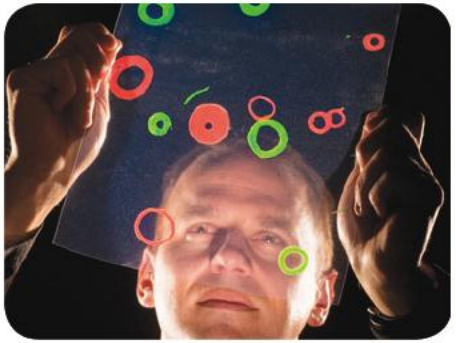
SAND2011-7808 C

Exceptional service in the national interest

SAND2011-7808C

Sandia National Laboratories



Sandia National Laboratories

Overview and Career Discussion

Geoff Klise

Earth Systems Analysis Department

October 18, 2011

U.S. DEPARTMENT OF ENERGY

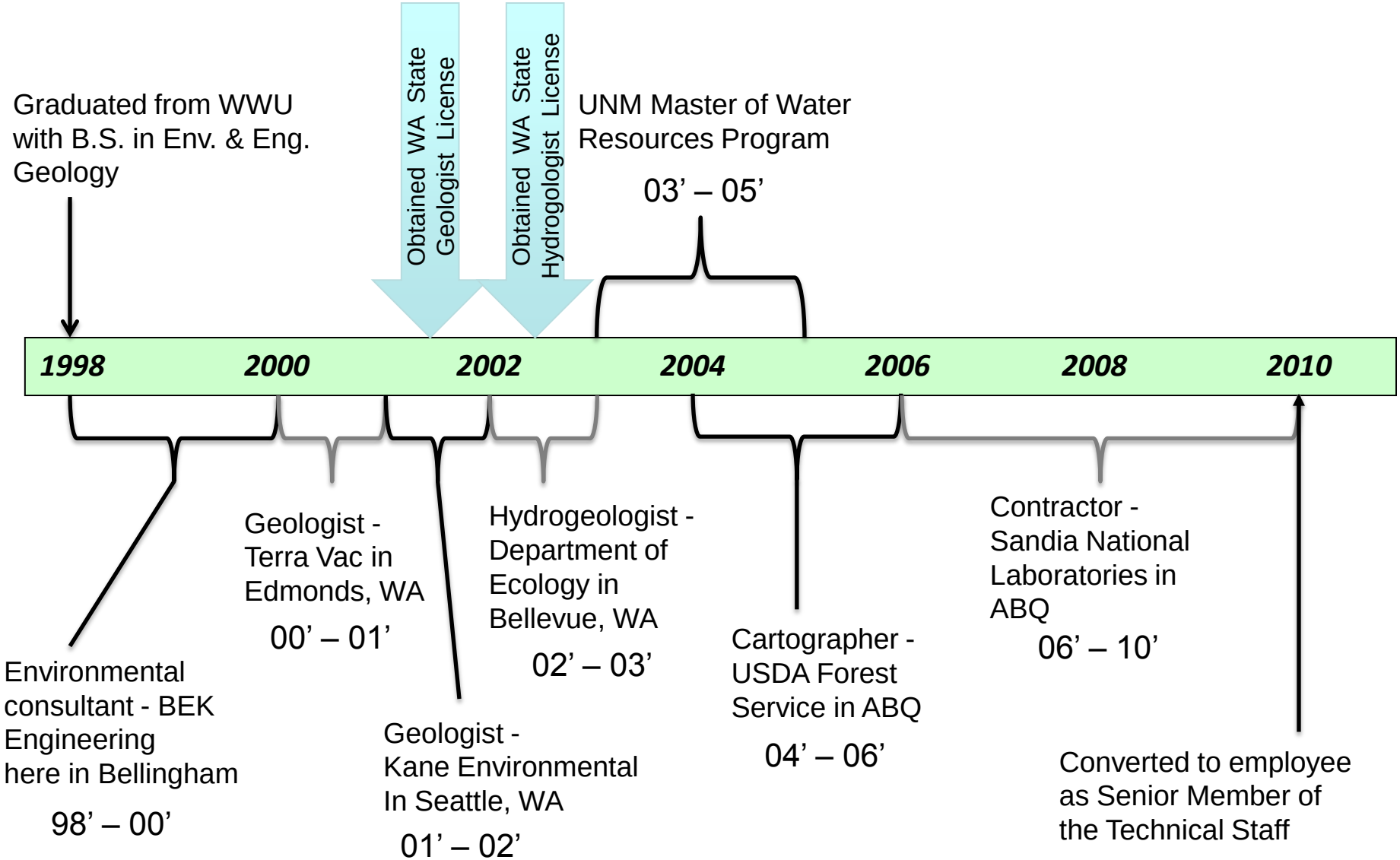
National Nuclear Security Administration

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.

Today's Talk

- Introduction to Sandia National Laboratories
  - What do we do?
  - Why I work here
  - Research in the Geosciences
  - Systems research in water & energy

- Potential Student Opportunities
  - Requirements
  - Types of work available


Graduated from WWU with B.S. in Env. & Eng. Geology
Obtained WA State Geologist License
Obtained WA State Hydrogologist License
UNM Master of Water Resources Program
03' – 05'
1998
2000
2002
2004
2006
2008
2010
Environmental consultant - BEK Engineering here in Bellingham
98' – 00'
Geologist - Terra Vac in Edmonds, WA
00' – 01'
Geologist - Kane Environmental In Seattle, WA
01' – 02'
Hydrogeologist - Department of Ecology in Bellevue, WA
02' – 03'
Cartographer - USDA Forest Service in ABQ
04' – 06'
Contractor - Sandia National Laboratories in ABQ
06' – 10'
Converted to employee as Senior Member of the Technical Staff

Sandia's History

Sandia National Laboratories

AMERICAN TELEPHONE & TELEGRAPH CO. BELL SYSTEM AND ASSOCIATED COMPANIES

THE WHITE HOUSE
WASHINGTON

May 13, 1949

Dear Mr. Wilson:

I am informed that the Atomic Energy Commission intends to ask that the Bell Telephone Laboratories accept under contract the [illegible] at Albuquerque, New Mexico. This operation, which is a [illegible] atomic [illegible] national defense, and should have the [illegible] national direc-[illegible].

I hope that after you have heard more in detail from the Atomic Energy Commission, your organization will find it possible to [illegible] this task. In my opinion you have here an opportunity to render an **exceptional service in the national interest.**

I am writing a similar note direct to Dr. C. E. Buckley.

Very sincerely yours,

Harry Truman

Mr. Leroy A. Wilson,
President,
American Telephone and Telegraph Company,
195 Broadway,
New York 7, N. Y.

exceptional service in the national interest.

Sandia's Sites

Sandia National Laboratories

Albuquerque, New Mexico

Livermore, California

Las Vegas, Nevada

Carlsbad, New Mexico

Kauai, Hawaii

Pantex, Texas

Tonopah, Nevada

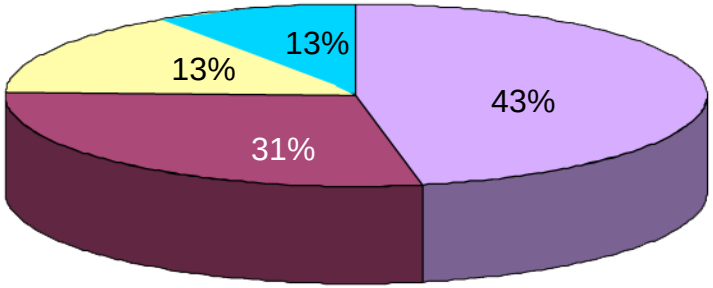
Kodiak, Alaska

People and Budget

(As of October 15, 2010)

- On-site workforce: 11,677
- Regular employees: 8,607
- Gross payroll: ~$898.7 million

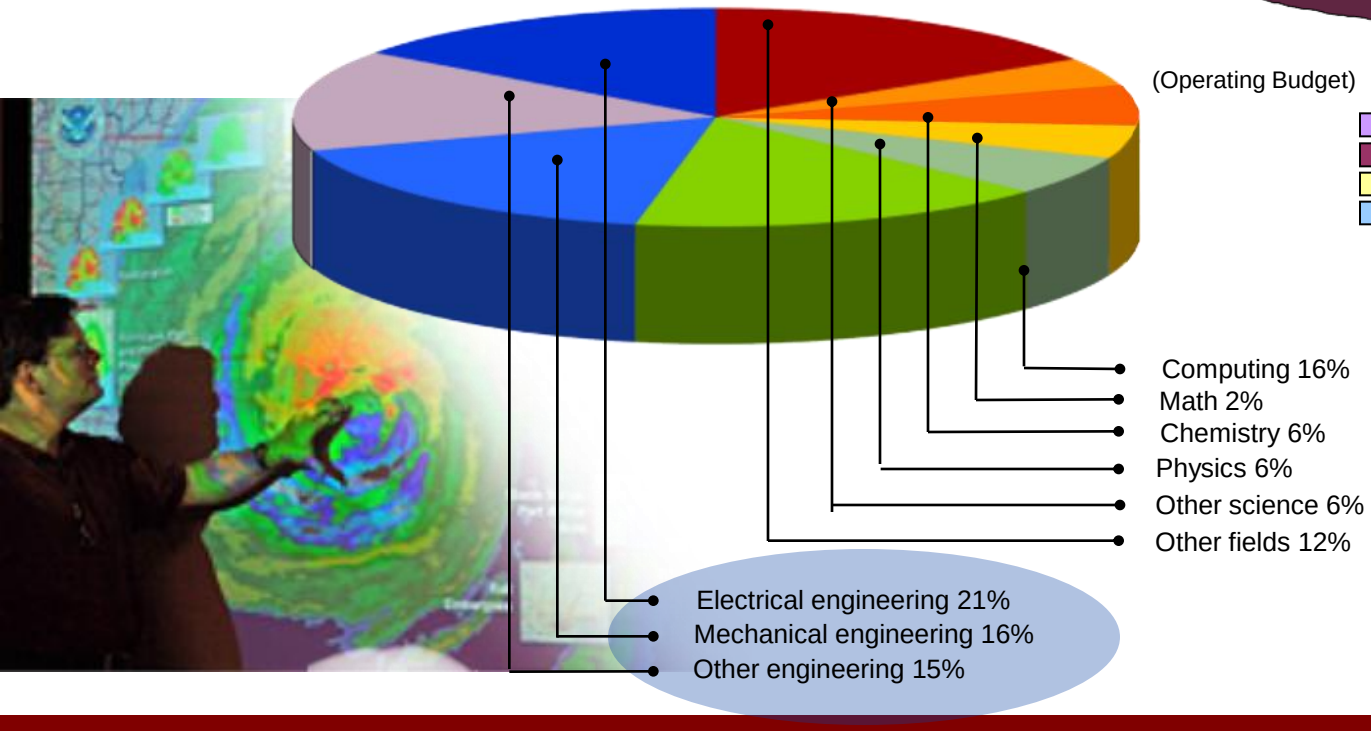
FY10 operating revenue
$2.3 billion



(Operating Budget)

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

Technical staff (4,277) by discipline:



The Mission Has Evolved for Decades

Sandia National Laboratories

1950s	1960s	1970s	1980s	1990s	2000s
Production engineering & manufacturing engineering	Development engineering	Multiprogram laboratory	Research, development and production	Post-Cold War transition	Broader national security challenges

Energy, Climate, and Infrastructure Security

http://energy.sandia.gov/

Sandia National Laboratories

Program Areas

- Infrastructure Security
- Energy Security
- Climate Security
- Enabling Capabilities

Areas of Expertise

- Modeling & Analysis, Cyber, Electricity Distribution, and Energy Assurance
- Renewables, Energy Efficiency, Energy for Transportation, and Nuclear Energy Systems
- Sensing & Monitoring, Carbon Capture, Sequestration, Modeling and Analysis, and Water
- Discovery Science & Engineering, Systems Analysis, and Regulatory & Policy

Why is Sandia in this business?

Sandia National Laboratories

National Security is intimately linked with Energy, Climate, & Infrastructure Security Challenges.

Prosperity

"Without energy, there is no economy."

Environmental Stewardship

"Without climate, there is no environment."

National Security

"Without energy and environment, there is no security."

John Holdren

Director of the White House Office of Science and Technology Policy

Program Areas

Sandia National Laboratories

Energy	Climate	Infrastructure	Enabling Capabilities
Renewables	Sensing and Monitoring	Modeling Analysis	Discovery
Nuclear	Modeling and Analysis	Cyber	Systems Analysis
Transportation	Carbon Management	Electricity	Regulations and Policy
Efficiency	Water	Energy Assurance	(ARPA-E)*
		International Assurance	

* Advanced Research Projects Agency-Energy

Program Areas

Sandia National Laboratories

Energy	Climate	Infrastructure	Enabling Capabilities
Renewables	Sensing and Monitoring	Modeling Analysis	Discovery
Nuclear	Modeling and Analysis	Cyber	Systems Analysis
Transportation	Carbon Management	Electricity	Regulations and Policy
Efficiency	Water	Energy Assurance	(ARPA-E)*
		International Assurance	

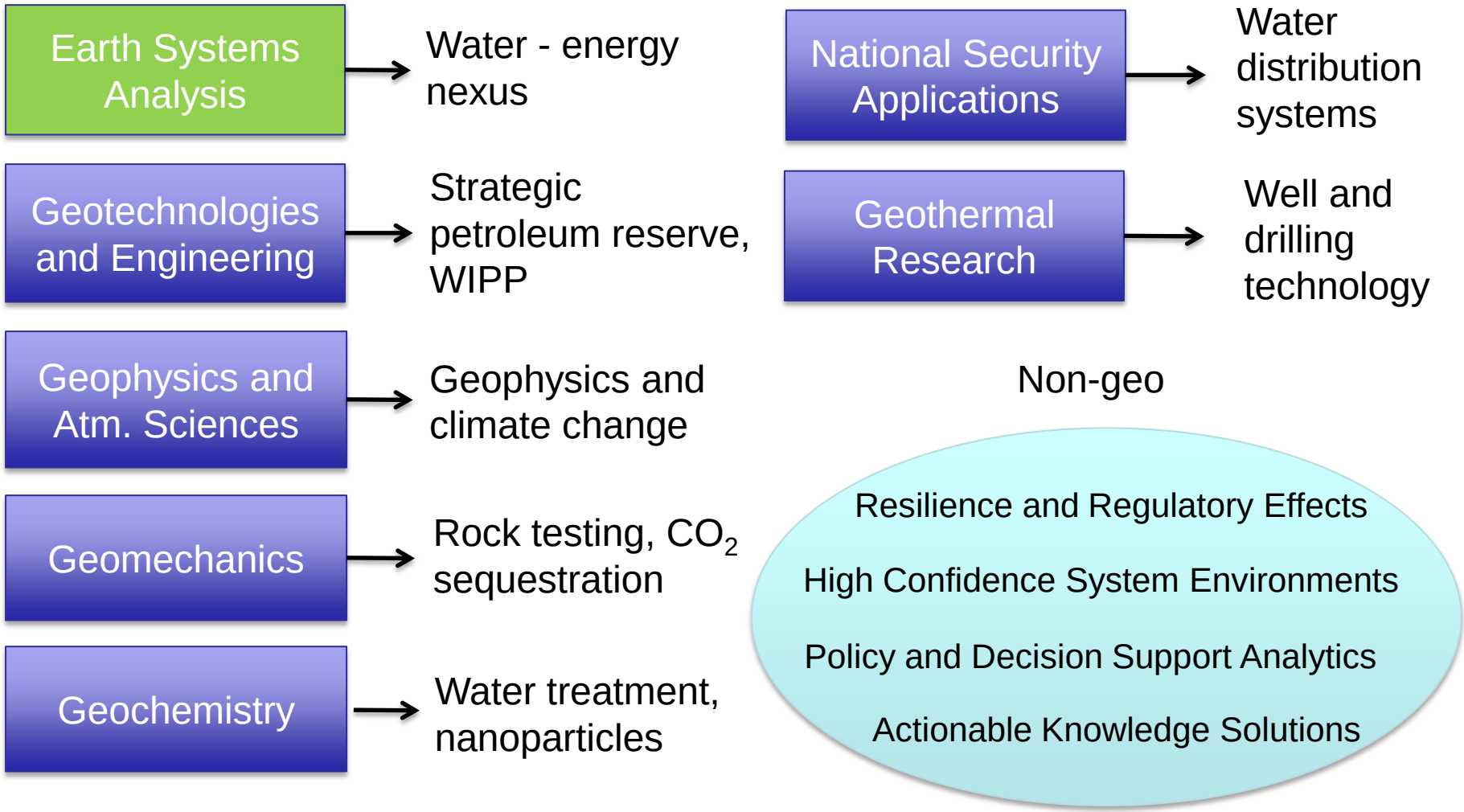
* Advanced Research Projects Agency-Energy

Why I work here….

Sandia National Laboratories

- Challenging work environment
- Creativity is encouraged
- Research for renewable energy technologies
  - Solar photovoltaics
  - Algal biofuels
  - Hydrogen infrastructure
- Climate risk and water use research
  - Tie-in to water-energy nexus

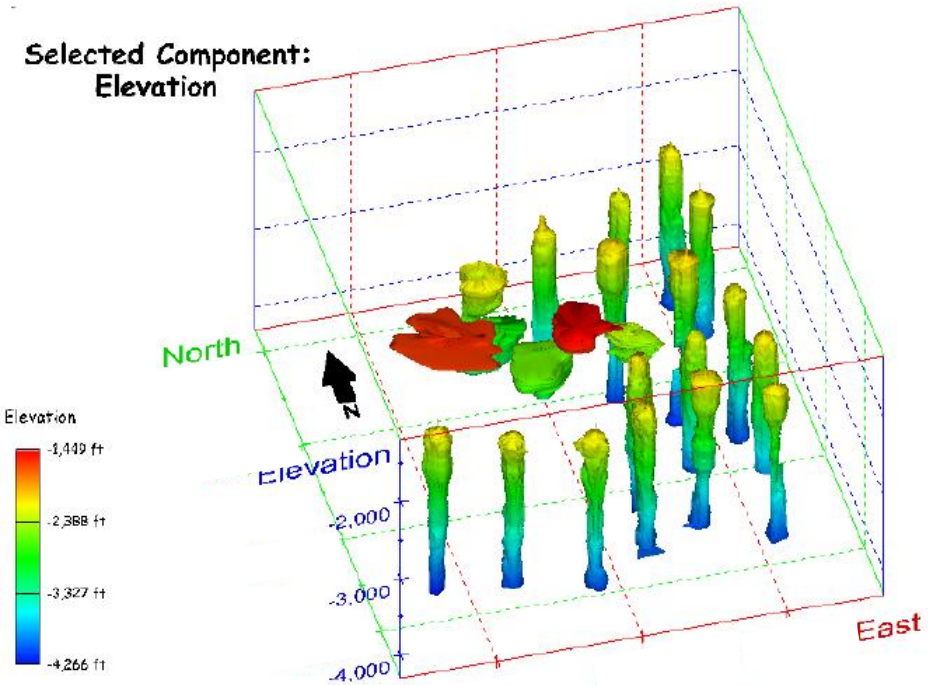
Geoscience, Climate and Consequence Effects



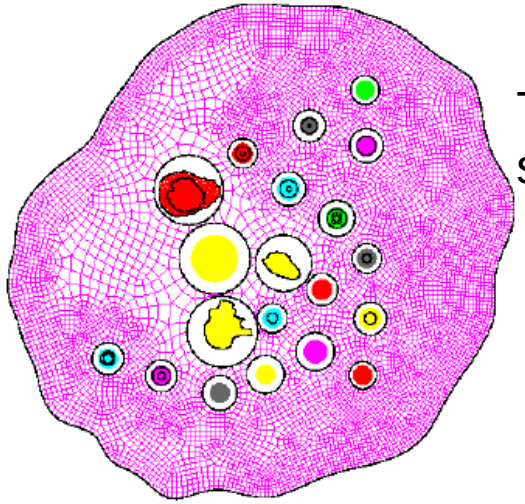
Sandia National Laboratories

Geomechanical Model Applications

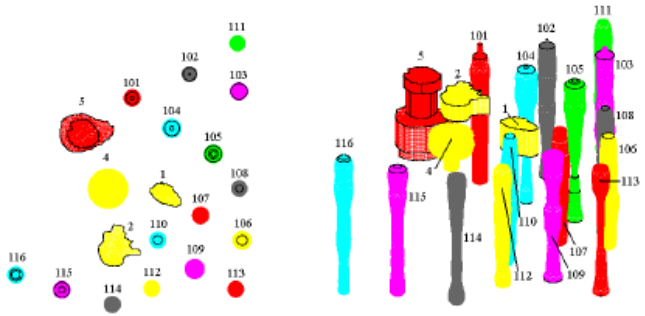
Visualization of Bryan Mound SPR cavern field from geologic data



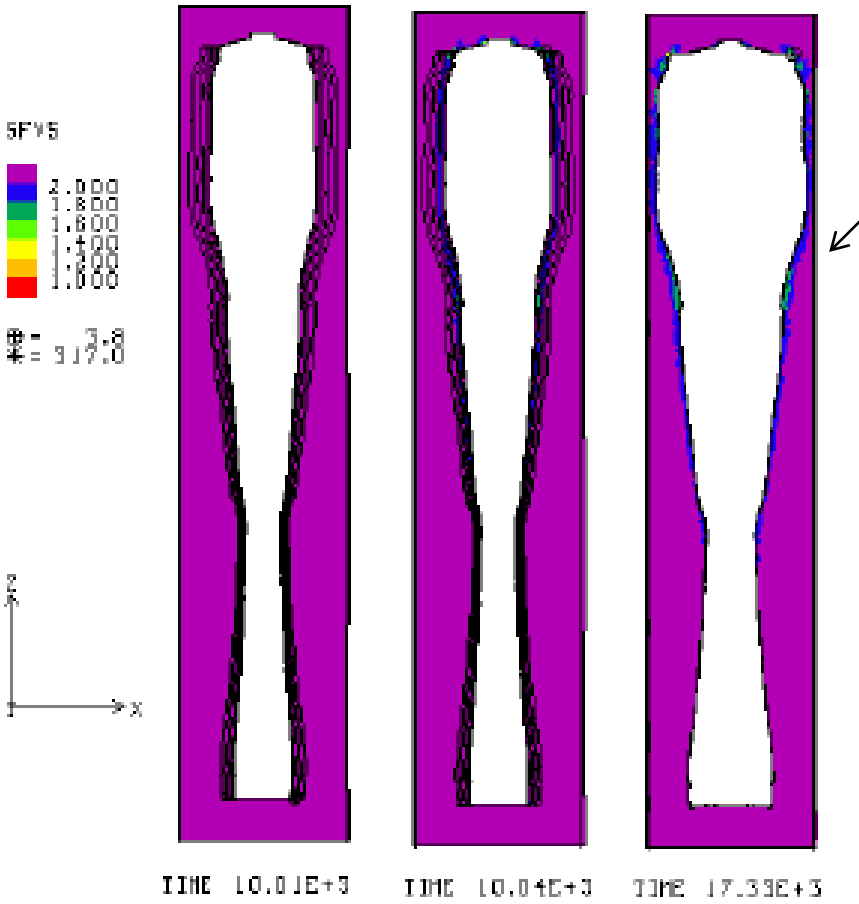
Interpretation for geomechanical modeling



Top view of salt dome

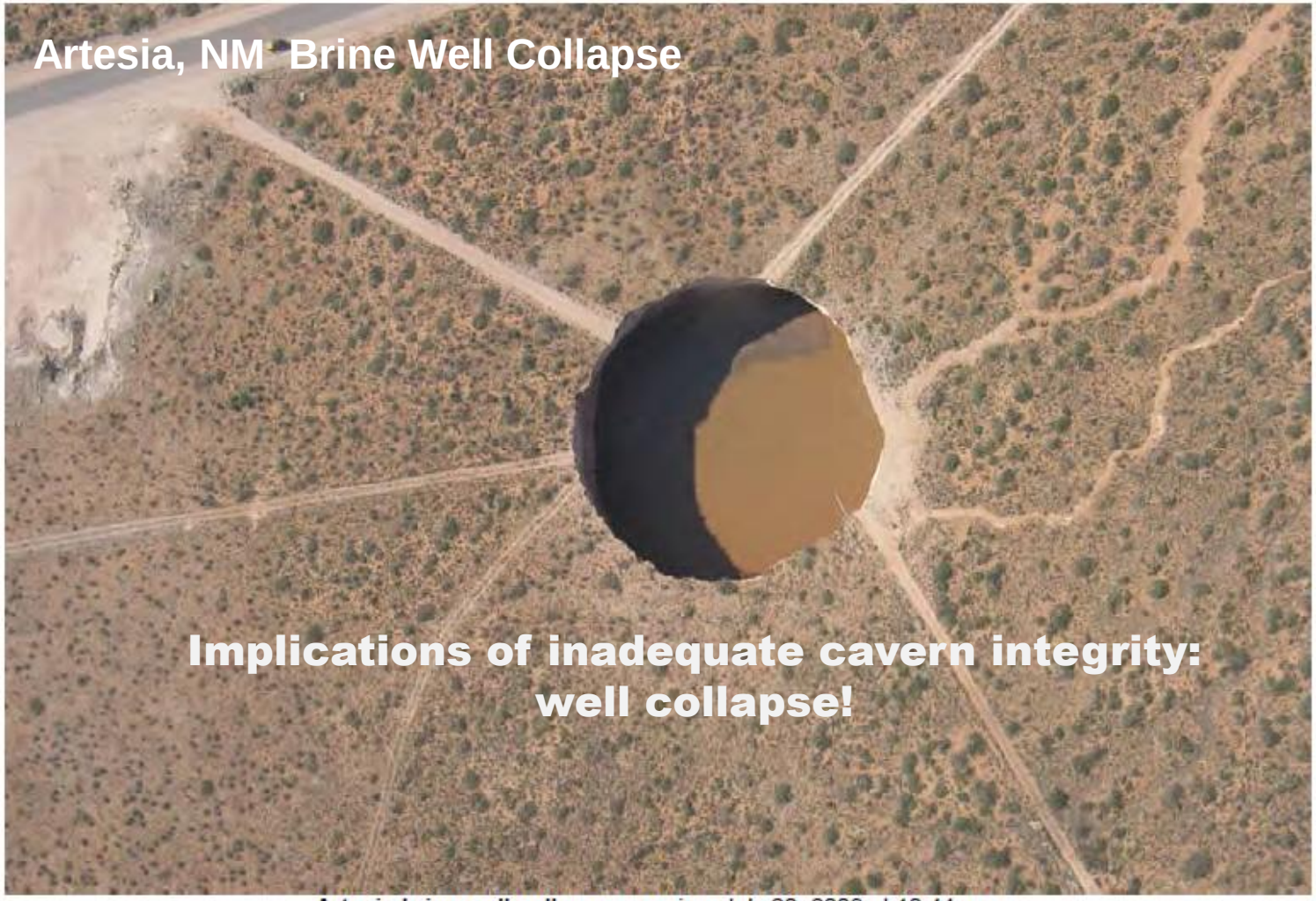


Geomechanical Model Results



Identifying regions of likely damage during theoretical operations scenario

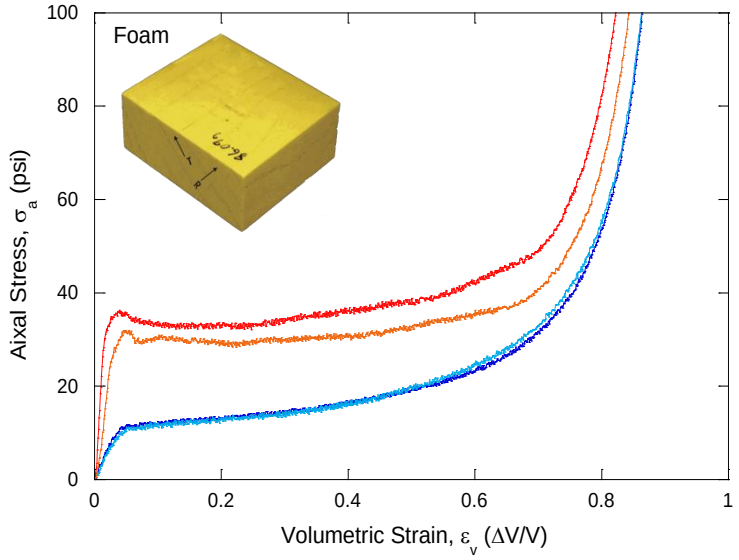
Geomechanical analyses help establish guidelines for safe and effective cavern operations

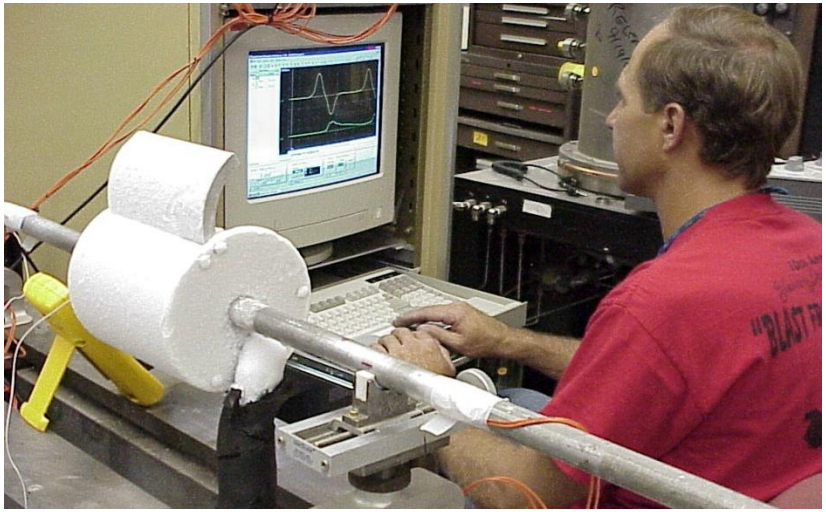


Artesia brine well collapse, morning, July 20, 2008 at 10:44 am.
Photo courtesy of National Cave and Karst Research Institute

Geomechanics - Materials Testing Capabilities

- *Physical Properties:*
  - Density, ultrasonic velocity
  - Porosity, pore structure imaging
  - Mineralogy/chemistry
- *Mechanical Properties:*
  - Strength & deformation (intact & joints)
  - Acoustic emission mapping
  - Powder compaction
  - Creep
- *Thermal Properties:*
  - Conductivity & expansion
- *Hydrologic Properties:*
  - Single & two-phase flow, *k*
- *Electrical Properties:*
  - Phase transformation

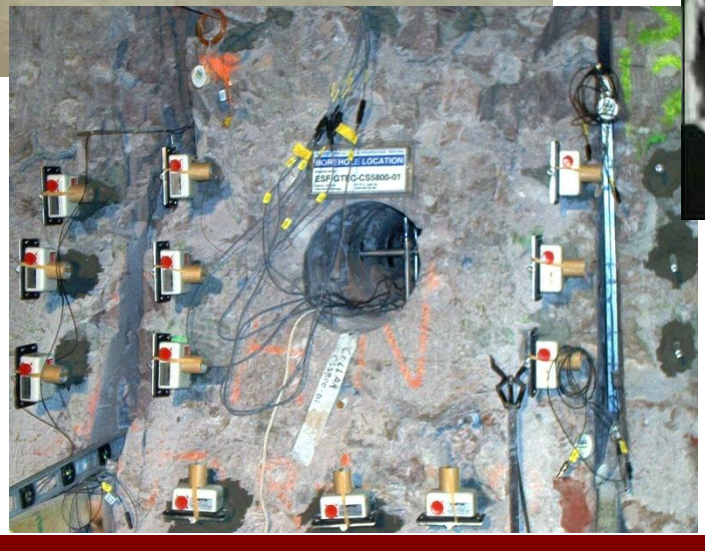




Split Hopkinson Bar

Geomechanics - Field Validation

Salt – WIPP Heated Pillar Test



YMP – Rock Mass Testing

National Security Applications – Water Security

Sandia National Laboratories

What is the threat? Unintentional or malicious contamination of a water distribution system

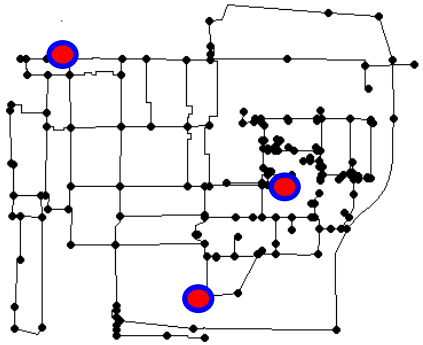
Challenges

- Dynamic, non-linear system
- Unknown contaminant
  - Biological or chemical agent
- Unknown location
  - Source water
  - Treatment facility
  - Storage tanks
  - Backflow contamination
- Unknown injection time
  - Pulse or continuous

National Security Applications – Water Security

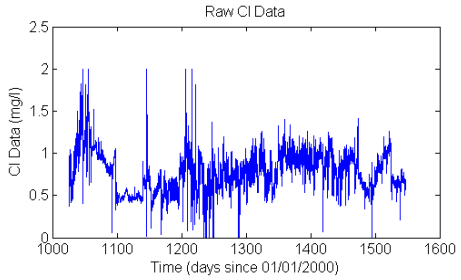
Sandia National Laboratories

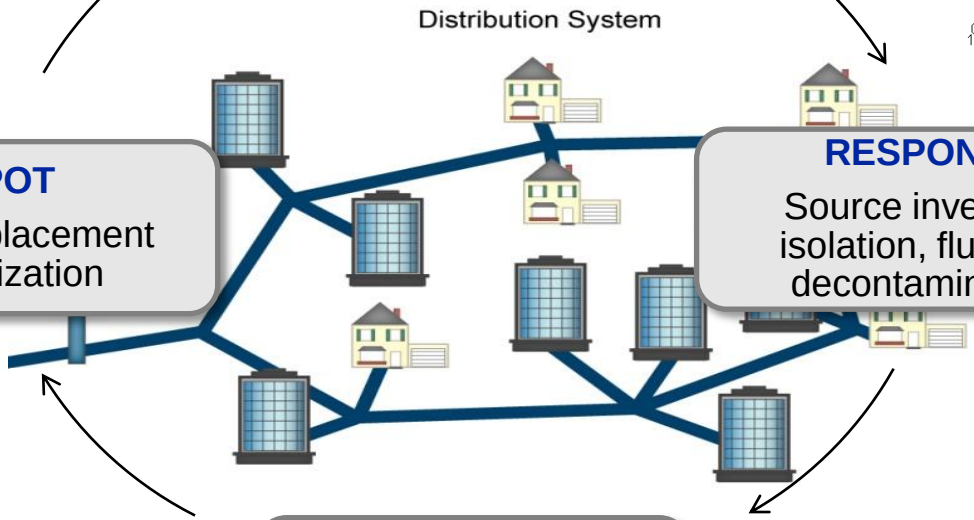
Contaminant warning systems and response action plans for water distribution networks



CANARY

Real-time event detection



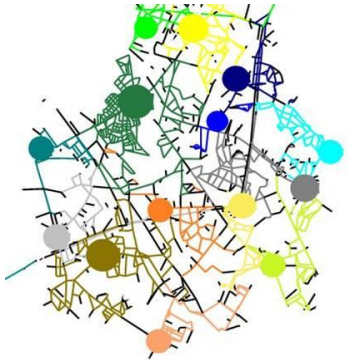


SPOT

Sensor placement optimization

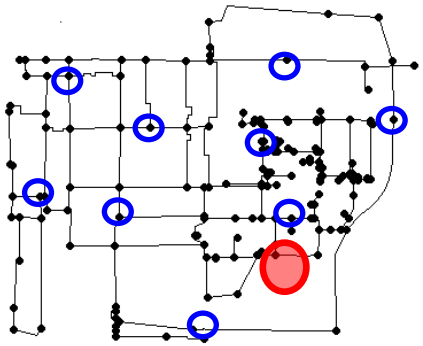
RESPONSE

Source inversion, isolation, flushing, decontamination



TEVA

Contaminant simulation and vulnerability assessment



National Security Applications – Canary

Online Water Quality Event Detection

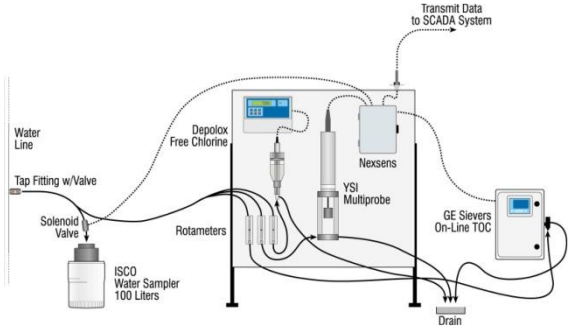
Goal: Detect anomalous water quality signals in real time

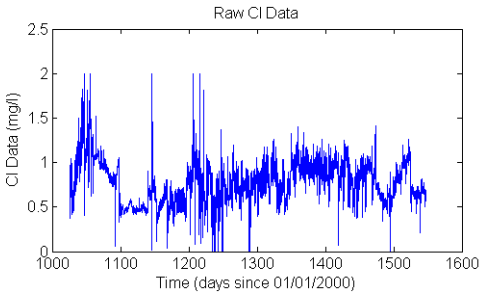
Motivating Factors

- Currently no robust sensor for all contaminants
- Leverage existing utility infrastructure
- Adapt to noisy environments
- Provide open source toolkit

Impact

- Used or evaluated by all 4 US WSI pilot cities
- Installed in largest water system in the world (Metropolitan Water District)
- Running on Singapore national system since July 2009
- Dual-use benefits of more efficient utility operation





Earth Systems Analysis

Sandia National Laboratories

- Water for Energy in the Western Interconnect
- Algae biofuels assessment for Canada
- Solar City decision-support model
- **Water-Energy-Carbon Sequestration simulation model**
- Solar America Cities program support
- Economic impacts of climate change to 70 industries in the U.S.
- Geothermal systems modeling
- Native American water settlement support
- Collaborative decision-support modeling
- Ecology of National Security
- Iraq Water Planning Model

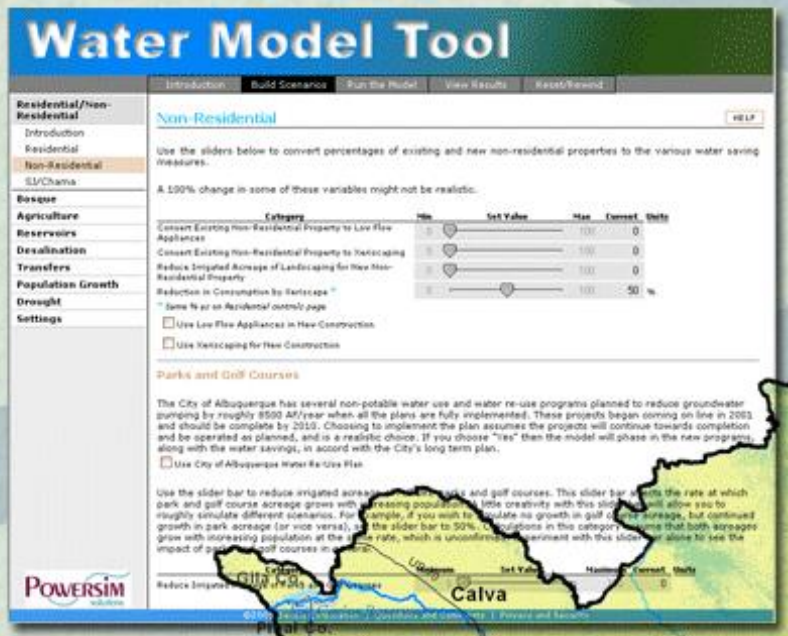
gila san francisco RIVER BASINS

Sandia National Laboratories

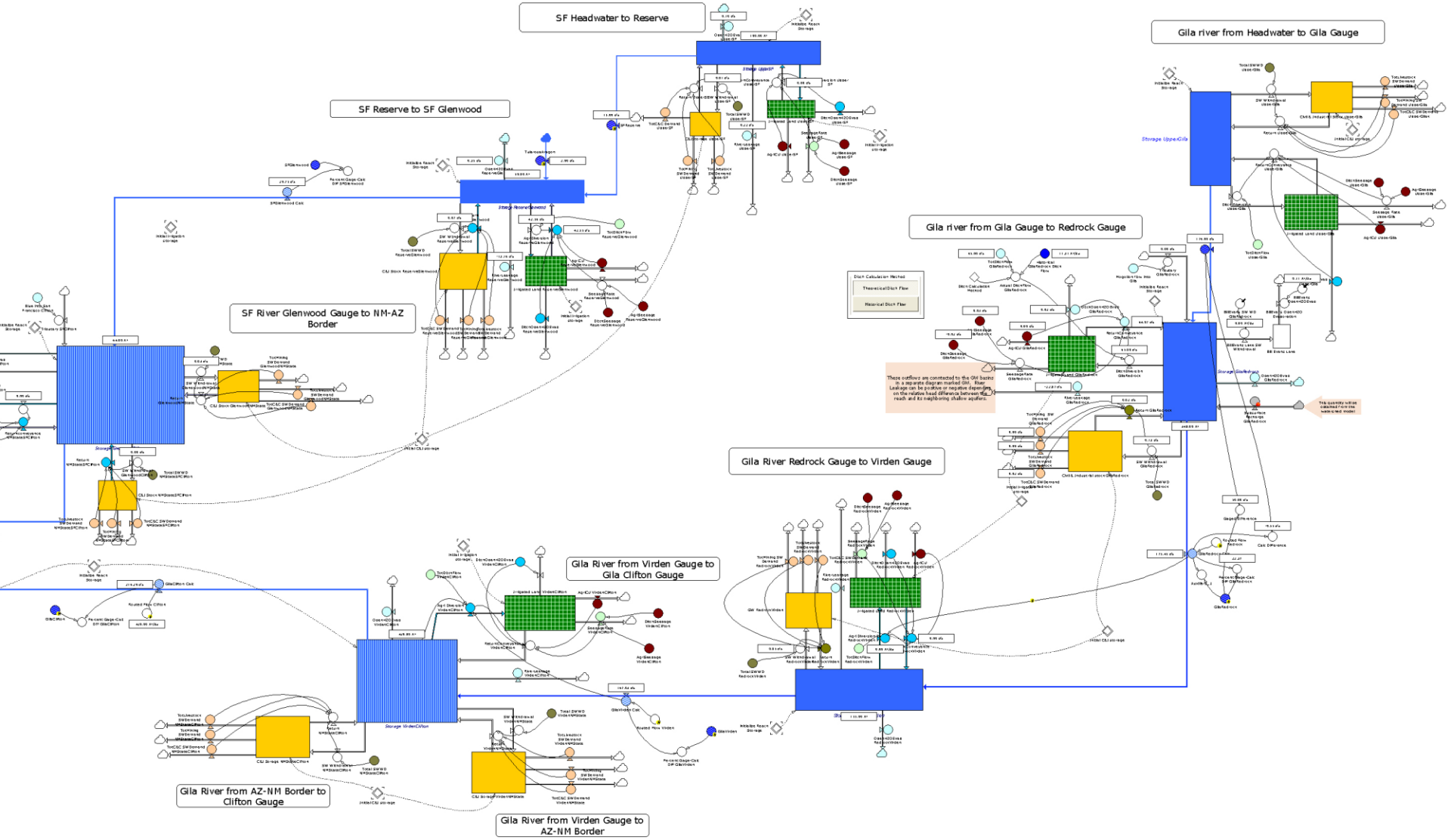
contents

- Home
- Introduction
- Planning & Decision Process
- Methods
- Team
- Model
- Interactive Map
- References
- Links
- Contacts

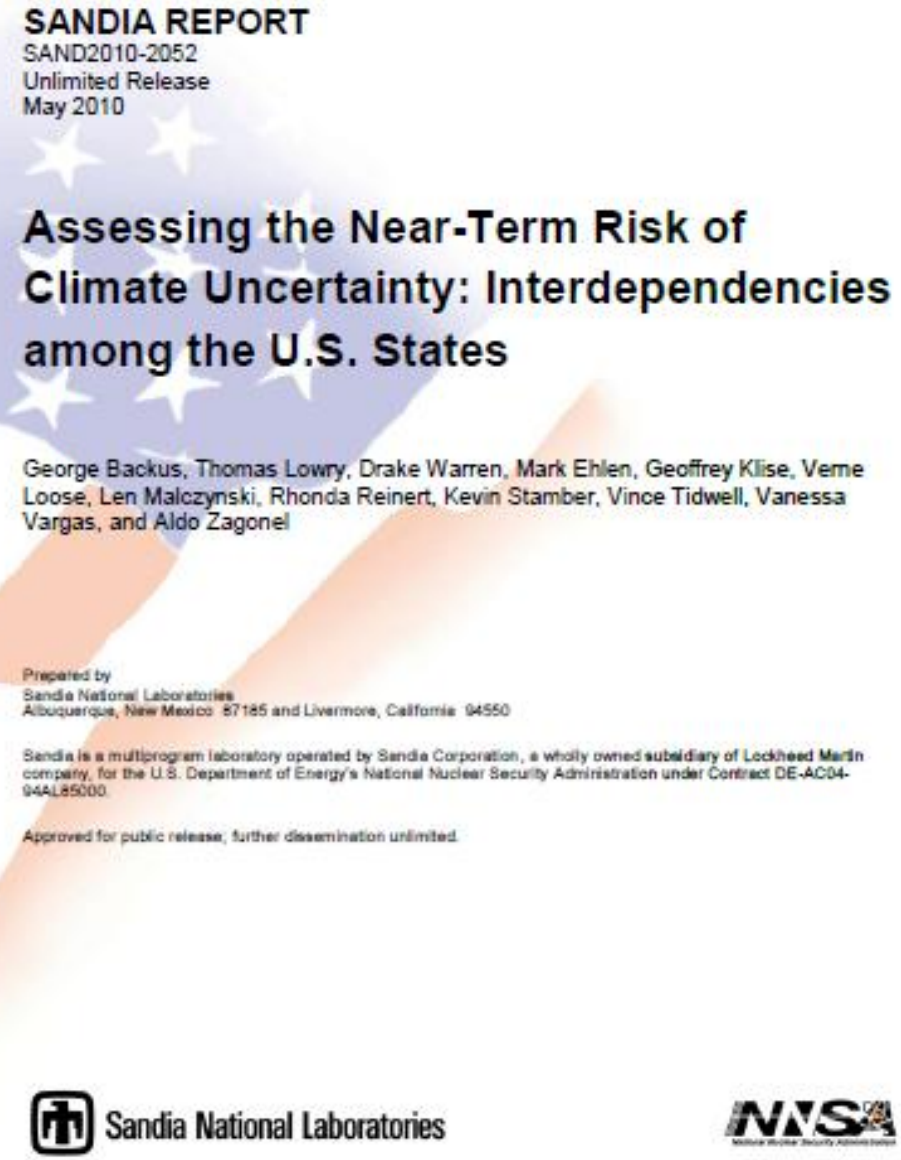
Sandia National Laboratories is assisting the New Mexico Interstate Stream Commission by creating an interactive water supply model tool that will engage stakeholders and decision makers in developing plans for utilizing the water and funds made available through the 2004 Arizona Water Settlements Act.



Interactive Map

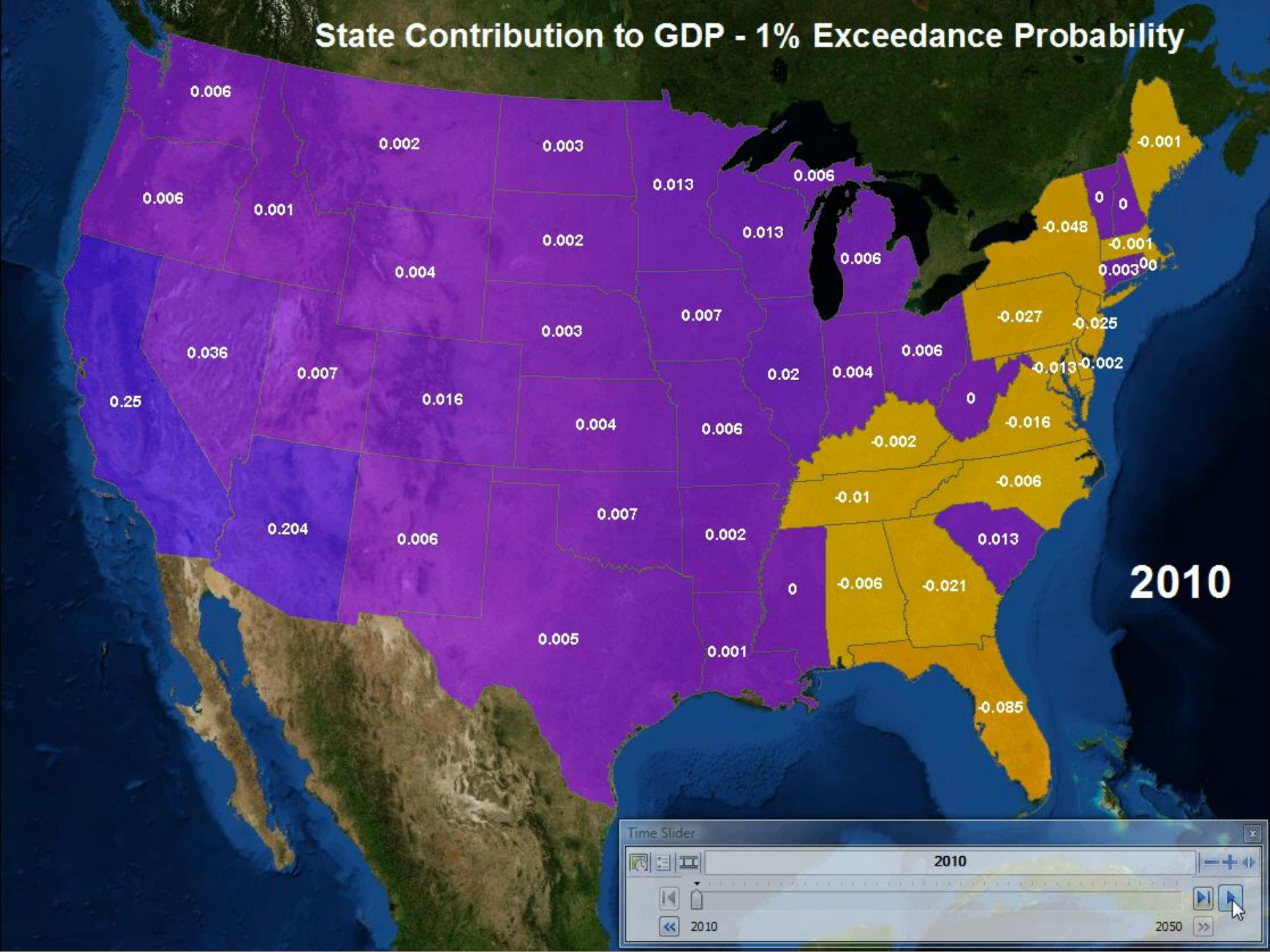

SF Headwater to Reserve
SF Reserve to SF Glenwood
SF River Glenwood Gauge to NM-AZ Border
Gila river from Headwater to Gila Gauge
Gila river from Gila Gauge to Redrock Gauge
Gila River Redrock Gauge to Virden Gauge
Gila River from Virden Gauge to Gila Clifton Gauge
Gila River from AZ-NM Border to Clifton Gauge
Gila River from Virden Gauge to AZ-NM Border

Sandia National Laboratories



- Quantify climate change risk
  - » Population and business impacts
- IPCC AR4 Ensemble of simulations for 40-year uncertainty proxy
- Risk extends through precipitation and temp. uncertainty
- Create probability distributions of climatic futures for precipitation and temperature
- Use Regional Economics Models Incorporated (REMI) macroeconomic model
  - » Cost to adjust water usage to match water availability
  - » How do people respond?

Predicted future costs of climate change and state GDP output


State Contribution to GDP - 1% Exceedance Probability
0.006
0.002
0.003
0.013
0.006
-0.001
0.006
0.001
0.013
0
0
-0.048
0.002
-0.001
0.004
0.006
0.003
0
0.007
-0.027
-0.025
0.036
0.003
0.006
0.007
0.02
0.004
-0.013
-0.002
0.25
0.016
0
0.004
0.006
-0.016
-0.002
-0.01
-0.006
0.007
0.013
0.204
0.006
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0.001
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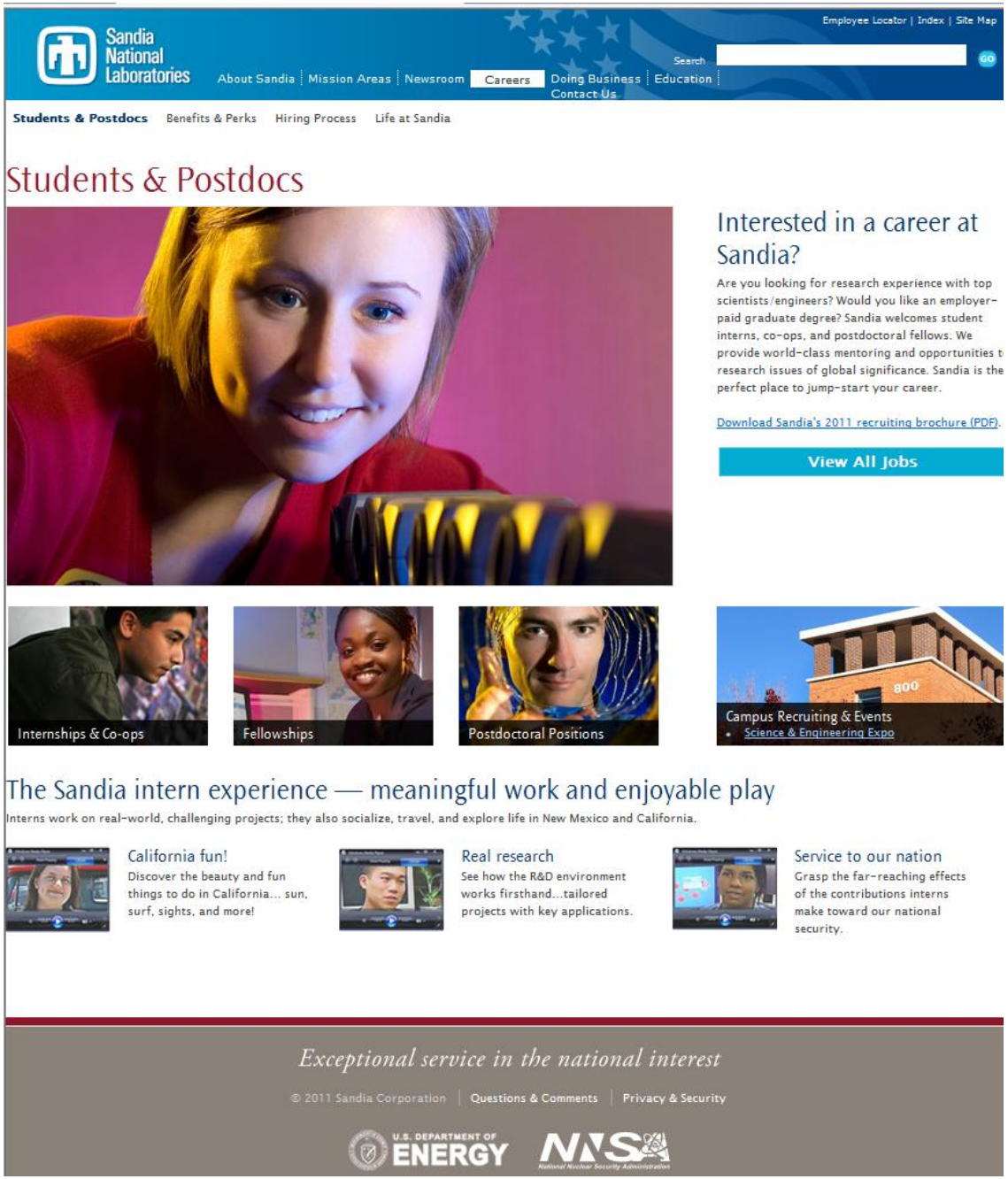
2010
Time Slider
2010
2010
2050



Sandia National Laboratories

http://www.sandia.gov/careers/students_postdocs/

- Internships: NM or CA
  - Summer
  - Co-op (Aug-Dec)
  - Travel Reimbursement
  - 3.5 GPA
- Fellowships: NM or CA
  - Specific fields
  - Specific schools
  - 3.2 undergrad
  - Maintain 3.5 M.S.

More Information

Sandia National Laboratories

Public Website

http://www.sandia.gov

Student Internships

http://www.sandia.gov/careers/students_postdocs/

ECIS

http://energy.sandia.gov

Earth Systems Analysis Department

http://energy.sandia.gov/?page_id=4431

Facebook

http://www.facebook.com/SandiaLabs

Twitter

https://twitter.com/#!/SandiaLabs

YouTube

http://www.youtube.com/user/SandiaLabs

Thank you

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