS) survey takes ~ 4 years to plan, acquire, process and interpret.



WATS Imaged parts of the Field previously hidden!

Response to Remaining MMS questions

- **What other eligibility criteria should be considered?**
  - Discovery made prior to application

- **What would tangible/observable milestones be for technology development related to a lease?**
  - Detailed Activity Schedule of investment and activity commitments addressing the technological challenges
  - Approved by the MMS and updated regularly to demonstrate progress
  - Schedule milestones could include, but not limited to, the planning and execution of:

Milestones:

- Advanced seismic acquisition or processing
- Appraisal wells, sidetracks, deepenings, whole cores
- Dynamic well testing
- Technology development
  - Feasibility study
  - Preliminary engineering design
  - Detail engineering design
  - Prototype testing
  - Field trial
- Equipment commitments

Response to Remaining MMS questions

- **How long should such a suspension last, and should it be renewable?**
  - On the project level, the length should be covered by the Activity Schedule
  - Periodic reviews will address progress toward the technological challenges
  - Suspension should be renewable/revisable based on results from activities

Conclusion:
Challenges of Unlocking New Provinces in GoM

- The MMS and industry have a proven track record of collaboration in successfully meeting technology challenges in the Gulf of Mexico and can mutually benefit from a flexible regulatory framework as challenges arise
- An orderly appraisal program which considers dynamic testing and technology development is the key to delivering development.
  - Decreased cycle time to first oil
  - Enable technology development that will help unlock the next generation of resource development for the country.
  - Enable the pursuit of proper activities on a prioritized schedule without having to make inefficient drilling and/or premature exit decisions.
  - Allow for the most efficient allocation of scarce resources in service of technology development to enable earlier delivery of oil and gas production.
  - Ensure the activities undertaken are consistent with goals of natural resource conservation and fulfill the express purpose of the OCS Lands Act