



# Ultra Deepwater Advances in Drilling and Development

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***OCS Policy Committee Meeting  
March 6, 2008***

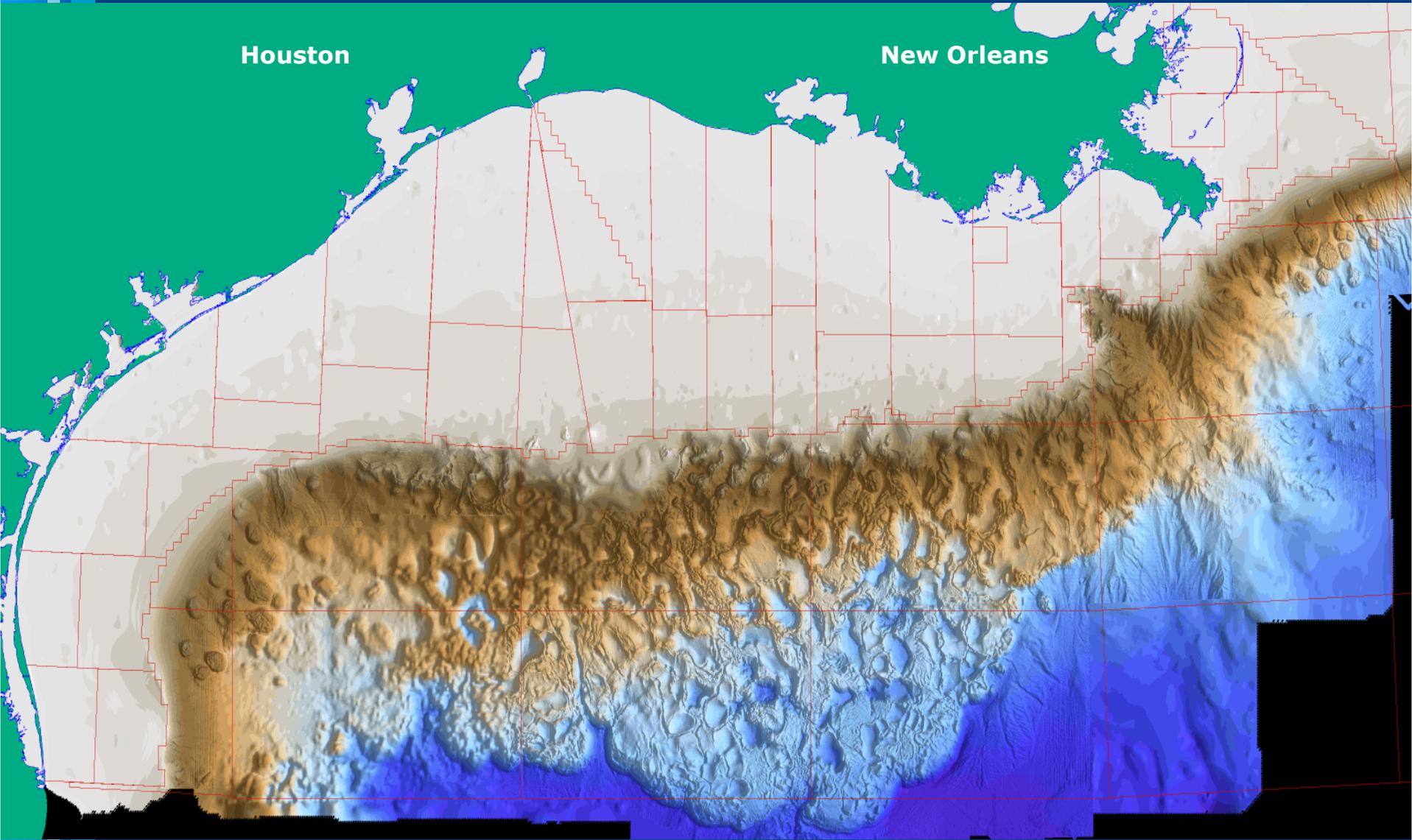


# Outline

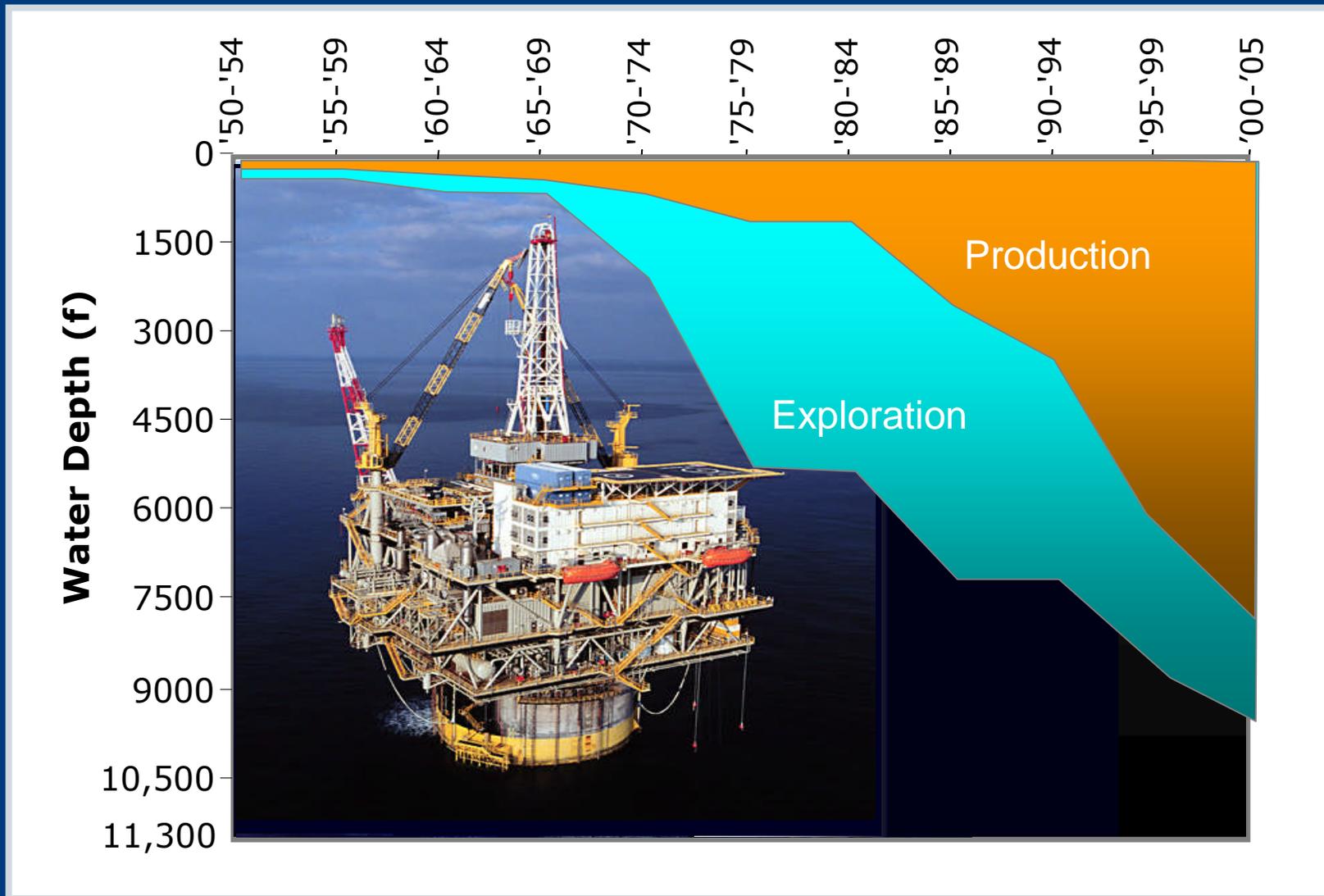
- Shelf, Deepwater & Ultra Deepwater
- Deepwater Trends
- Drilling & Completion Advances
- Production Systems
- Floating Production, Storage and Offloading System (FPSO)
- Questions



# Gulf of Mexico Seafloor Bathymetry -- Shelf, Deepwater and Ultra Deepwater

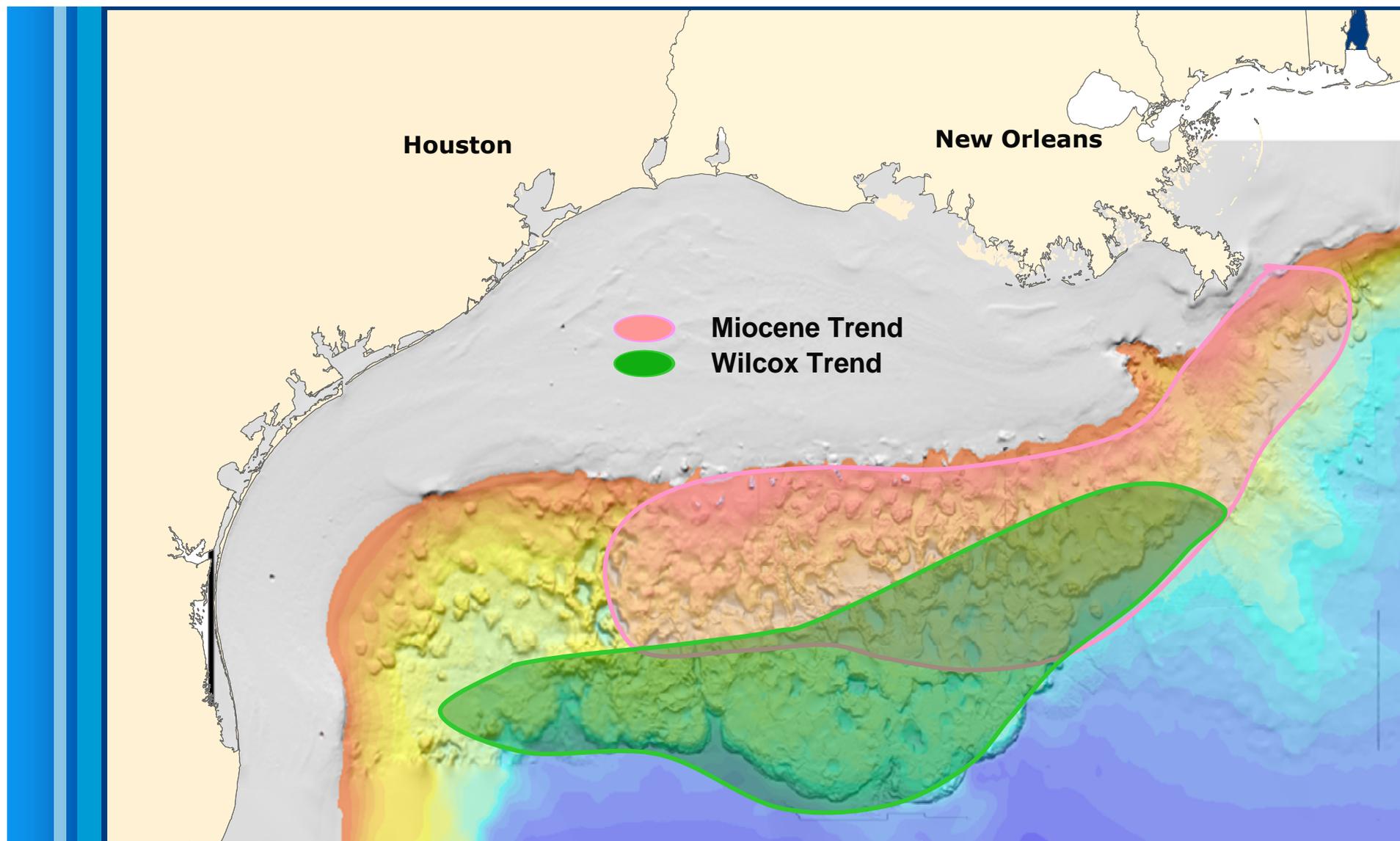


# Industry Production from Deep Water is Moving Deeper at an Increasing Pace





# Deepwater Geological Trends



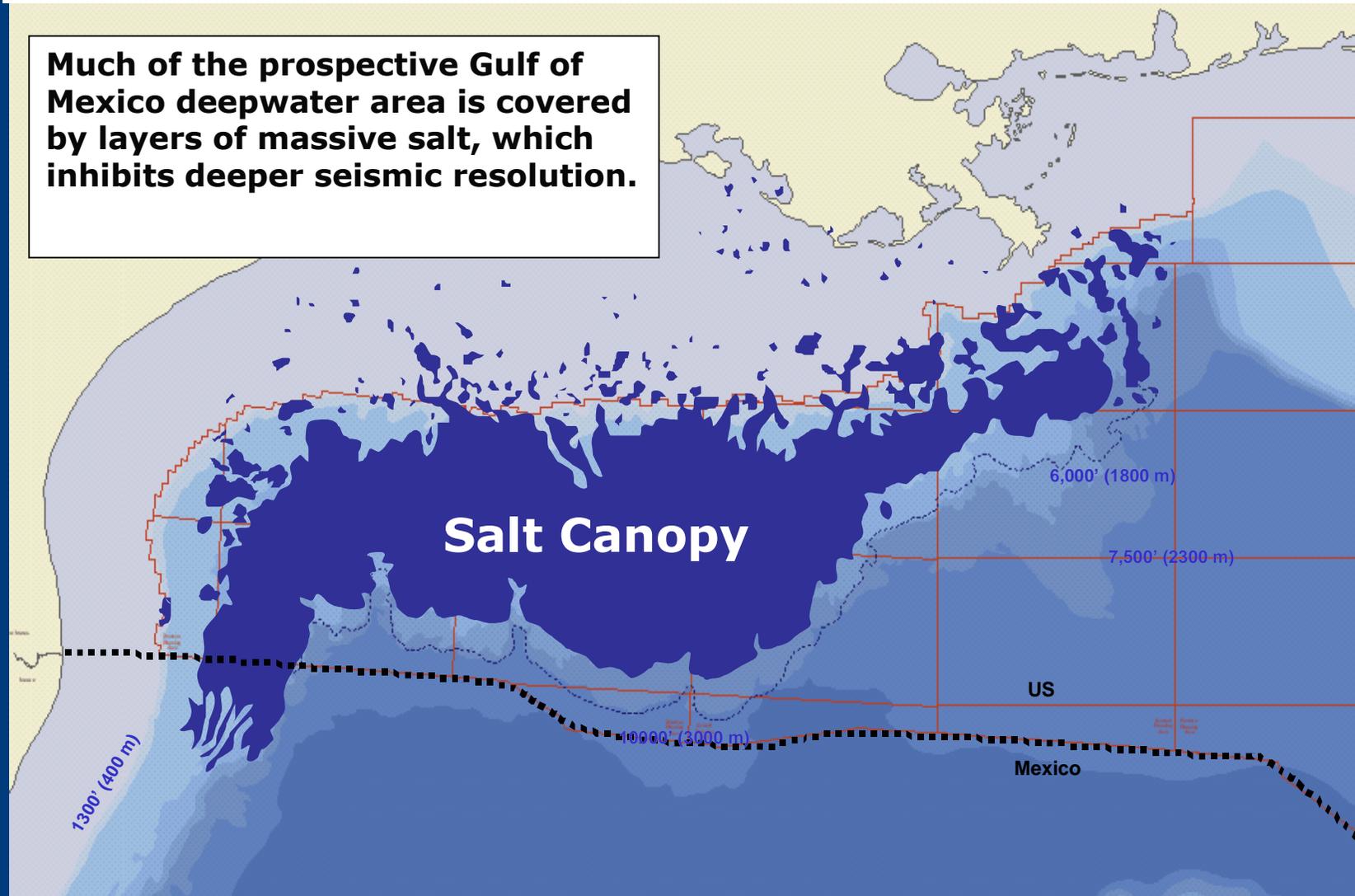


# Deepwater Gulf of Mexico

## Technically Challenging Environment



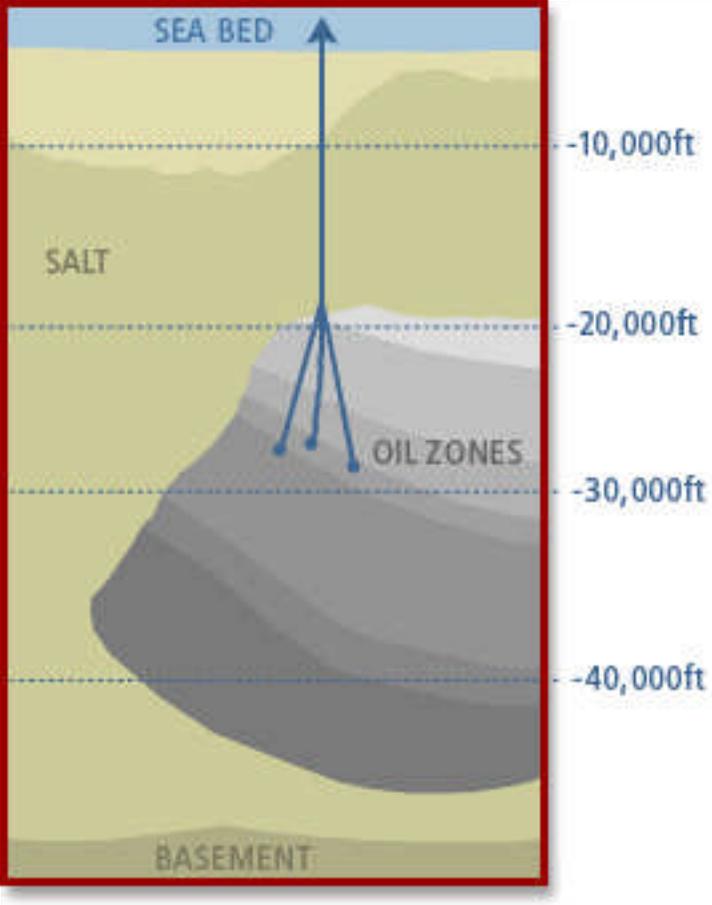
Much of the prospective Gulf of Mexico deepwater area is covered by layers of massive salt, which inhibits deeper seismic resolution.



# Technology is Pushing the Envelope on Water Depths



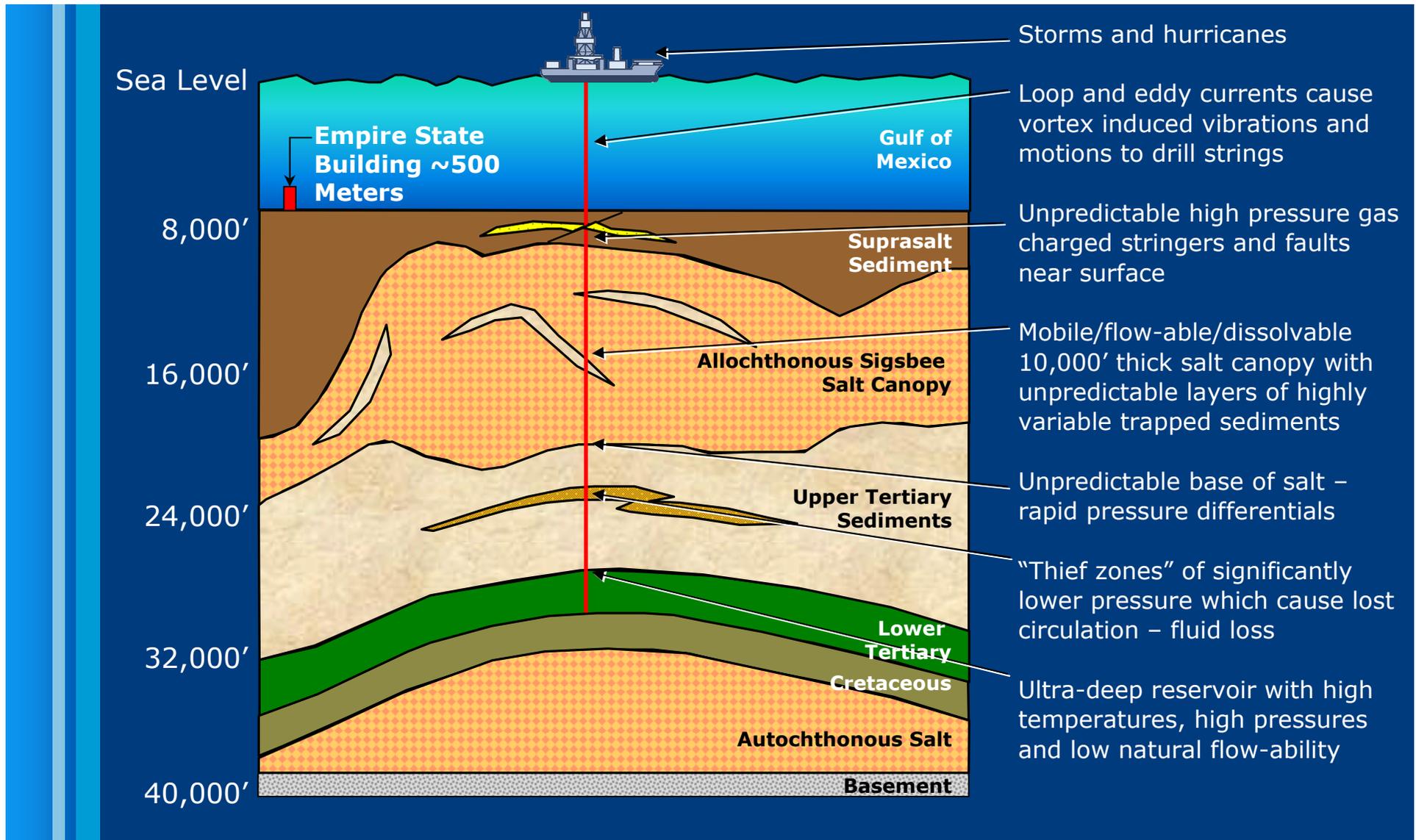
Under 4,000' of water and five miles below the seabed



Drilling in depths that only yesterday seemed impossible...

# Ultradeep Water Gulf of Mexico

## Drilling Technical Challenges



# Effective Drilling and Completions

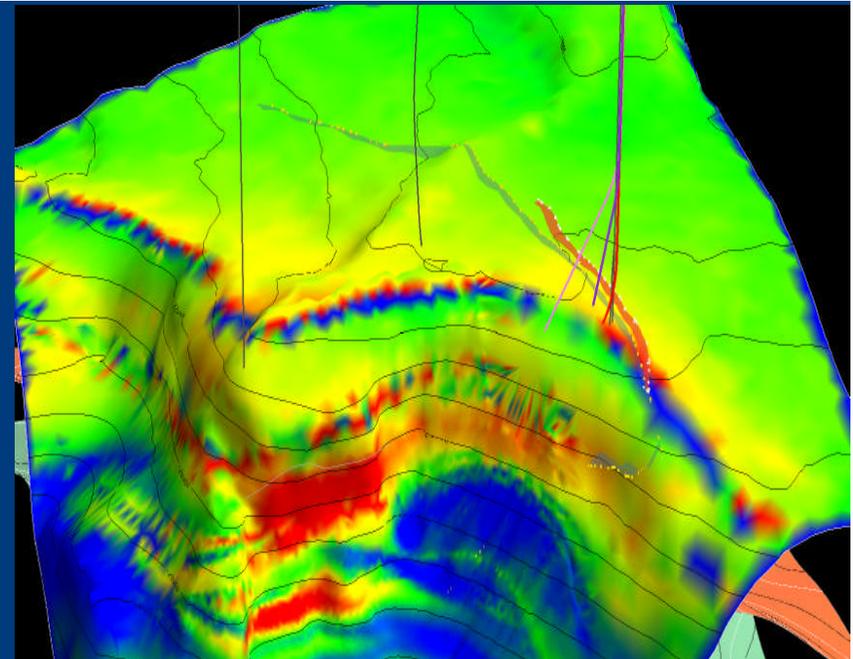
## Optimizing Performance



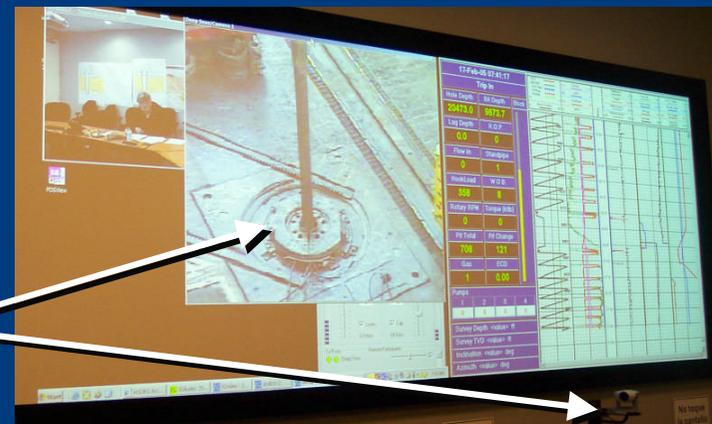
### Drilling and Completions Technology

Integrated technology solution

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



(Live video camera and feed from rig)



# Semi-Submersible Drilling Rig Moored/Anchored



# Semi-Submersible Drilling Rig - Dynamically Positioned





# Drill Ship - Dynamically Positioned

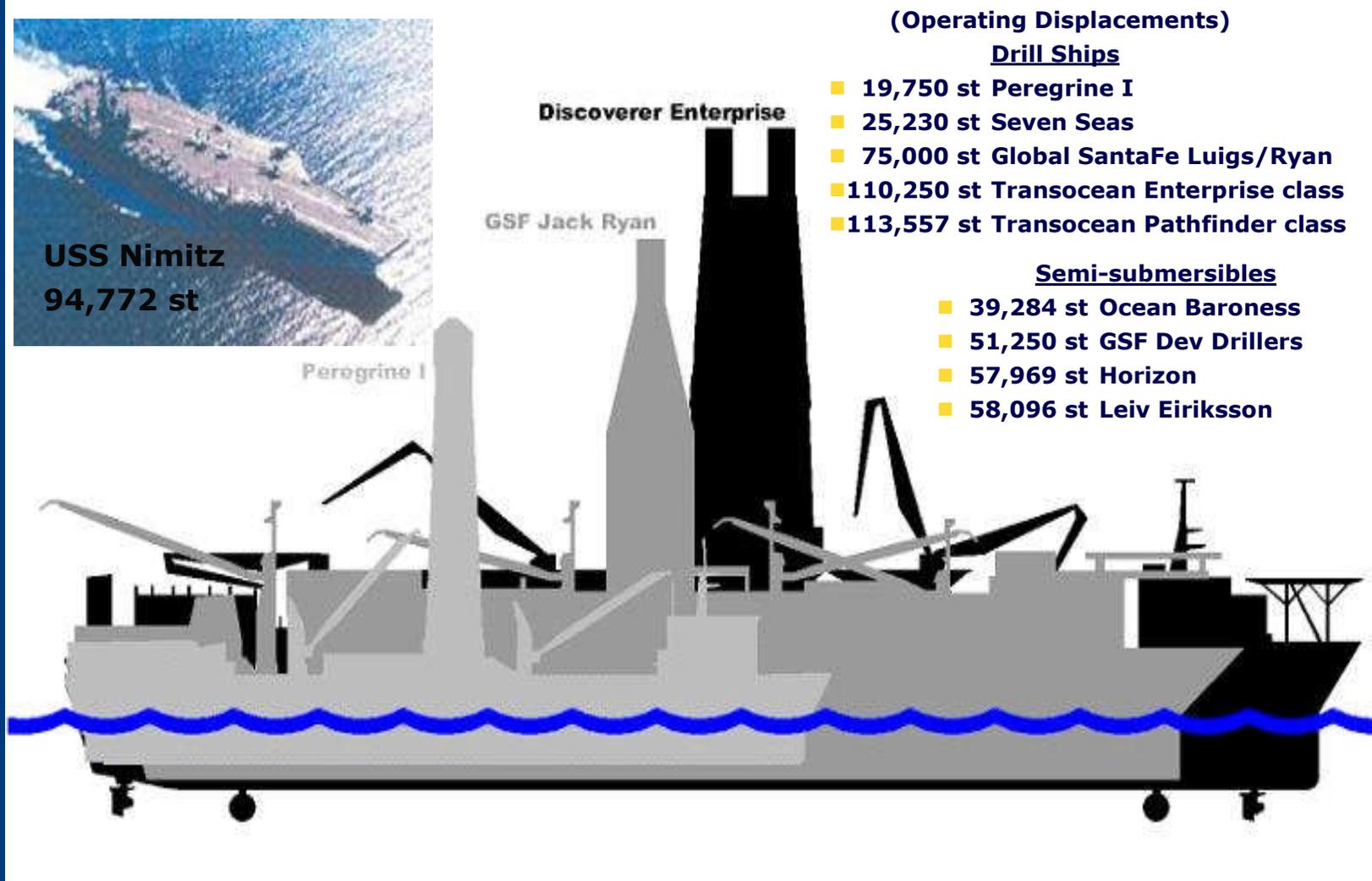
Length - 835 Ft.  
Breadth - 125 Ft.  
Max. Drill Depth - 35,000 Ft.  
Max. Water Depth - 10,000 Ft.



# Offshore Drill Ships



**USS Nimitz**  
94,772 st



# ***Deep Water Technology Breakthrough*** **New Deep Water Drillship**



- Most advanced drilling capabilities
- Dynamically positioned, with double-hull
- Two drilling systems in a single derrick
- Stronger and more efficient top drive so wells can be drilled deeper
- Other unique features will target drilling wells up to 40,000 feet of total depth
- Variable deck load of over 20,000 metric tons; capable of drilling in water depths of up to 12,000 feet



**Transocean's Discoverer Clear Leader**

# Deepwater Well Test



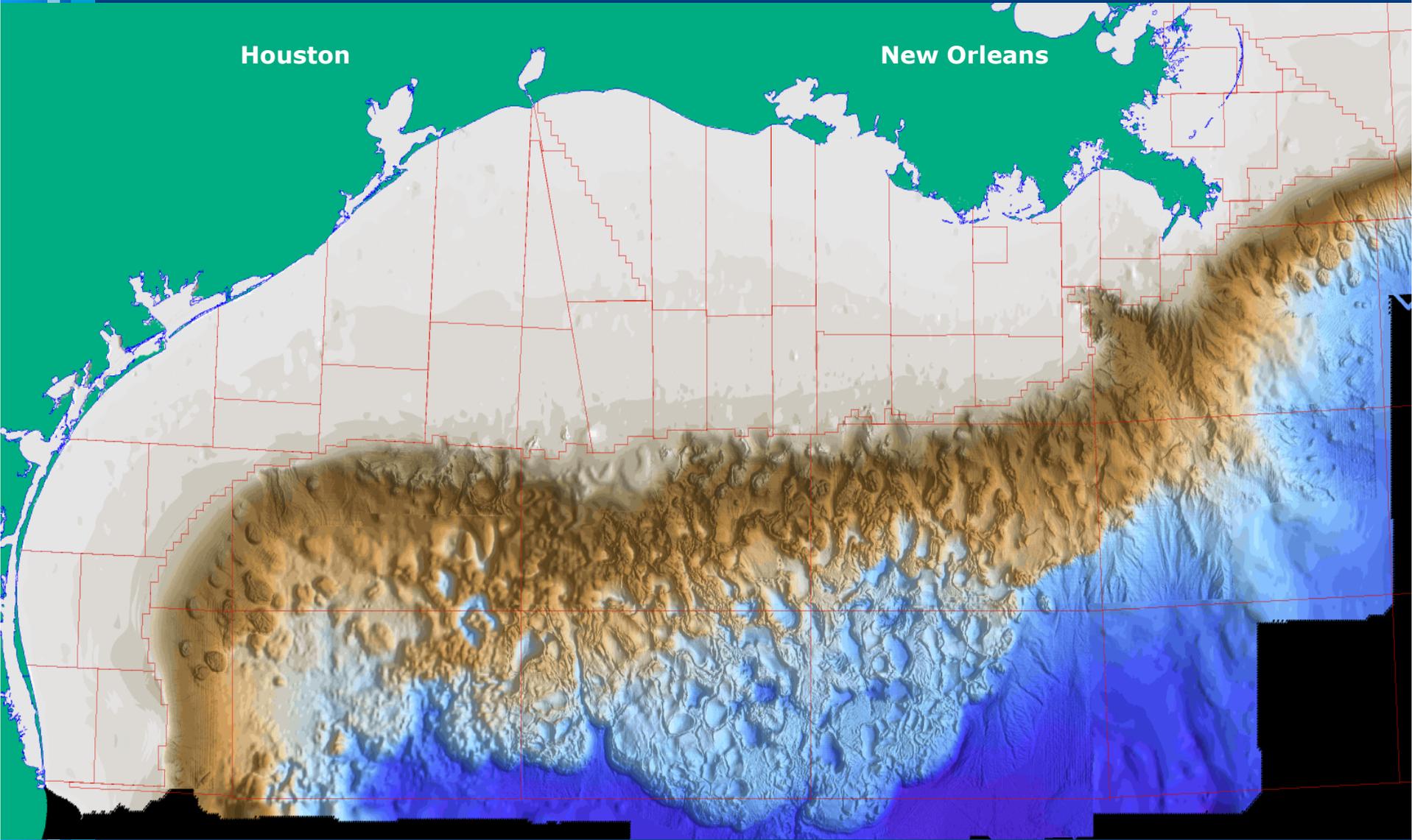
- Well drilled to a total depth of 28,175 feet.
- Completed and tested in 7,000 feet of water, and more than 20,000 feet under the sea floor
- During the test, sustained a flow rate of more than 6,000 barrels of crude oil per day





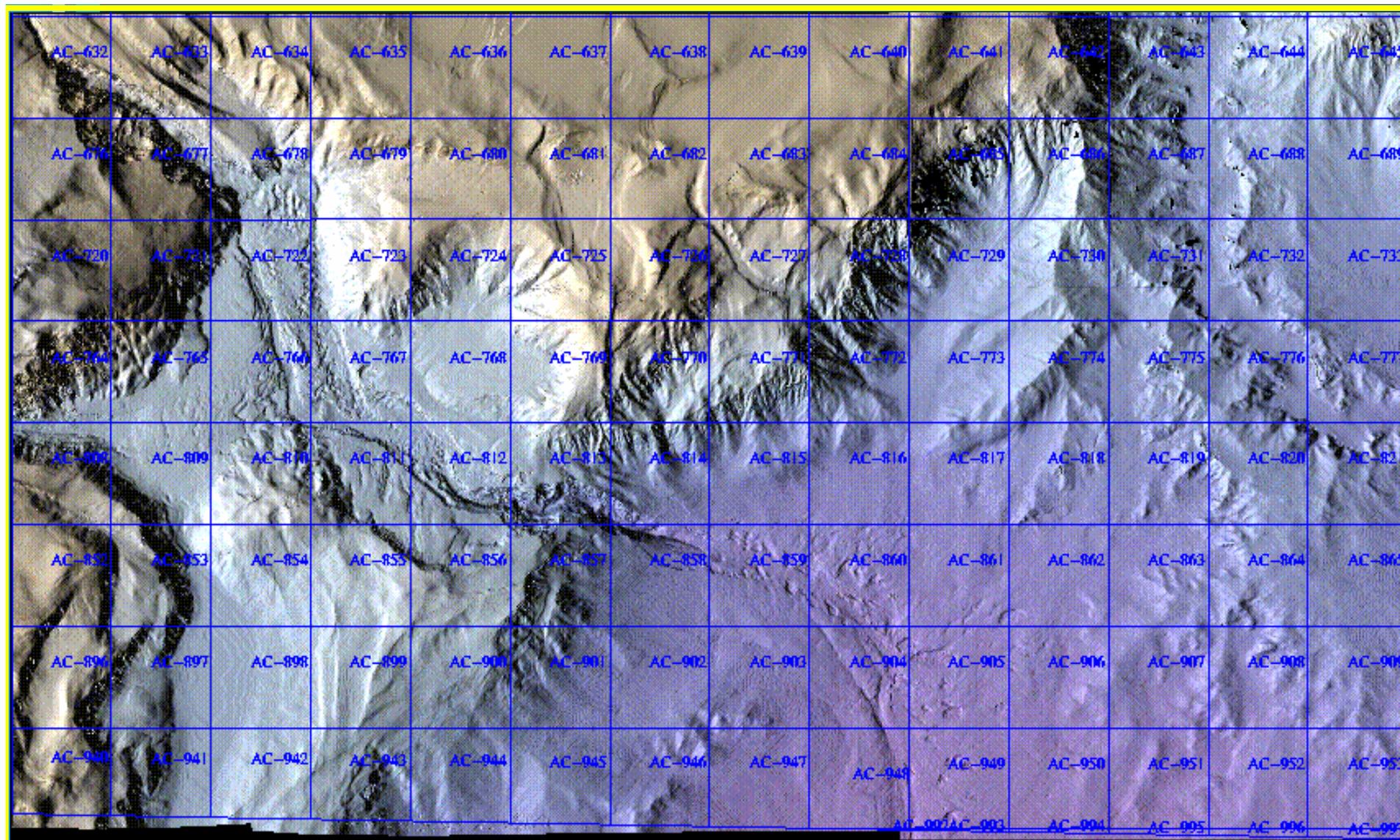
# Deepwater Production Systems

# Gulf of Mexico Seafloor Bathymetry -- Shelf, Deepwater and Ultra Deepwater





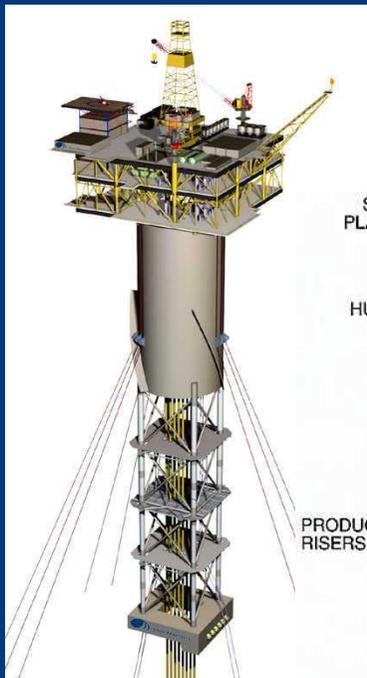
# Deepwater Seafloor Topography



# Floating System Concepts

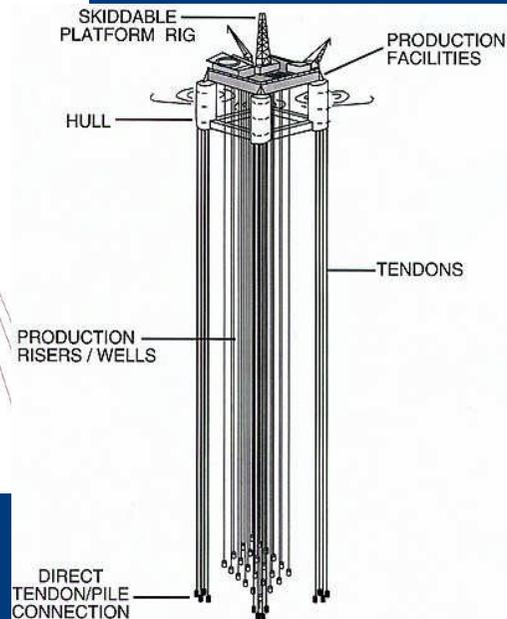


## (Dry Tree Solutions)



### Tension Leg Platform

- Weight sensitive
- Depth limited



### Spar

- VIM effects
- Suppliers limited

## (Wet Tree Solutions)



### Semi-Submersible

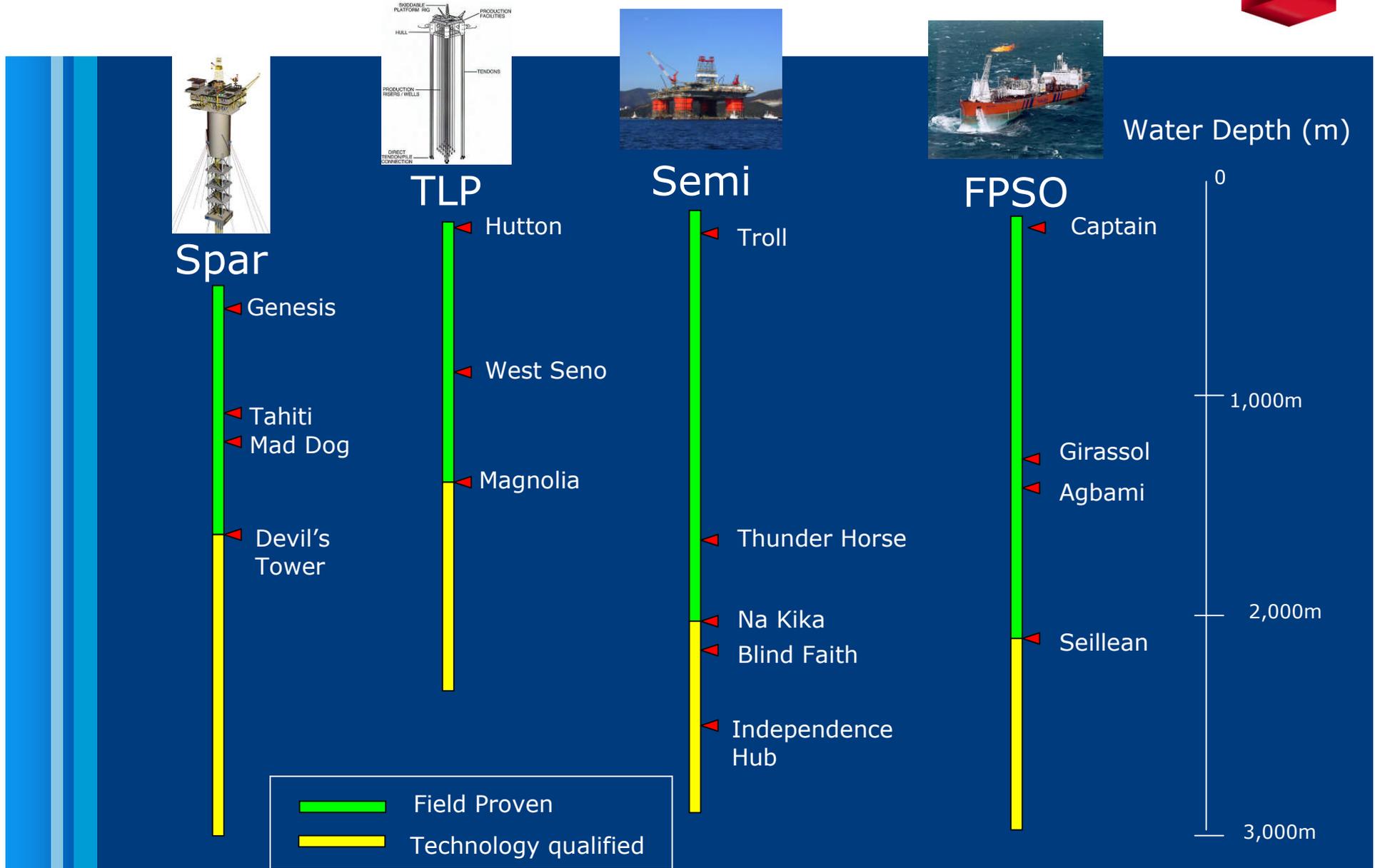
- + Quayside integration
- Riser fatigue

### FPSO

- + Storage capacity
- + Quayside integration
- Riser interface
- Riser fatigue

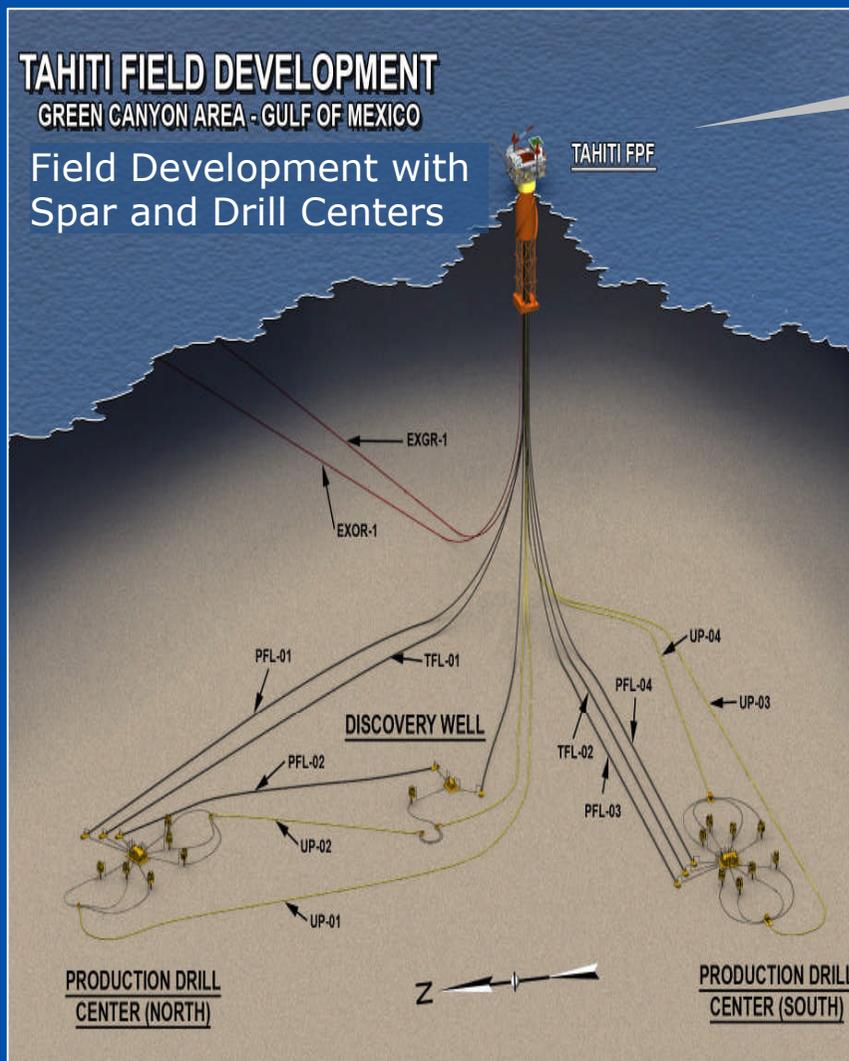


# Water Depth Comparison

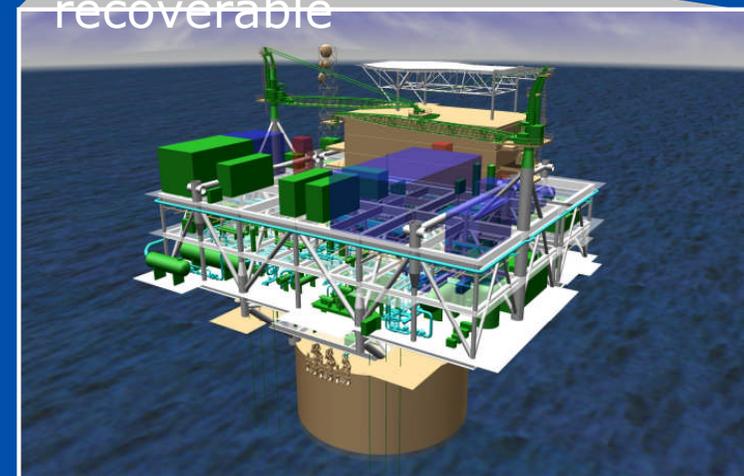
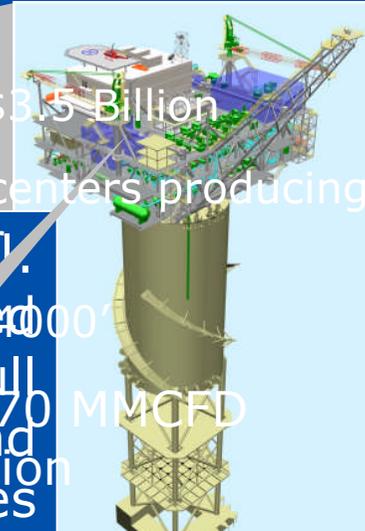


# Major Capital Projects – Gulf of Mexico

## Tahiti Field Development



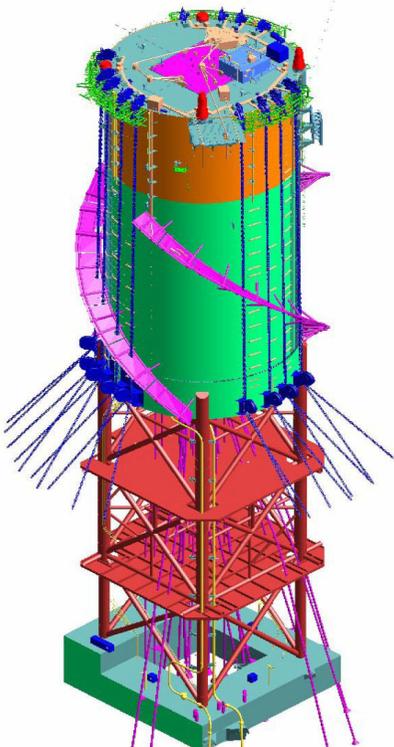
- Total capital: \$3.5 Billion
- 2 subsea drill centers producing to a truss Spar.
- Water integrated 100' Hull and topsides
- 125 MBOPD/70 MMCFD peak production
- 400-500 MMBOE potentially recoverable



# Major Capital Projects – Gulf of Mexico Tahiti in Fabrication



Hull Fabrication



Hull 3-D Model



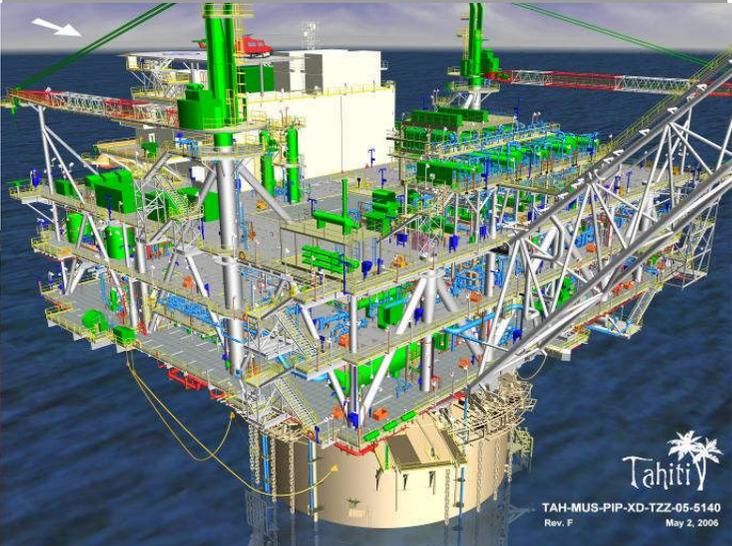
Subsea Production Manifold



Hull Transportation



Subsea Tree

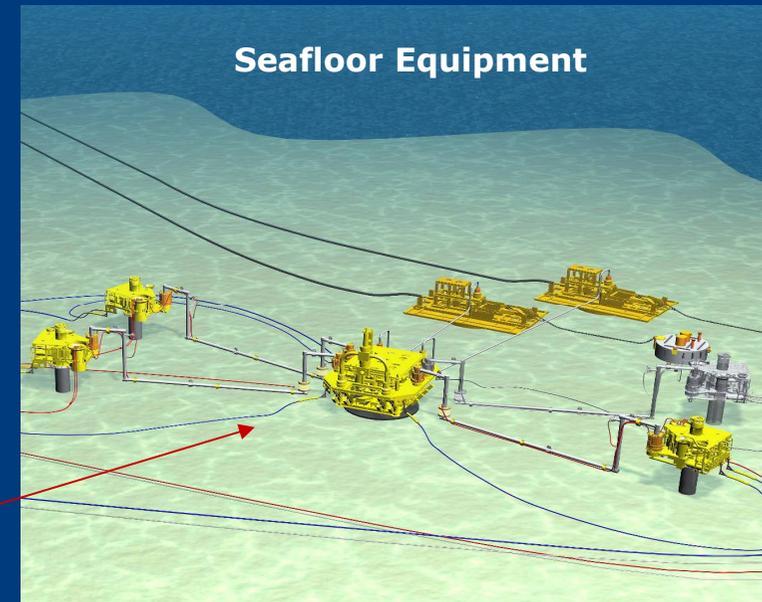
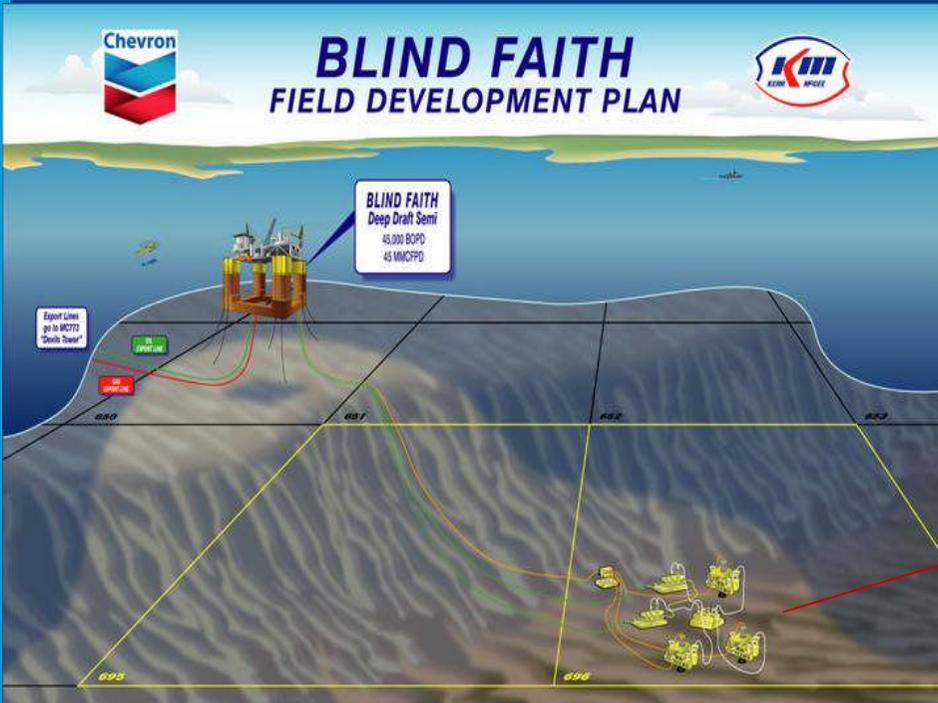


Topside Design

Tahiti  
TAH-MUS-PIP-XD-TZZ-05-5140  
Rev. F  
May 2, 2006

# Major Capital Projects – Gulf of Mexico

## Blind Faith Project

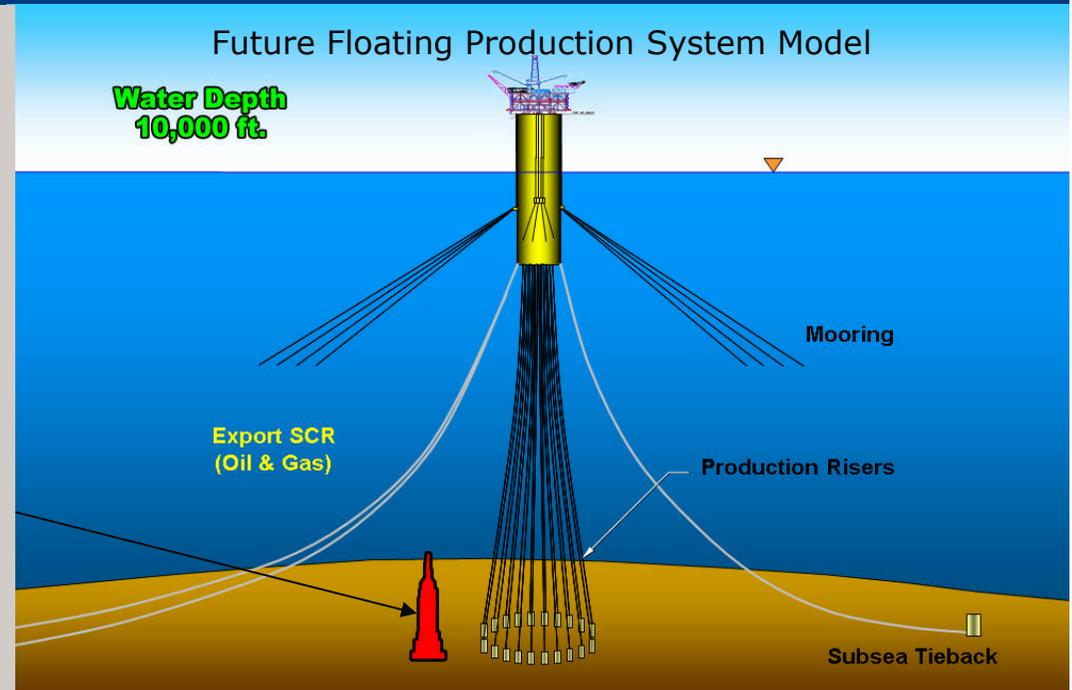
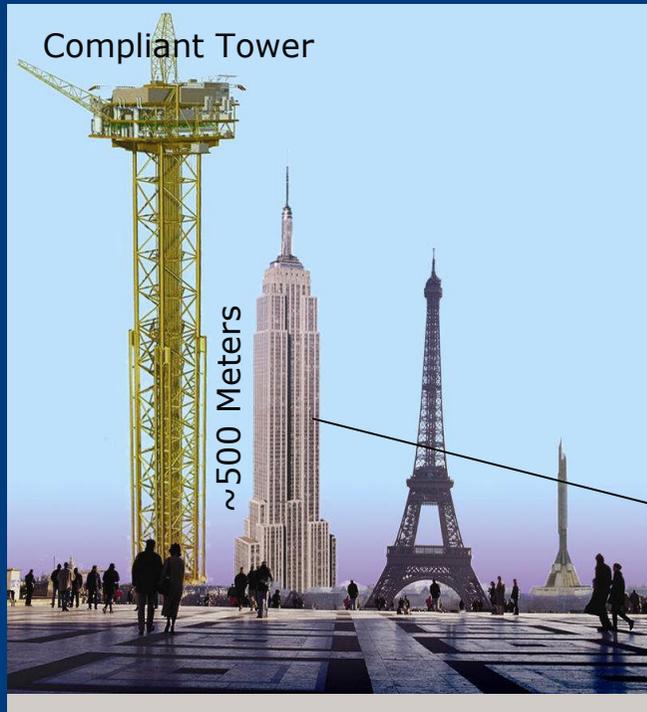




# Deepwater Challenges

# Deepwater Facilities/Infrastructure

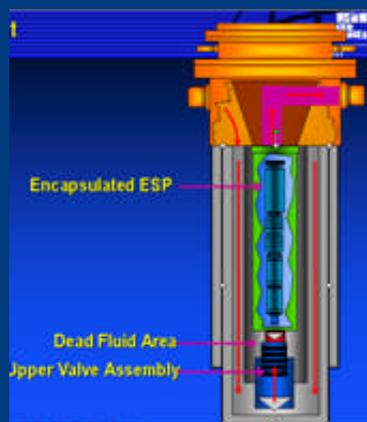
## Meeting Future Technology Challenges



- More Ultra Deepwater Developments
- Reliability – Surface, Risers & Export Systems
- Reliability – Seafloor Systems
- Flow Assurance
- Long Distance Subsea Tiebacks
- Subsea Intervention
- Small Field Development Systems
- Standard Facility Concepts
- Standard Regional Subsea Equipment
- Life-Cycle Water Management

# Subsea & Pipelines

- Qualify seafloor boosting beyond 5000 ft. WD
- Enable long distance tiebacks for satellite field development
- Subsea Reliability – ensure subsea systems operate as designed



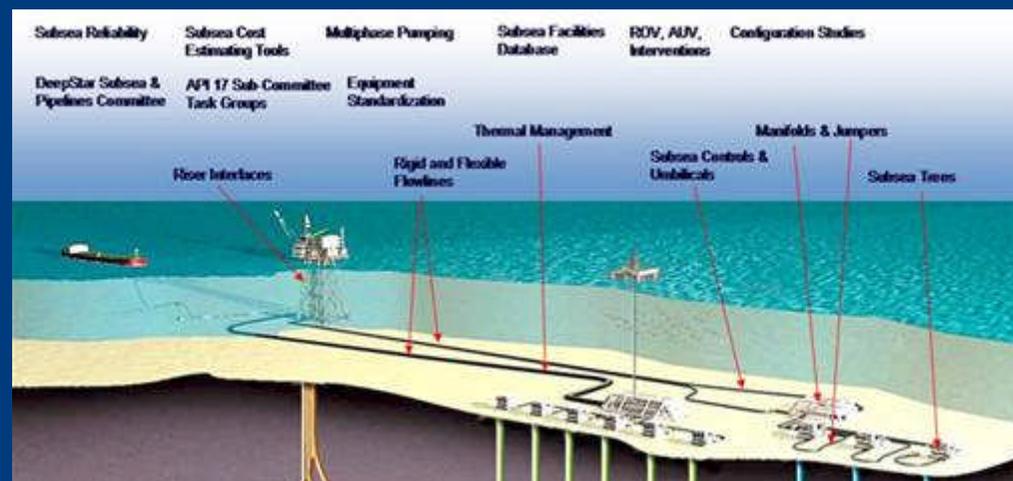
Subsea Pumps



Multiphase Flowmeters



Subsea Electrical Power Distribution



# Cost, Schedule, and Technical Challenges



- **Higher Pressure & Temperature**
- **More Difficult Reservoir Fluids**
- **Remote Areas with Limited or No Infrastructure**
- **Industry has More Deepwater Projects Underway than ever before**
- **Certain Suppliers are Fully Booked**
- **Extreme Competition for Limited Manpower and Supplier Resources**





## Summary



Many technical challenges remain to be solved, but the industry is focused on finding solutions.

Advances in technology have allowed industry to drill and produce offshore resources safely.

Access to areas currently unavailable for leasing could provide future sources of oil and natural gas for the U.S.

# Questions ?????

