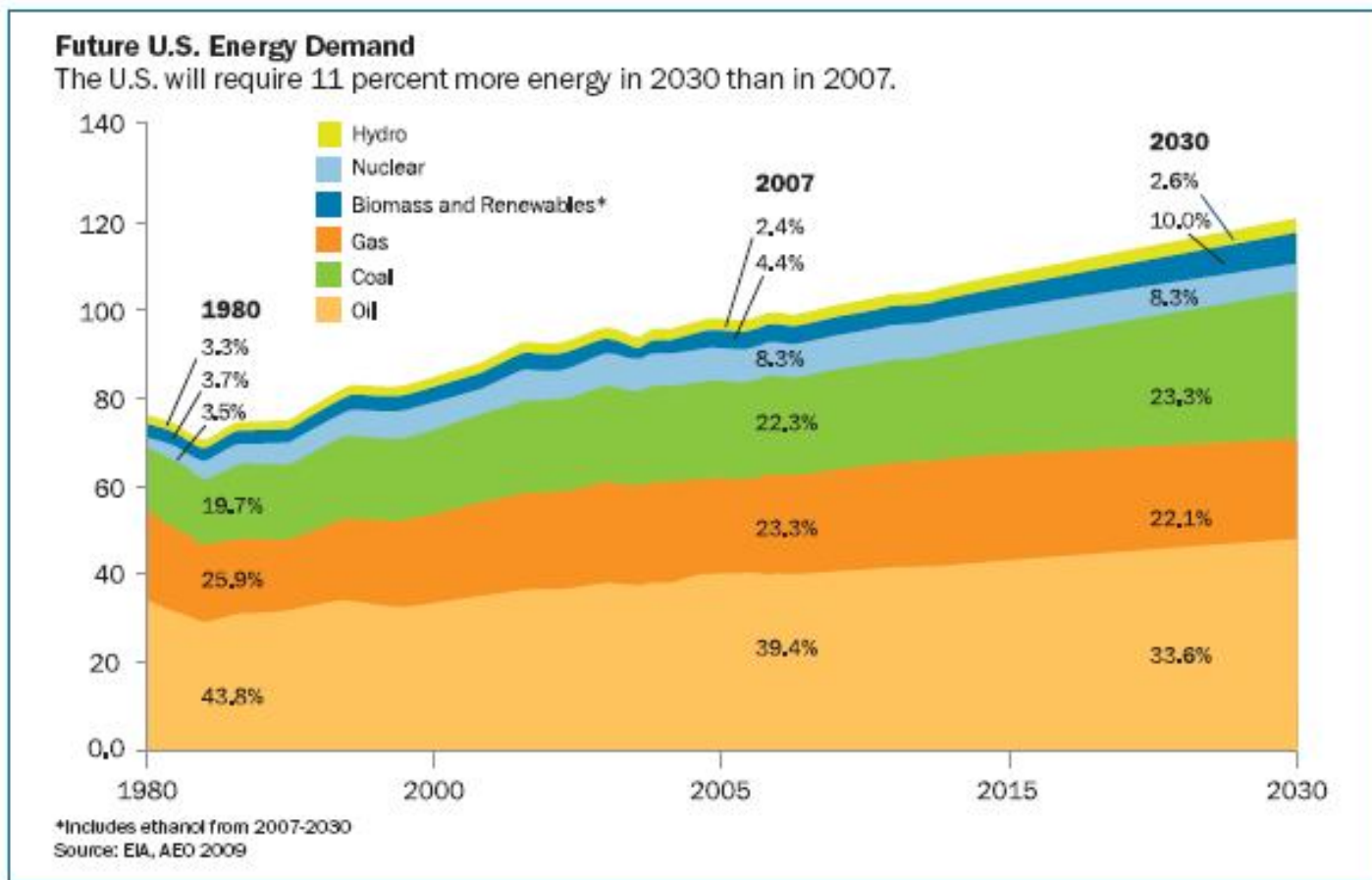


# State of North Carolina Legislative Research Commission Advisory Subcommittee on Offshore Energy Exploration

Andy Radford  
American Petroleum  
Institute

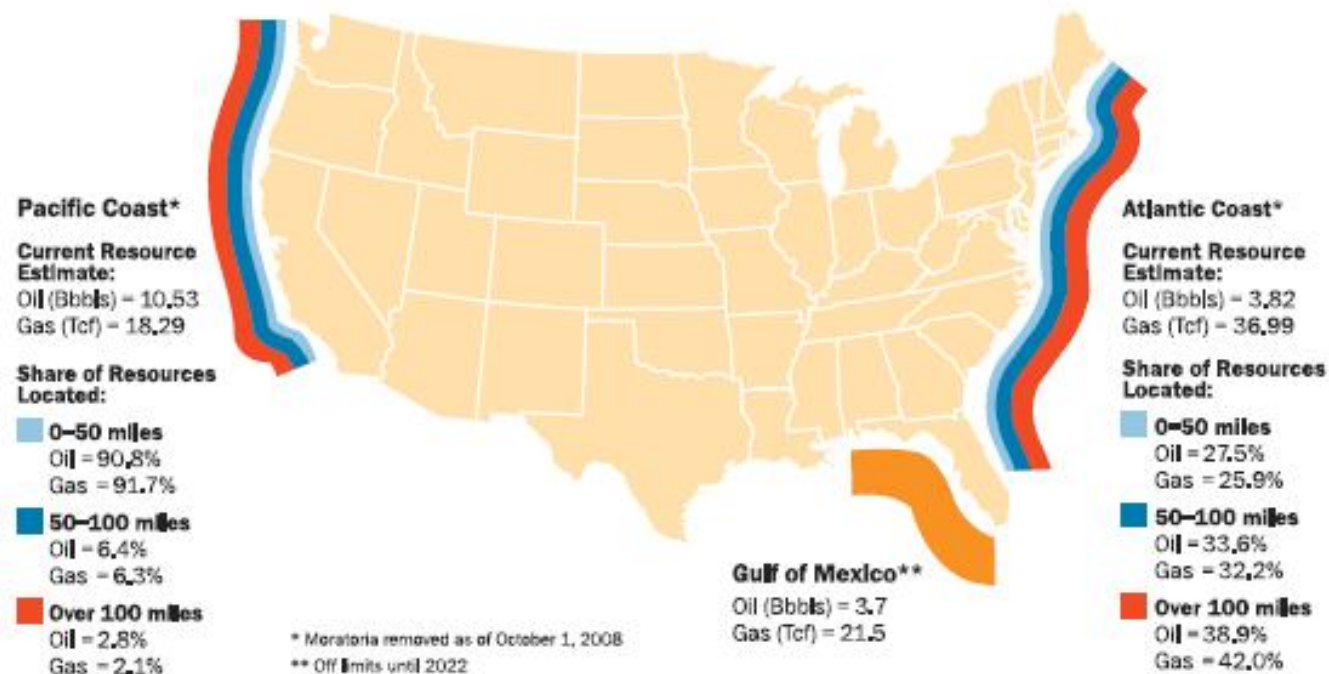
April 15, 2009

# Why we need additional sources of oil and natural gas



# Where might we find additional reserves?

## OCS Lower 48 "Moratoria" Resources (Undiscovered, Technically Recoverable Federal Resources)



Source: API projections based on MMS resource estimates by water depth for the Outer Continental Shelf.



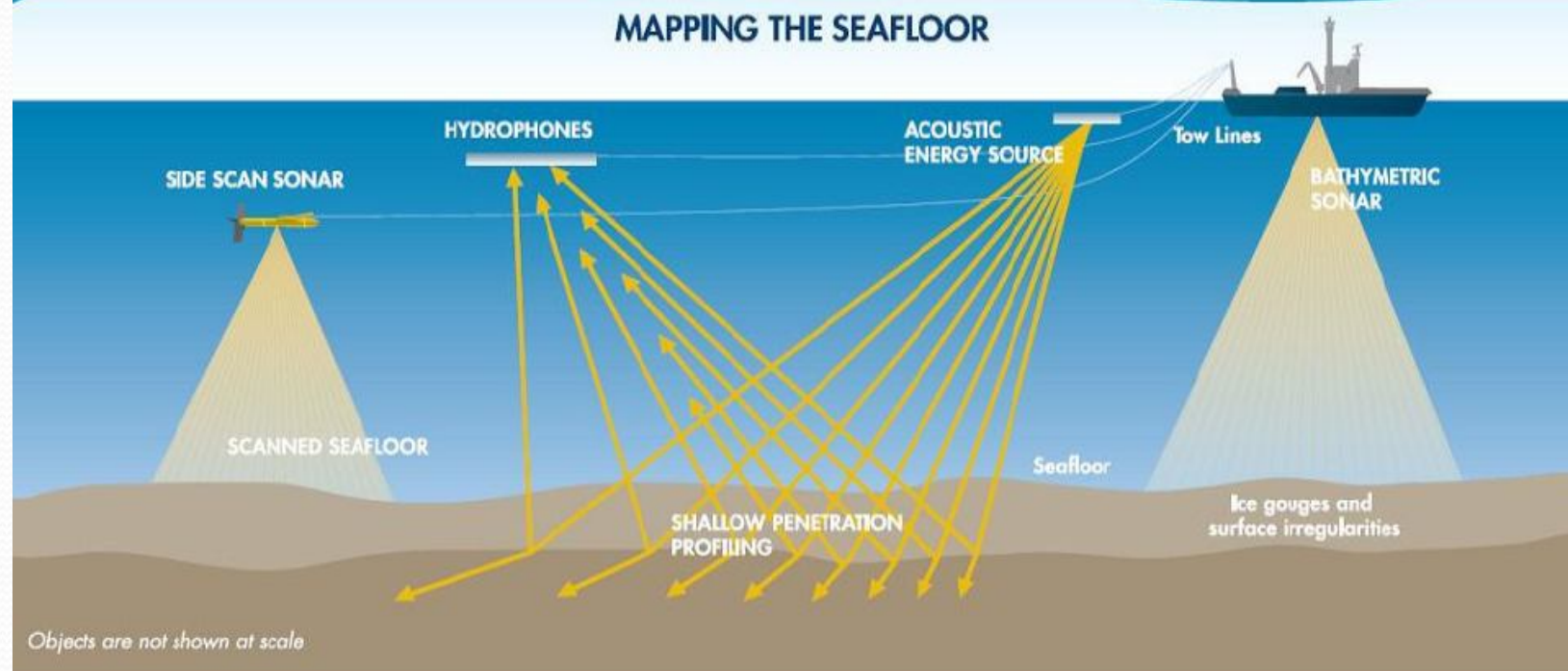


# Technological Advances

- Equipment Materials
  - Ability to withstand higher temperatures and pressures
- Computing Power
  - Rapid detection and reaction
- Waste Management Practices
  - Produced Water discharge oil and grease limits
  - Drilling and other fluid discharge limits
- Shallow Hazard Identification



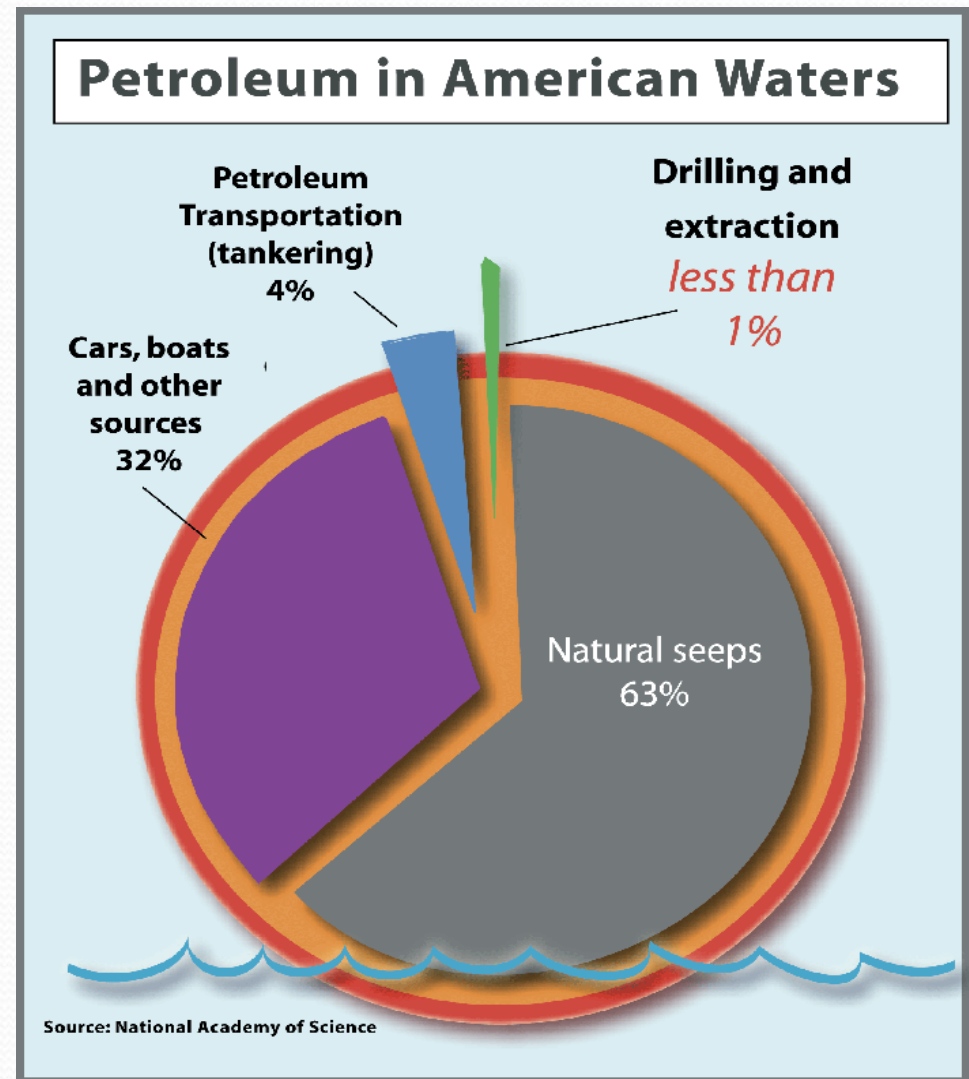
# Shallow Hazards Surveys



State-of-the-art technology is used to determine the best surface locations to drill

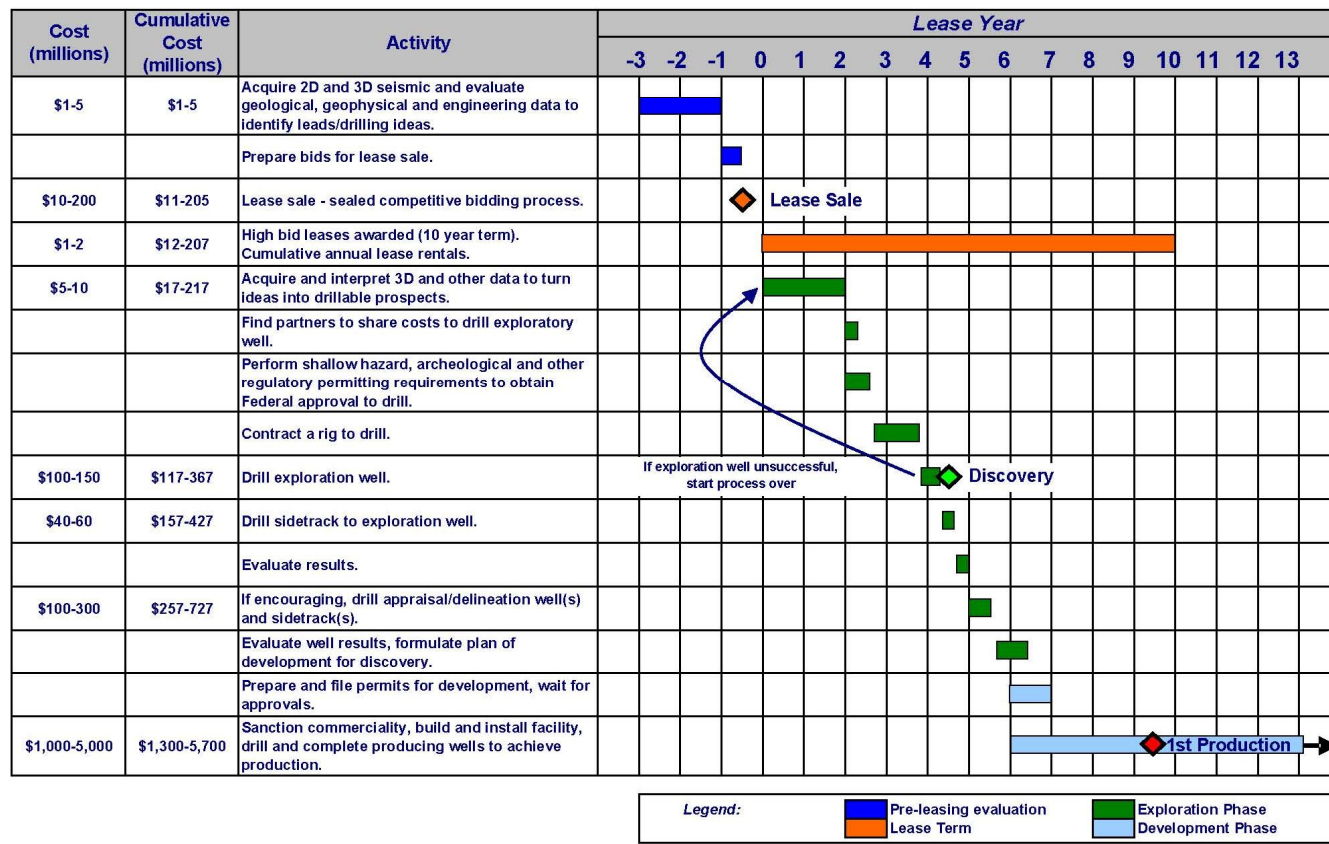
# Environmental Performance

- Enviably Record of Environmental Performance
- Continuous improvements in safety and environmentally sensitive operations
- MMS conducts 12,000 inspections annually
- 2005/2008 hurricanes demonstrate resilience



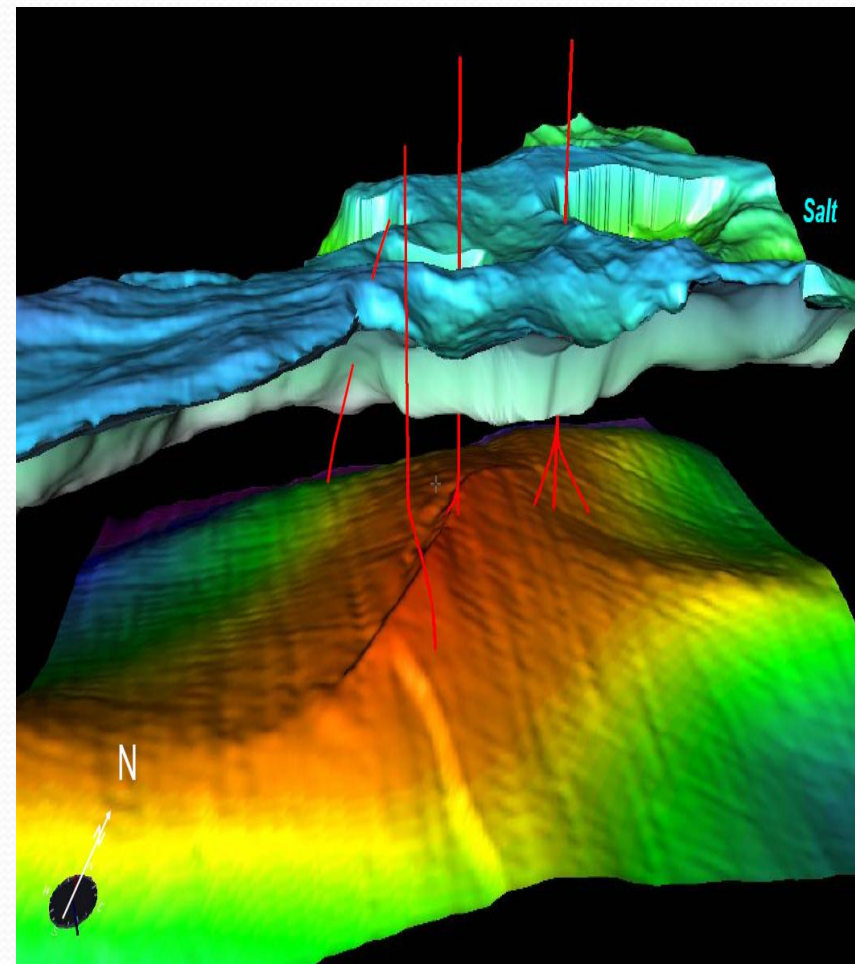
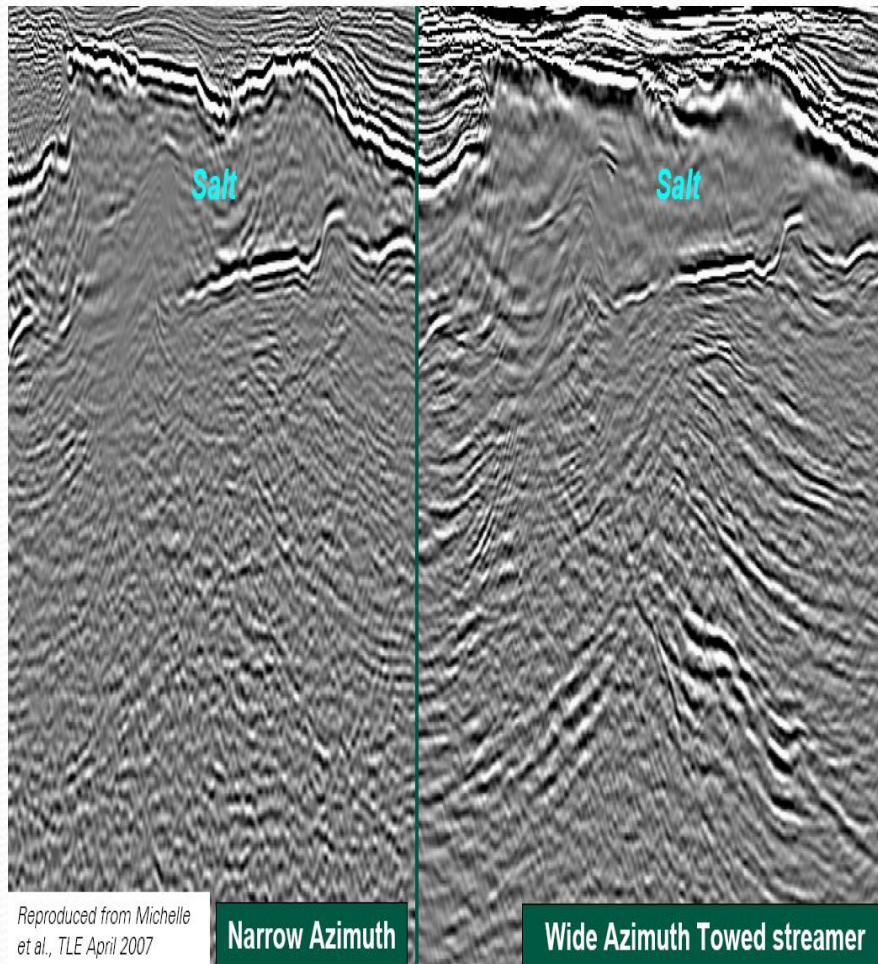
# Offshore Project Timeline

## Gulf of Mexico Deepwater Frontier Exploration and Production Timeline Individual Prospect: 5,000' Water Depth, 30,000' Drilling Depth





# Seismic Imaging



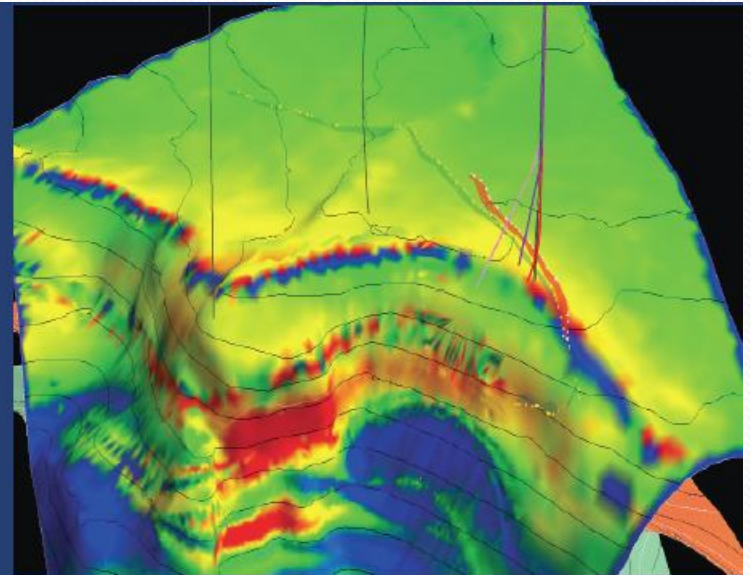


# Effective Drilling and Completions

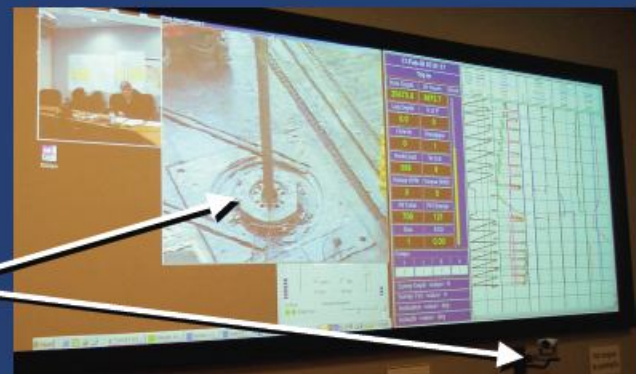
## Drilling and Completions Technology

Integrated technology solution

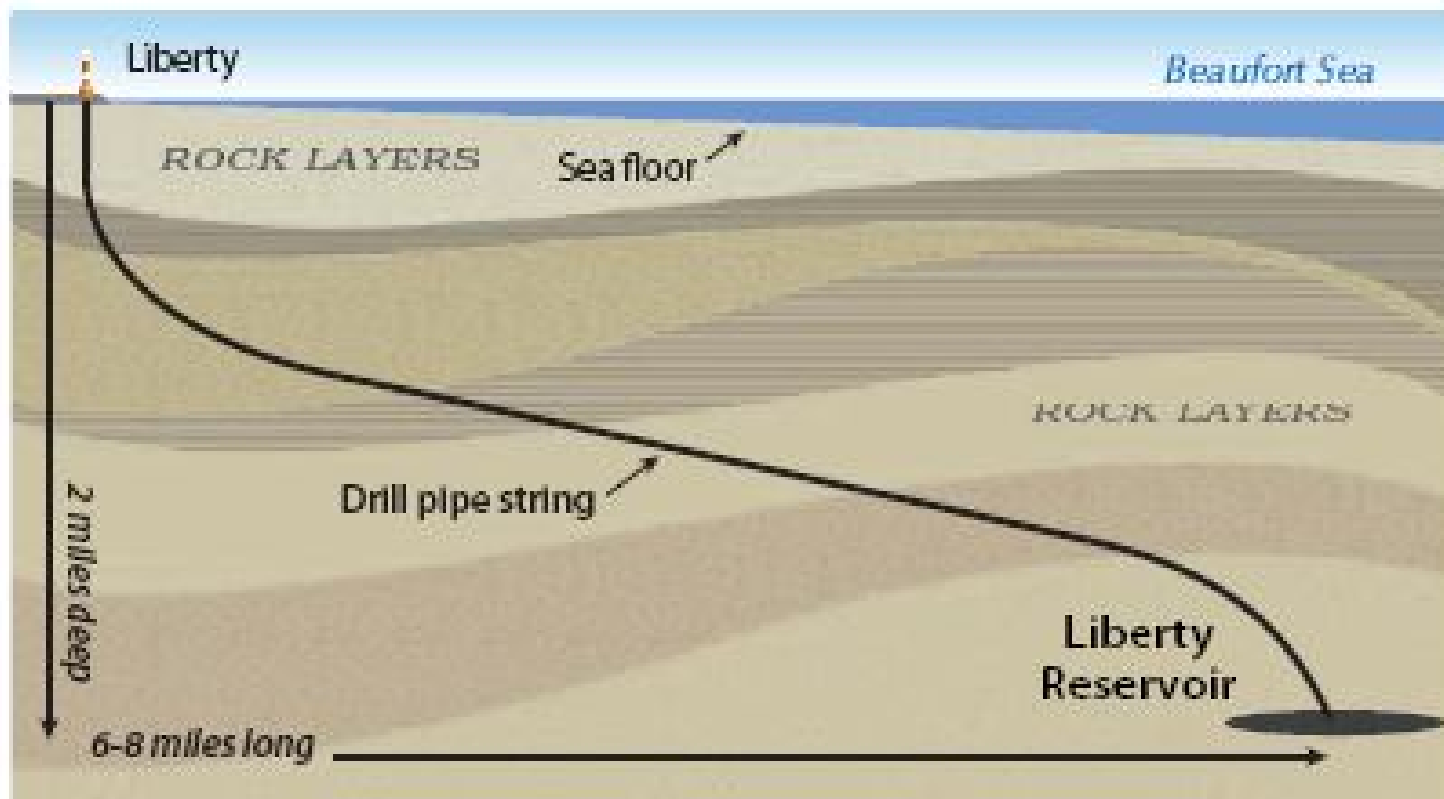
- Seismic imaging
- Reservoir modeling
- Rock mechanics
- Drilling operations
- Real-time monitoring



(Live video camera  
and feed from rig)

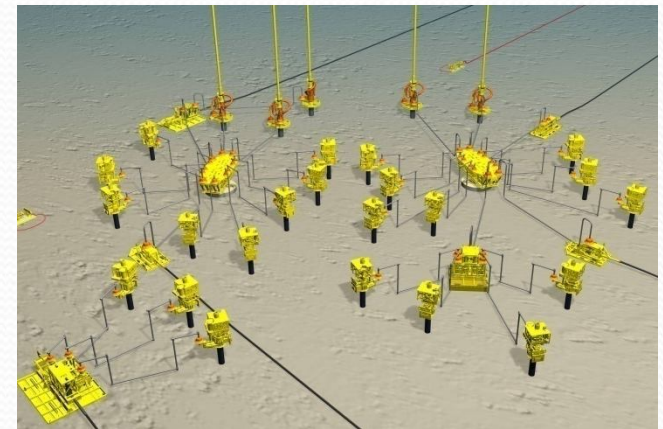
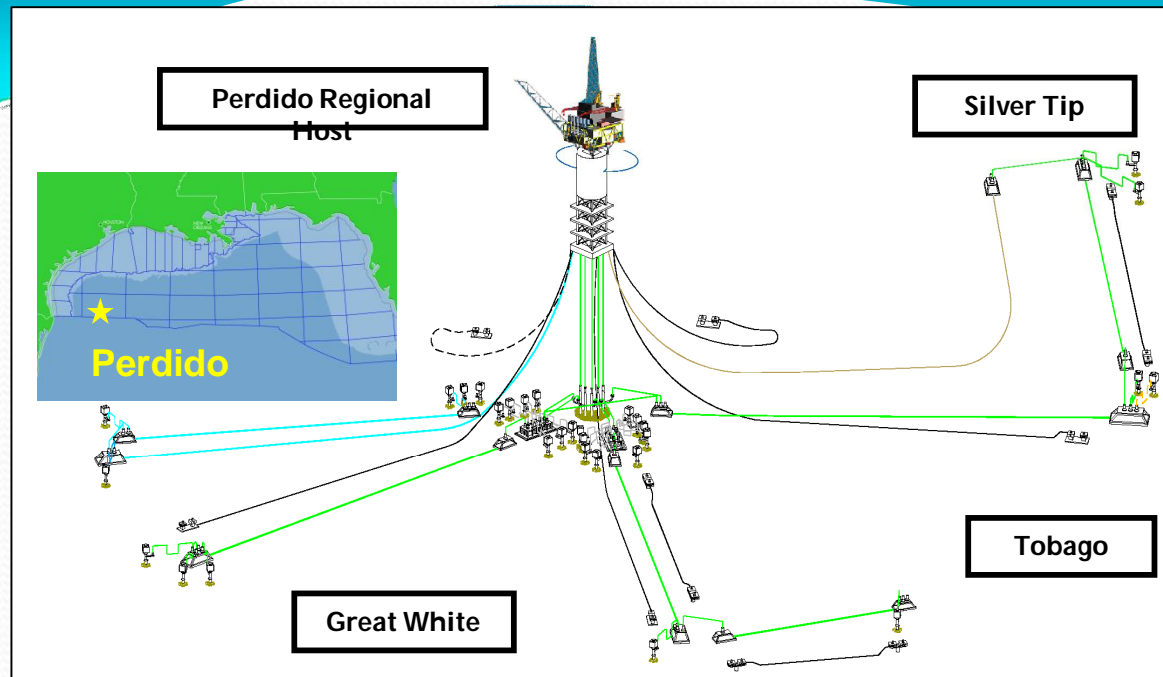


# BP Alaska – Liberty Project Extended Reach Drilling

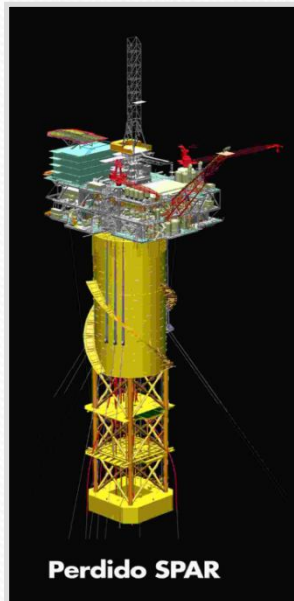




# Shell Perdido

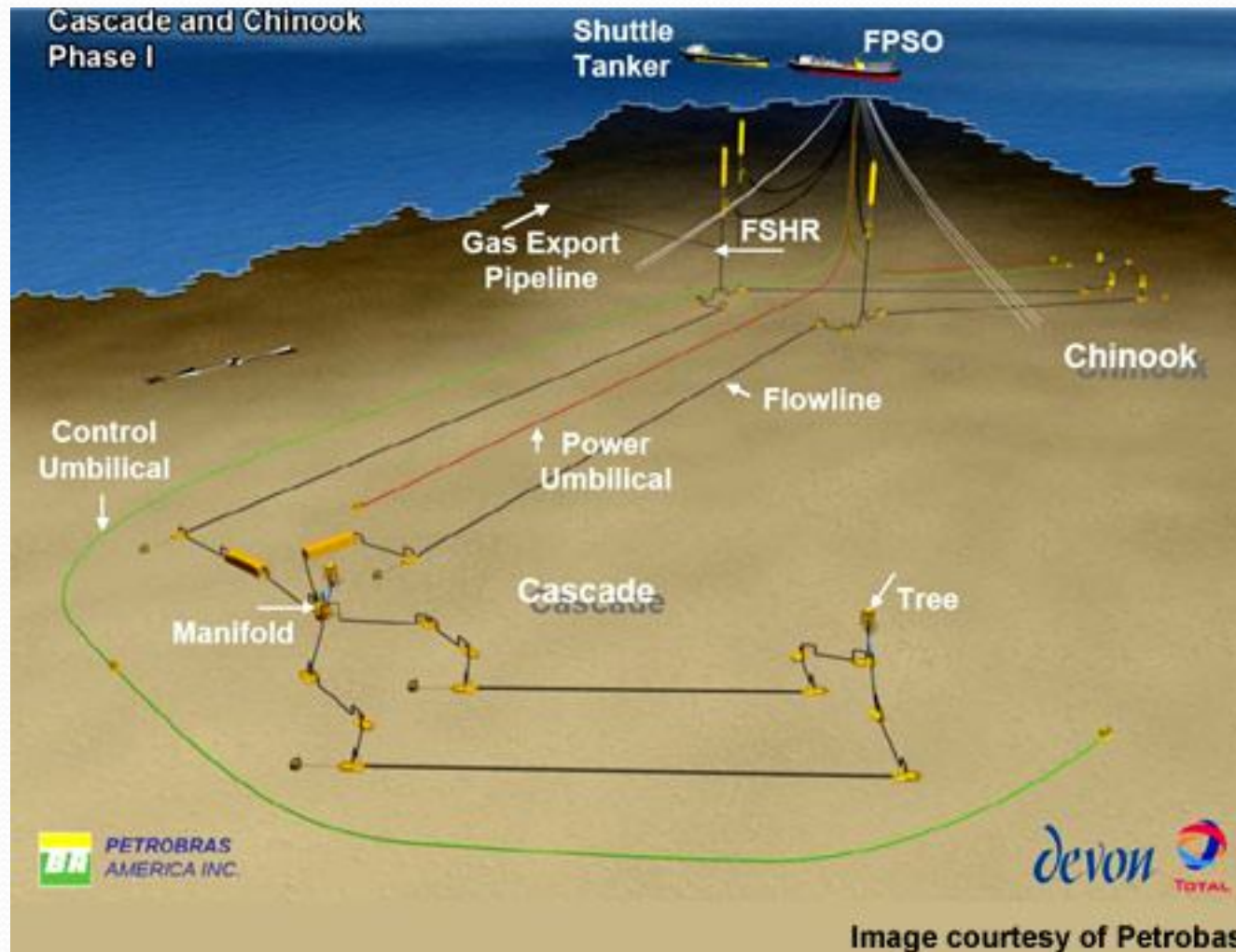


Subsea Layout under the Spar



- Deepest drilling & production facility at 7817 ft (2382m)
- Deepest subsea well at Tobago 9627 ft (2934m)
- Remote location in western GOM; 200 miles south of Freeport; 60 miles from nearest infrastructure
- High risk oil reservoirs: 1<sup>st</sup> Paleogene (Lower Tertiary) production in GOM, large well count
- Extreme weather: designed to withstand CAT-5 (1000yr) hurricanes
- New technologies had to be developed to enable the project

# Petrobras – GOM – Cascade/Chinook







# FPSO Technology

- Good for remote fields with little infrastructure
- Minimal seafloor disturbance
- Eliminate need for pipeline
- Can disconnect for severe weather
- FDPSO - Faster field development



# Subsea Processing Advances

- Multiphase pumping
- Subsea separation
- Longer tie backs
- In some cases production directly to shore – no platform needed

INITIAL ORMEN LANGE FIELD LAYOUT

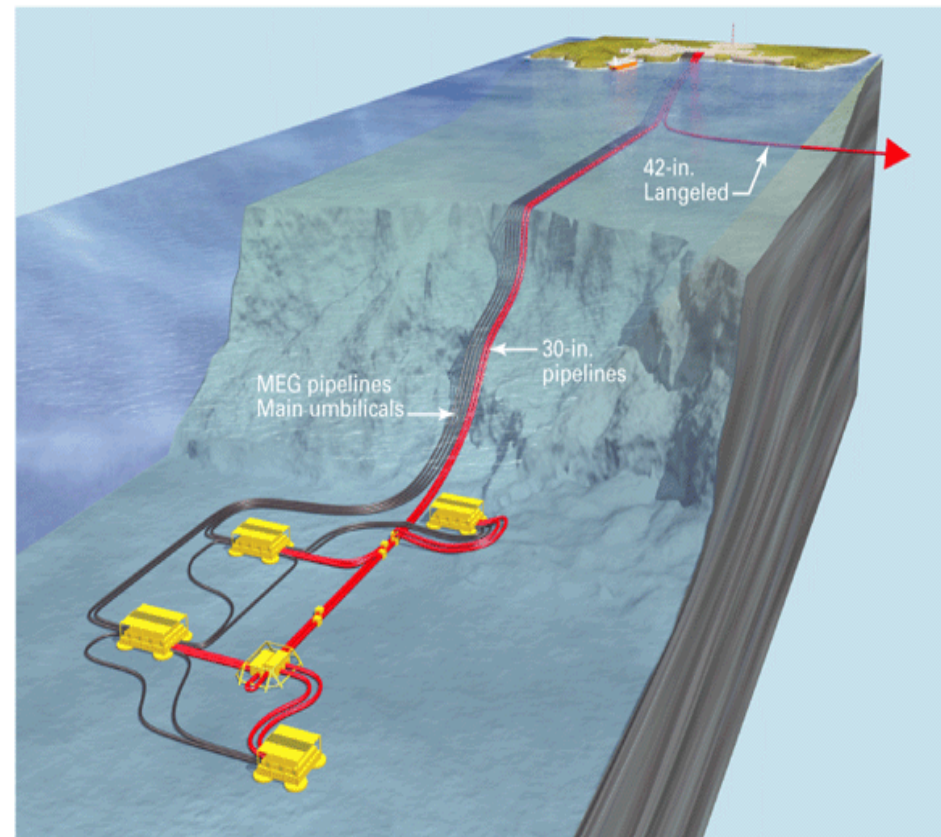


Fig. 1

# Other Future Technological Advances

- Materials
  - lighter, stronger drill pipe to allow for greater distance extended reach drilling
- Advances in computing technology
  - linking seismic data to other subsurface measurements
  - increases the accuracy and resolution of subsurface images
- Nanotechnology
  - enhanced recovery – could boost the average global recovery factor of oil and gas by 10 percentage points



Thank You

Questions?

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