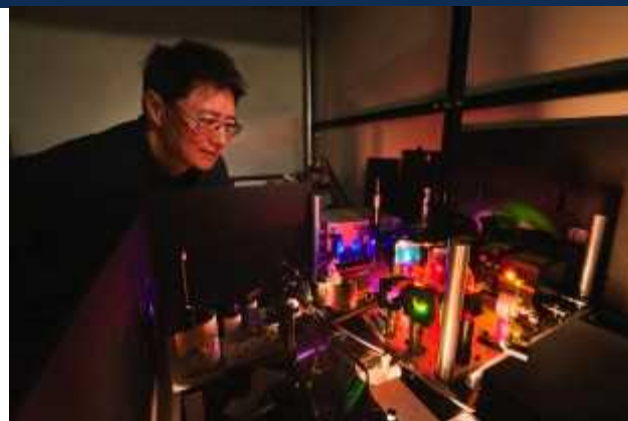
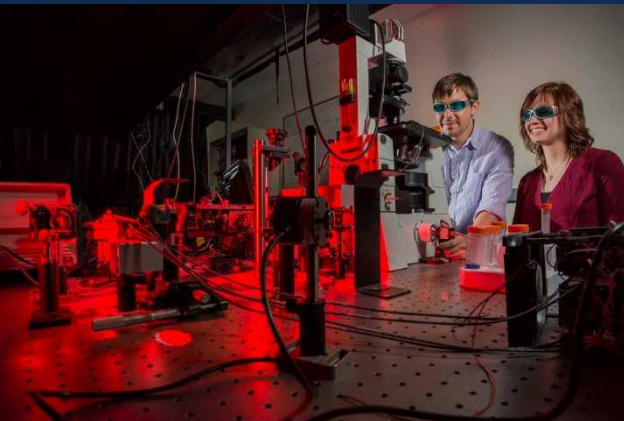


Exceptional service in the national interest



The Accidental Physicist Sandia National Laboratories

17 November 2016

University of Illinois alumna, Carla Busick



Sandia National Laboratories is a multi-mission 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. SANDxxx-xxxx. Unclassified Unlimited Release

An Accidental Physicist's Journey

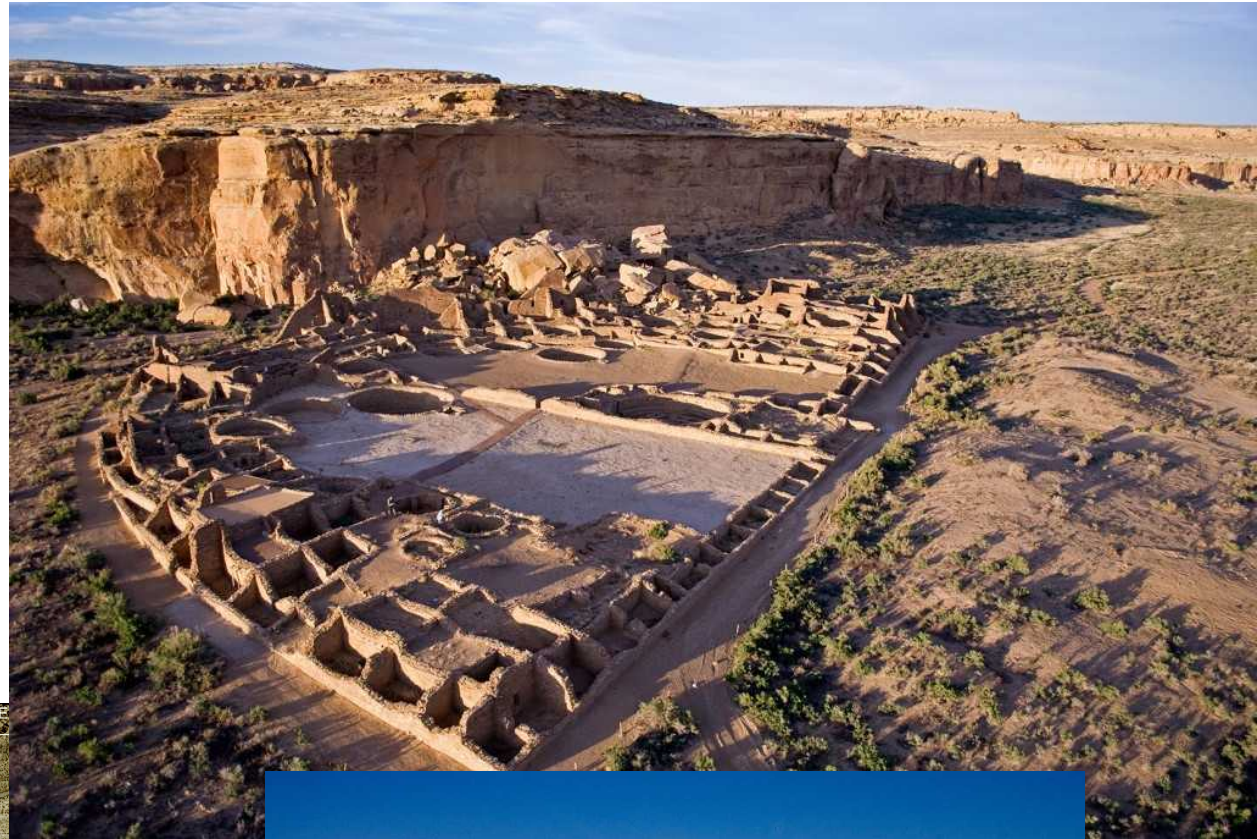
- Illinois



We used paper! to register every semester, can you believe we had to stand in line at the armory, one-by-one for each class and time slot we requested?

An Accidental Physicist's Journey

- Illinois
- Albuquerque



An Accidental Physicist's Journey

- Illinois
- Albuquerque
- Illinois



Lorado Taft: After being homeschooled by his parents, Taft earned his [bachelor's degree](#) (1879) and master's degree (1880) from the Illinois Industrial University (later renamed the [University of Illinois at Urbana-Champaign](#)) where his father was a professor of geology. The same year he left for Paris to study sculpture, yet maintained his connections with the university for the rest of his life. In 1929, he dedicated his sculpture of *Alma Mater* on the University of Illinois campus. Taft envisioned his *Alma Mater* as a benign and magnificent woman, about fourteen feet high and dressed in classical draperies, rising from a throne and advancing a step forward with outstretched arms in a gesture of generous greeting to her children. Two figures behind her on either side represent the university's motto, Learning and Labor

An Accidental Physicist's Journey

- Illinois
- Albuquerque
- Illinois
- Los Angeles



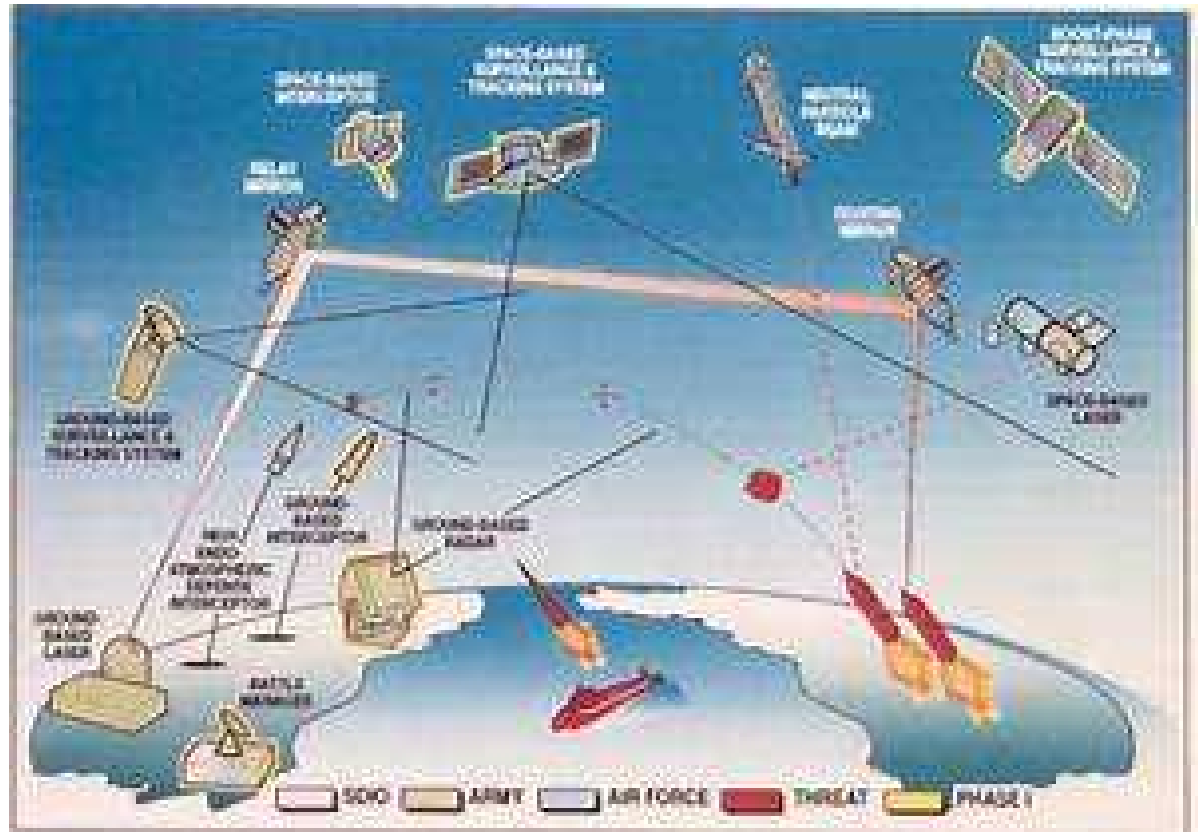
An Accidental Physicist's Journey

- Illinois
- Albuquerque
- Illinois
- Los Angeles
- Tucson



An Accidental Physicist's Journey

- Illinois
- Albuquerque
- Illinois
- Los Angeles
- Tucson
- Los Angeles



An Accidental Physicist's Journey

- Illinois
- Albuquerque
- Illinois
- Los Angeles
- Tucson
- Los Angeles
- Albuquerque

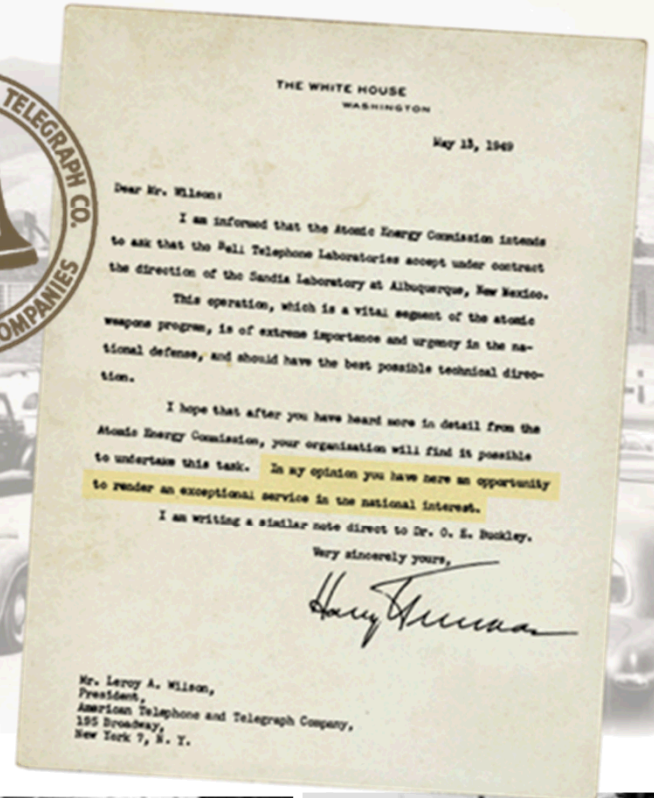
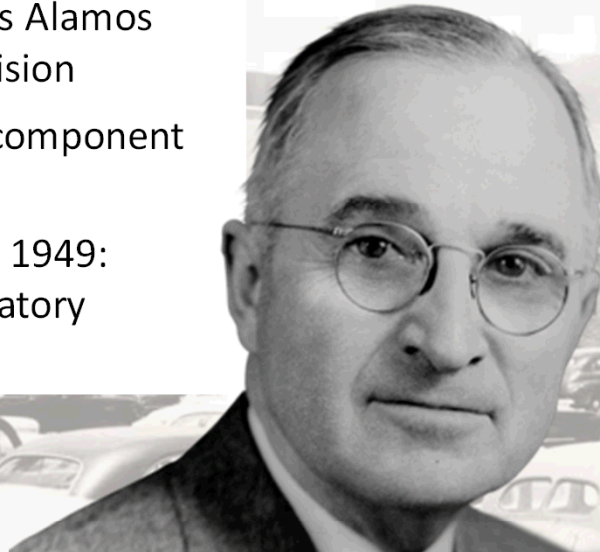


Moved 12 times in 6 years

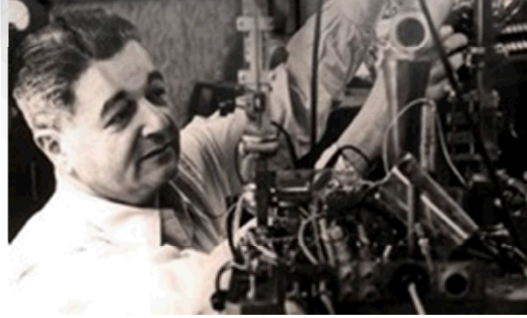
Sandia's History

Exceptional service in the national interest

- July 1945: Los Alamos creates Z Division
- Nonnuclear component engineering
- November 1, 1949: Sandia Laboratory established

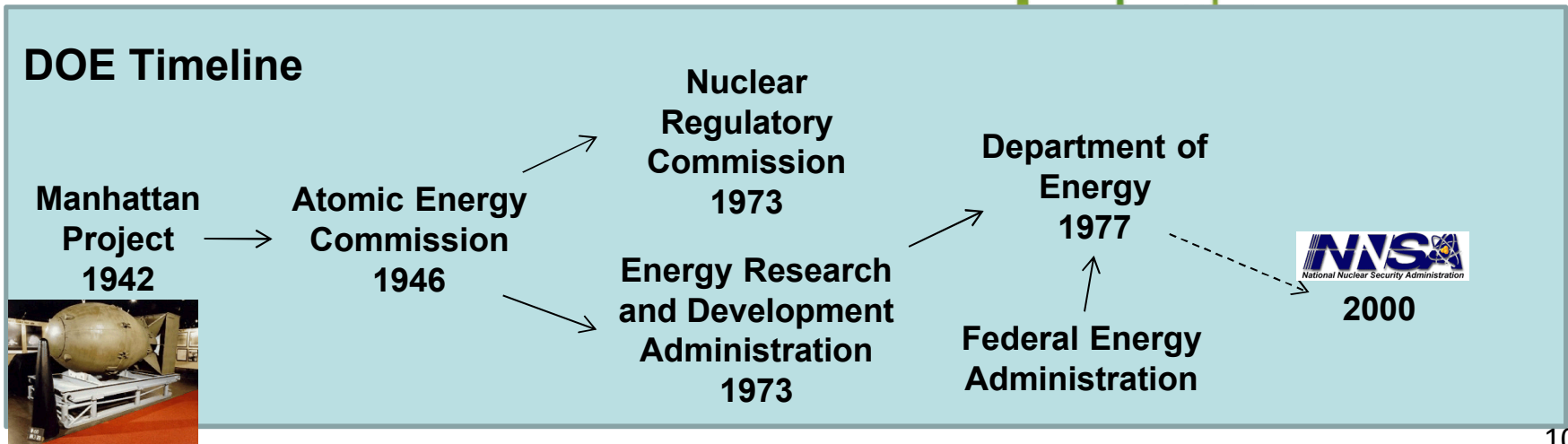


to undertake this task. In my opinion you have here an opportunity to render an exceptional service in the national interest.



Department of Energy

- Cabinet-level department: US policies on Energy and Nuclear Material safety.
 - Nuclear weapons
 - Nuclear propulsion (Navy)
 - Energy conservation and research
 - Radioactive waste disposal
 - Domestic energy production, security, and sustainability
 - Basic and applied scientific research



Sandia Addresses National Security Challenges

1950s

Nuclear weapons

Production and manufacturing engineering



1960s

Development engineering

Vietnam conflict



1970s

Multiprogram laboratory

Energy crisis



1980s

Missile defense work

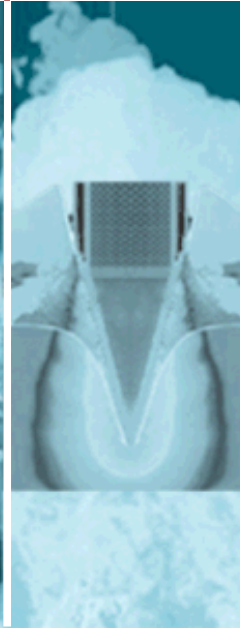
Cold War



1990s

Post-Cold War transition

Stockpile stewardship



2000s

START
Post 9/11

National security



2010s

LEPs
Cyber, biosecurity proliferation

Evolving national security challenges



Sandia Sites

Albuquerque, New Mexico



Livermore, California



Kauai, Hawaii



*Waste Isolation Pilot Plant,
Carlsbad, New Mexico*



*Pantex Plant,
Amarillo, Texas*



*Tonopah,
Nevada*



National Laboratories



KEY:

- = NNSA Labs
- = Science
- = Nuclear Energy
- = Environmental Management
- = Fossil Energy
- = Energy Efficiency and Renewable

OUR LOCATIONS

LIVERMORE, CALIFORNIA

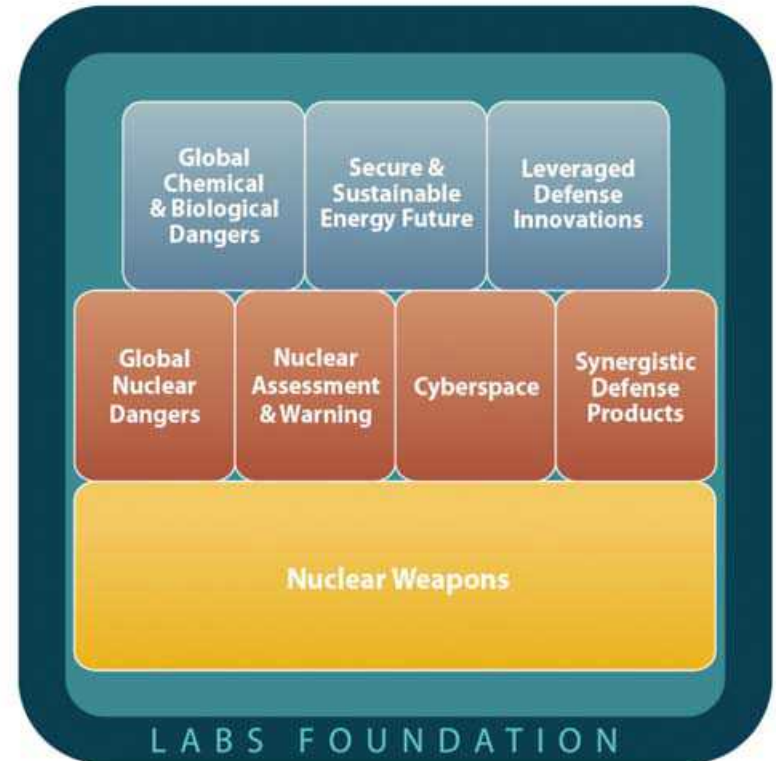
Sandia/California is uniquely situated at the edge of the San Francisco Bay Area. Livermore enjoys close proximity to first-tier universities, Silicon Valley companies, and other top research laboratories and facilities. Livermore is just a short drive from the beach, the mountains, the desert, or wine country.

ALBUQUERQUE, NEW MEXICO

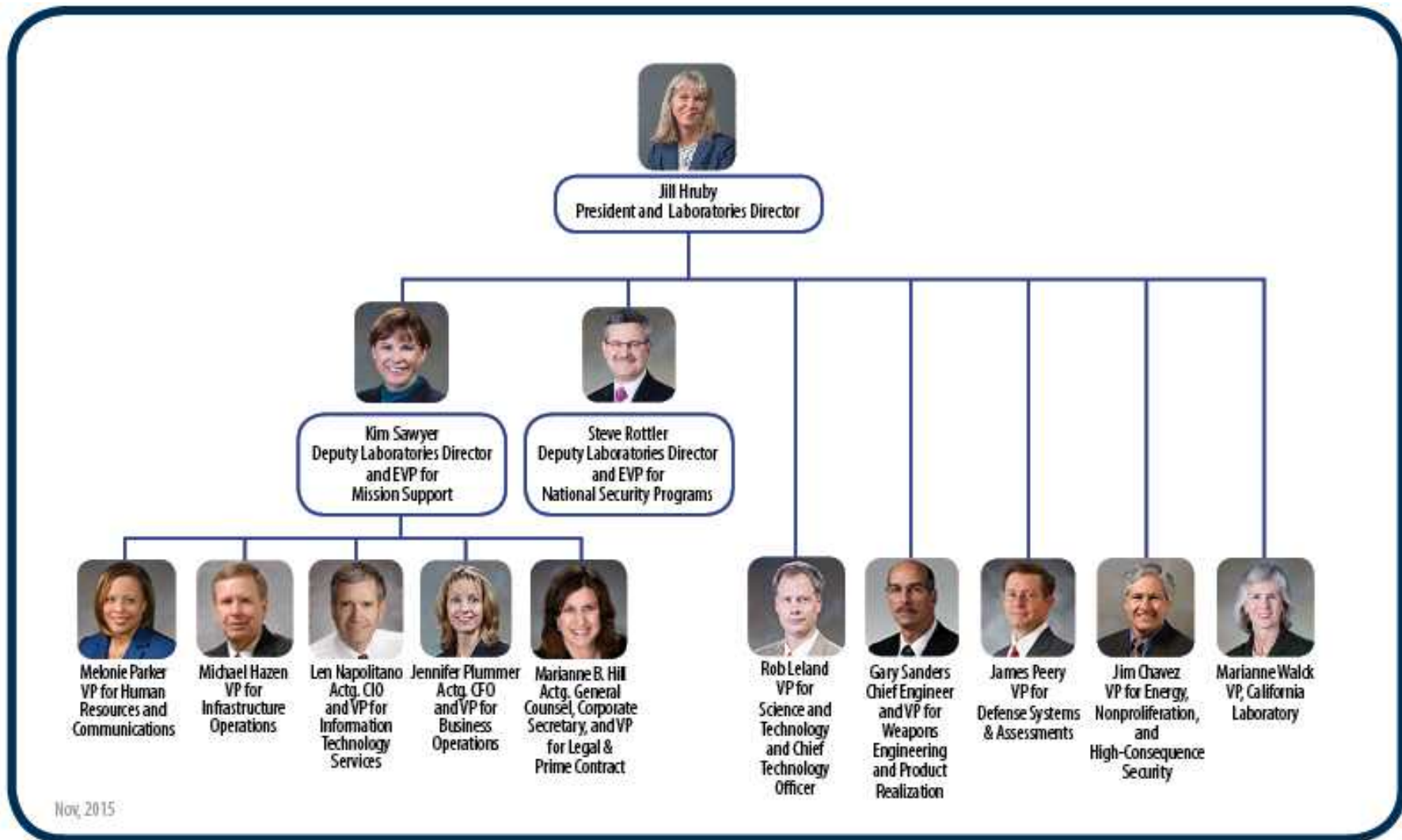
Sandia/New Mexico is located in Albuquerque, a city immersed in the vibrant Southwest culture. The greatest strengths of the city are its diversity, its proximity to the great outdoors and year-round good weather. Outdoor enthusiasts take advantage of our sunny skies and go mountain biking, hiking, and skiing, and take part in the world's largest hot air balloon festival.

SNL Mission areas

- Nuclear weapons material and energy
- Reducing global nuclear dangers
- Providing nuclear assessments and warning
- Defending and dominating in cyberspace
- Maintaining US defense technological superiority
- Reducing global chemical and biological dangers
- Ensuring a secure and sustainable energy future



Executive Management Organization Chart



Nov, 2015

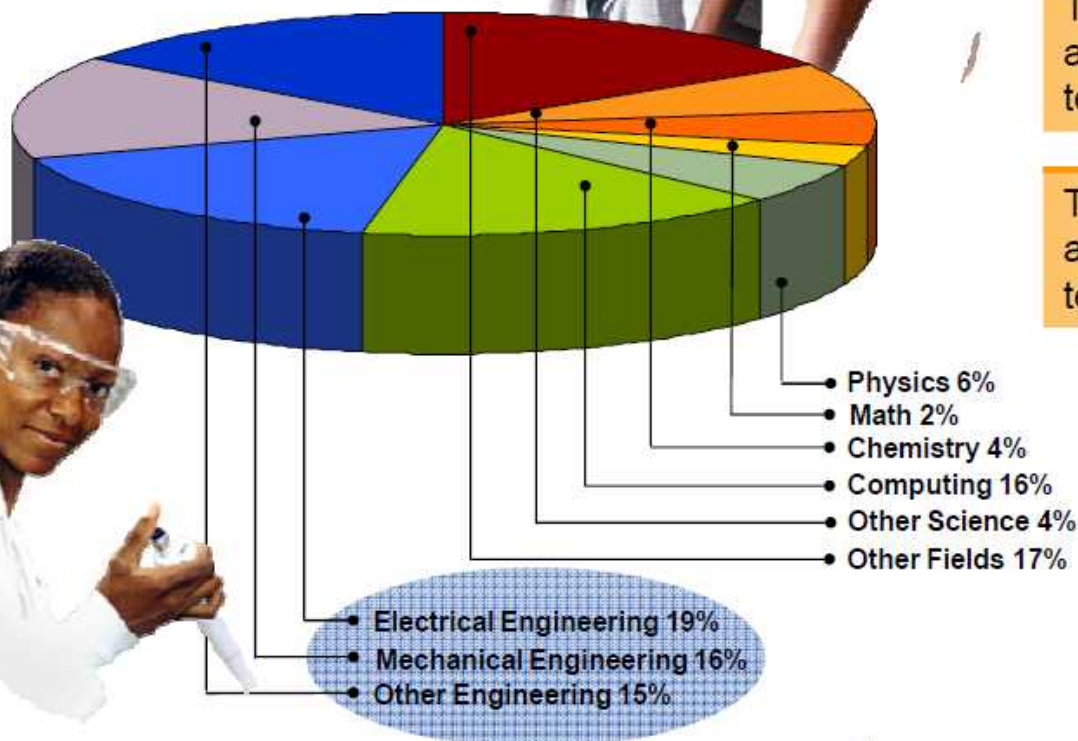


Sandia's People

- On-site workforce: 11,200
- FY08 permanent workforce: 8,400
- FY08 gross payroll: \$886.1M
- FY08 budget: \$2.3B



Technical Staff (3,844) by Degree (End of FY08)



Diciplines of Most Technical Hires (FY03 – FY05)

Top 3 hire fields comprise approximately 55% of technical hires

- IT
- ME
- EE

Top 5 hire fields are approximately 70% of technical hires

- Physics
- Chemistry

Top 11 hire fields represent approximately 90% of technical hires

- Chemical Eng
- Materials Science
- Math
- Biology
- Nuclear Eng
- Aerospace Eng



Nuclear Weapons Material & Energy

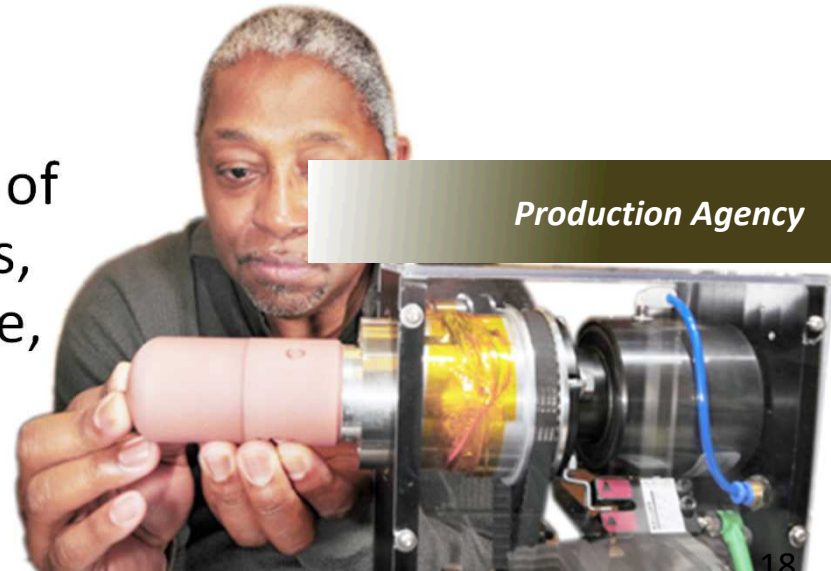


*Warhead Systems Engineering
and Integration*



Balance:

- (1) Stewarding the current nuclear stockpile
- (2) Modernizing the stockpile into the future through life extension programs and alterations
- (3) Advancing the foundational aspects of our science and engineering capabilities, business and management tools, people, and facilities and infrastructure



[back](#)

Reducing Global Nuclear Dangers

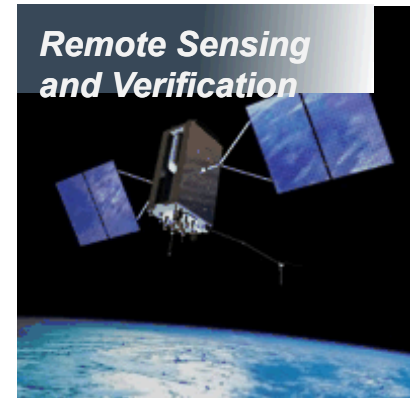
Reducing Global Nuclear Dangers involves addressing risks and improving the situational awareness of emerging risks posed by

- (1) nuclear weapons — whether controlled by the US or another nuclear weapon state, or whether they are in the hands of rogue states and non-state actors and terrorists;
- (2) the misuse of nuclear and radiological materials, nuclear weapons knowledge, and/or nuclear weapons components; and
- (3) A large-scale radioactive release from a nuclear power plant



[back](#)

Nuclear Assessment & Warning



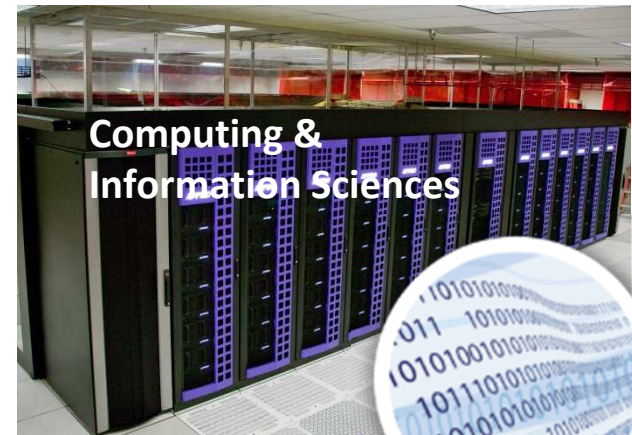
Non-proliferation:

- (1) Develop technologies and systems to detect, evaluate, and disseminate information on nuclear detonations to decision makers in a timely manner
- (2) Provide analyses and assessments to help the US counter existential threats and avoid strategic technology surprise
- (3) Develop pathfinding technologies and systems to track items, events, people, communications, and transactions across the full spectrum of human interactions

[back](#)

Cyberspace Defense

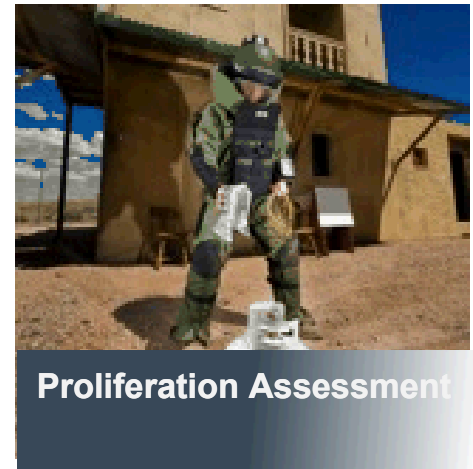
- (1) Tools and techniques to improve cyber defense in depth, networks, surety of data and communication, and trust added to systems built from untrusted components
- (2) Technologies and techniques to determine vulnerabilities and associated defense, detection, and remediation that keep pace with commercial advancements in communications, microelectronics, computational systems (static and mobile), and software
- (3) Technologies and techniques for the US to assess situational awareness, assure resilient command and control of strategic and tactical systems, and support DoD in the evolution of networks becoming a warfare platform



[back](#)

Defense Technology

- (1) High-performance nonnuclear sensing
- (2) Anticipating and countering novel asymmetric threats
- (3) Providing sensor access to difficult areas
- (4) Key enabling technologies for warfare dominance and response
- (5) Applied data intelligence and decision support systems



[back](#)

Chem-Bio

Sandia works internationally to reduce the risk of biological or toxic chemical agents falling into the hands of our adversaries

- (1) Design CB warning and response architectures for civilian protection and plays a central role in their deployment, operation, and response
- (2) Develop next-generation CB detection systems — including devices that can monitor a person's exposure to a toxin or pathogen;
- (3) Lead national efforts in CB event response and recovery by providing tools and expertise in event characterization,
- (4) Manage crises, decontamination, and restoration of capability and infrastructure.

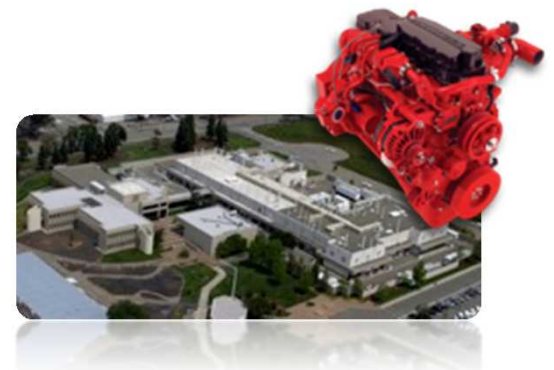
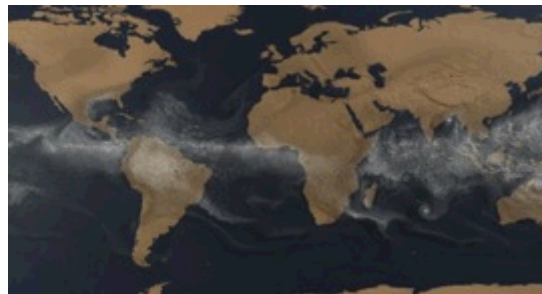
[back](#)



Bioscience

Energy

- (1) Renewable and fossil energy, including concentrating solar and photovoltaics, wind, hydrokinetics, geothermal, biomass, and natural gas drilling;
- (2) Electric grid integration and resiliency and the integration of stored renewable energy;
- (3) safety and security of nuclear power systems and nuclear waste management
- (4) Cleaner and more efficient vehicle technologies
- (5) Energy efficiency in solid-state lighting and innovative semiconductors.



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.

World-class mentoring and opportunities to research issues of global significance.

Sandia is the perfect place to jump-start your career.

Reduce Global Chemical & Biological Dangers

Global Nuclear Assurance & Security

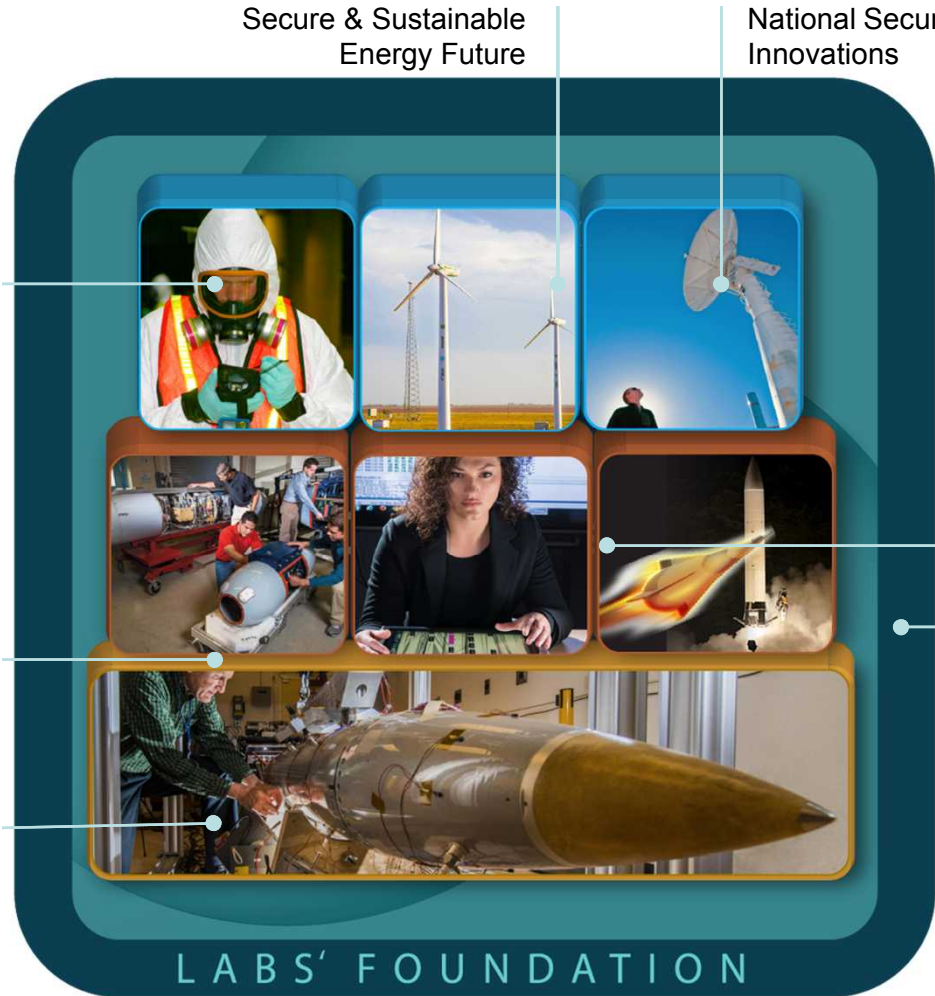
Nuclear Weapons

Secure & Sustainable Energy Future

National Security Space Innovations

Cyberspace

Synergistic Defense Products



Accidental Physicist: how I landed in Albuquerque

- Every era presents a spectrum of scientific challenges
- Establish, cherish and sustain your advisors!
- Be open and manage expectations – happiness studies show humans are terrible at predicting what will make us happy.
- Life is only 10% what happens to you and 90% how you react.
- Flexibility lends to one's contributions
- Prototyping work is exciting, but relies heavily on constant marketing; Genius is 1% inspiration and 99% perspiration.
- Advantages of large employer include opportunities for trying new things without major upheaval
- There are so many great opportunities – stay active and open those doors when you hear a knock!

BACKUP

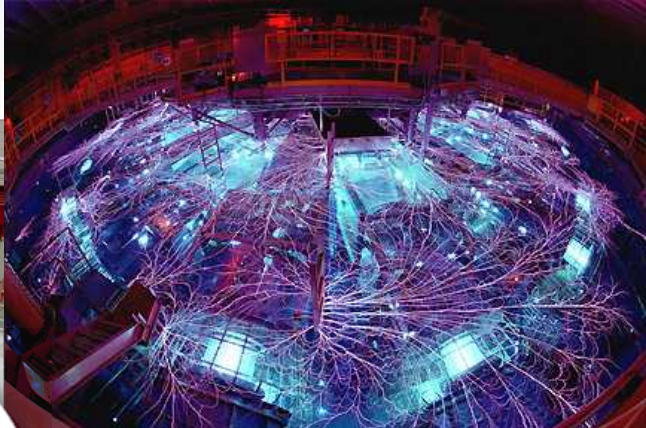
Many of Sandia's unique research centers are available for use by U.S. industry, universities, academia, other laboratories, state and local governments, and the scientific community in general

- [Advanced Power Sources Laboratory](#)
- [Combustion Research Facility](#)
- [Design, Evaluation, and Test Technology Facility](#)
- [Distributed Energy Technology Laboratory](#)
- [Engineering Sciences Experimental Facilities](#)
- [Explosive Components Facility](#)
- [Explosive Technology Group](#)
- [Geomechanics Laboratory](#)
- [Ion Beam Laboratory](#)
- [Materials Science and Engineering Center](#)
- [Mechanical Test and Evaluation Facility](#)
- [Microsystems and Engineering Sciences Applications \(MESA\)](#)
- [National Solar Thermal Test Facility](#)
- [Nuclear Energy Safety Technologies \(NEST\)](#)
- [Nuclear Facilities Resource Center \(NUFAC\)](#)
- [Photovoltaic Laboratories](#)
- [Pulsed-Power and Systems Validation Facility](#)
- [Primary Standards Laboratory](#)
- [Radiation Detection Materials Characterization Laboratory](#)
- [Shock Thermodynamic Applied Research Facility \(STAR\)](#)
- [Weapon and Force Protection Center](#)

Our Research Framework

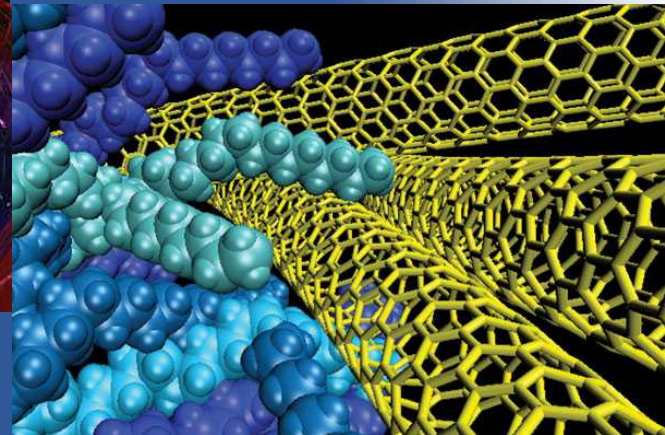
Strong research foundations play a differentiating role in our mission delivery

Computing & Information Sciences

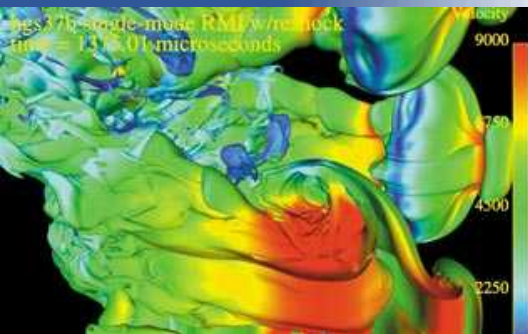


Radiation Effects & High Energy Density Science

Materials Sciences

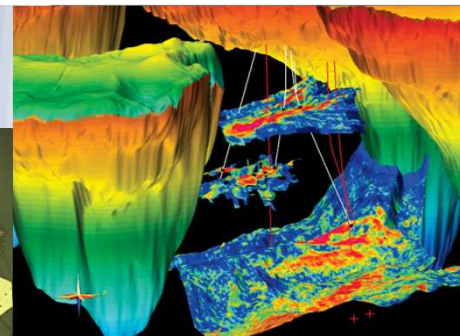


Engineering Sciences



Bioscience

Nanodevices & Microsystems



Geoscience

Energy & Climate

Energy Research

ARPAe, BES Chem Sciences, ASCR, CINT, Geo Bio Science, BES Material Science

Climate & Environment

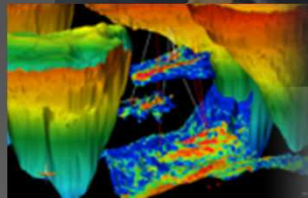
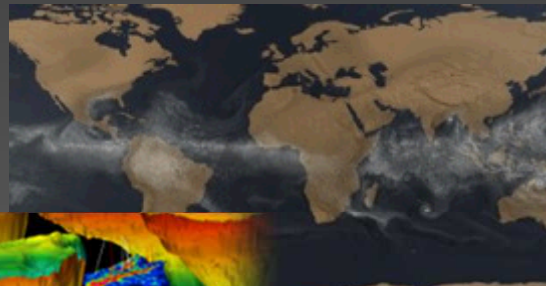
Measurement & Modeling, Carbon Management, Water & Environment, and Biofuels

Nuclear Energy & Fuel Cycle

Commercial Nuclear Power & Fuel, Nuclear Energy Safety & Security, DOE Managed Nuclear Waste Disposal

Renewable Systems & Energy Infrastructure

Renewable Energy, Energy Efficiency, Grid and Storage Systems



Transportation Energy & Systems

Vehicle Technologies, Biomass, Fuel Cells & Hydrogen Technology



International, Homeland, & Nuclear Security

Global Security



Remote Sensing and Verification



Homeland Security Programs



WMD Counterterrorism and Response



Homeland Defense and Force Protection

Cyber and Infrastructure Security



Defense Systems & Assessments Programs



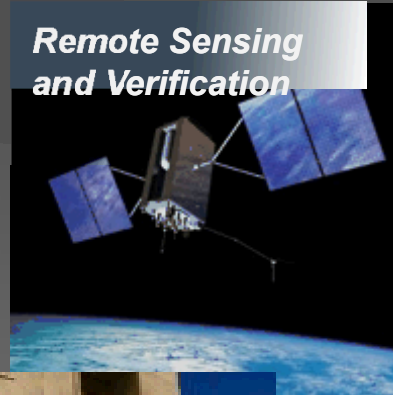
Information Operations



Surveillance & Reconnaissance



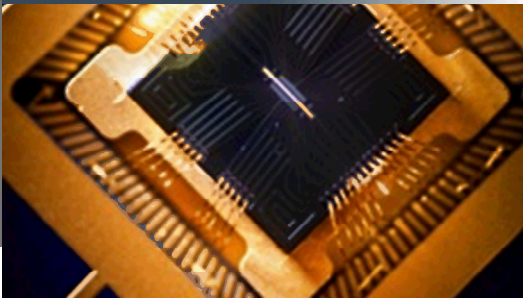
Remote Sensing and Verification



Space Mission

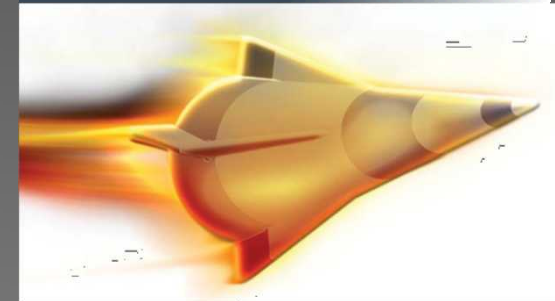


Science & Technology Products



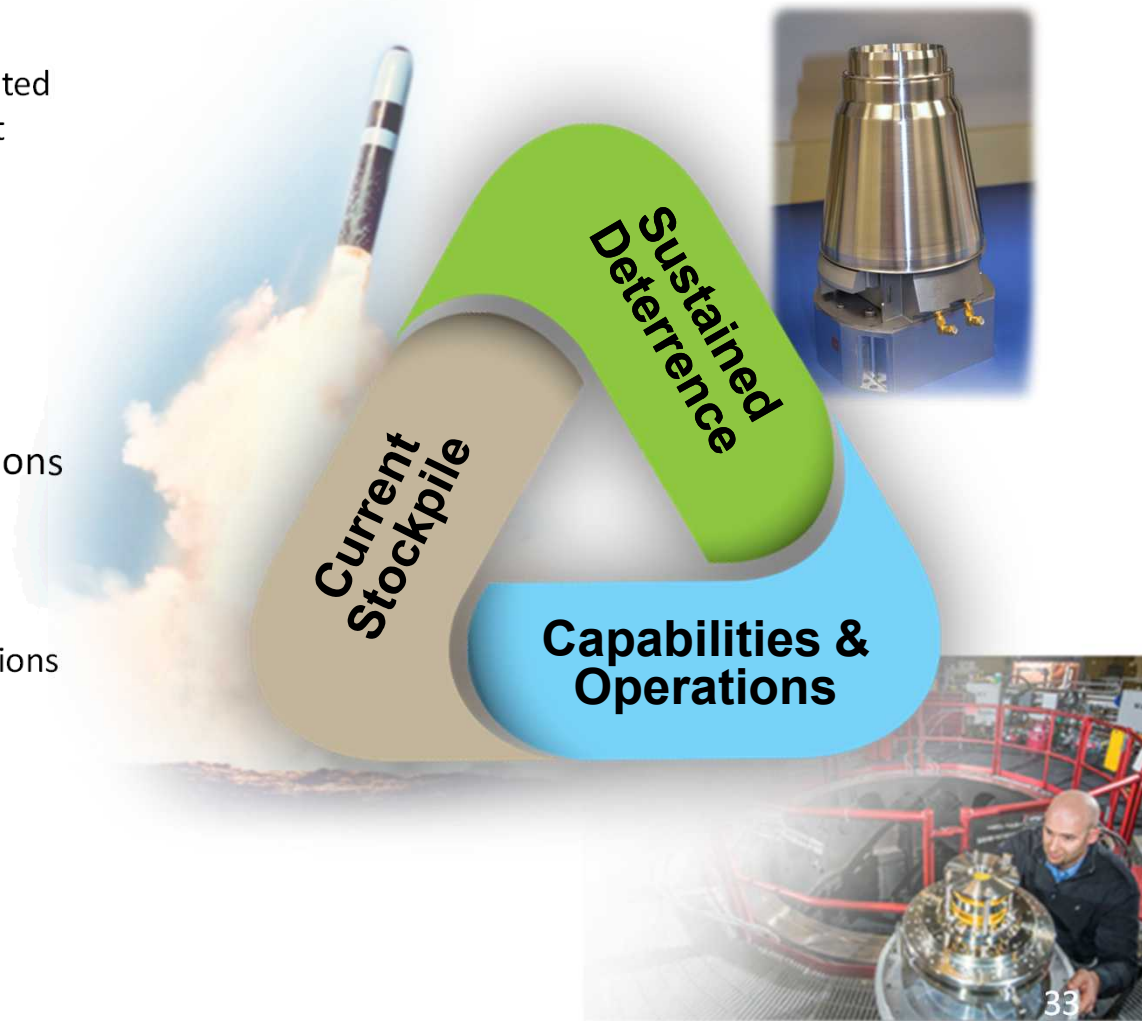
Proliferation Assessment

Integrated Military Systems



Sandia's Nuclear Weapons Mission

- Maintain the current U.S. nuclear weapons stockpile
 - Annual Assessment, Surveillance, Limited Life Component Exchanges, Significant Finding Investigations
- Sustain the stockpile into the future
 - Life Extension Programs, Alterations, technology maturation
- Steward the long-term vitality of our capabilities, infrastructure and operations
 - Persistent commitment to multi-disciplinary staff, state-of-the-art labs, equipment, facilities and safe/secure/quality/affordable operations



Sandia's Current Nuclear Weapons Activities



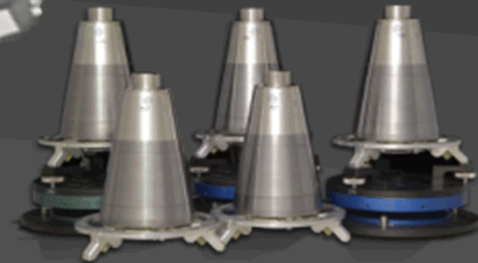
Warhead Systems Engineering and Integration



Gas Transfer systems



Design Agency for Nonnuclear Components



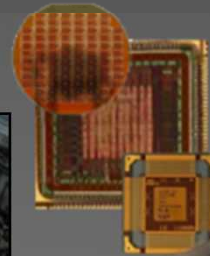
Arming, fuzing, and firing systems

Safety systems



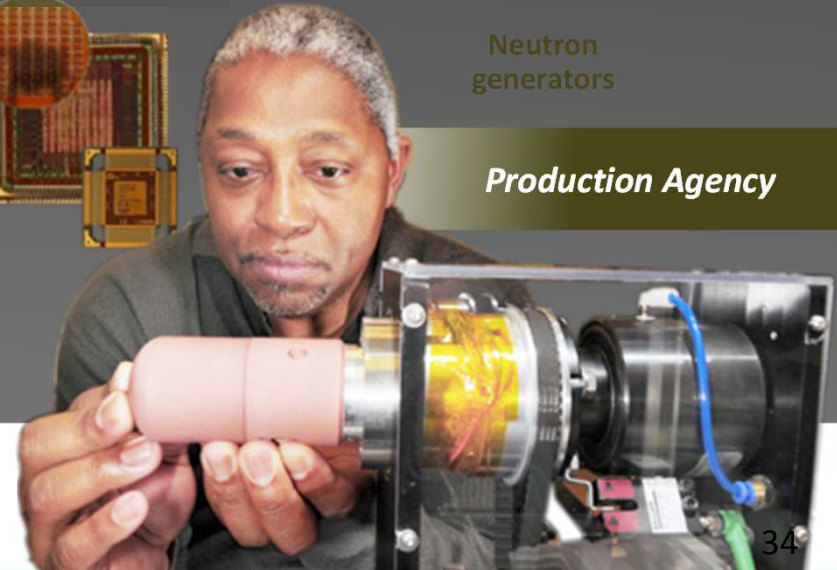
An extensive suite of multi-disciplinary capabilities are required for Design, Qualification, Production, Surveillance, Experimentation / Computation

MESA Microelectronics



Neutron generators

Production Agency



Major Environmental Test Facilities and Diagnostics



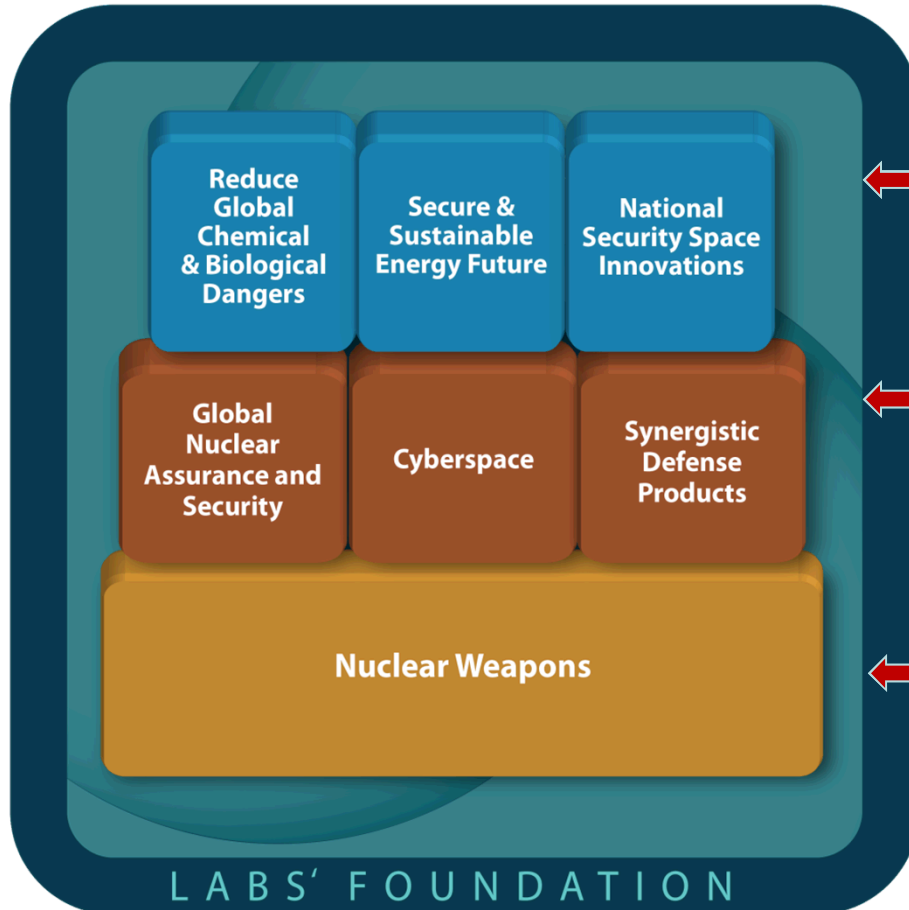
Z Machine



Light Initiated High Explosive Annular core research reactor



National Security Mission Areas



- Top row: Critical to our national security, these three mission areas leverage, enhance, and advance our capabilities.
- Middle row: Strongly interdependent with NW, these three mission areas are essential to sustaining Sandia's ability to fulfill its NW core mission.
- Bottom row: Our core mission, nuclear weapons (NW), is enabled by a strong scientific and engineering foundation.

Governance of Sandia Laboratories

Sandia Corporation

- AT&T: 1949–1993
- Martin Marietta: 1993–1995
- Lockheed Martin: 1995–present
- Existing contract expires: April 30, 2017
- Government owned, contractor operated

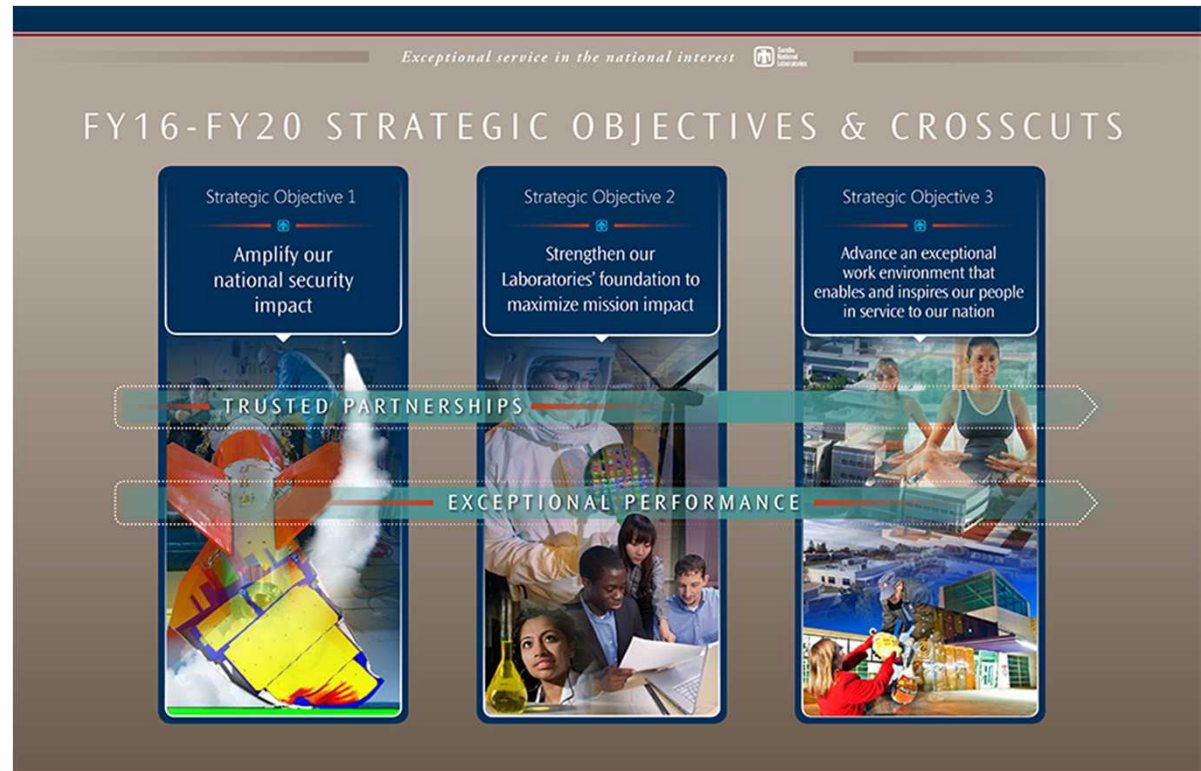
Federally funded
research and development center



Strategic Plan

Strategic Objectives

- Amplify our national security impact
- Strengthen our Laboratories' foundation to maximize mission impact
- Advance an exceptional work environment that enables and inspires our people in service to our nation



Our Core Values

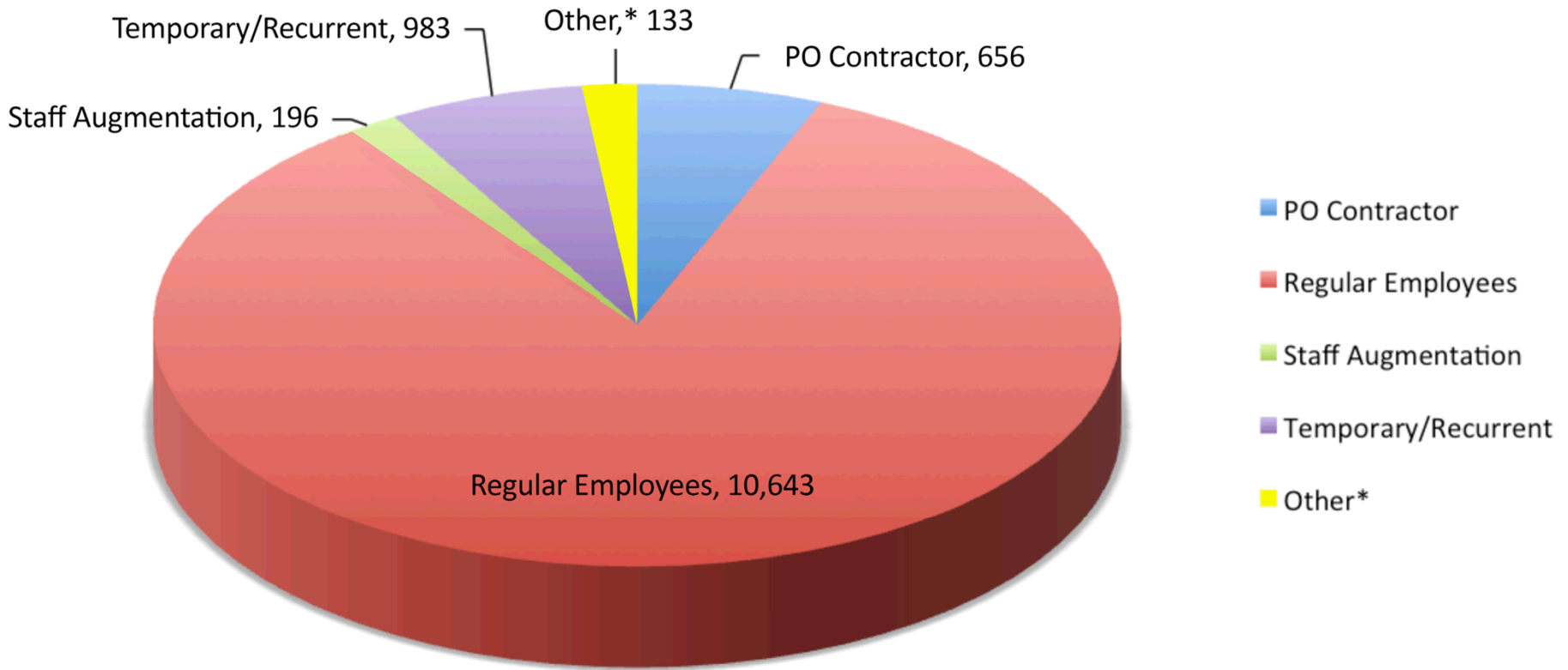
- Serve the nation
- Team to deliver with excellence
- Respect each other
- Act with integrity
- Live safe and healthy lives



Our Workforce

- Total Sandia workforce: 12,611
- Regular employees: 10,643
- Advanced degrees: 5,898 (55%)

Data as of December 14, 2015



* Other badged personnel

Sandia National Laboratories



OUR VISION

On behalf of our nation, we anticipate and solve the most challenging problems that threaten security in the twenty-first century.

OUR MISSION

The synergy and interdependence between our nuclear deterrence mission and broader national security missions forge a robust capability base and empower us to solve complex national security problems.

OUR VALUES

We Serve the Nation

We Team to Deliver
with Excellence

We Respect Each Other

We Act with Integrity

We Live Safe and Healthy Lives

Secure & Sustainable Energy Future

National Security Space Innovations

Reduce Global Chemical & Biological Dangers



Global Nuclear Assurance & Security



Cyberspace

Synergistic Defense Products

Nuclear Weapons



LABS' FOUNDATION



Slide 41

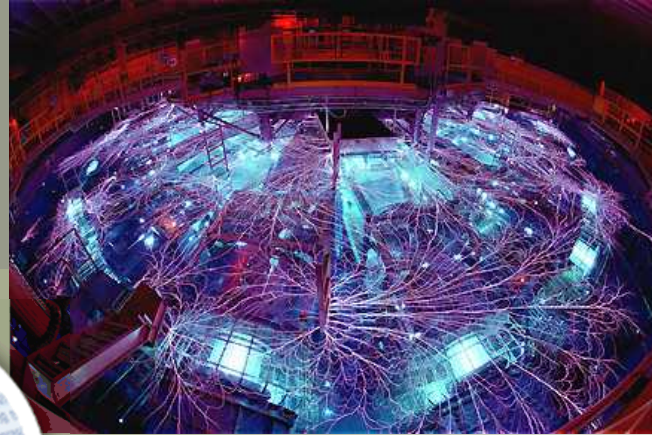
CCA1

Make photos as large as possible and other icon legible but as small as possible; Can do away with headline completely if that helps

Connelly, Cathy Ann, 6/8/2016

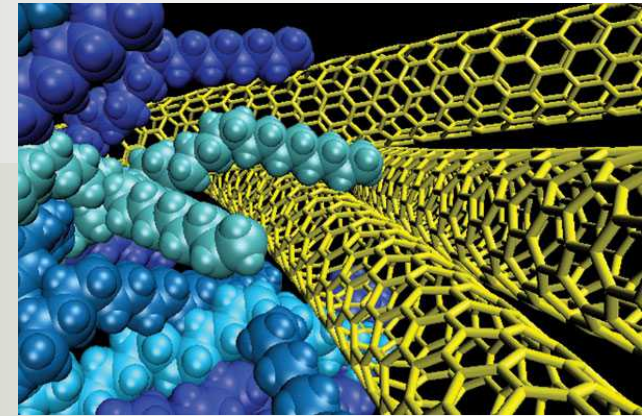
Research foundations

Computing & Information Sciences

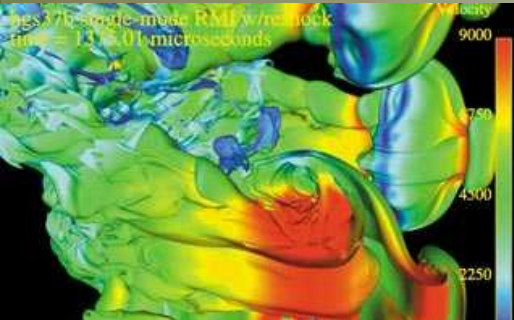


Radiation Effects & High Energy Density Science

Materials Sciences

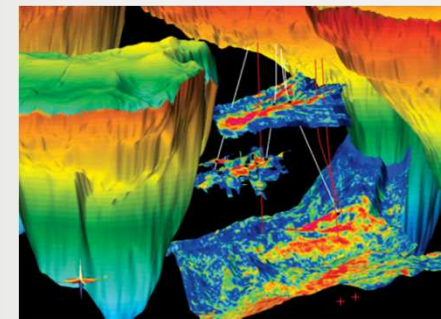
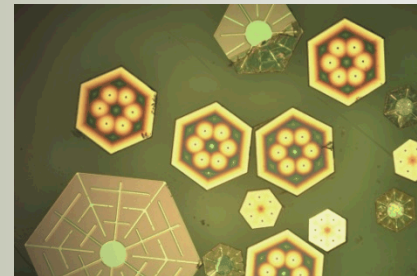


Engineering Sciences



Bioscience

Nanodevices & Microsystems



Geoscience

Sandia's Strategic Objectives

- Deliver with excellence on our commitments to the unique nuclear weapons mission
- Amplify our national security impact
- Lead the Complex as a model 21st century government-owned contractor-operated national laboratory
- Excel in the practice of engineering
- Commit to a learning, inclusive, and engaging environment for our people

The National Laboratory System

- **Ames Laboratory**
Ames, Iowa
- **Argonne National Laboratory**
Argonne, Illinois
- **Brookhaven National Laboratory**
Upton, New York
- **Fermi National Accelerator Laboratory**
Batavia, Illinois
- **Idaho National Laboratory**
Idaho Falls, Idaho
- **Lawrence Berkeley National Laboratory**
Berkeley, California
- **Lawrence Livermore National Laboratory**
Livermore, California
- **Los Alamos National Laboratory**
Los Alamos, New Mexico
- **National Energy Technology Laboratory**
Morgantown, West Virginia
Pittsburgh, Pennsylvania
Albany, Oregon
- **National Renewable Energy Laboratory**
Golden, Colorado
- **Oak Ridge National Laboratory**
Oak Ridge, Tennessee
- **Pacific Northwest National Laboratory**
Richland, Washington
- **Princeton Plasma Physics Laboratory**
Princeton, New Jersey
- **Sandia National Laboratories**
Albuquerque, New Mexico
Livermore, California
- **Savannah River National Laboratory**
Aiken, South Carolina
- **SLAC National Accelerator Laboratory**
Menlo Park, California
- **Thomas Jefferson National Accelerator Facility**
Newport News, Virginia



An Investment in
Innovation and Prosperity

Sandia National Laboratories

