SAND2015-8966PE

Exceptional service in the national interest

Sandia National Laboratories

UC Boulder, October 15, 2015

Sandia Research and Collaborative Opportunities

Jim Redmond

Senior Manager, Solid Mechanics and Shock Physics

Sandia National Labs, Albuquerque, NM

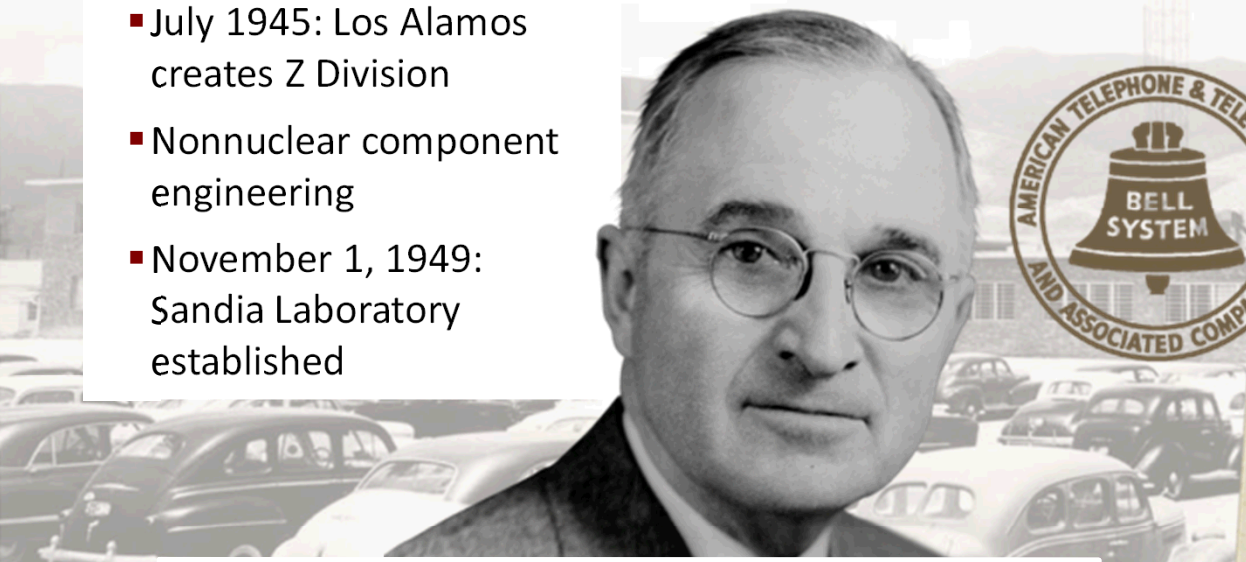
U.S. DEPARTMENT OF ENERGY | NNSA National Nuclear Security Administration

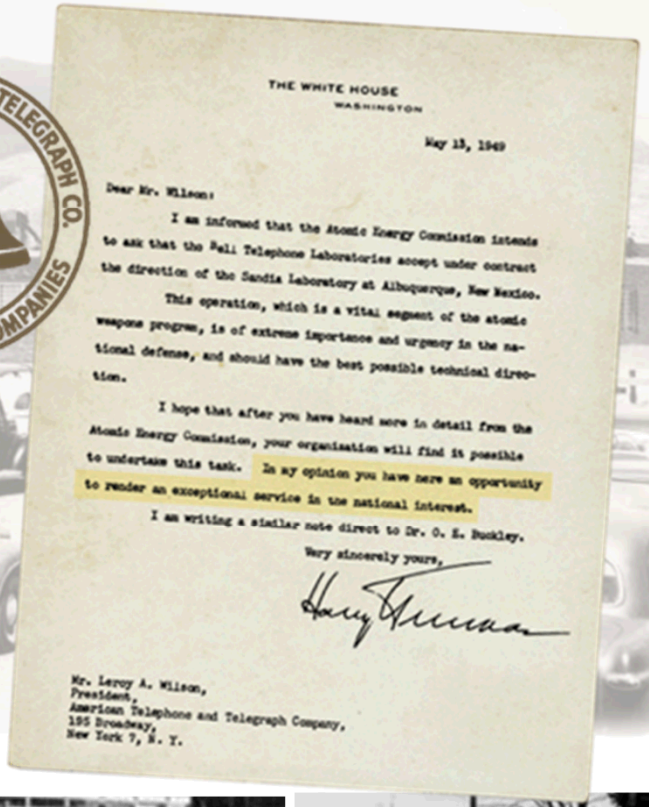
Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000. SAND 2013-7957P

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





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 direction of the Sandia Laboratory at Albuquerque, New Mexico.

This operation, which is a vital segment of the atomic weapons program, is of extreme importance and urgency in the national defense, and should have the best possible technical direction.

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

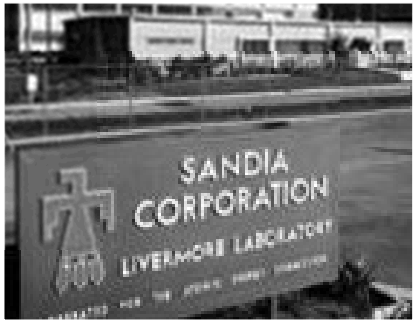
I am writing a similar note direct to Dr. O. E. Buckley.

Very sincerely yours,

Harry Truman

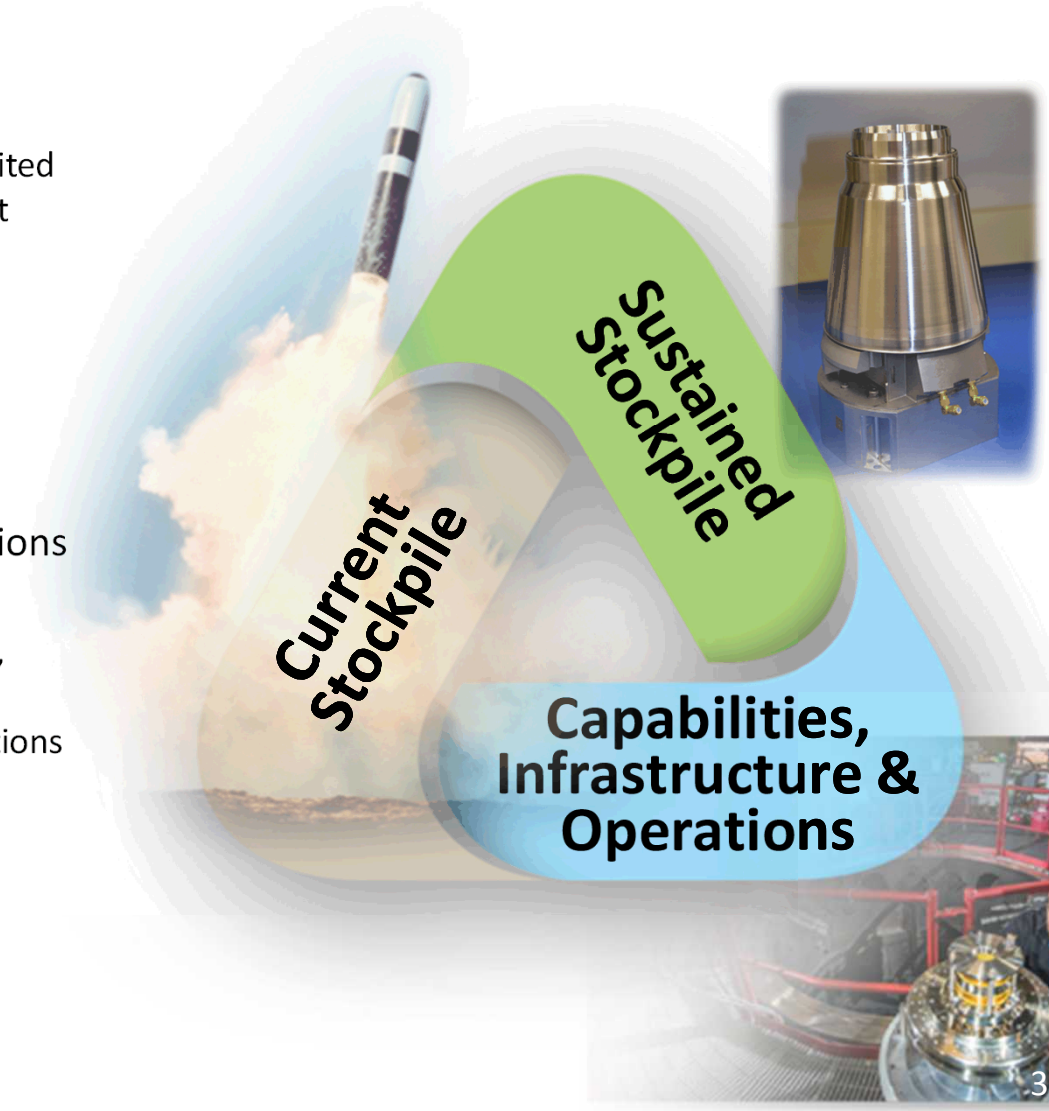
Mr. Leroy A. Wilson,
President,
American Telephone and Telegraph Company,
195 Broadway,
New York 7, N. Y.

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



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



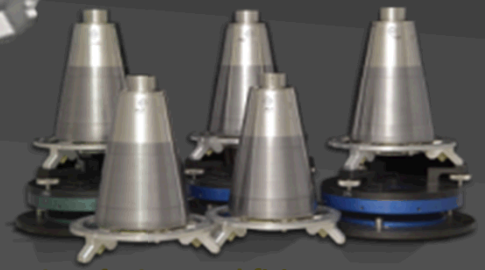
Sandia's Current Nuclear Weapons Activities

Sandia National Laboratories

Warhead Systems Engineering and Integration

Design Agency for Nonnuclear Components

Gas Transfer systems

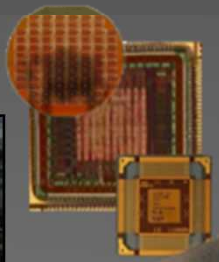


Arming, fuzing, and firing systems

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

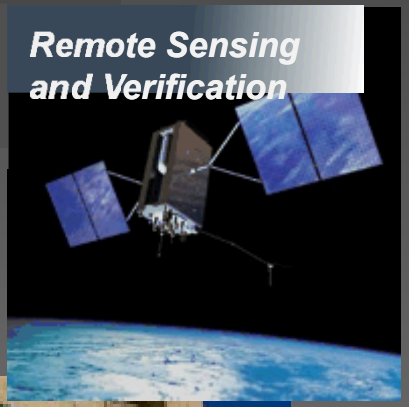
Defense Systems & Assessments Programs

Sandia National Laboratories

Information Operations

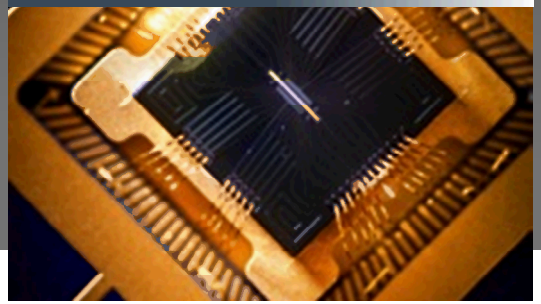
Surveillance & Reconnaissance

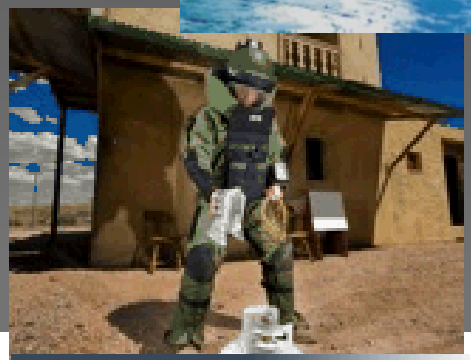
Remote Sensing and Verification



Space Mission

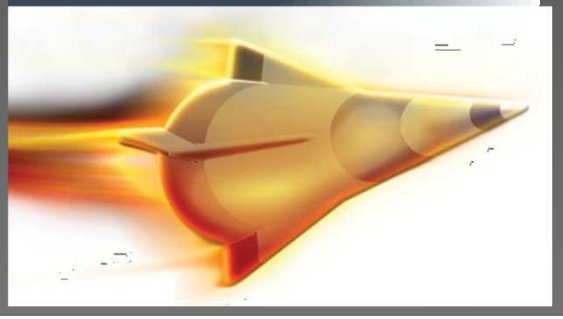
Science & Technology Products





Proliferation Assessment

Integrated Military Systems



Energy & Climate

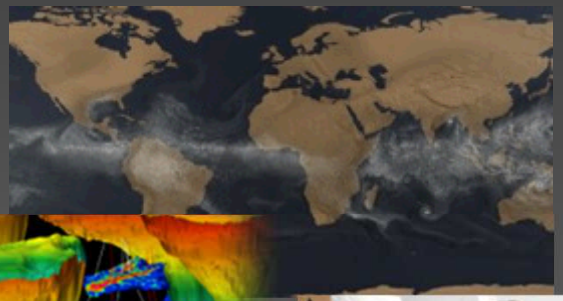
Sandia National Laboratories

Energy Research

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

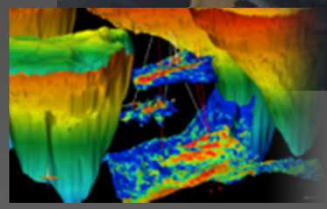
Climate & Environment

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

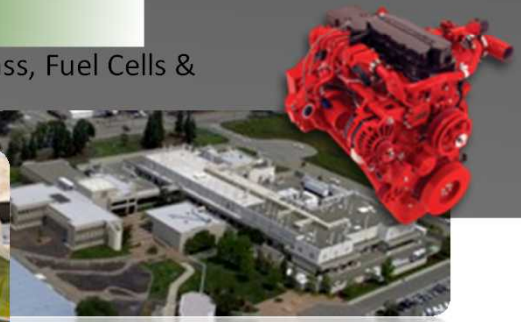


Renewable Systems & Energy Infrastructure

Renewable Energy, Energy Efficiency, Grid and Storage Systems

Transportation Energy & Systems

Vehicle Technologies, Biomass, Fuel Cells & Hydrogen Technology



International, Homeland, & Nuclear Security

Sandia National Laboratories

Global Security

WMD Counterterrorism and Response

Homeland Security Programs

Homeland Defense and Force Protection

Cyber and Infrastructure Security

Sandia's mission, research objective

Our unique mission responsibilities in the nuclear weapons (NW) program create a foundation from which we leverage capabilities, enabling us to solve complex national security problems.

Research conducted at Sandia shall
enable mission delivery now and in the future and
advance the frontiers of science and engineering.



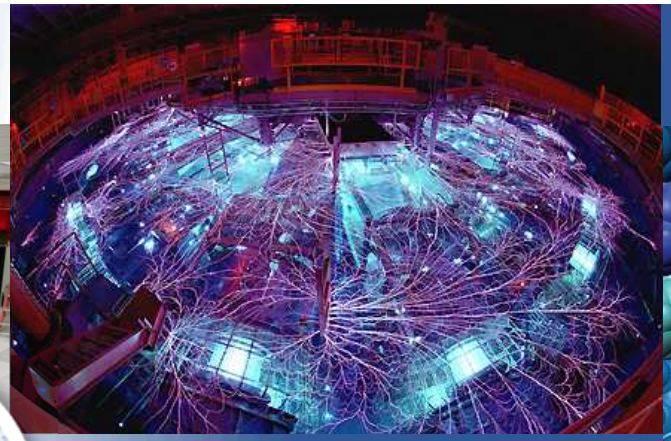


Sandia's Research Foundations

Enduring discipline-based competencies essential to our mission

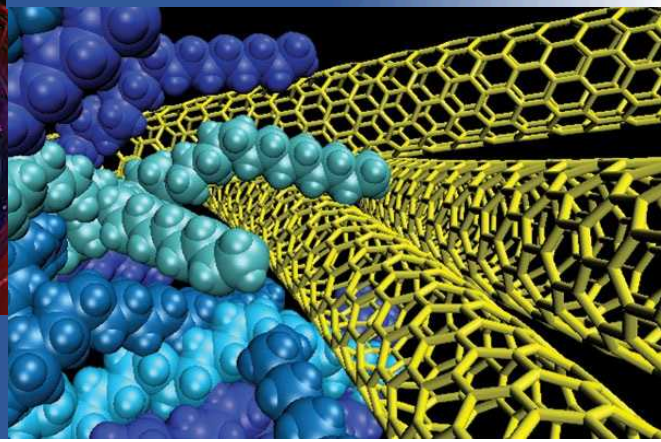
Sandia National Laboratories

Computing & Information Sciences

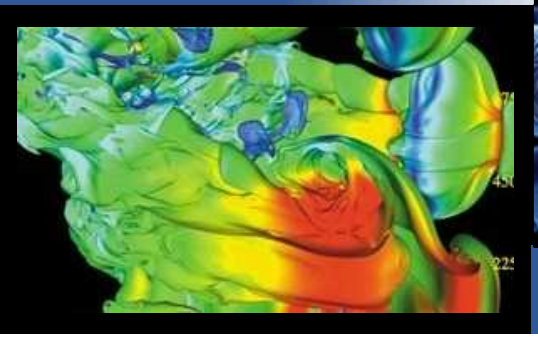


Radiation Effects & High Energy Density Science

Materials Sciences

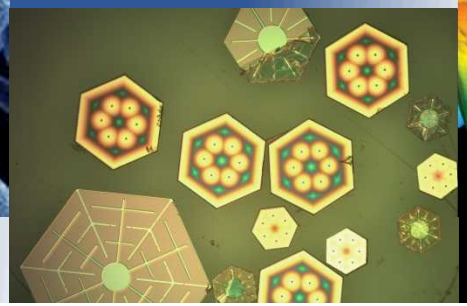


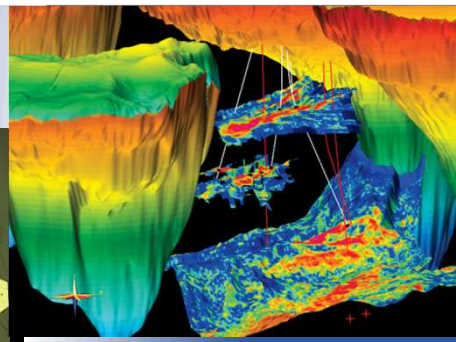
Engineering Sciences



Bioscience

Nanodevices & Microsystems





Geoscience

Examples of diverse facilities that enable collaborative basic and applied research

Sandia National Laboratories

Center for Integrated Nanotechnologies

- One of five DOE Nanoscale Science Research Centers (user facilities)
  - Averages ~350 users per year
- Focused on assembling nanoscale materials across length scales to design and achieve new properties and functionality
- Developed novel Discovery Platforms™, modular, microlaboratories for studying the physical and chemical properties of nanoscale materials and devices

Combustion Research Facility

- Office of Science collaborative research facility
  - Hosts ~100 visiting researchers per year
- Focused on improving energy efficiency and reducing emissions from energy conversion
- Pioneered laser-based optical diagnostics for combustion research


CINT Facility at Sandia

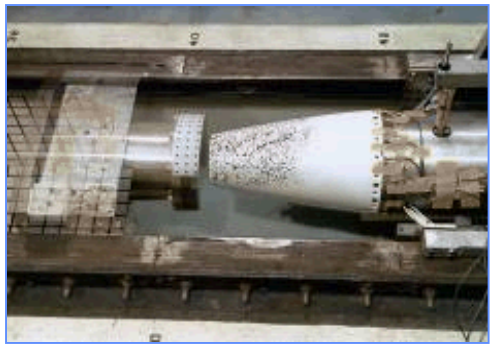

CRF at Sandia

Our large-scale test capabilities are important for design, qualification, and surveillance of systems

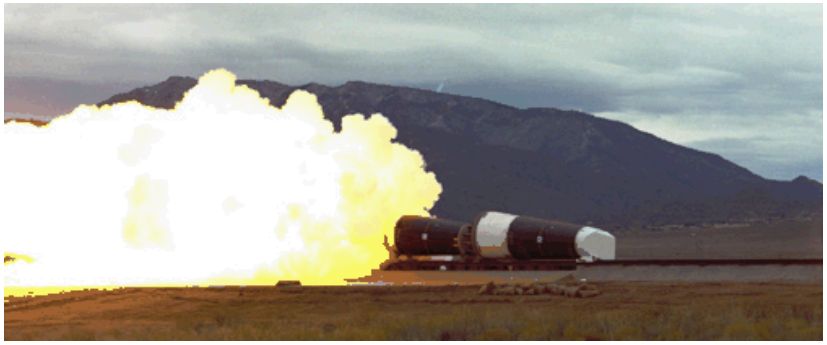
Sandia National Laboratories

Large scale vibration

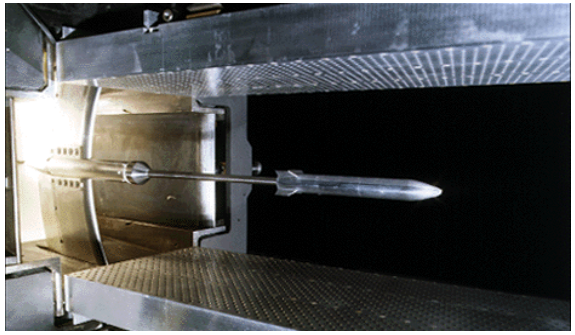
Centrifuge: acceleration



Mechanical Shock Facility: shock & impact



Rocket sled track: impact, acceleration



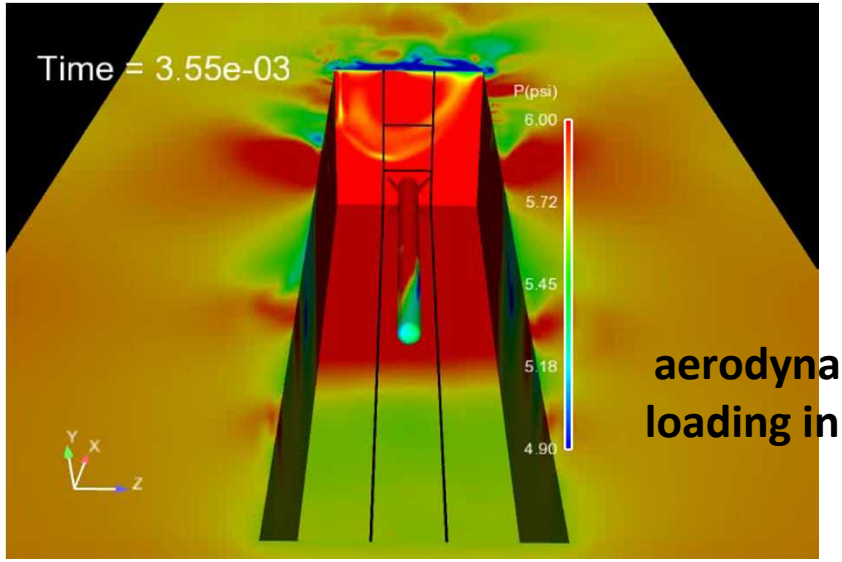
Wind Tunnel: aerodynamics

Fire: accident

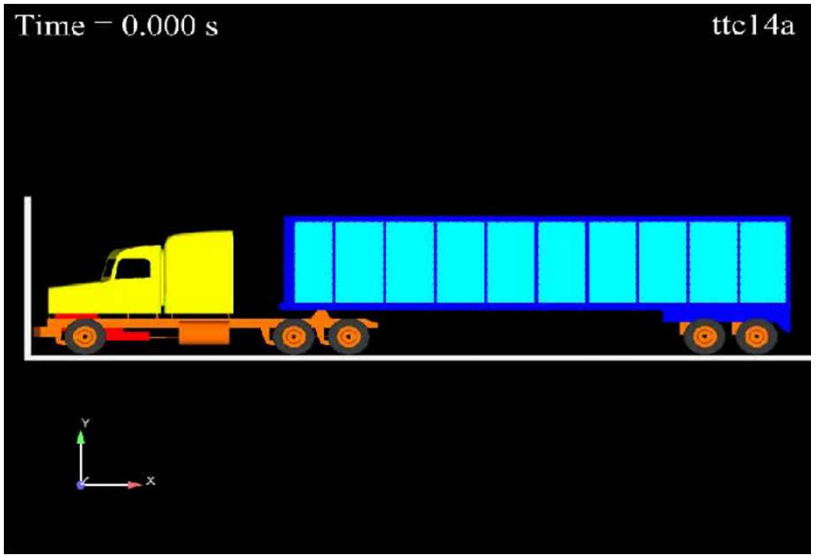
We are completing a limited scope upgrade of several important test facilities: Test Capabilities Revitalization Phase 2 project

Engineering environments can be numerically quantified with computational simulation

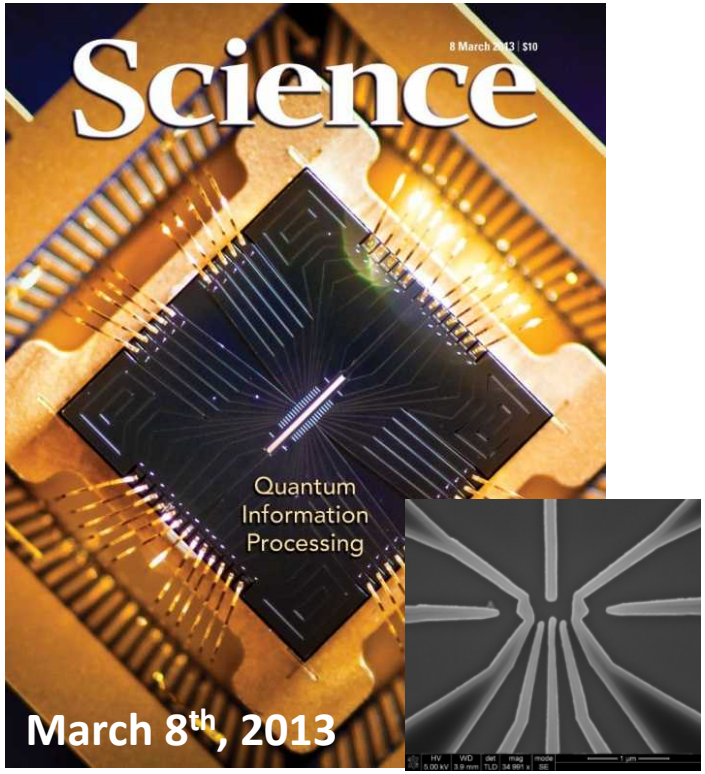
Sandia National Laboratories

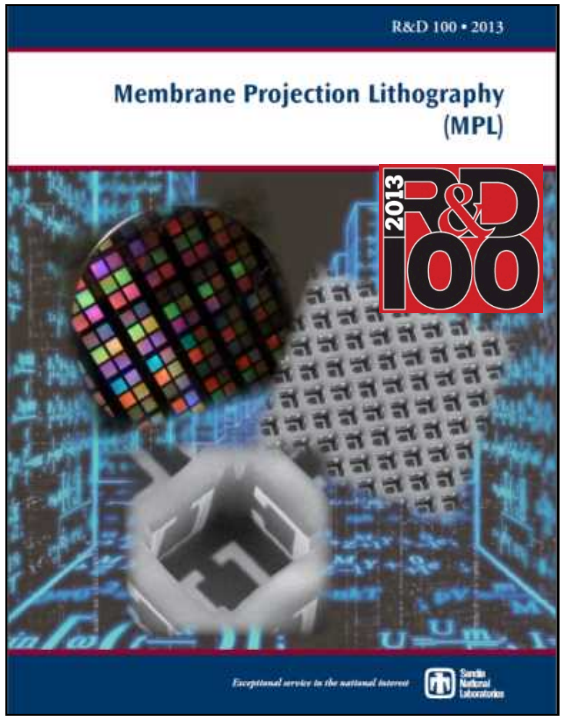


aerodynamic acoustic loading in a bomb bay

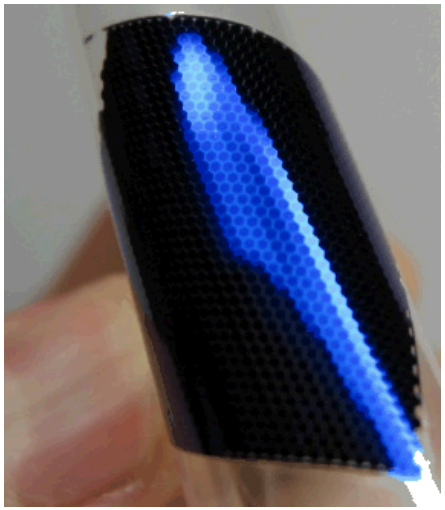


The MESA facility provides a world-class capability for leading edge micro-systems research





R&D 100 Award from Grand Challenge LDRD



Micro-enabled Photovoltaic devices Grand Challenge LDRD

Quantum Information Processing:

- World-class fabrication of ion traps
- Understanding quantum phenomena
- Devices that support university research

Sandia's Research Challenges

Multidisciplinary research campaigns that drive research-mission integration

Current Research Challenges:

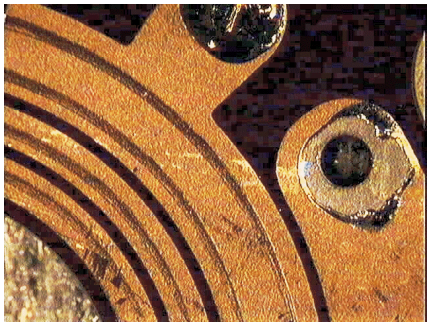
- Detection at the Limit
- Power on Demand
- Revolutionary Approaches to the Stockpile
- Science & Engineering of Quantum Information Systems
- Trusted Systems & Communications
- Beyond Moore Computing
- Cyber Resiliency
- Data Science
- Engineering Abiotic/Biotic Living Systems
- Engineering of Materials Reliability
- First to High-Yield Fusion
- Resiliency in Complex Systems

Research Challenge attributes:

- Advances the frontiers of science and engineering
- Surmounts a critical path technical obstacle for a mission challenge
- Long-lived, with a measurable endpoint
- Integrates in multiple dimensions
- Requires partnerships

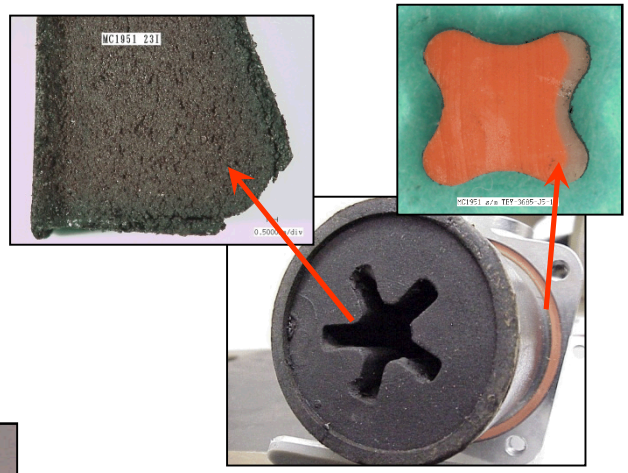
Understanding aging and reliability of materials is critical to meeting demanding lifetime requirements

Sandia National Laboratories

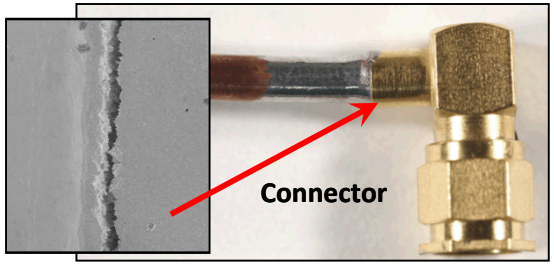


Electrical Contacts

NiCr Resistor Corrosion

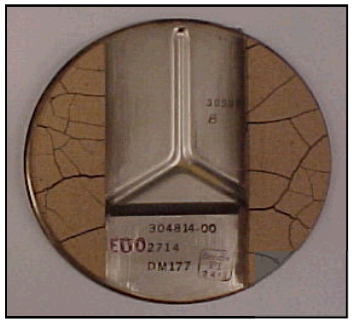


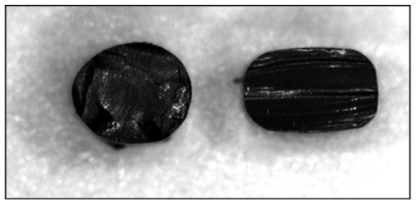
Aging of propellant



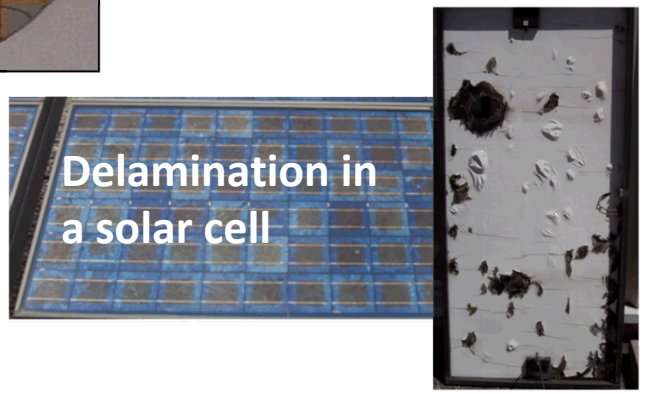
Solder joint aging in cable connectors

Aging of Desiccant





O-ring Compression Set



Sandia's university partnerships strategy

Provide national leadership in science and engineering by establishing enduring partnerships with a focused set of universities

The Campus Executive program provides the foundational framework by which Sandia's university partnerships are executed

University Collaborations

- Campus visits, recruiting
- Seminars information exchange
- Graduate/undergraduate student internships
- Teaching/design project sponsorship
- Faculty sabbaticals
- Campus Executive Fellowships (?)
- Research collaboration contract
- Joint pursuits

FY15: ~8 active UC-Sandia Collaborations totaling ~$400K