SAND2012-2469C

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Sandia National Laboratories



Fossil Energy Partnerships with Industry at SNL

John Merson

March 20, 2012

U.S. DEPARTMENT OF ENERGY

National Nuclear Security Administration

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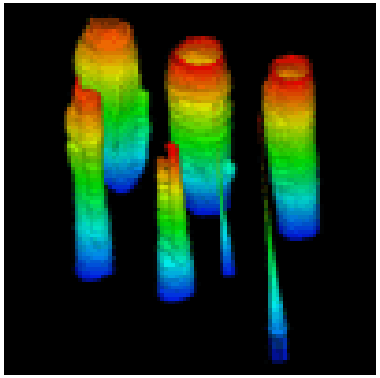
Our Industrial Partnerships Have Many Forms

- CRADAs
- WFOs
- Licenses and Technology Transfer
- Joint Industrial Partnerships
- Special Government Sponsored Activities
  - NGOTP
  - Science Advisor Roles
- Collaborative Proposals



Licenses and Technology Transfer

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Sandia's Defense Programs

- **Design of Delivery and Safeguard Systems**
- **Engineering, Electronics, Materials, Simulation**
- **Information Systems, Telemetry**

Sandia's Fossil Energy Programs

- **Drill-bit design, for example**
- **Engineering, Electronics, Materials, Simulation**

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A Joint Industrial Partnership Example:

Well Integrity Assurance for Sub-Salt and Near-Salt Deepwater GoM Reservoirs

Deepwater GoM field setting

bp

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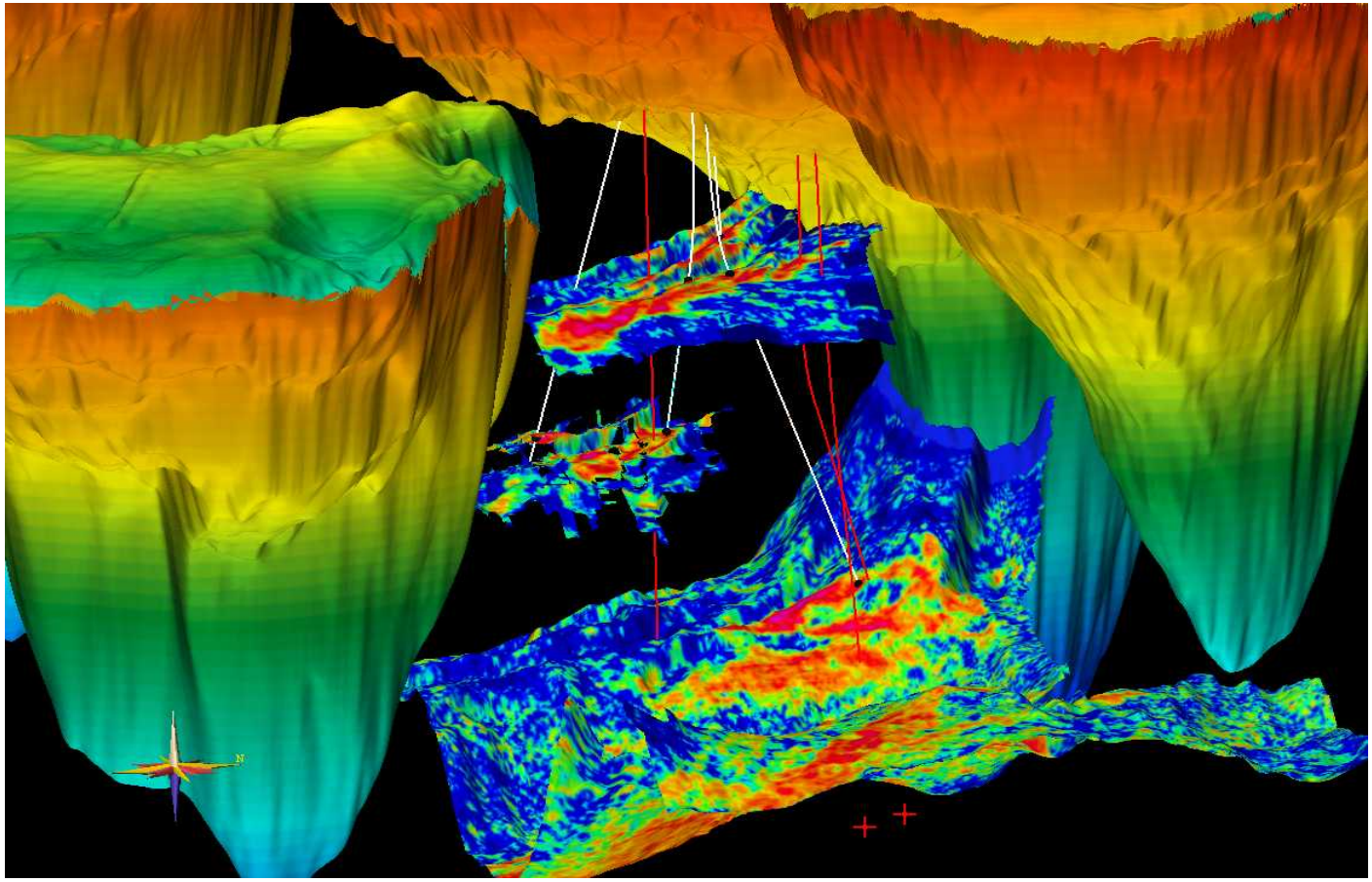

J. T. Fredrich, A. F. Fossum, D. D. Coblentz

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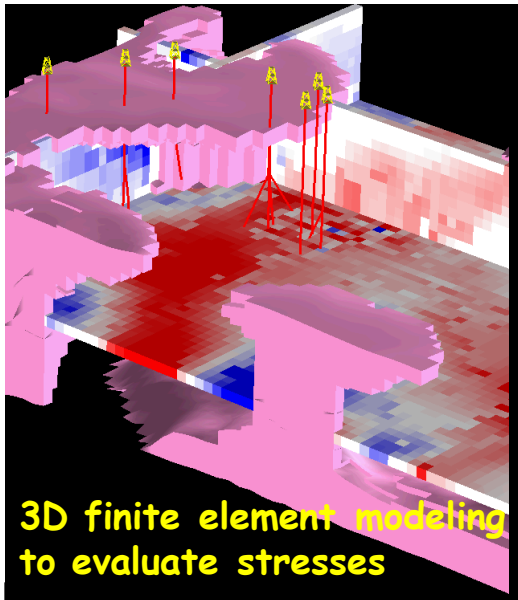
The deepwater Gulf of Mexico contains as much oil & gas as the North Slope of Alaska

Enhance national security by stabilizing energy supplies & reducing foreign dependence

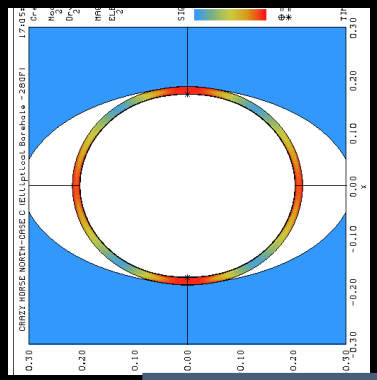
Major technical innovation required to develop these reservoirs

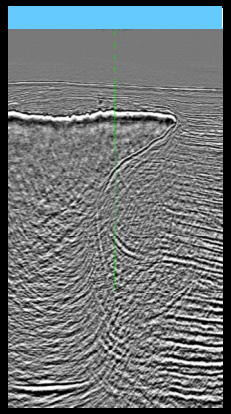
Water depths of 5,000-10,000 feet !!
Reservoirs 20,000-30,000 feet below mudline !!
Tens of thousands of feet of salt to drill through !!



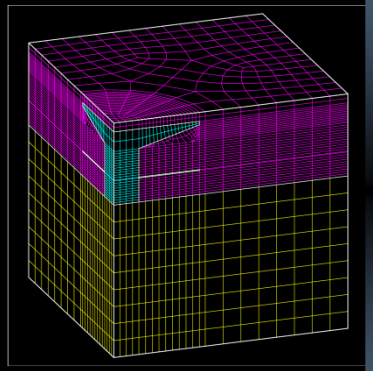
3D finite element modeling to evaluate stresses

Finite element modeling to evaluate salt loading on casing during production





3D seismic survey

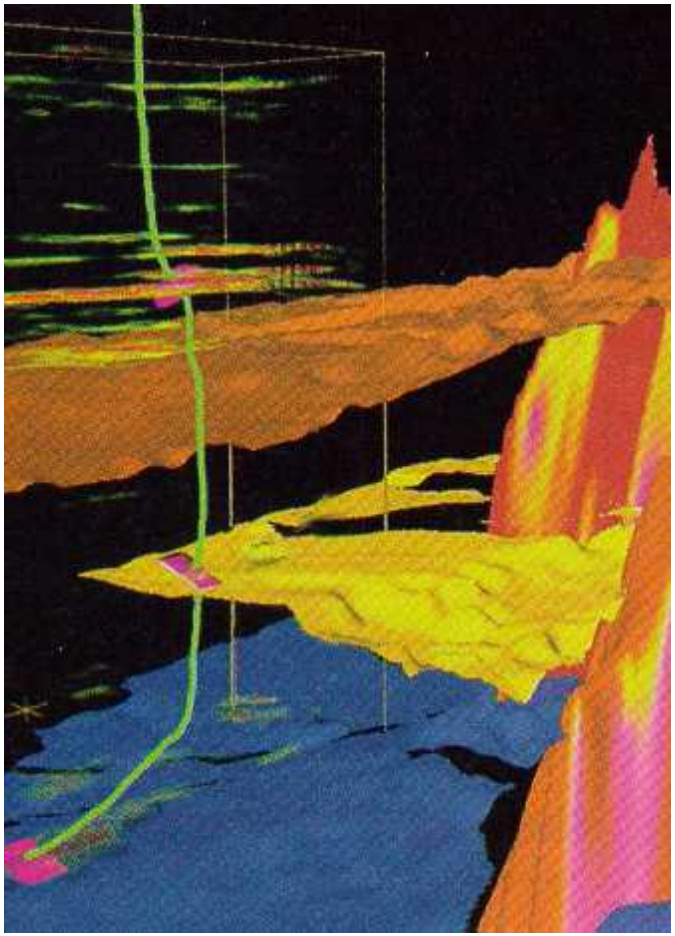


FE mesh

Sandia R&D has led to over $30M in savings for two of the five biggest discoveries

Natural Gas and Oil Technology Partnership

Sandia National Laboratories



Partnership Concept:
The national laboratories, DOE's National Petroleum Technology Office and the nation's petroleum industry working together to develop advanced technologies for natural gas and oil recovery

Partnership Principles:
- **Industry Driven**
- **Simple**
- **Flexible**

Technology Areas:
- **Oil & Gas Recovery**
- **Drilling, Completion, & Stimulation**
- **Diagnostics & Imaging**
- **Upstream Environmental**
- **Downstream Environmental**

Some Industry Participants

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- ABB
- Advanced Data Solutions
- Aera Energy LLC
- Amerada Hess
- Amoco
- Arco
- Artificial Lift Forum
- Baker-Hughes
- Bakersfield Energy Resources
- BHP
- BP
- Cal Resources
- Chevron
- Conoco
- Cray Research
- Crutcher-Tufts
- DeepLook Consortium
- DeepStar Consortium
- DeepTech International
- Electromagnetic Instruments (EMI)
- Exxon-Mobil
- Golden Geophysical
- GX Technology
- GTI
- Halliburton Energy Services
- Harbison-Fischer
- HarCor Energy
- IBM
- Intel
- Kerr-McGee
- Monterey Resources
- Noble
- Oryx
- OYO Geospace
- Passband
- PGS Tensor
- P/GSI
- Phillips
- Pinnacle Technologies
- Production Control Services
- Providence Technologies
- Schlumberger
- Shell
- TGS Calibre Geophysical
- Terralog Technologies
- Texaco
- TomoSeis
- Union Pacific
- Unocal
- Western Atlas

NGOTP History

- **1988:** DOE initiates Oil Recovery Technology Partnership with Sandia and Los Alamos consisting of three technology areas: Oil Recovery, Drilling and Production, and Crosswell Seismic
  (2 labs, 4 projects, 4 participants)
- **1994:** Partnership renamed Natural Gas and Oil Technology Partnership, Lawrence Berkeley and Lawrence Livermore national laboratories join
  (4 labs, 20 projects, 25 participants)
- **1995:** Argonne, Brookhaven, Idaho, Pacific Northwest, and Oak Ridge national laboratories join
  (9 labs, 25 projects, 25 participants)
- **1995:** Advanced Computational Technology Initiative significantly increases partnership scope and size
  (9 labs, 45 projects, 175 participants)
- **1997:** Upstream Environmental Technology Area added
  (9 labs, 45 projects, 175 participants)
- **1998:** Downstream Environmental Technology Area added
  (9 labs, 50 projects, 200 participants)

NGOTP Impacts & Successes

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- Reduced well failure rate at Belridge, CA oil field from 10% to 5%/yr.. - saving operators $25 to $50 million/yr. in lost production.
- Automatic Casing Swab yielded $2 million in federal tax revenue and $10 million in reserves to a West Virginia operator
- Reservoir simulation of the Carpinteria reservoir reduced financial risk of redevelopment to independent producers

- Marine magnetotellurics determined thickness of salt structures, a task difficult for traditional seismic methods
- SALVO algorithm developed to quickly generate 3D images of complex geologic structures from seismic data (1999 R&D 100 winner)
- Six patents were obtained for the Wireless Telemetry tool - technology licensed to Baker-Atlas, Houston