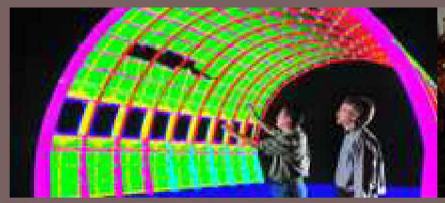
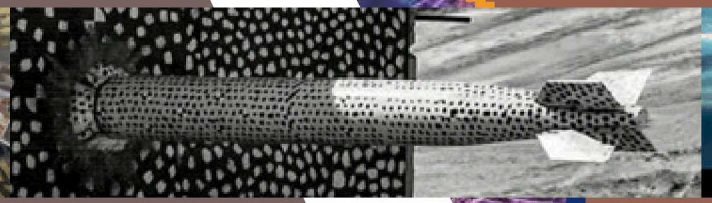
SAND2019-3375PE

Exceptional service in the national interest








SANDIA NATIONAL LABORATORIES

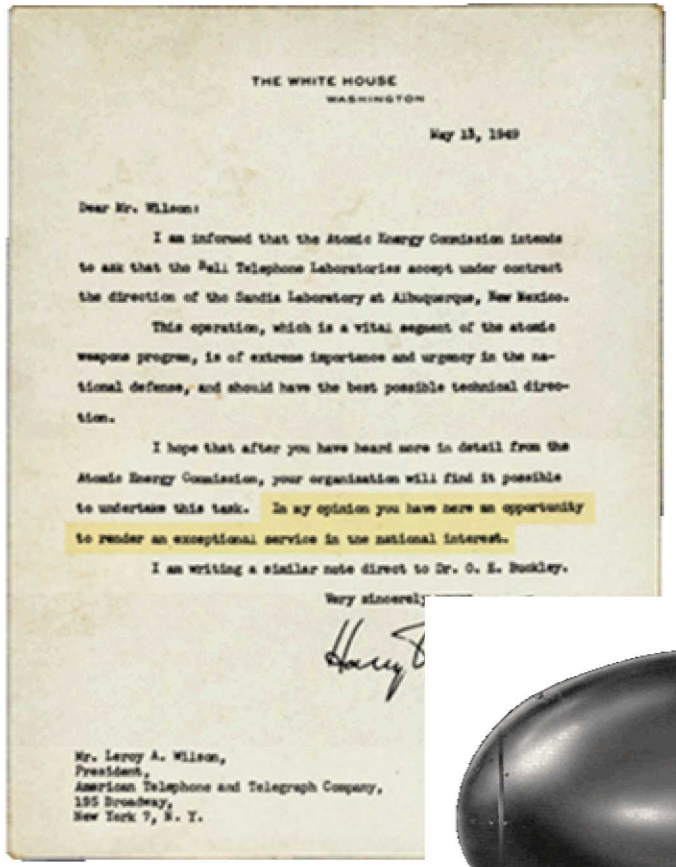
An Overview

Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia LLC, a wholly owned subsidiary of Honeywell International Inc. for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.
SAND 2018-4900 PE

SANDIA'S HISTORY IS TRACED TO MANHATTAN PROJECT

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

- July 1945
  Los Alamos creates Z Division
- Nonnuclear component engineering
- November 1, 1949
  Sandia Laboratory established
- AT&T: 1949–1993
- Martin Marietta: 1993–1995
- Lockheed Martin: 1995–2017
- Honeywell: 2017–present



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,

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

SANDIA IS A FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTER MANAGED AND OPERATED BY

National Technology & Engineering Solutions of Sandia, LLC, a wholly owned subsidiary of Honeywell International Inc.: 2017 – present

Government owned, contractor operated

SANDIA HAS FACILITIES ACROSS THE NATION

Main sites

- Albuquerque, New Mexico
- Livermore, California

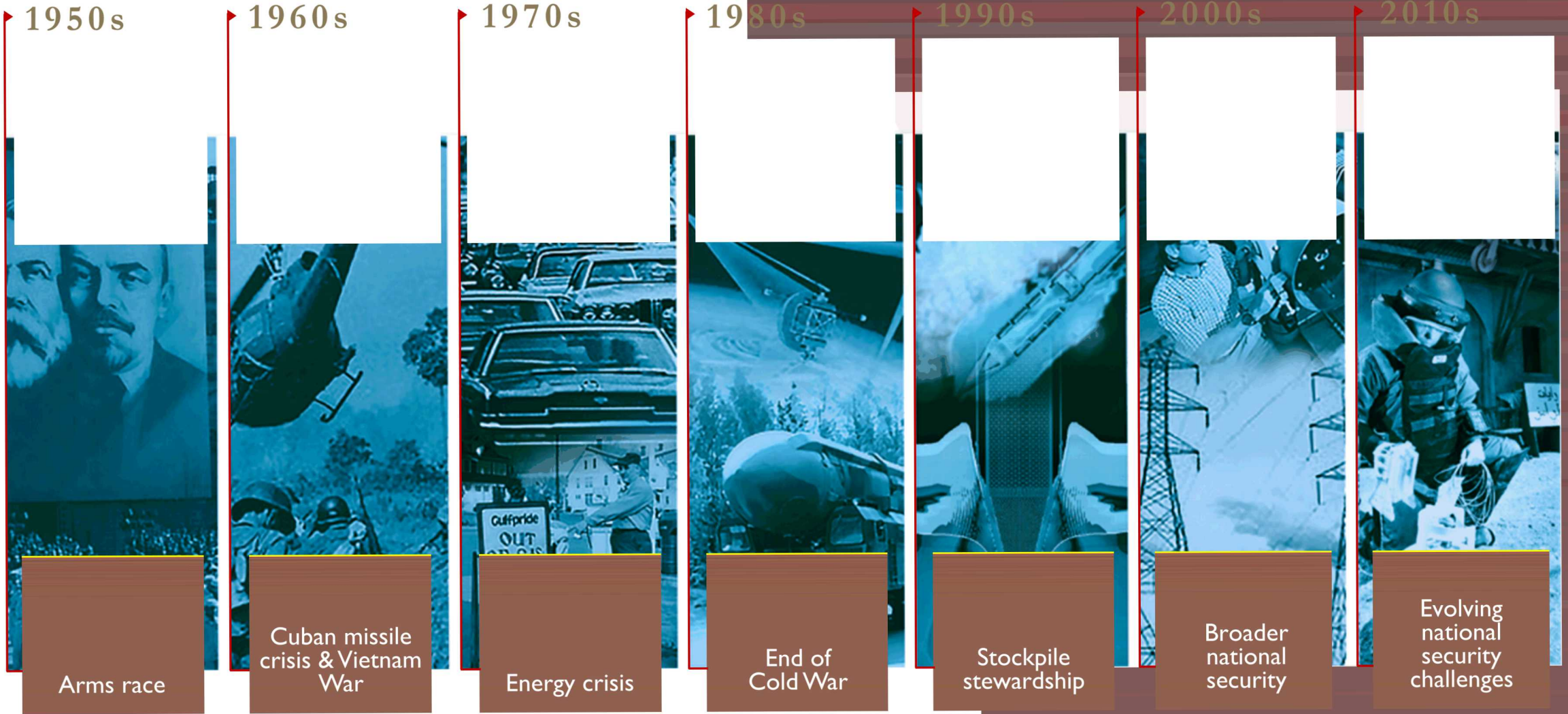
Activity locations

- Kauai, Hawaii
- Waste Isolation Pilot Plant, Carlsbad, New Mexico
- Pantex Plant, Amarillo, Texas
- Tonopah, Nevada

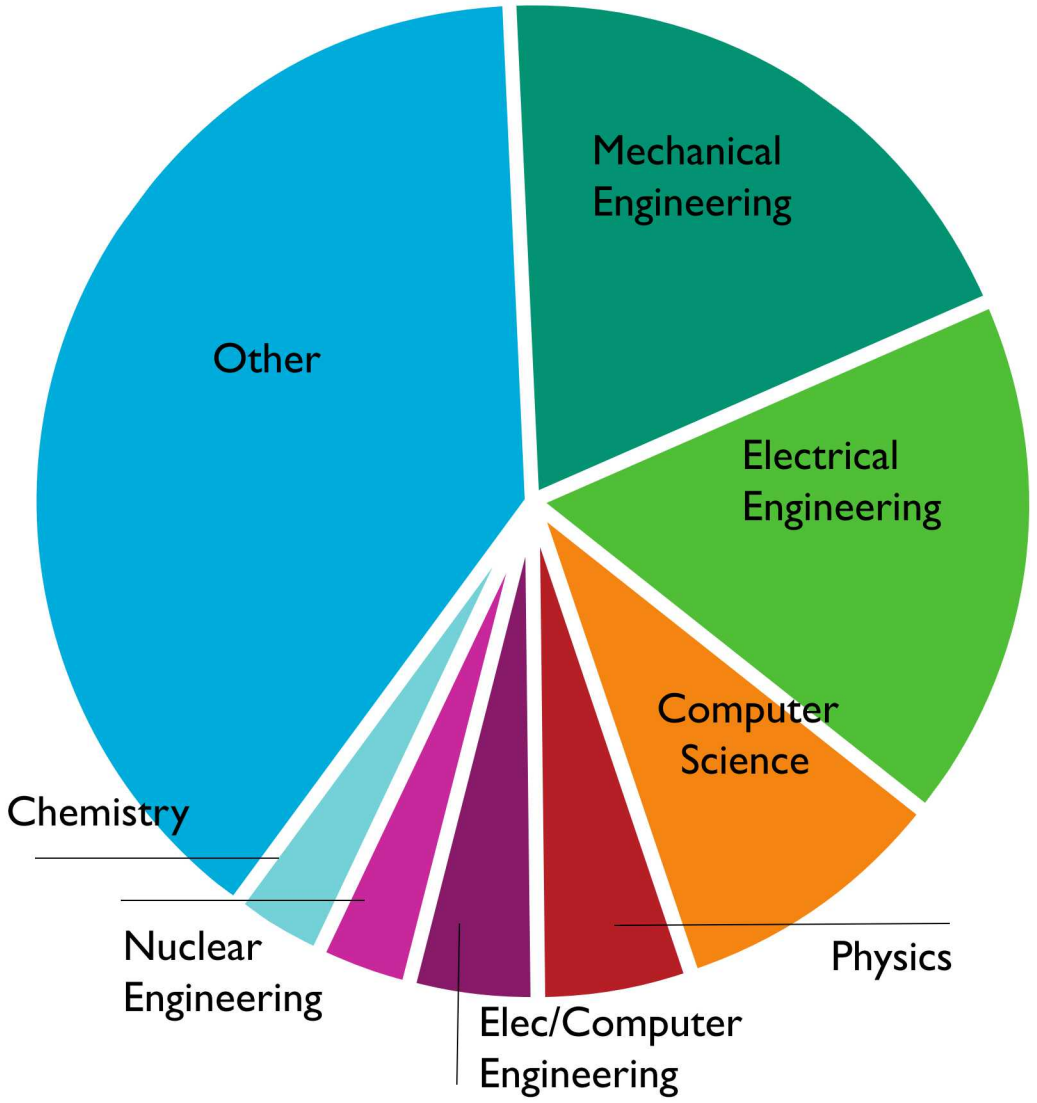
PURPOSE STATEMENT DEFINES WHAT WE DO

Sandia develops advanced technologies to ensure global peace

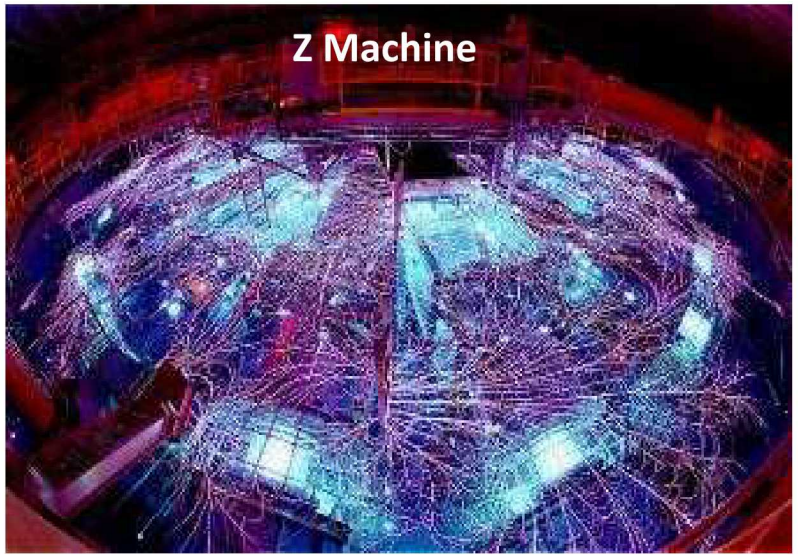
SANDIA ADDRESSES NATIONAL SECURITY CHALLENGES



SANDIA'S WORKFORCE

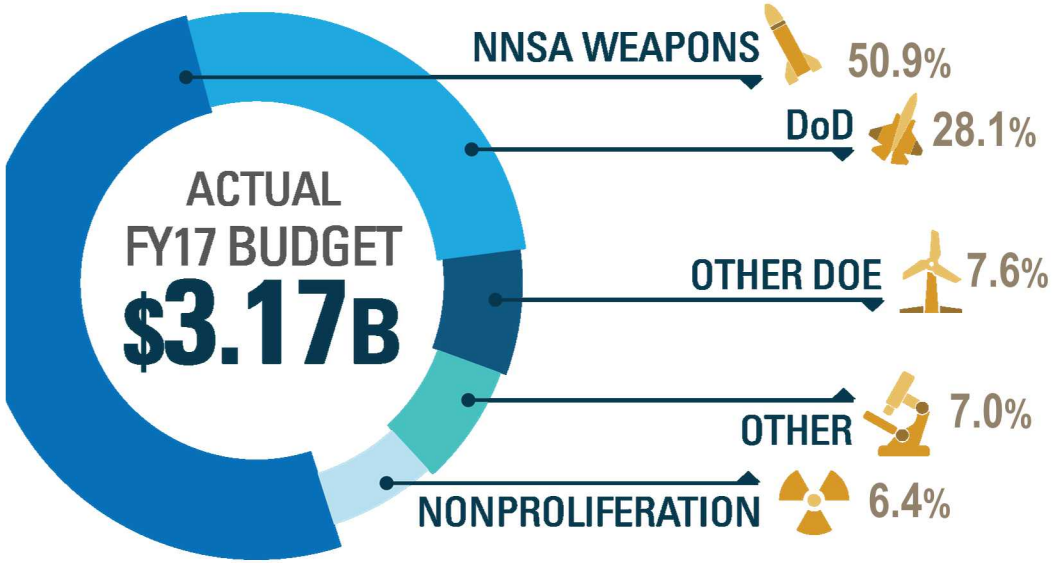


WORLD-LEADING RESEARCH FACILITIES



MESA = Microsystems Engineering, Science, and Applications

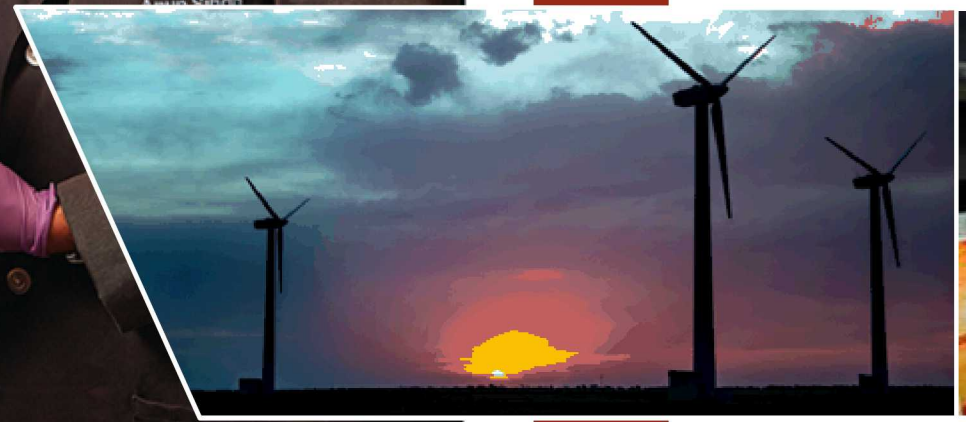
SANDIA'S BUDGET SUPPORTS A BROAD RANGE OF CUSTOMERS AND MISSIONS

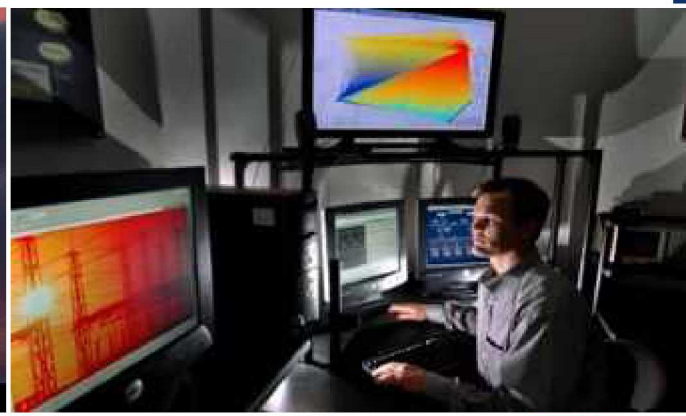


ENERGY & HOMELAND SECURITY

Innovates for a secure future

- Perform fundamental and applied R&D to support the resilience and security of the nation's energy system
- Provide protection for our nation's digital and physical critical infrastructures
- Reduce U.S. vulnerability to chemical, biological, radiological, and nuclear threats
- Accelerate transformative innovations in the transportation sector through foundational physical and computational research





ENERGY & CLIMATE

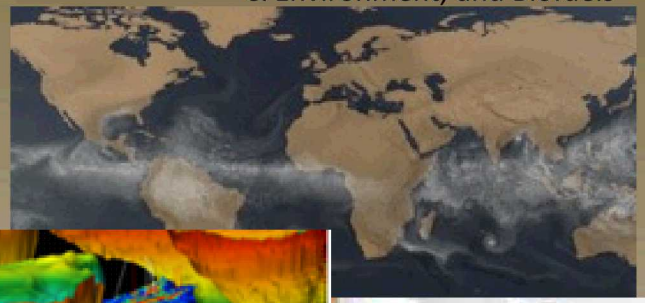
*

Energy Research

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

Climate & Environment

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

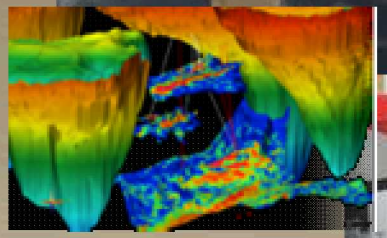


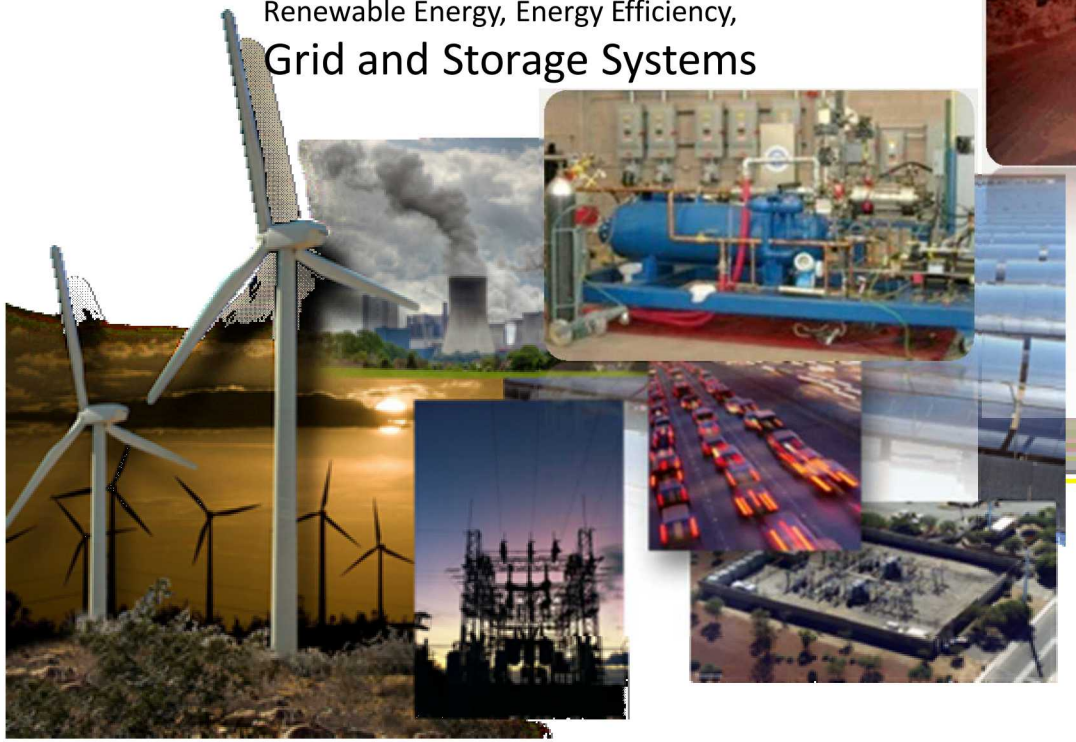
Nuclear Energy & Fuel Cycle

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

CINT IS A NANOSCALE SCIENCE RESEARCH CENTER (DOE/SC NATIONAL USER FACILITY)

"A DOE/SC user facility has unique world-class research capabilities and technologies which are available broadly to science community worldwide from universities, industry, private laboratories, and other Federal laboratories for work that will be published in the open literature."

The DOE/SC nanoscience centers are different from traditional user facilities

- Defined by a scientific field, not specific instrumentation.
- NSRC staff support user projects and conduct original research.
- Capabilities involve hardware plus research expertise.

CINT SCIENTISTS AND THEIR CAPABILITIES ARE LOCATED IN THE CORE AND GATEWAY FACILITIES

Core Facility (SNL)

- TEM, SEM, XRD
- Low Temp Transport
- Scanning Probe Microscopy
- Ultra-fast Spectroscopy
- Molecular Beam Epitaxy
- Chem & Bio labs
- Molecular films
- E-beam lithography
- Photolithography
- Deposition & Etch
- SEM / FIB

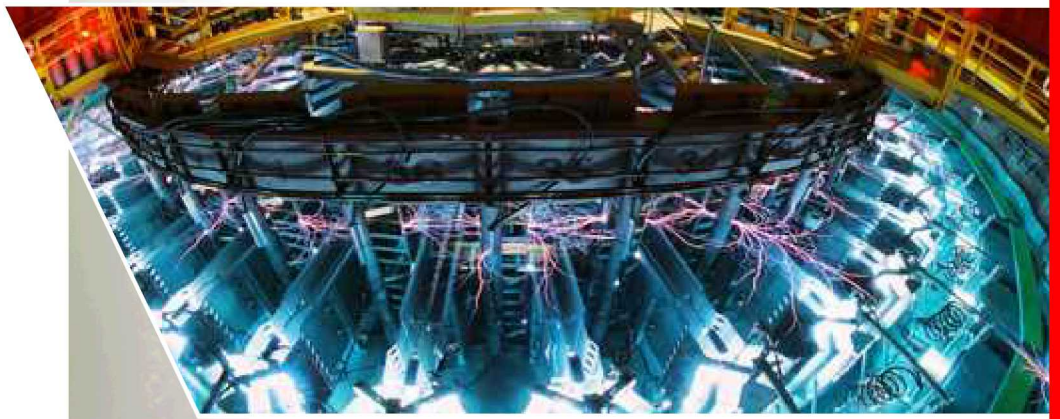
Gateway Facility (LANL)

- Biomaterials & Chem synthesis
- XRD, SEM
- UV-vis, ellipsometry
- Nano-indentation
- Nanoscale optical probes
- Microscopies
- Physical Synthesis
- Pulsed Laser Deposition
- Ultra-fast Spectroscopy
- Computer Cluster
- Visualization Lab

ADVANCED SCIENCE & TECHNOLOGY

Research role in mission delivery

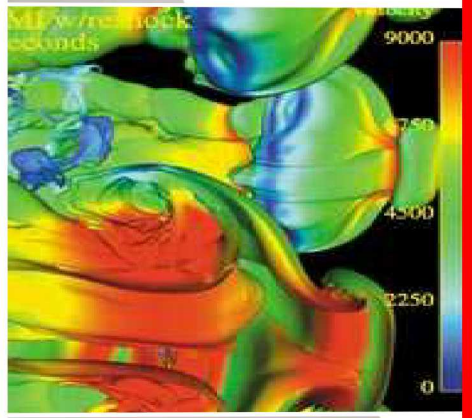
Nanodevices & Microsystems



Radiation Effects & High Energy Density Science

Materials Science

Computing & Informa



Engineering Science

Geoscienc e

Bioscience

Jessica Rimsza
D. Jon Vogel

SNL COMPUTATIONAL CAPABILITIES

Available HPC Systems

		Nodes	Cores	Processor Type	RAM per Core / Node	Processor Hrs/Yr	GA Date
SRN	Skybridge	1848	29568	2.6 GHz Intel Sandy Bridge E5-2670	4/64	259,015,680	March 2015
	Chama	1232	19712	2.6 GHz Intel Sandy Bridge E5-2670	4/64	172,677,120	Sept 2012
	Uno	201	334	2.7 GHz Intel Sandy Bridge	168x4	29,296,440	August 2014
	Ghost	740	26640	2.1 GHz Intel Broadwell EG-2695	3.5/128	233,366,400	July 2017
	Doom	30	430080	2.1 GHz Intel Broadwell E5-2695 v4	512		Pre-Deployment
ECN	Solo	374	13464	2.1 GHz Intel Broadwell E5-2695 v4	128	117,944,640	Feb 2017

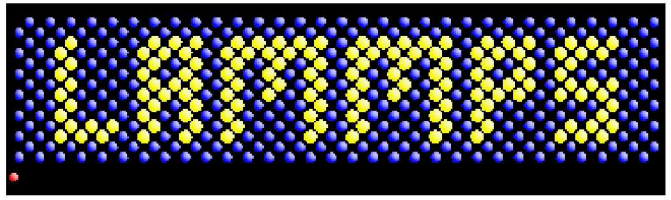
SARAPE Access: Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Savannah River National Laboratory, Notre Dame University, Stanford University, Texas A&M University, University of Florida, University of Illinois Urbana-Champagne, University of Utah

Access: Best options is to have a visiting scholars at SNL for a summer/semester to access computational resources and then maintain access when they return to their home institution

SNL Developed Codes:

DAKOTA
Explore and predict with confidence.
Optimization

SIERRA MECHANICS
Solid Mechanics

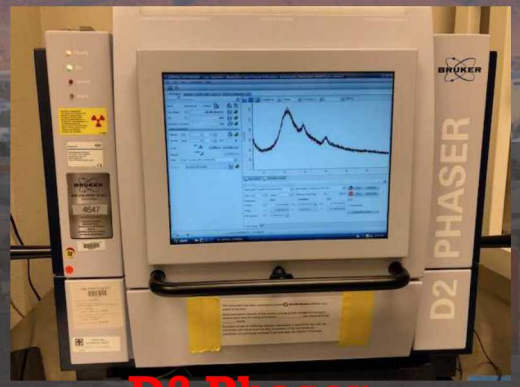

Molecular Dynamics

Socorro
an open-source density-functional theory project
Electronic Structure

Labs Capabilities: T. Nenoff, D. Sava Gallis, G. Vincent

Jessica Rimsza
D. Jon Vogel

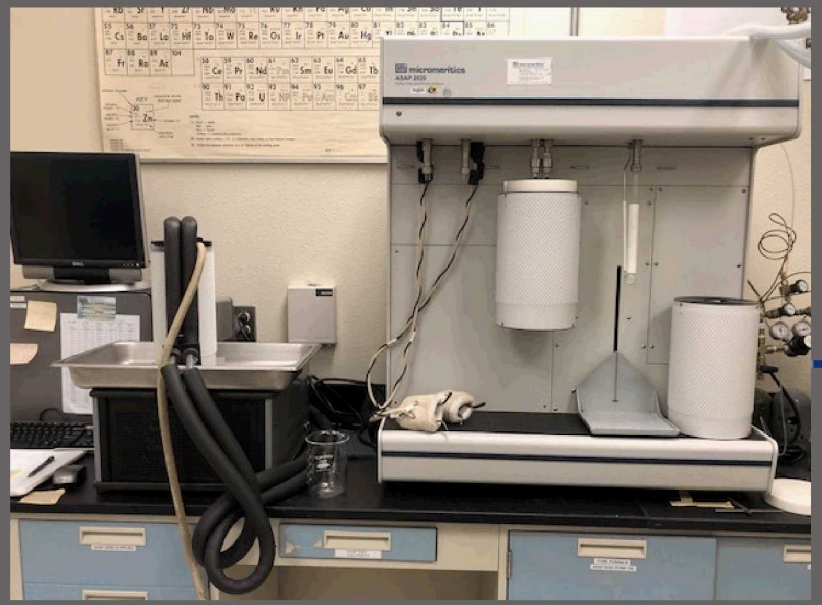
40 sample changer
D500 PXRD



D2 Phaser
PXRD

Parr Reactors
23-250ml
1liter, 1 gal

FTIR, CO_2 critical dryer
UV-vis



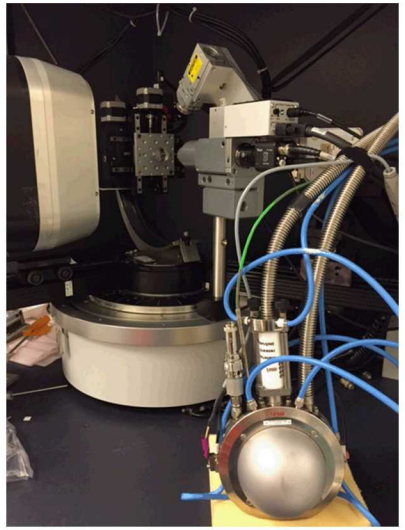
Micromeritics-BET
Enabled ambient +
O_2 adsorption

Q600
TGA-DTA/MS

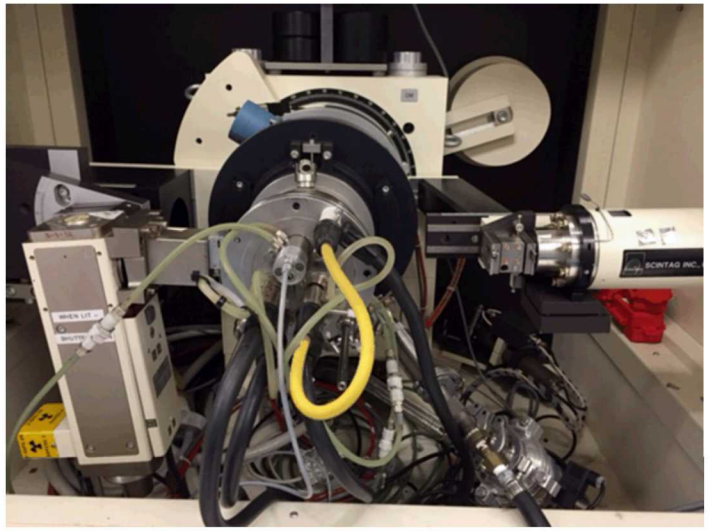
Diffraction Capability in Materials Center (1800)

M. Rodriguez, SNL

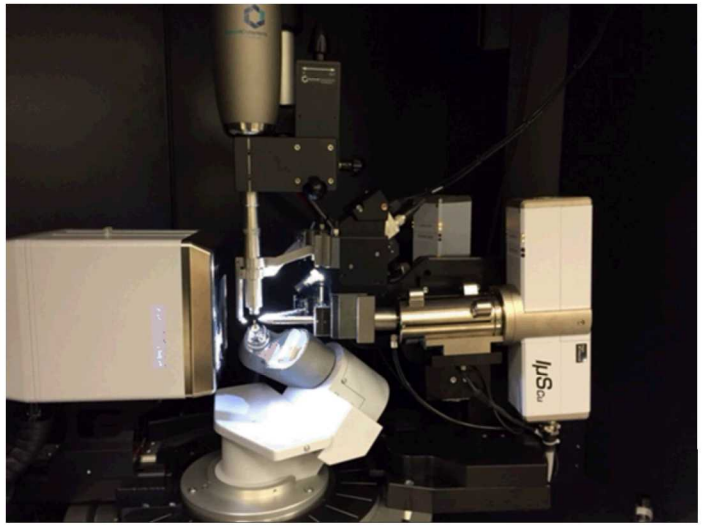
CRYOSTAGE FOR D8 MICRODIFFRACTOMETER



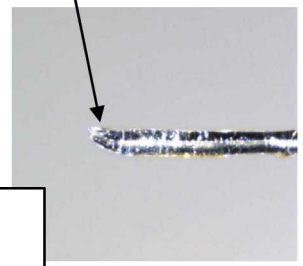
SCINTAG HIGH TEMP XRD: WITH GAS HANDLING SYSTEM



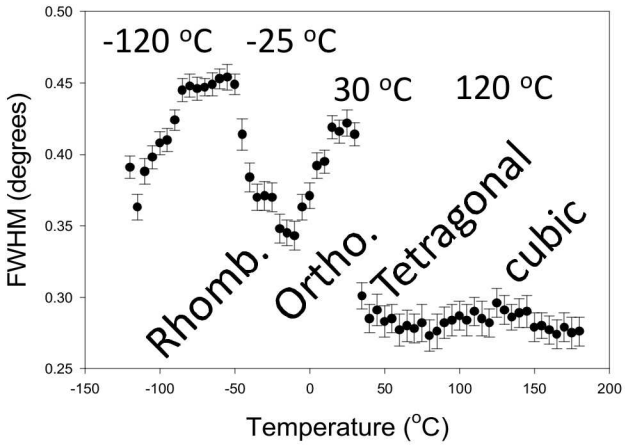
D8 VENTURE 1° CRYSTAL: LOWER LIMIT 20 MICRON COPPER SOURCE



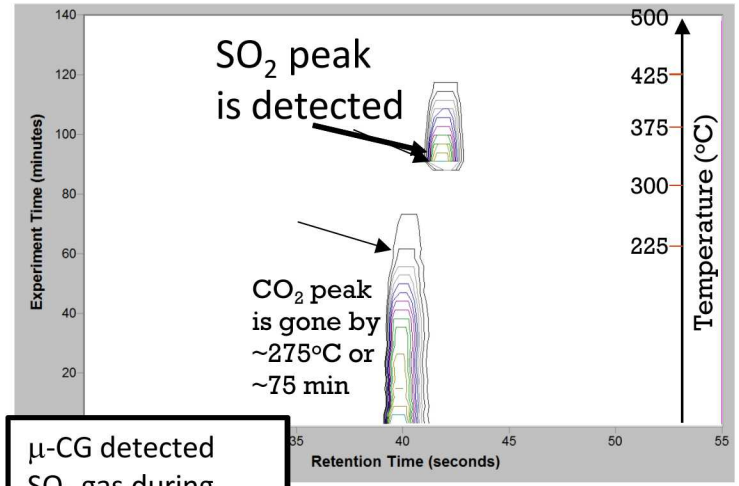
13 x 58 x 88 μm crystal



Variable temp stage ***cryo to*** ~400°C

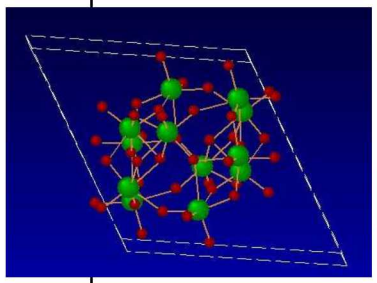


Micro Gas Chromatograph (μ-GC)



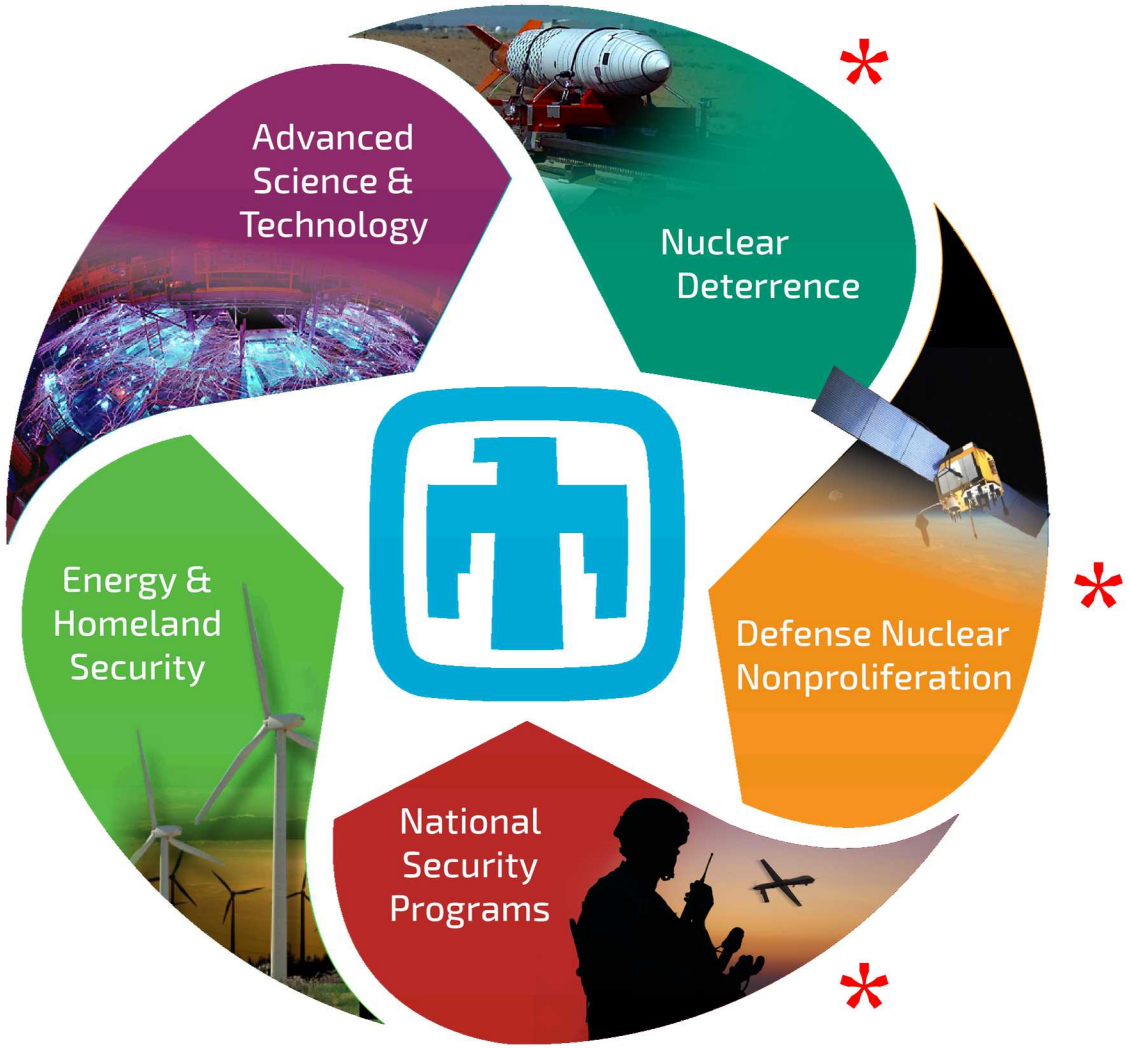
μ-CG detected SO_2 gas during Pyrite breakdown as monitored via insitu XRD

Crystal data:
$Na_4W_{12}O_{42}\cdot xH_2O$
Triclinic P-1
a = 10.71 Å
b = 10.80
c = 12.85
α = 100.1°
β = 106.1
γ = 113.4
R_1 ~7 %
3100 observations



SNL: NUCLEAR DETERRENCE & NATIONAL SECURITY MISSIONS

- EXTRA SLIDES



NUCLEAR DETERRENCE IMPERATIVES

Maintain the current U.S. nuclear weapons stockpile

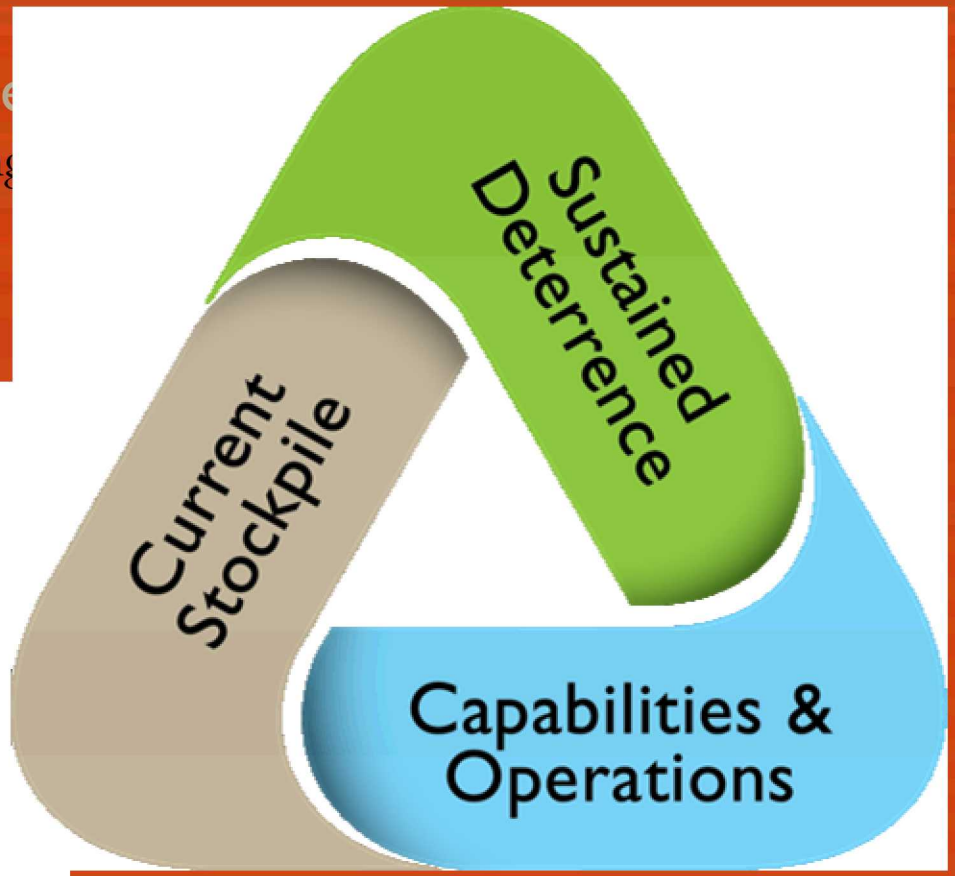
Annual Assessment, surveillance, limited life component exchang
significant finding investigations

Sustain the stockpile into the future

Life Extension Programs, alterations, modifications, technology maturation, advanced & exploratory work

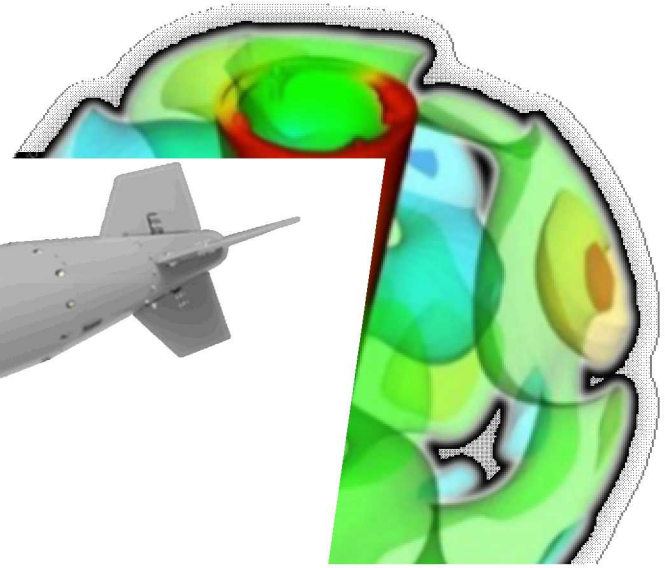
Steward the long-term vitality of our capabilities, infrastructure, and operations

Persistent commitment to world-class, multi-disciplinary staff, state-of-the-art labs, equipment, facilities, and safe/secure/quality/affordable operations



Responsibilities form a critical mandate

Warhead systems engineering & integration



tidisciplinary
ıbilities

ired for design,
ication, production,
illance, computation/
imentation
ajor environmental test
ilities & diagnostics
aterials sciences
ght-initiated high explosives
mputational analytics

Design agency for nonnuclear components

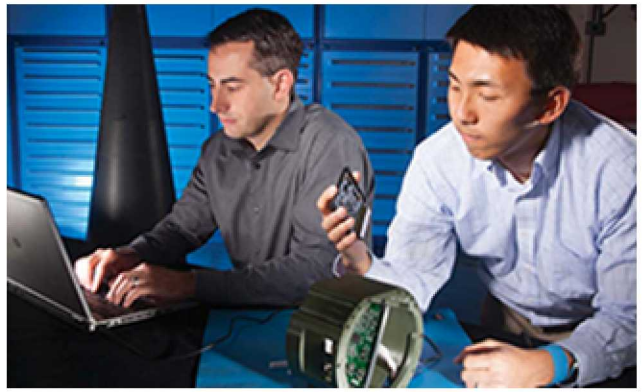
- Gas transfer systems
- Radar
- Safety systems
- Arming, fuzing & firing systems
- Neutron generators

Production agency

- Neutron generators
- Sandia external production
- Microelectronics
- Thermal battery backup

Six major programs are carried out

NUCLEAR DETERRENCE



W87/Mk21 Arming & Fuzing Assembly

W88-0/Mk5 Alteration 370

Mobile Guardian Transporter

W80-4 Life Extension Program

B61-12 Life Extension Program

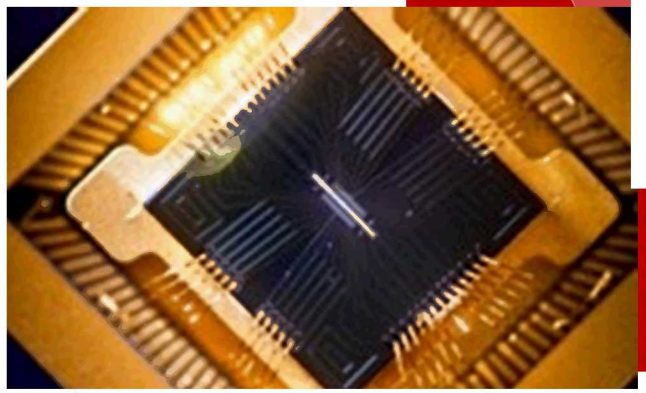
W76-1 Life Extension Program

DEFENSE NUCLEAR NONPROLIFERATION

- Develop space- and ground-based sensor systems for monitoring emerging threats
- Supply technology, crisis response, and training to respond to a crisis associated with weapons of mass destruction
- Provide capabilities for protecting U.S. nuclear weapons and materials at fixed sites and in transit
- Produce systems that deter proliferation and verify compliance with international agreements using space-borne and ground-based sensing technology
- Lead global technical engagement to prevent the misuse of nuclear, chemical, biological, and radiological materials

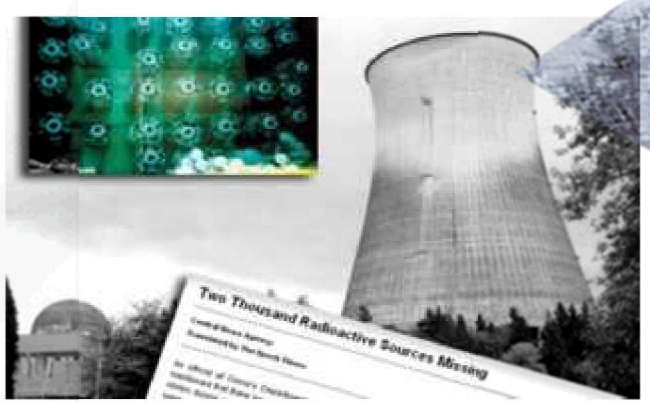
NATIONAL SECURITY PROGRAMS

Information operations



Science & technology products

Integrated military systems



Proliferation assessment

Surveillance & reconnaissance