SAND2012-2095C

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Sandia National Laboratories

Pi Tau Sigma – University of Michigan

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Principal Member of Technical Staff
Geotechnology & Engineering Department

March 21, 2012

Exceptional Service in the National Interest

National Nuclear Security Administration

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Sandia National Laboratories

Goals

- Introduce you to Sandia National Laboratories
- Information about Sandia employment
- My pathway from U of M to Sandia
- Brief overview of projects I've worked on at Sandia

Sandia National Laboratories

Sandia's Sites

Albuquerque, New Mexico

Livermore, California

Las Vegas, Nevada

Carlsbad, New Mexico

Kauai, Hawaii

Pantex, Texas

Tonopah, Nevada

Kodiak, Alaska

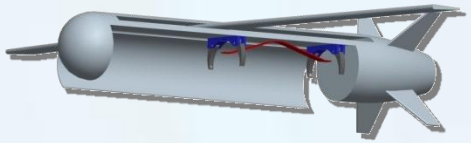
Sandia's Broad National Security Role

Defense Systems & Assessments

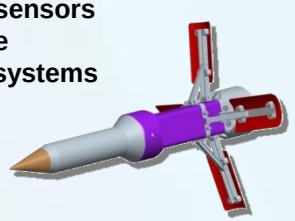
SAR imagery

Missile defense

Small robotic vehicle



Ground sensors for future combat systems



International, Homeland, and Nuclear Security

Critical Asset Protection

Homeland Security

Global Security

Homeland Defense & Force Protection

Energy, Climate, and Infrastructure Security

Nonproliferation

Infrastructure

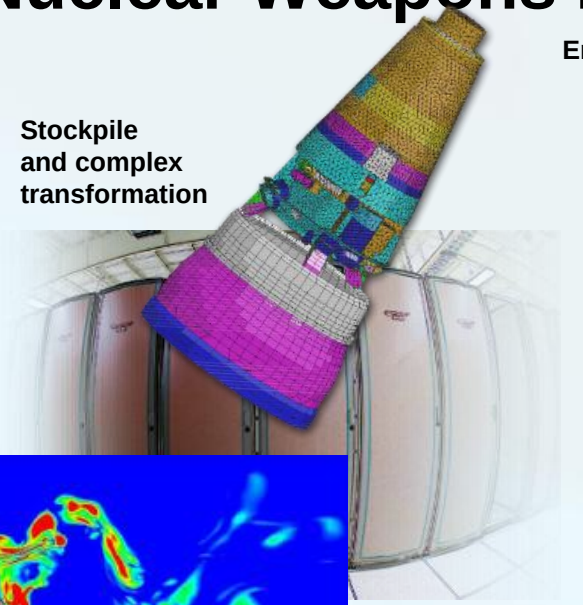
Energy supply

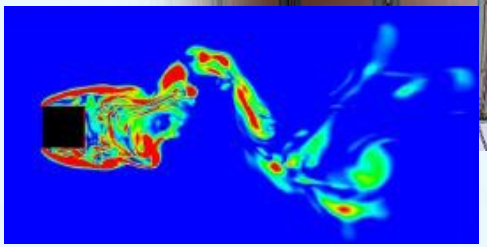
Sandia National Laboratories

Sandia's Nuclear Weapons Program

Weapon system and component engineering

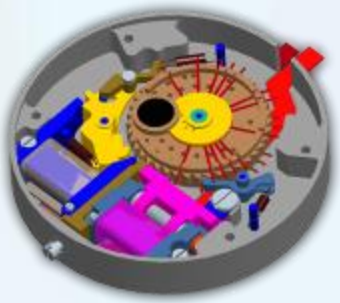
Stockpile and complex transformation



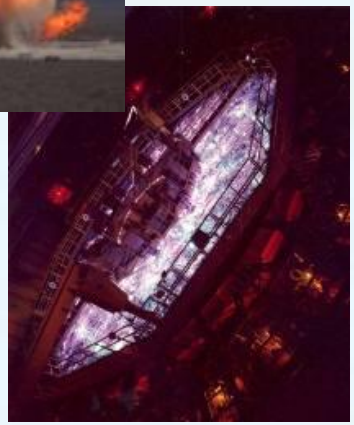


Modeling and simulation

Enhancing the safety of the stockpile

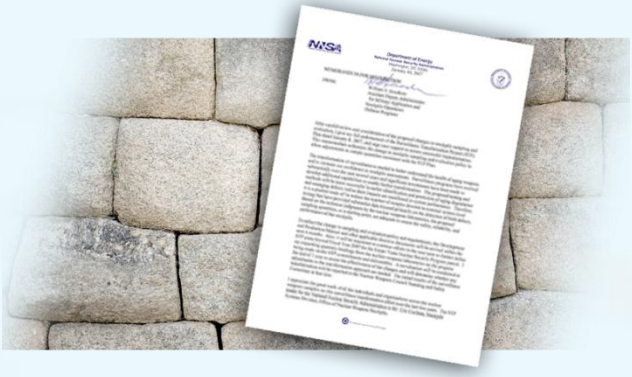


Testing and evaluation



Production and responsive infrastructure

Annual Stockpile Assessment



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Emerging National Security Thrusts

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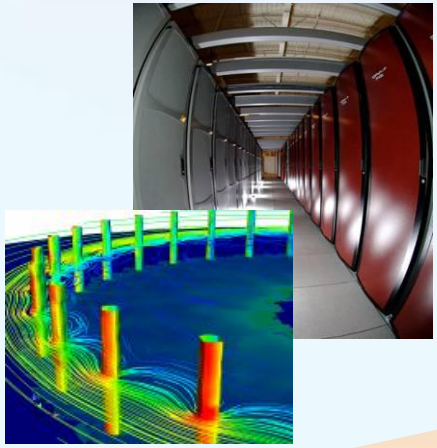
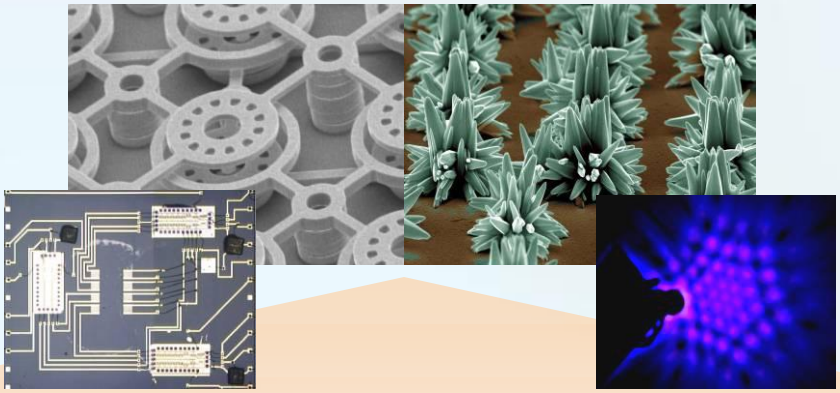
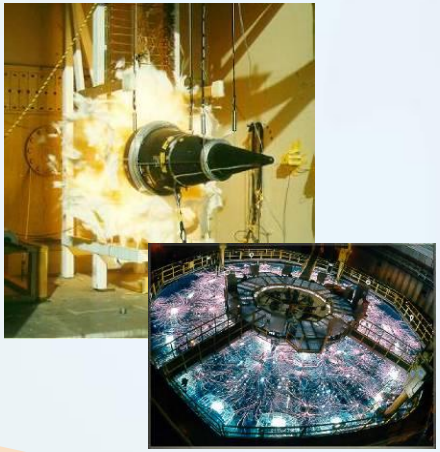
Research Disciplines Drive Capabilities



High Performance Computing

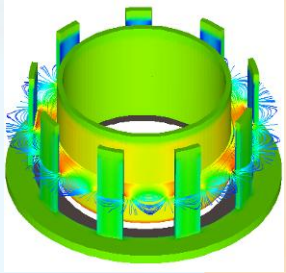


Nanotechnologies & Microsystems

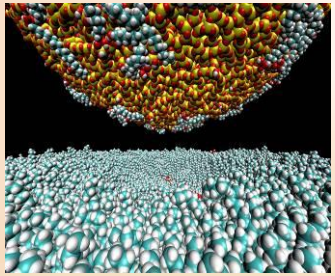


Extreme Environments

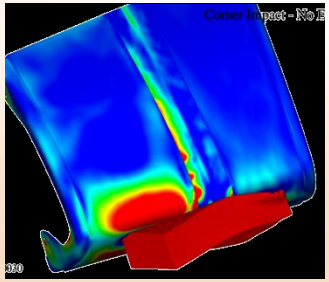
Computer Science



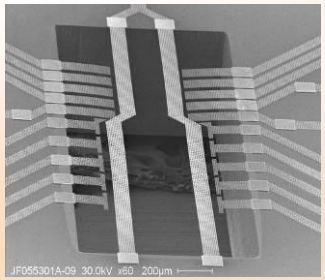
Materials



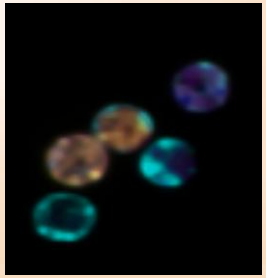
Engineering Sciences



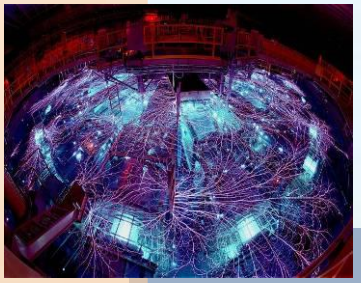
Micro Electronics



Bioscience



Pulsed Power



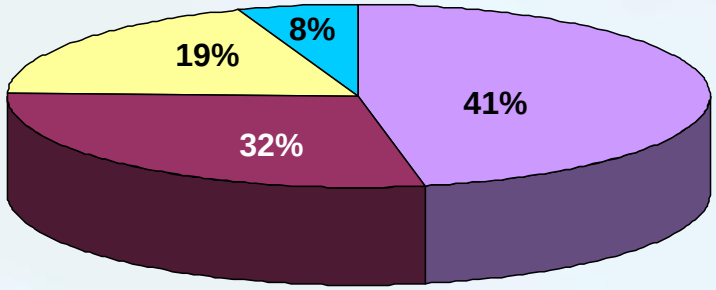
Research Disciplines

Sandia National Laboratories

People and Budget *(According to 2009 Annual Report)*

- On-site workforce: 11,400
- Regular employees: 8,250
- Gross payroll: ~$900 million

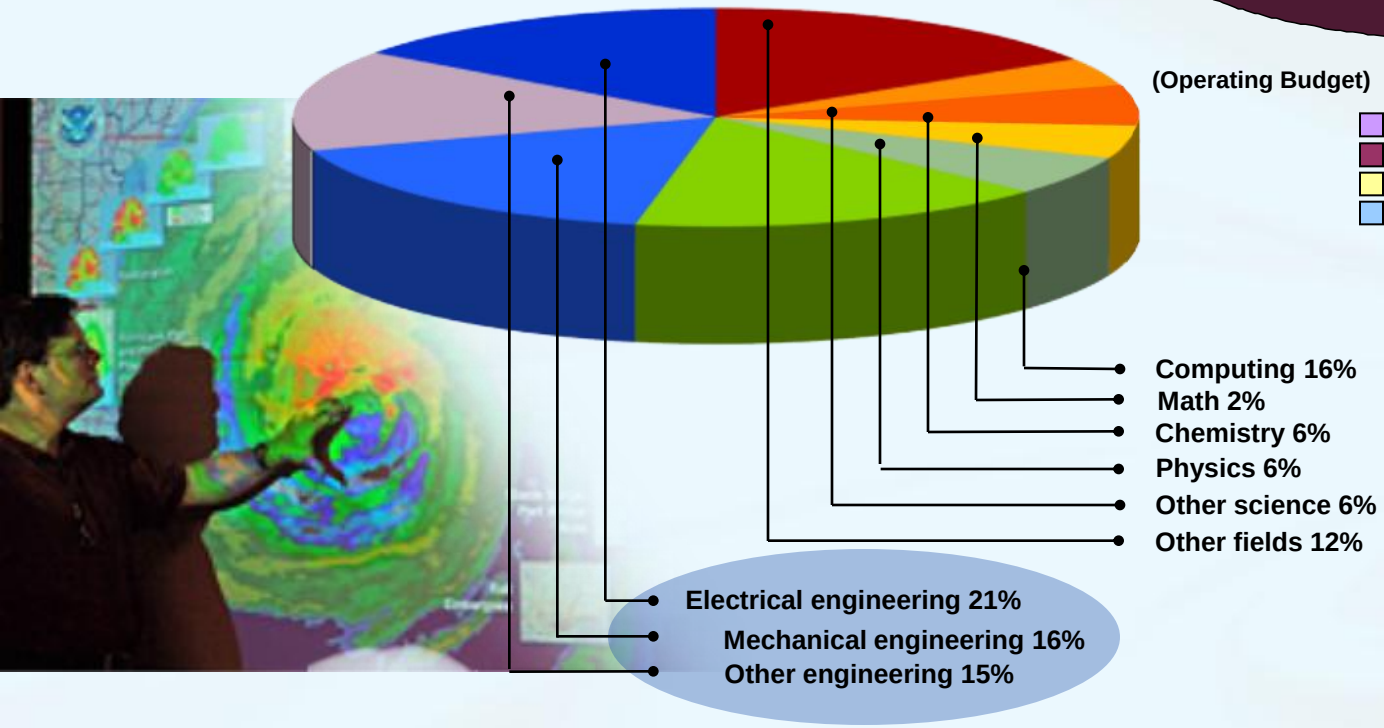
FY10 operating revenue
$2.4 billion



(Operating Budget)

- Nuclear Weapons
- Defense Systems & Assessments
- Energy, Climate & Infrastructure Security
- International, Homeland, and Nuclear Security

Technical staff (3,850) by discipline:



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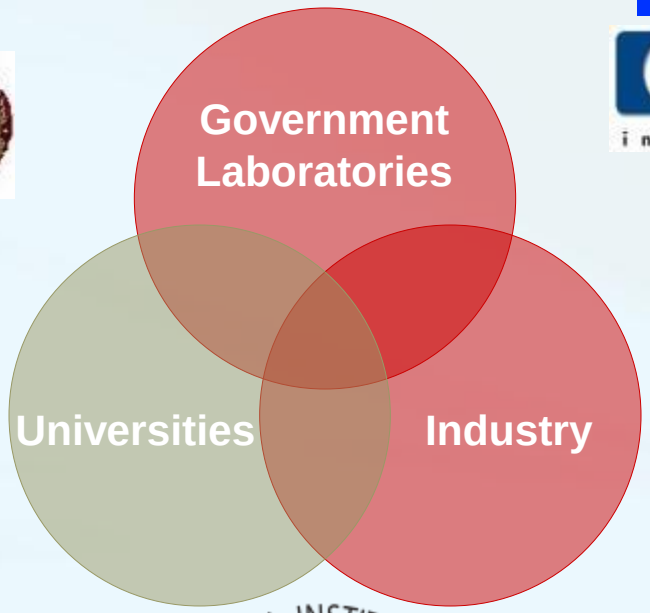
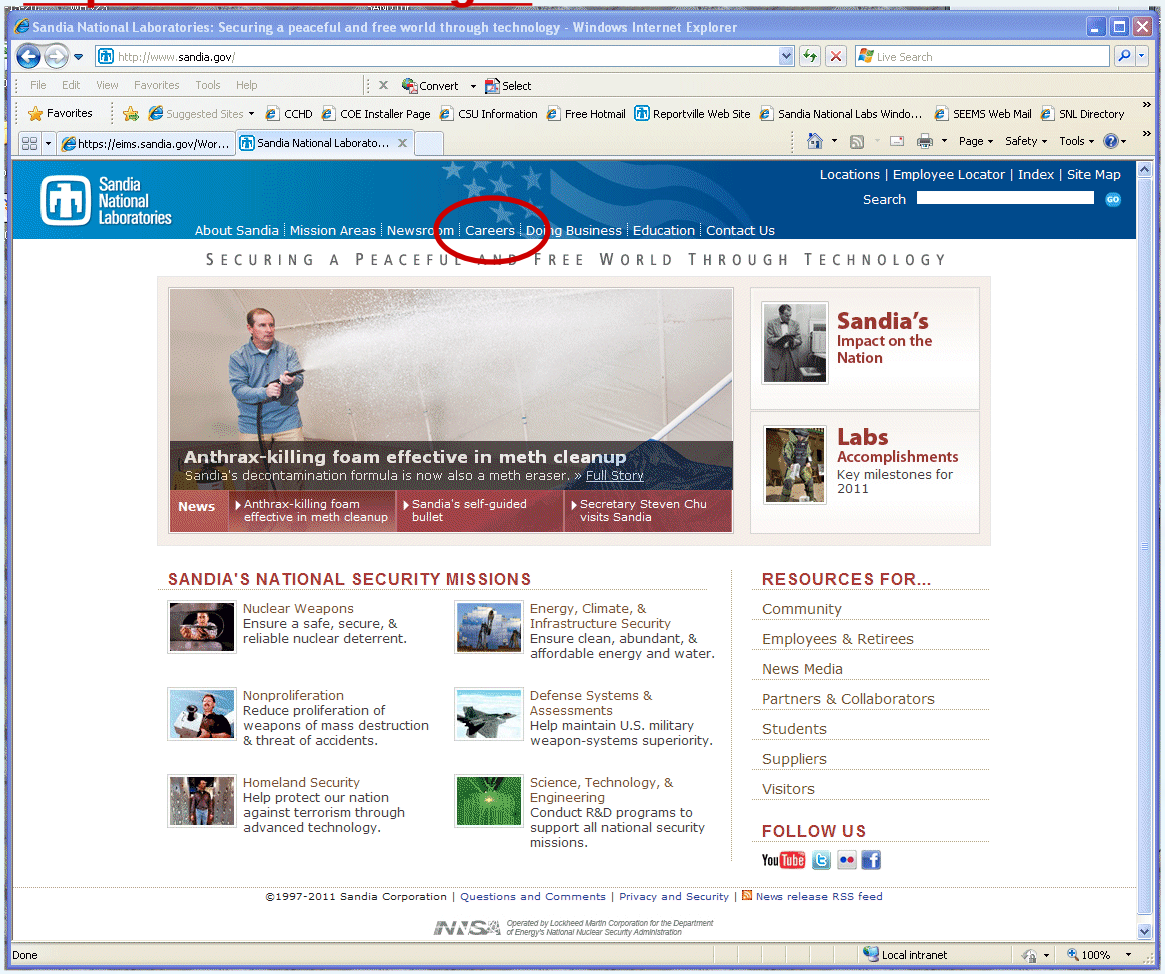
Partnerships and collaboration accelerate innovation



Careers at Sandia

- http://www.sandia.gov



Sandia National Laboratories

Student Internships and Co-ops

- Year-round and summer
- Must be a U.S. citizen with full-time enrollment status
- Minimum cumulative GPA of 3.2/4.0 for undergraduates or 3.5/4.0 for graduate students
- STEM and business disciplines
- Apply online at Sandia's website: www.sandia.gov

Fellowship Programs

GEM
5

Truman Fellowship
6

Doctoral Studies Program
19

National Physical Sciences Consortium
9

Special Master's Program
7

Master's Fellowship Program
22

Laboratory Directed Research & Development
30

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University of Michigan to Sandia

MY PATH

Education and Work

- **University of Michigan**
  - BS, Mechanical Engineering, 1991
  - MS, Mechanical Engineering, 1992
  - Ph.D., Environmental Engineering, 1999
- **New Mexico Institute of Mining and Technology**
  - Post-doctoral research assistant, 1999-2001
- **Sandia National Laboratories, Albuquerque, NM**
  - Technical staff, 2001-present

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My role at Sandia

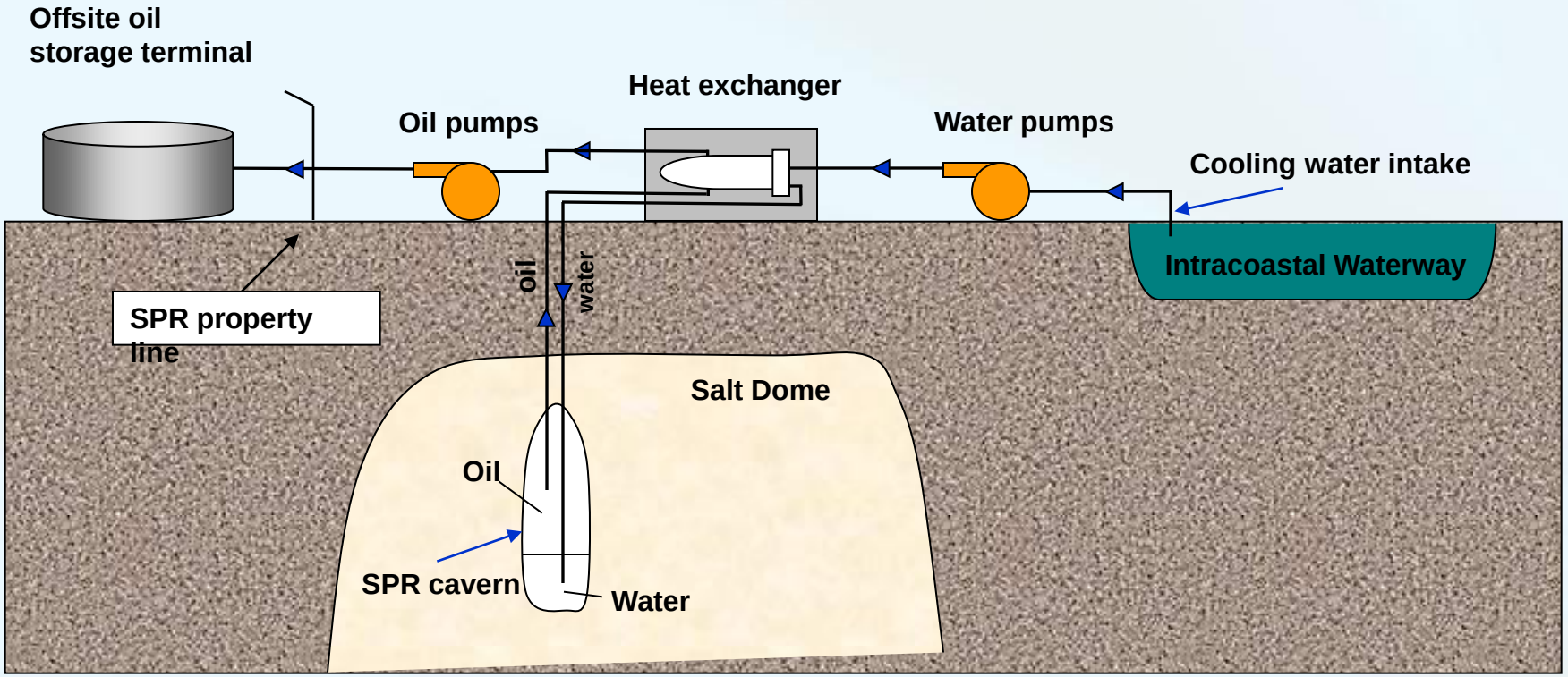
- **Principal Member of Technical Staff**
  - Direct work of junior Ph.D., MS, BS-level technical staff and contractors
  - Perform original engineering analyses
  - Interact regularly with external project partners and Department of Energy customers
- **Projects**
  - Nuclear waste management
    - Waste Isolation Pilot Plant (WIPP)
  - Crude oil storage in underground salt caverns
    - U.S. Strategic Petroleum Reserve (SPR)

US Strategic Petroleum Reserve (SPR)

- **Strategic stockpile of crude oil stored in underground salt caverns on Gulf Coast**
  - Owned and operated by US DOE
- **Started in the 1970's under the Ford administration**
- **Designed to protect against supply interruptions**

Design Concept

- Oil is stored in solution-mined salt cavern
- Oil is displaced with water when needed
- Inexpensive to build ($/bbl storage) and very secure



Sandia Role on SPR

- **Sandia is R&D advisor to SPR project**
  - 1.5% SPR annual operating budget goes to Sandia
  - About 9 FTEs in Albuquerque, NM
- **Sandia applies expertise in geology, geomechanics, chemical engineering, and fluid dynamics**
  - Develop field monitoring and laboratory experimental programs
  - Develop models of storage site geology and structural features, dissolution mining to build storage caverns, oil phase behavior, and fluid dynamics

Artesia, NM Brine Well Collapse

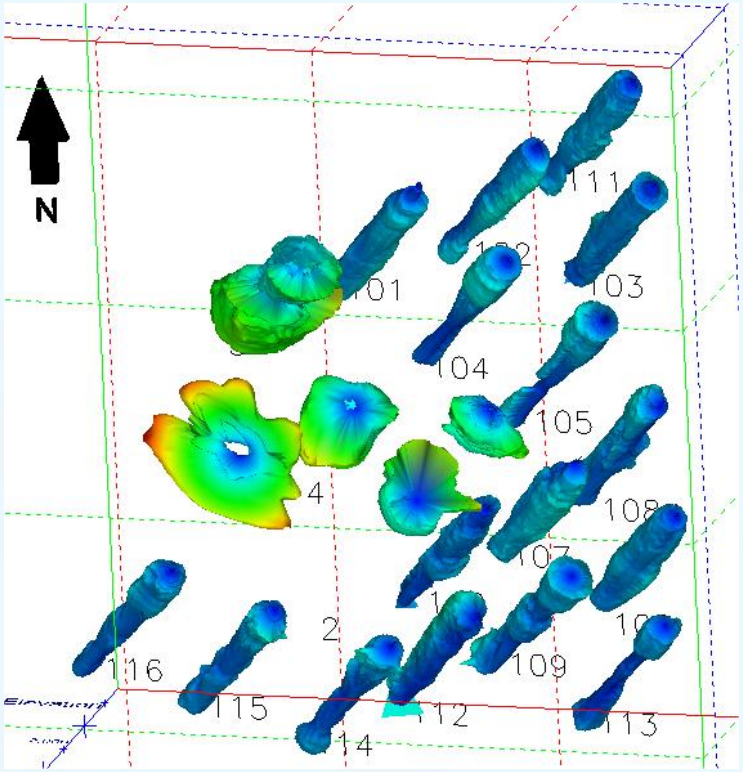
Artesia brine well collapse, morning, July 20, 2008 at 10:44 am.
Photo courtesy of National Cave and Karst Research Institute

Mechanical Integrity

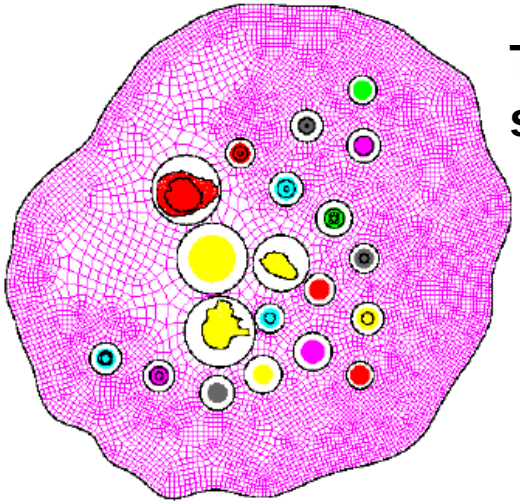
- **Assure containment of process fluids**
  - Brine, oil
- **Assure safety of operations**
  - Surface subsidence
  - Pressure controls
- **Apply geomechanical models to evaluate the stress-strain-failure relationships in geologic storage systems**
  - Site planning and maintenance

Geomechanical Model Applications

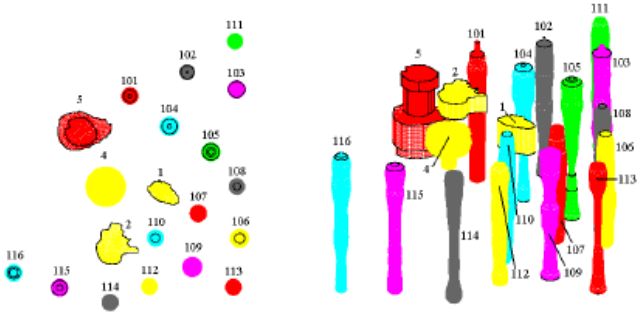
Visualization of Bryan Mound SPR cavern field from geologic data



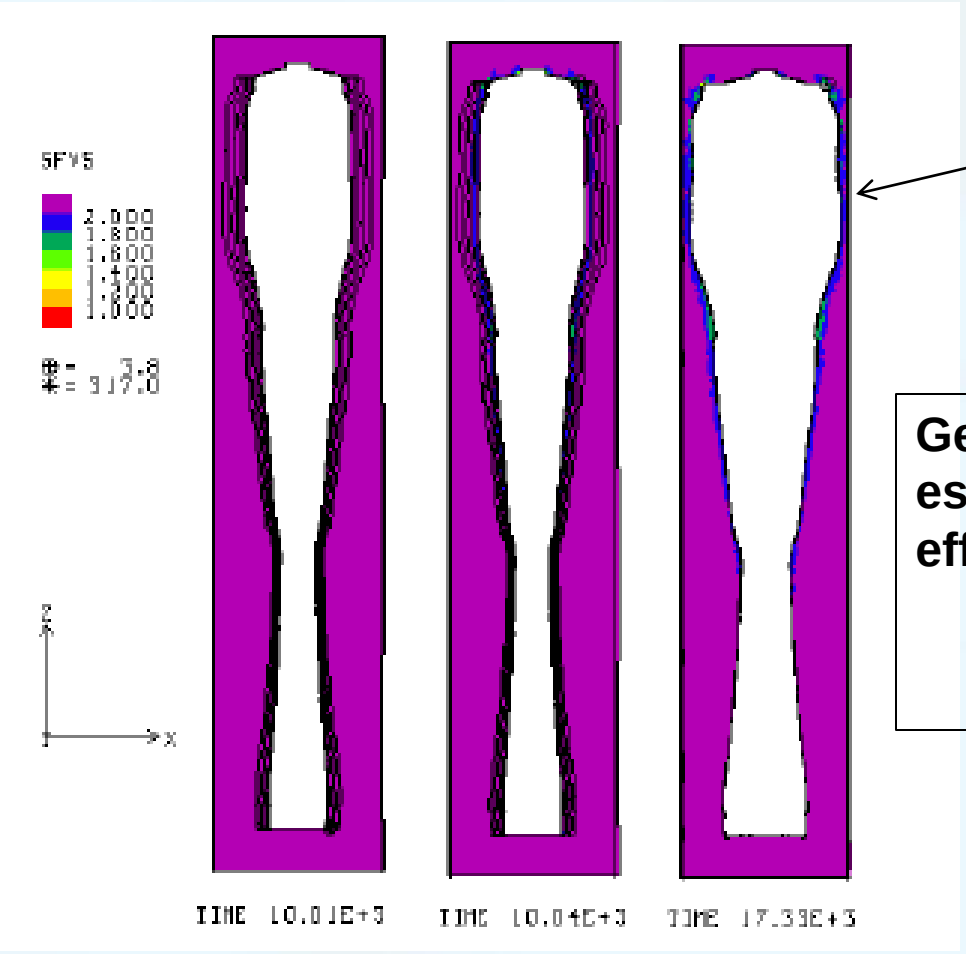
Interpretation for geomechanical modeling



Top view of salt dome



Geomechanical Model Results



Identifying regions of likely damage during theoretical operations scenario.

Geomechanical analyses help establish guidelines for safe and effective cavern operations.

Job Search Keys

- **Engage your faculty advisor**
- **Keep in touch with recent graduates in the work force**
- **Look into co-ops and internships**
  - Effective trial period for both parties
  - Often lead to permanent jobs
- **Use ECRC resources**
- **Most applicable to Ph.D.'s**
  - Present your work at professional conferences and market yourself while you are there
  - Contact people in your field about post-docs because many are not advertised

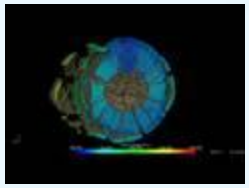
Post doc job search: What really worked

- **Sent unsolicited e-mails to the top 10 researchers I wanted to work for**
  - Sources for contacts
    - Dissertation bibliography
    - Conference proceedings
  - Polite e-mail saying that I am graduating soon, interested in their work, CV attached with publications list
- **8 responses, 5 interviews, 3 job offers in 2 months**
  - All post-doc positions

Stay Connected…

www.youtube.com/user/SandiaLabs

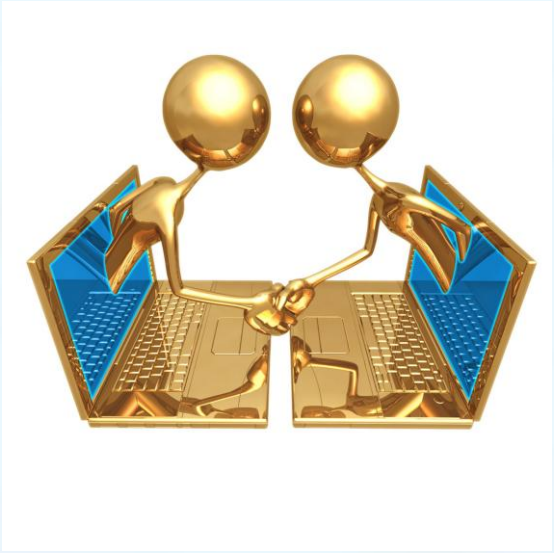
Top viewed videos:



Apophis destruction simulation
140,800+ views

Z Machine at Sandia Labs
64,200+ views

Rocket Powered Train Impact Test
59,000+ views



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