

Exceptional service in the national interest



Sandia National Laboratories

Overview and Career Discussion

Geoff Klise

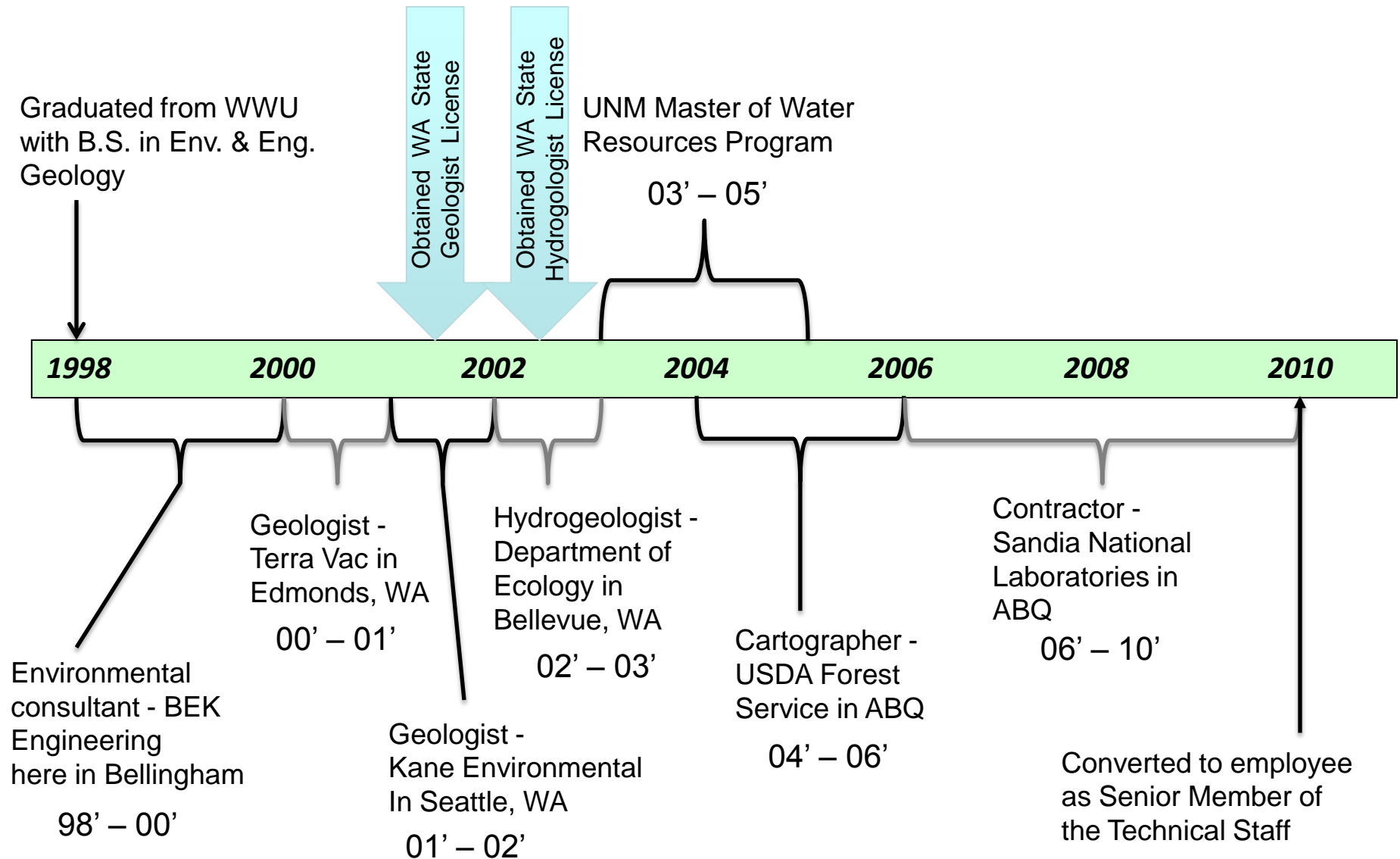
Earth Systems Analysis Department

October 18, 2011

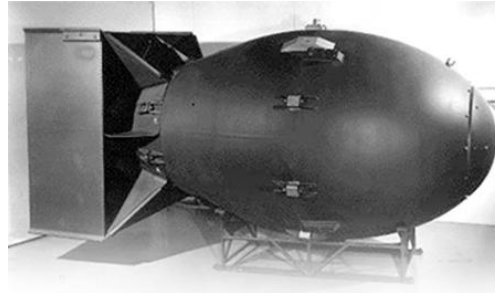
Today's Talk

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

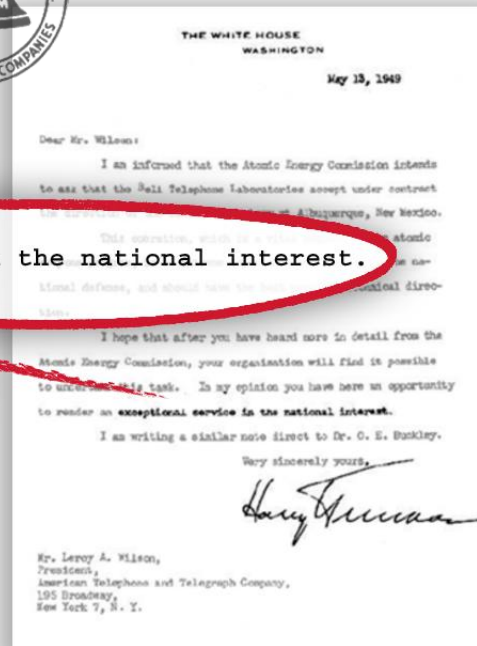
- Potential Student Opportunities
 - Requirements
 - Types of work available



Sandia's History



exceptional service in the national interest.



Sandia's Sites

Albuquerque,
New Mexico



Livermore,
California



Las Vegas,
Nevada



Carlsbad,
New Mexico



Kauai,
Hawaii



Pantex, Texas



Tonopah, Nevada



Kodiak, Alaska

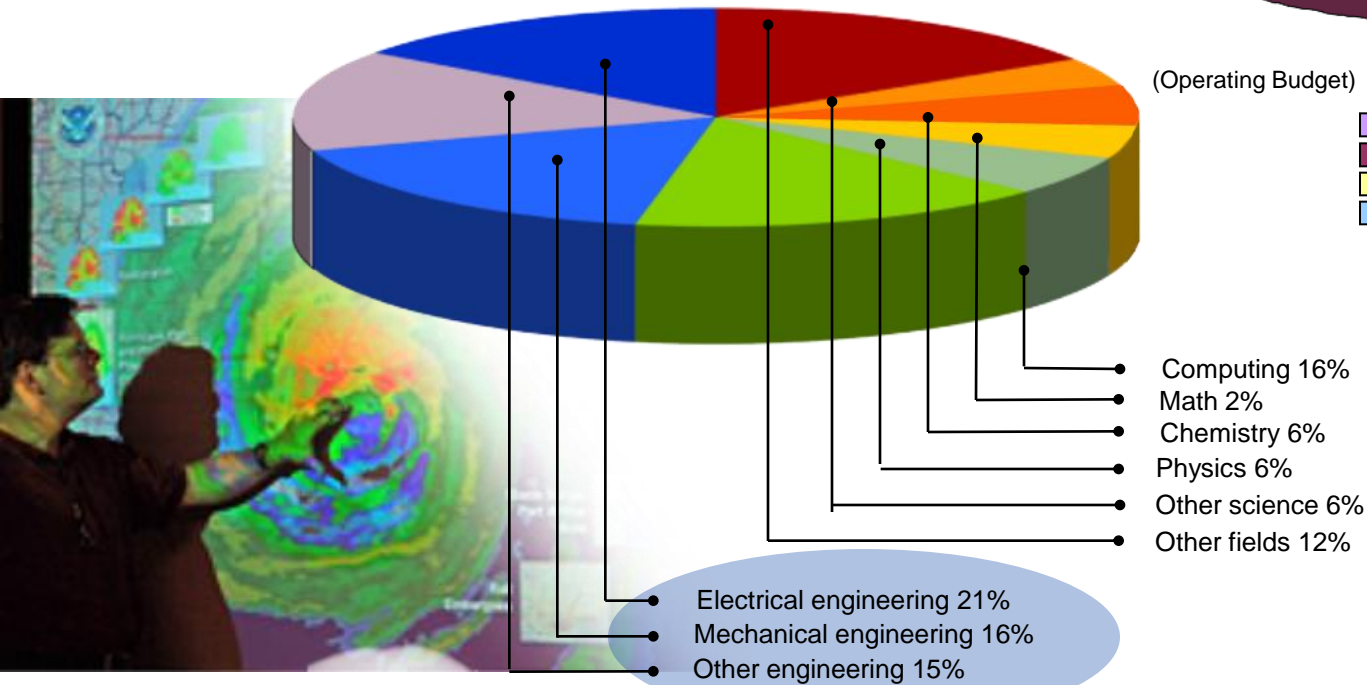


People and Budget

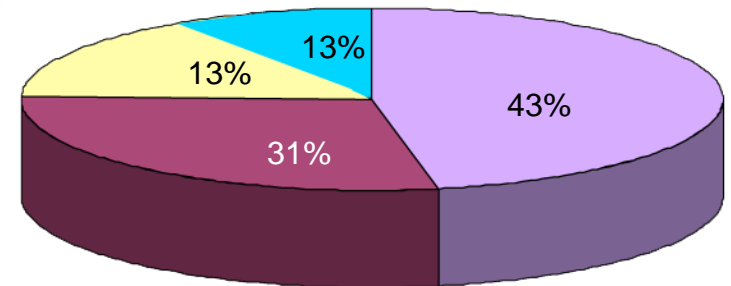
(As of October 15, 2010)

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

Technical staff (4,277) by discipline:



FY10 operating revenue \$2.3 billion



(Operating Budget)

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



The Mission Has Evolved for Decades

1950s

Production
engineering &
manufacturing
engineering

1960s

Development
engineering

1970s

Multiprogram
laboratory

1980s

Research,
development and
production

1990s

Post-Cold War
transition

2000s

Broader national
security challenges

% NON-NW FUNDING

100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%



Energy, Climate, and Infrastructure Security

<http://energy.sandia.gov/>

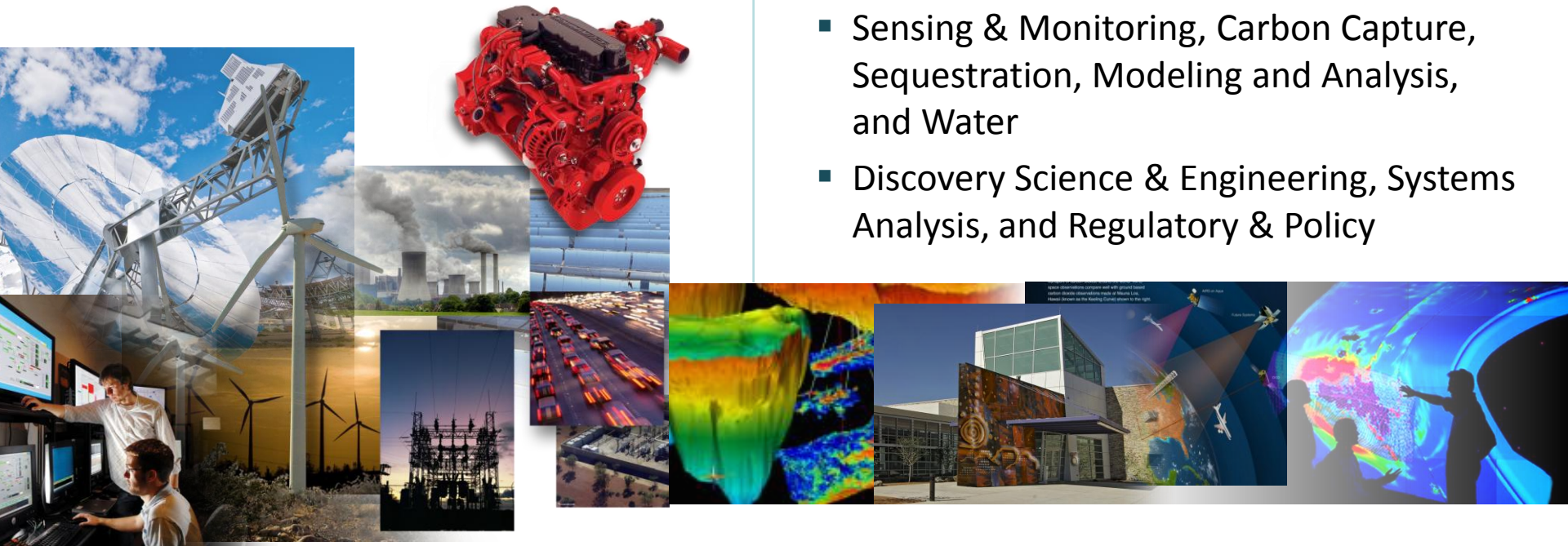


Program Areas

- 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?

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

Prosperity



**“Without energy,
there is no economy.”**

National Security



**“Without energy and environment,
there is no security.”**

John Holdren

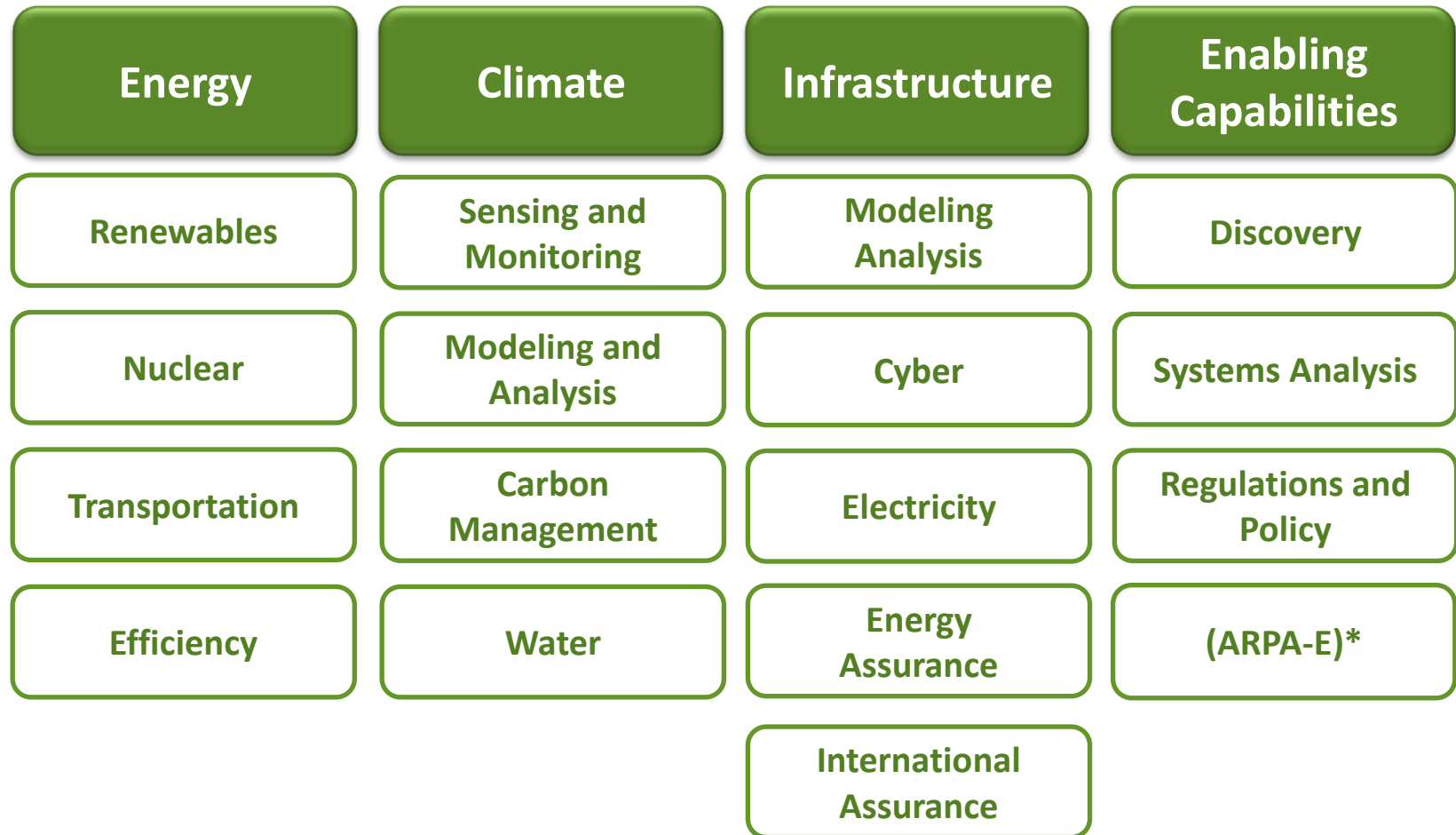
Director of the White House Office of
Science and Technology Policy

Environmental Stewardship



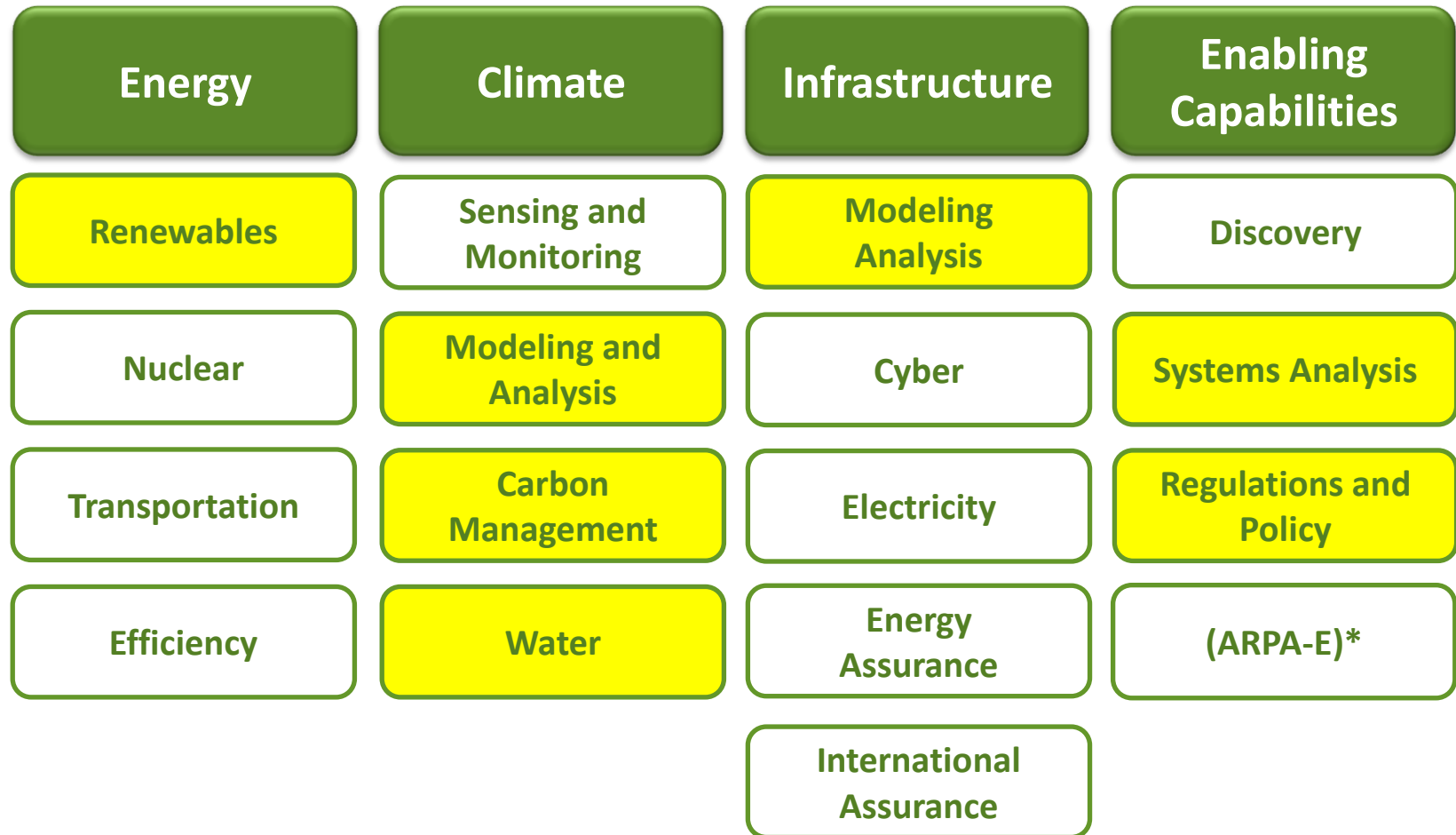
**“Without climate,
there is no environment.”**

Program Areas



* Advanced Research Projects Agency-Energy

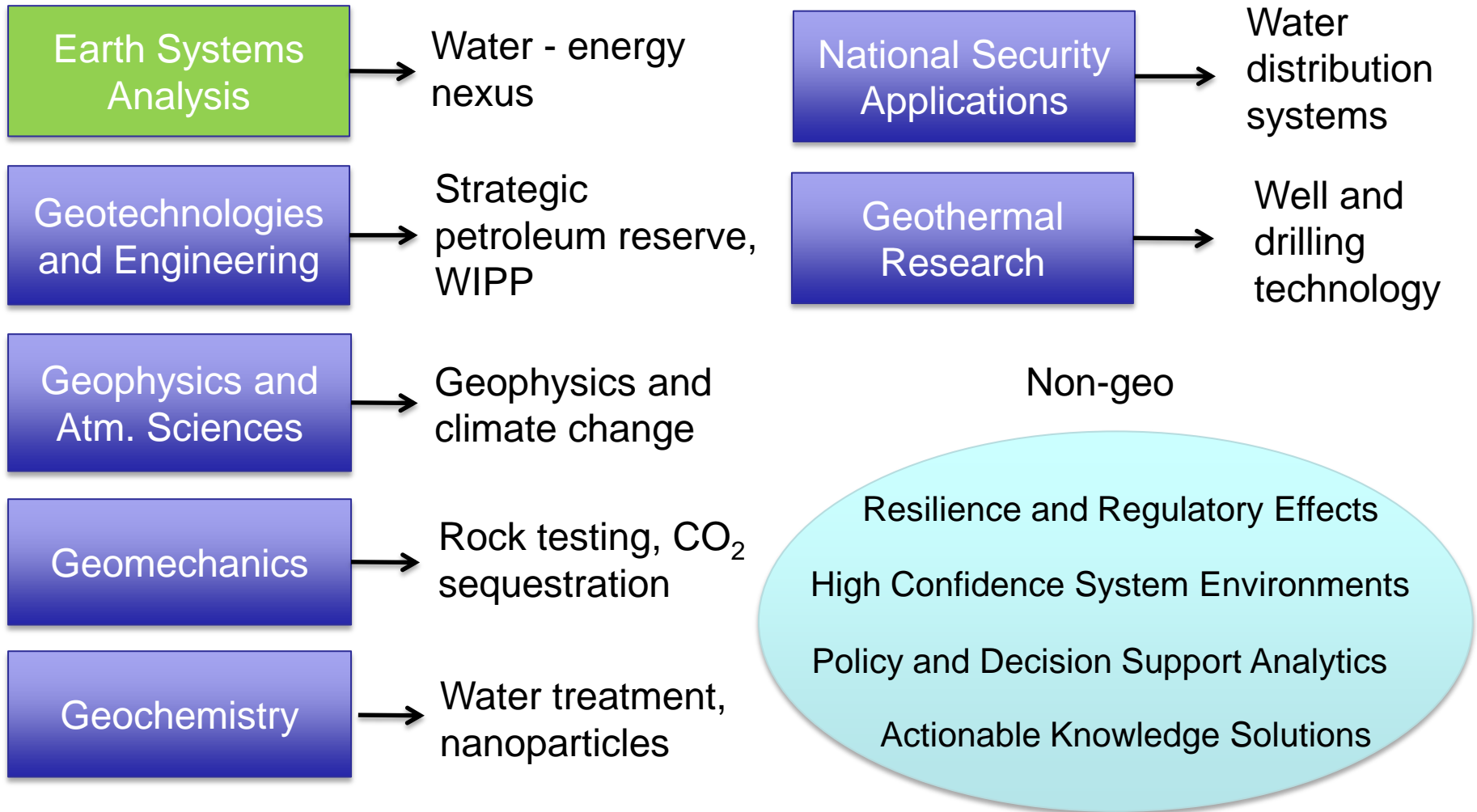
Program Areas



* Advanced Research Projects Agency-Energy

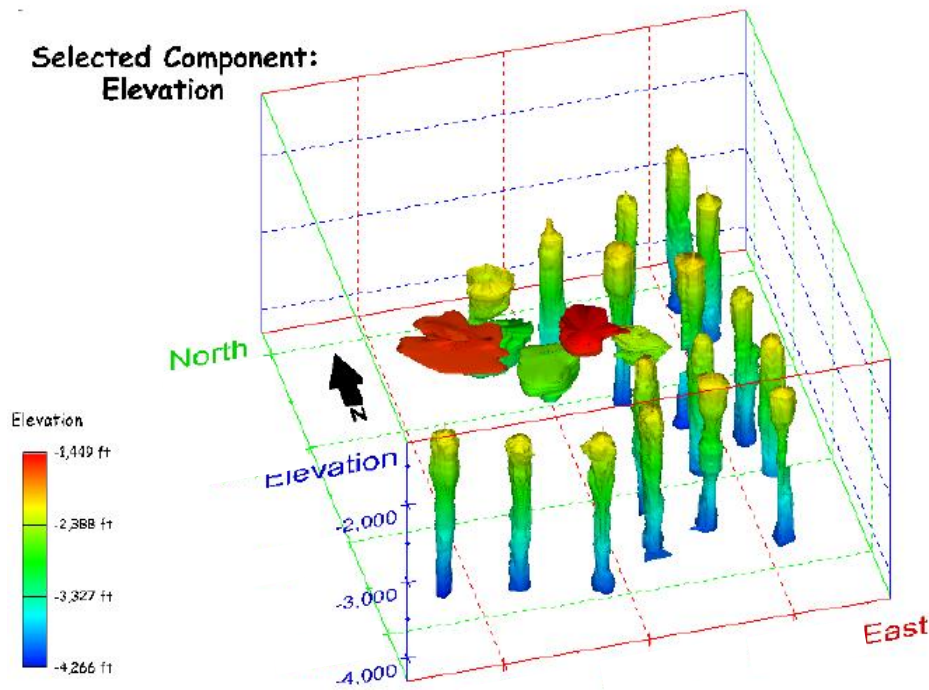
Why I work here....

- 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

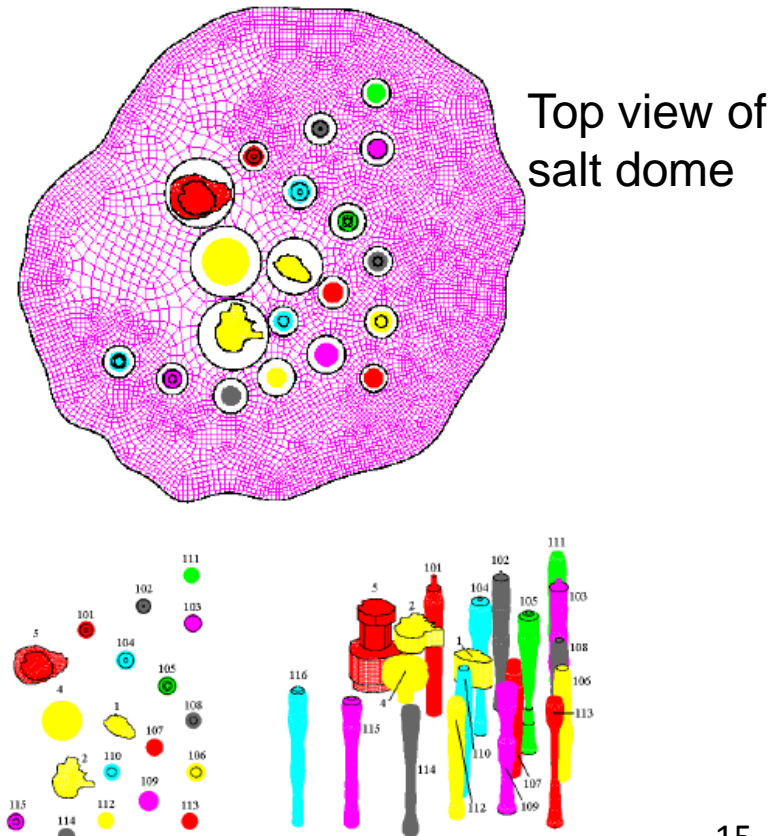


Geomechanical Model Applications

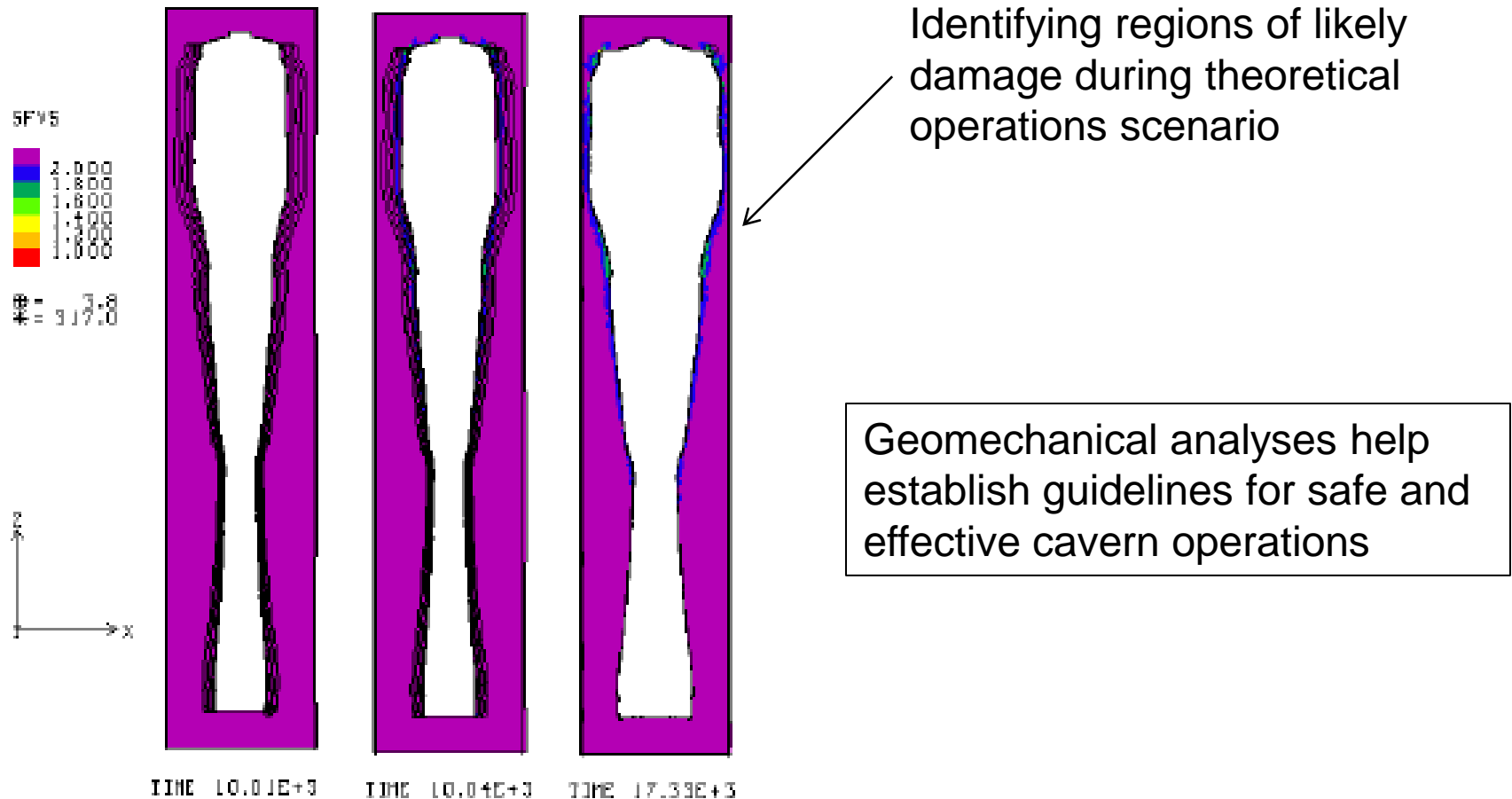
Visualization of Bryan Mound
SPR cavern field from geologic
data



Interpretation for
geomechanical modeling



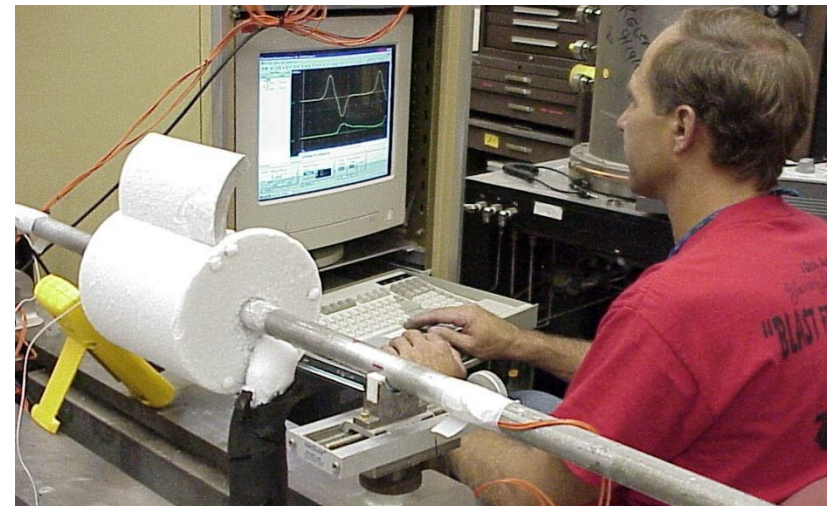
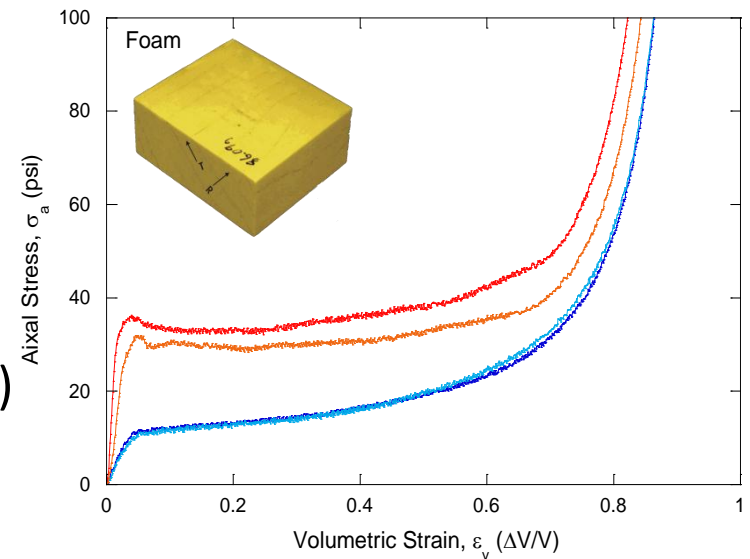
Geomechanical Model Results





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

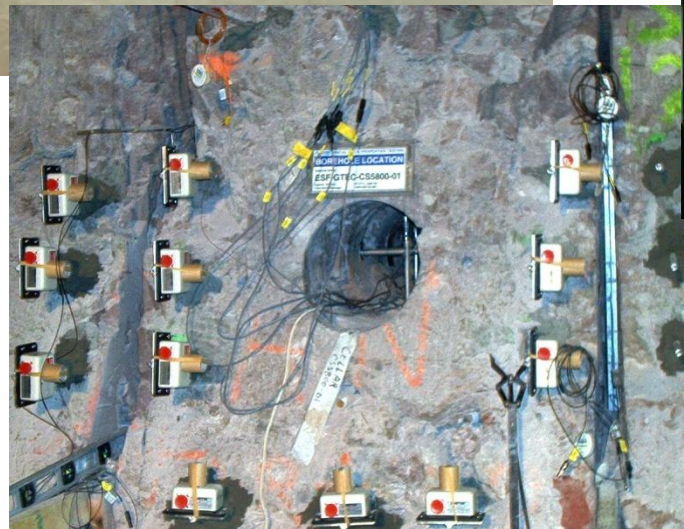
- ***Physical Properties:***
 - Density, ultrasonic velocity
 - Porosity, pore structure imaging
 - Mineralogy/chemistry
- ***Mechanical Properties:***
 - Strength & deformation (intact & joints)
 - Acoustic emission mapping
 - Powder compaction
 - Creep
- ***Thermal Properties:***
 - Conductivity &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



Split Hopkinson Bar



Salt – WIPP Heated Pillar Test



YMP – Rock Mass Testing

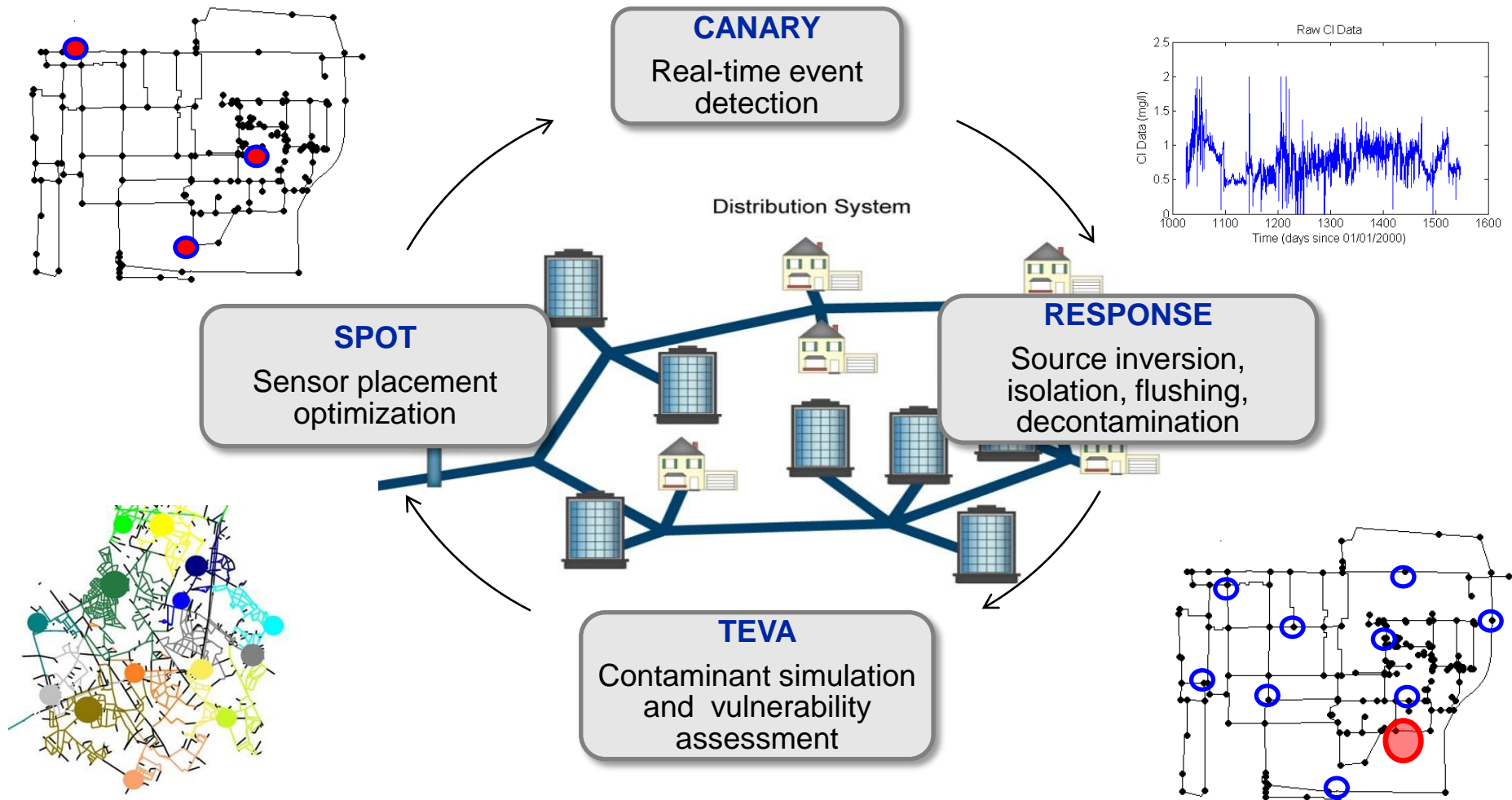
What is the threat? Unintentional or malicious contamination of a water distribution system

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



Contaminant warning systems and response action plans for water distribution networks

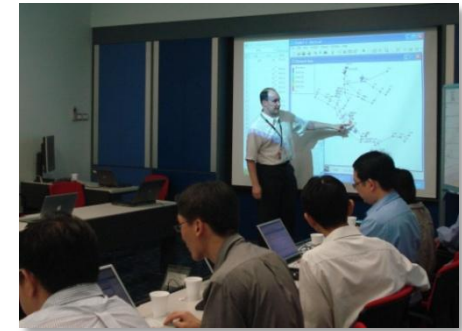


Online Water Quality Event Detection

Goal: Detect anomalous water quality signals in real time

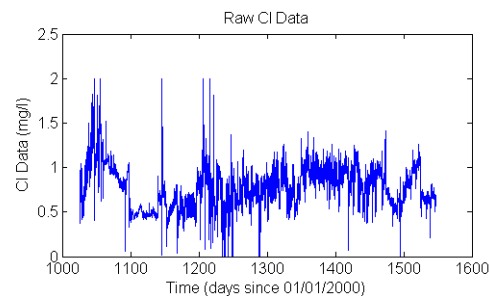
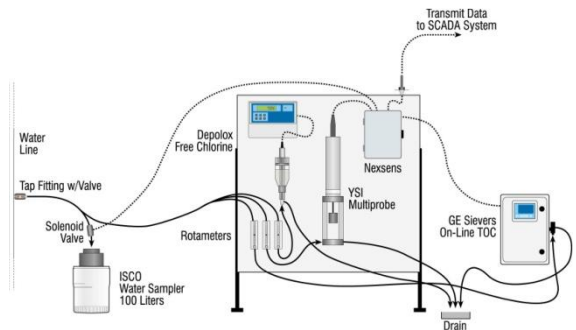
Motivating Factors

- 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



- 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

Water Model Tool

Introduction
Build Scenarios
Run the Model
View Results
Reset/Reload

Residential/Non-Residential

Introduction

Residential

Non-Residential

SU/Chama

Basque

Agriculture

Reservoirs

Desalination

Transfers

Population Growth

Drought

Settings

Non-Residential

HELP

Use the sliders below to convert percentages of existing and new non-residential properties to the various water saving measures.

A 100% change in some of these variables might not be realistic.

Category	Min	Set Value	Max	Current	Units
Consent Existing Non-Residential Property to Low Flow Appliances	0		100	0	%
Consent Existing Non-Residential Property to Xeriscaping	0		100	0	%
Reduce Irrigated Acreage of Landscaping for New Non-Residential Property	0		100	0	%
Reduction in Consumption by Xeriscaping*	0		100	50	%

* Same as or as Residential controls page

☐ Use Low Flow Appliances in New Construction

☐ Use Xeriscaping for New Construction

Parks and Golf Courses

The City of Albuquerque has several non-potable water use and water re-use programs planned to reduce groundwater pumping by roughly 8500 AF/year when all the plans are fully implemented. These projects began coming on line in 2003 and should be completed by 2010. Choosing to implement the plan assumes the projects will continue towards completion and be operated as planned, and is a realistic choice. If you choose "Yes" then the model will phase in the new program along with the water savings, in accord with the City's long term plan.

☐ Use City of Albuquerque Water Re-Use Plan

Use the slider bar to reduce irrigated acreage of parks and golf courses. This slider bar controls the rate at which parks and golf course acreage grows with increasing population. It allows you to choose to have no growth at all, or to allow roughly simulate different scenarios. For example, if you wish to simulate no growth in golf courses, but continued growth in park acreage (or vice versa), or if the slider is set to 50%, then the model will phase in the new program along with the water savings, in accord with the City's long term plan.

☐ Use City of Albuquerque Water Re-Use Plan

Reduce Irrigated Acreage of Parks and Golf Courses

Set Value: Min: 0 Max: 100 Current: 50 Units: %

Calva

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Residential

Sliders below to convert percentages of existing and new non-residential properties to the various water saving categories. Change in some of these variables might not be realistic.

Category	Min	Set Value	Max	Current	Units
Converting Non-Residential Property to Low Flow	0	100	100	0	%
Converting Non-Residential Property to Watercaping	0	100	100	0	%
Delayed Acreage of Landscaping for New Non-Residential Property	0	100	100	0	%
Water Conservation by Landscaping	0	100	100	50	%
Low Flow Appliances in New Construction	0	100	100	0	%
Landscaping for New Construction	0	100	100	0	%

and Golf Courses

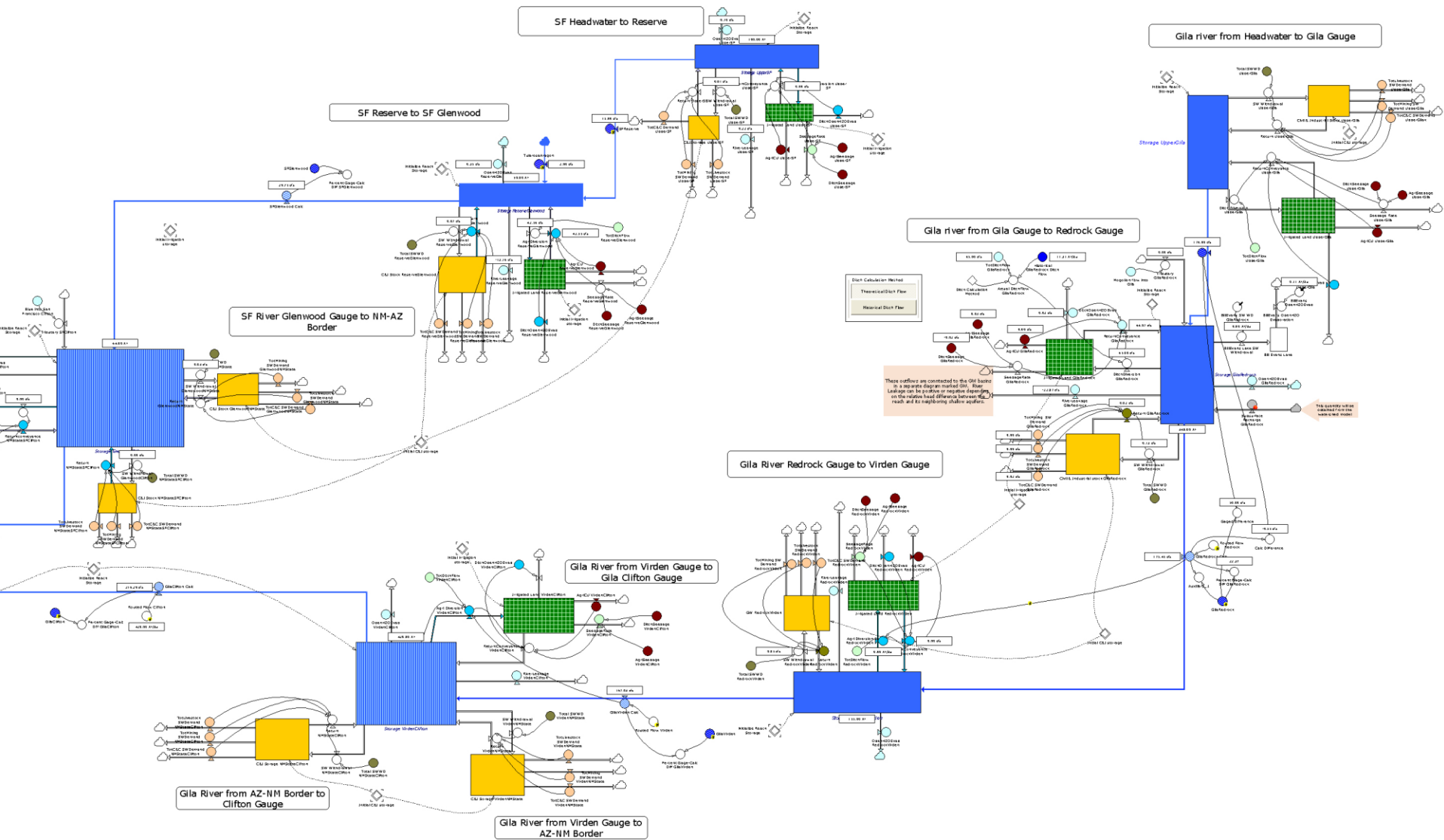
The City of Albuquerque has several non-potable water use and water re-use programs planned to reduce groundwater by roughly 8500 AF/year when all the plans are fully implemented. These projects began coming on line in 2013 and will be complete by 2019. Choosing to implement the plan assumes the projects will continue towards completion as planned, and is a realistic choice. If you choose "new" then the model will phase in the new program over time, in accordance with the City's long term plan.

Golf Course Slider: This slider bar reduces irrigated acreage for golf courses. This slider bar allows the rate at which golf course acreage grows with increasing population. The slider will allow you to simulate different scenarios. For example, if you wish to simulate no growth in golf course acreage, but continued park acreage (or vice versa), set the slider bar to 50%. Conditions in this category assume that both irrigated and non-irrigated land is used for recreation. Increasing population at the same rate, which is unrealistic, is assumed with this slider alone to see the effect on water savings in golf courses.

The map displays the southern portion of New Mexico, highlighting major water features and urban centers. Key elements include:

- Cities and Towns:** Calva, Fort Thomas, Safford, Morenci Mine, Clifton, Duncan, Virden, and Glenwood.
- Counties:** Alpine, Apache, Luna, Grant, Hidalgo, Graham, Greenlee, and Pima.
- Rivers and Creeks:** San Juan River, Blue River, Rio Grande, Bonita Creek, Gila River, and Salt River.
- Infrastructure:** Major highways such as US 191, SR 160, SR 78, SR 74, SR 70, SR 366, and SR 266 are shown.
- Geographic Features:** The Colorado Plateau is visible in the northwestern corner, and the Mexican border runs along the eastern edge.







Computer Assisted Dispute Resolution

A flexible modeling and decision-support software system developed for resource management problems.



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DECISION
PATHWAYS

ROBUST COGNITIVE
DECISION MAKING

SOCIAL CONTEXT
AND NARRATOLOGY

SYSTEM
ARCHITECTURE FOR
SYSTEMS MODELING

Protecting and
preserving
natural
resources for
communities.



Linking
science-based
models to
stakeholder
discussions.



CADRe results can be used for
planning and policy development.

To begin a CADRe application
select a project.

Barton Springs
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Willamette
[unavailable]



In partnership with
the
University of Texas
at Austin
and
Sandia National
Laboratories

SANDIA REPORT

SAND2010-2052

Unlimited Release

May 2010

**Assessing the Near-Term Risk of
Climate Uncertainty: Interdependencies
among the U.S. States**

George Backus, Thomas Lowry, Drake Warren, Mark Ehlen, Geoffrey Klise, Verne Loose, Len Malczynski, Rhonda Reinert, Kevin Stamber, Vince Tidwell, Vanessa Vargas, and Aldo Zagonel

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550

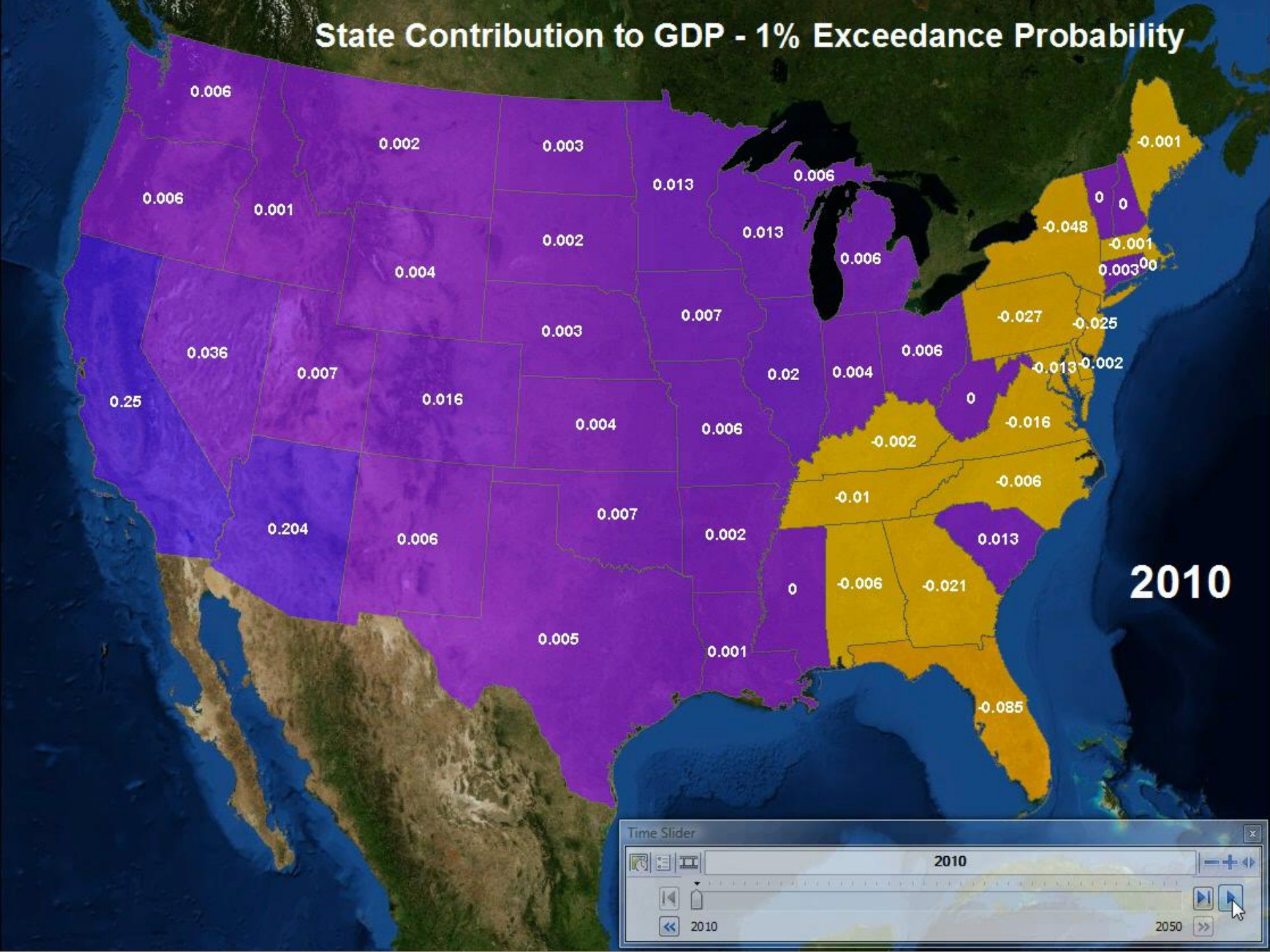
Sandia is a multiprogram laboratory operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin company, for the U.S. Department of Energy's National Nuclear Security Administration under Contract DE-AC04-94AL85000.

Approved for public release; further dissemination unlimited.

- 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

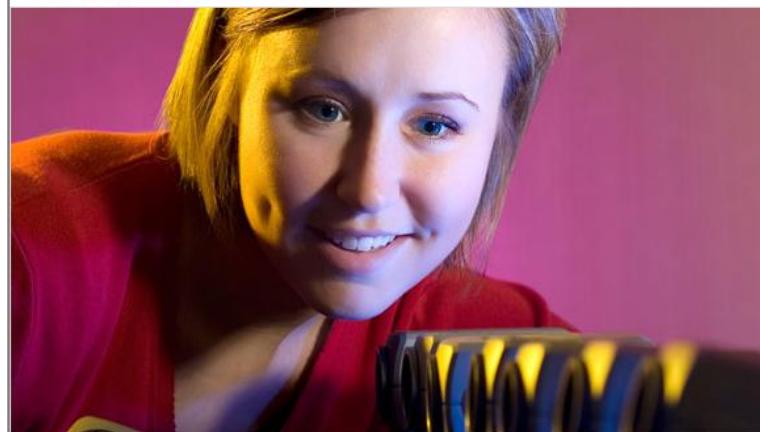


2010





Students & Postdocs



Interested in a career at Sandia?

Are you looking for research experience with top scientists/engineers? Would you like an employer-paid graduate degree? Sandia welcomes student interns, co-ops, and postdoctoral fellows. We provide world-class mentoring and opportunities to research issues of global significance. Sandia is the perfect place to jump-start your career.

[Download Sandia's 2011 recruiting brochure \(PDF\).](#)

[View All Jobs](#)



Internships & Co-ops



Fellowships



Postdoctoral Positions



Campus Recruiting & Events
• [Science & Engineering Expo](#)

The Sandia intern experience — meaningful work and enjoyable play

Interns work on real-world, challenging projects; they also socialize, travel, and explore life in New Mexico and California.



California fun!

Discover the beauty and fun things to do in California... sun, surf, sights, and more!



Real research

See how the R&D environment works firsthand...tailored projects with key applications.



Service to our nation

Grasp the far-reaching effects of the contributions interns make toward our national security.

Exceptional service in the national interest

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U.S. DEPARTMENT OF
ENERGY



National Nuclear Security Administration

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

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

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Thank you

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