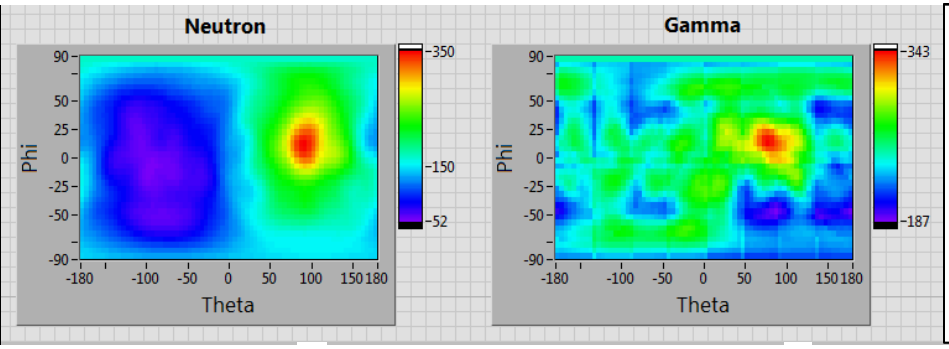
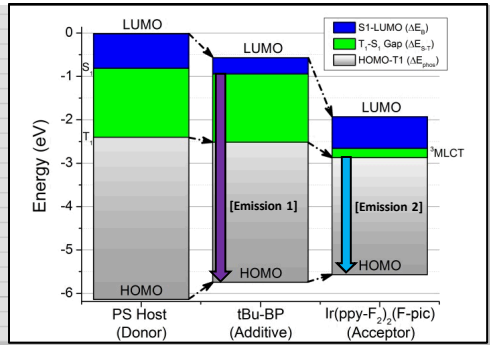
SAND2015-1952PE

Sandia National Laboratories





Overview of Sandia's Radiation and Nuclear Security Program

Craig R. Tewell

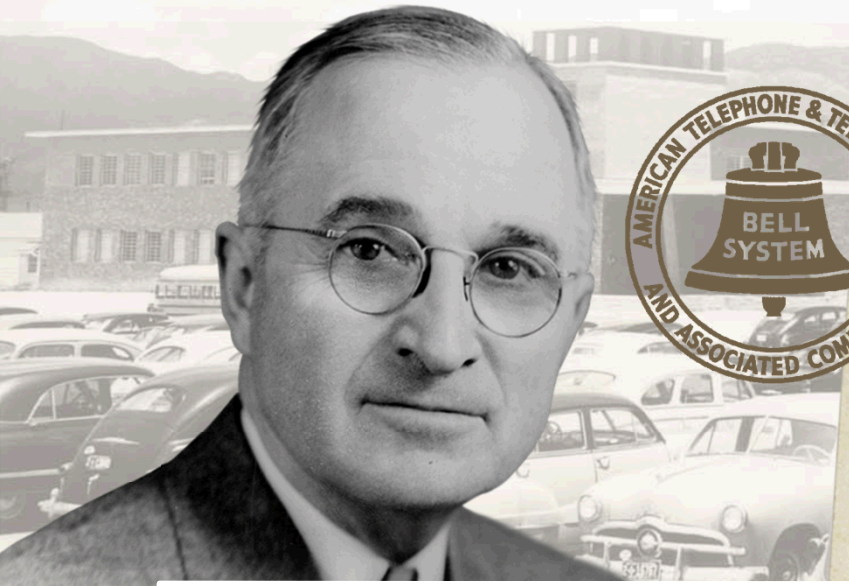
Manager, Rad/Nuc Detection Systems Dept.

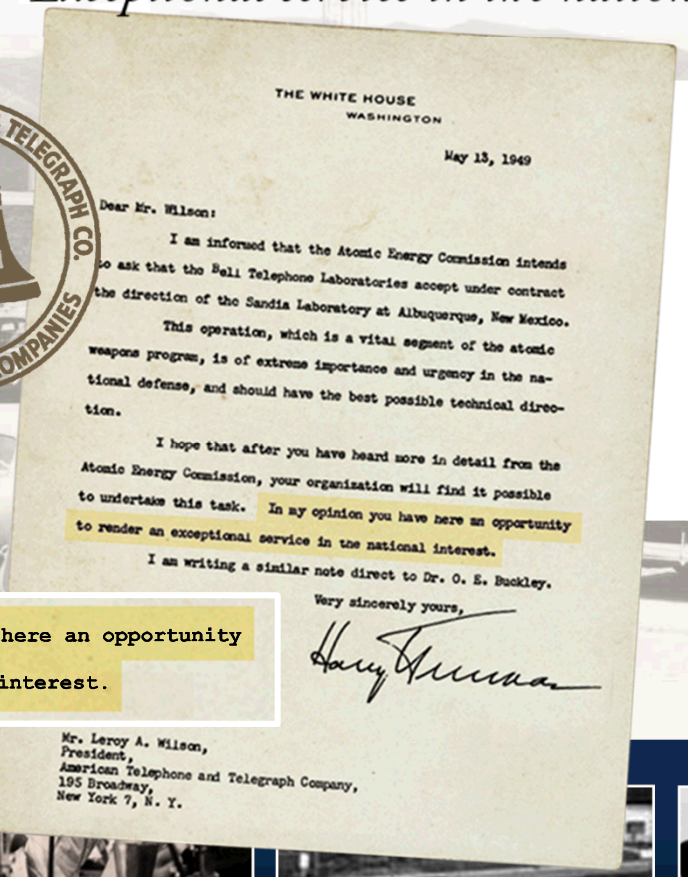
Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Sandia's history

Sandia National Laboratories

Exceptional service in the national interest





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.

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

Vision and mission statements

Sandia National Laboratories

- On behalf of our nation, we anticipate and solve the most challenging problems that threaten security in the 21st century
- Our unique mission responsibilities in the nuclear weapons program create a foundation from which we leverage capabilities enabling us to solve complex national security problems

Sandia's mission work reflects national security challenges

Sandia National Laboratories

1950s	1960s	1970s	1980s	1990s	2000s	2010s
NW production engineering & manufacturing engineering	Development engineering	Multiprogram laboratory	Missile defense work	Post–Cold War transition	Expanded national security role post 9/11	LEPs Cyber, Biosecurity Proliferation
	Vietnam conflict	Energy crisis	Cold War	Stockpile stewardship		Evolving national security challenges

Sandia's national security missions

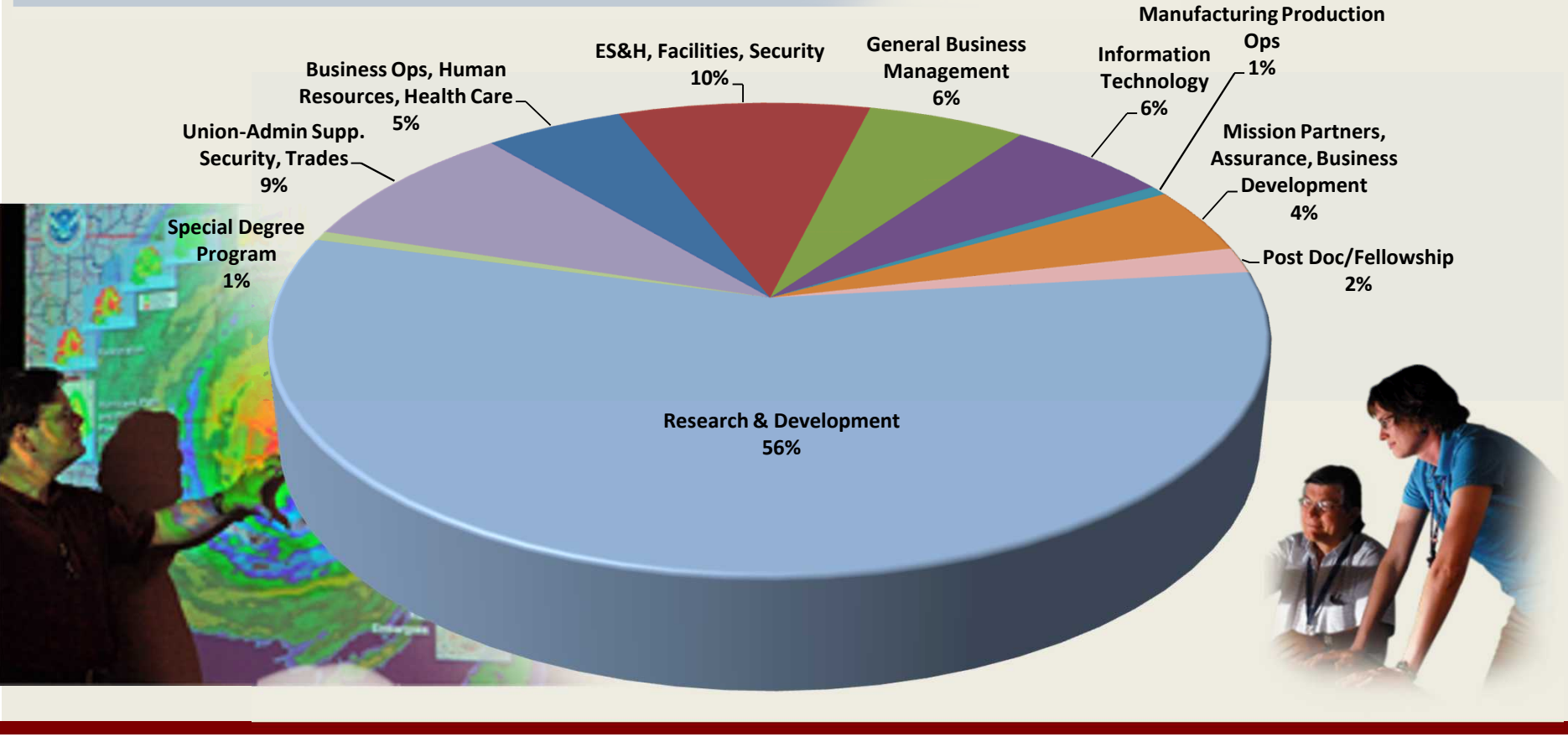
- Maintain a safe, secure stockpile and an effective nuclear deterrent now and into the future
- Reduce global nuclear dangers
- Provide nuclear assessments and warning
- Enable the United States to defend and dominate in cyberspace
- Maintain U.S. defense technological superiority through synergistic products
- Maintain U.S. defense technological superiority through leveraged innovations
- Reduce global chemical and biological dangers
- Ensure a secure and sustainable energy future

Who we are as a laboratory

(September, 2014)

Sandia National Laboratories

- On-site workforce: 11,093
- Regular employees: 10,860



Sandia's sites

Sandia National Laboratories

Albuquerque, New Mexico

Livermore, California

Kauai, Hawaii

Waste Isolation Pilot Plant, Carlsbad, New Mexico

Pantex Plant, Amarillo, Texas

Tonopah, Nevada

14,168 acres (labs); 179,333 acres (test areas); and 417 buildings

FY13 Total budget: $2.5 billion

Total workforce (all sites): 12,000

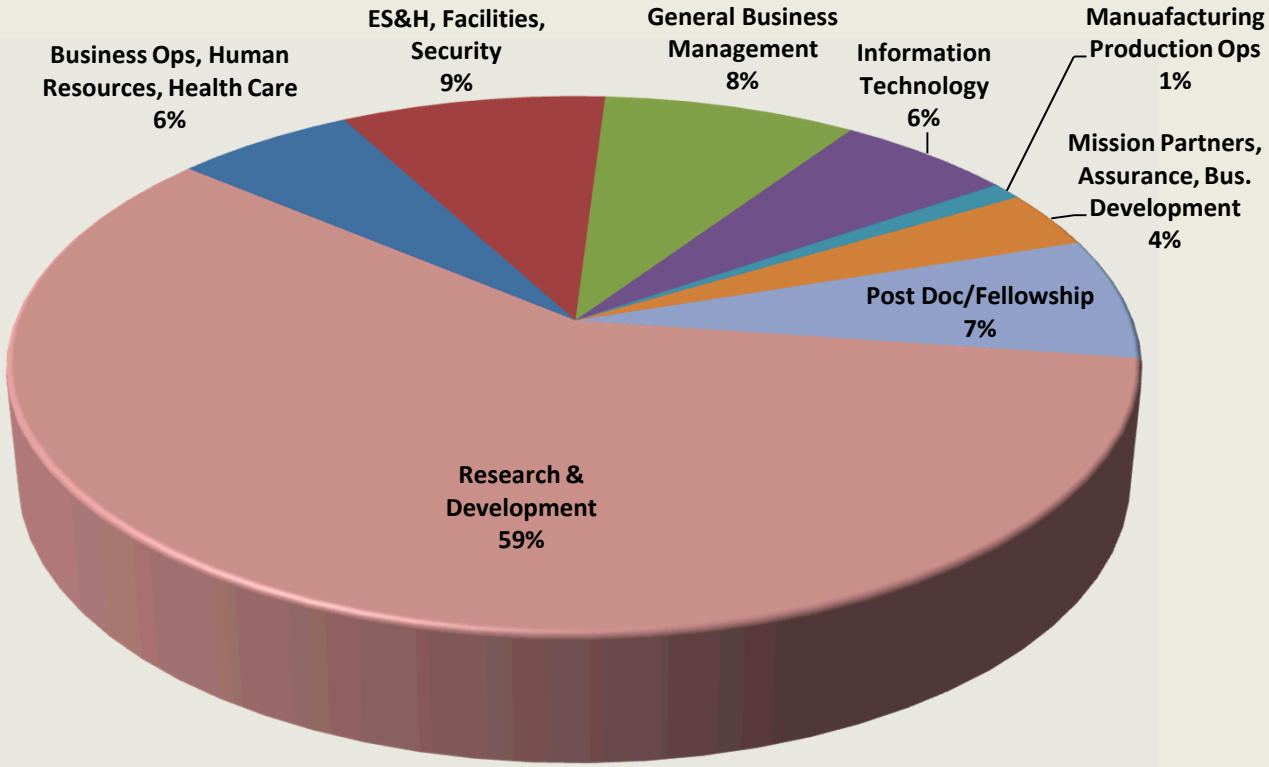
Who we are in Division 8000

(September, 2014)

Sandia National Laboratories

- On-site workforce: 1,142
- R&D staff: 625

CA site by Job Family



Includes 61 highly talented international workers

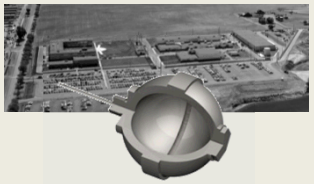
California laboratory history

Sandia National Laboratories

1956

California Laboratory opens, singular NW mission

1960s



Gas Transfer

Polaris - W47

Poseidon - W68

Strong NW mission, Energy crisis

1970s

W62 Minuteman III

Lance - W70

Combustion Research

Solar Tower

Strong NW mission, "Star wars"

1980s

AFAP – W79

B83

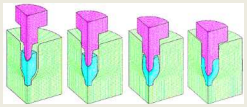
Peacekeeper - W87

"Tech Transfer", Stockpile stewardship

1990s

Extreme Ultraviolet Lithography

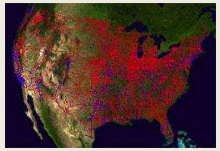
Demil



Stockpile Stewardship

Broader national security

2000s



Homeland Security

m - Chemlab

ALCM - W80 LEP

Stockpile modernization, Open campus

2010s

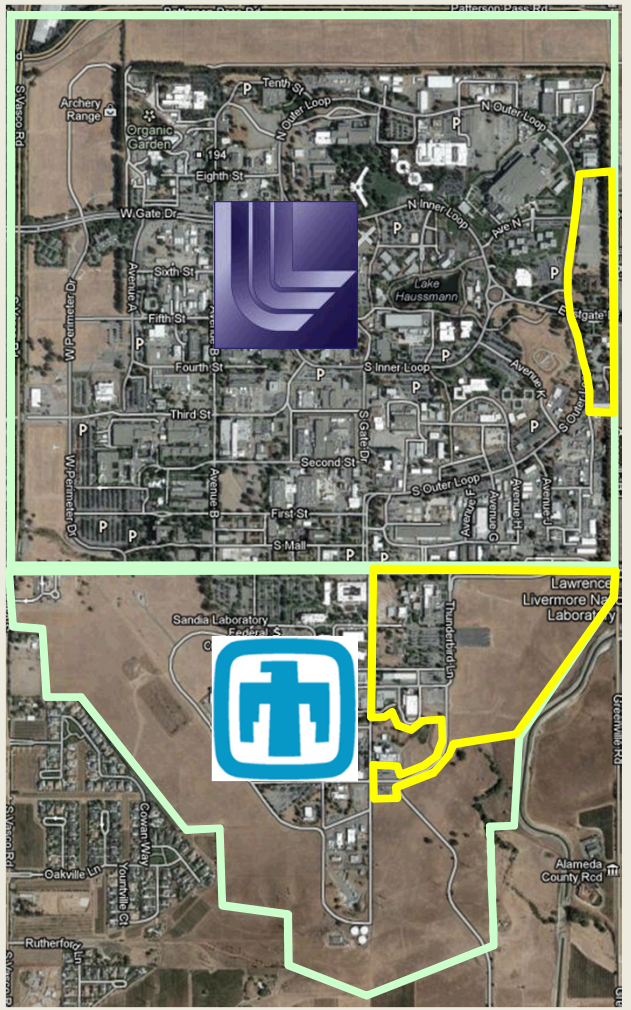
B61 LEP

Minuteman III W78 LEP

Livermore Valley Open Campus (LVOC)

Sandia National Laboratories

- Established to address NNSA's and DOE's broader national security objectives
  - Enable open, collaborative culture
  - Attract and retain an exceptional workforce
- Inaugural programs
  - Combustion Research Facility (CRF)
  - Cybersecurity Technologies Research Laboratory (CTRL)
  - Hydrogen Fueling Infrastructure Research and Station Technology (H2FIRST)
  - Institute for Translational Biomedicine (ITB)
  - Collaboration in Research and Engineering for Advanced Technology and Education (CREATE)



Sandia Executive Management Line Reporting Structure

Paul Hommert
President and Laboratories Director

Kim Sawyer
Deputy Laboratories Director and EVP for Mission Support

Jerry McDowell
Deputy Laboratories Director and EVP for National Security Programs

Division 1000

Division 2000

Division 5000

Division 6000

Division 8000

Becky Krauss
Acting VP for Human Resources & Communications

Division 3000

Michael Hazen
VP for Infrastructure Operations

Division 4000

Mike Vahle
CIO and VP for Information Technology Services

Division 9000

Bonnie Apodaca
CFO and VP for Business Operations

Division 10000

Marianne Hill
Acting VP, General Counsel, and Legal and Prime Contract

Division 11000

Rob Leland
VP for Science and Technology And Chief Technology Officer

Gary Sanders
Chief Engineer And VP for Weapons Engineering And Product Realization

Jerry McDowell
Acting VP for Defense Systems and Assessments

Jill Hruby
VP for Energy, Non-Proliferation And High Consequence Security

Steve Rottler
VP for California Laboratory

Sandia Executive Management Programmatic Reporting Structure

Paul Hommert
President and Laboratories Director

Steve Rottler
Deputy Lab Director and EVP for National Security Programs

Program Integration

James Peery, Defense Systems and Assessments

Jill Hruby International, Homeland, and Nuclear Security

Marianne Walck Energy & Climate

Rob Leland
CTO

Gary Sanders
NW Chief Engineer

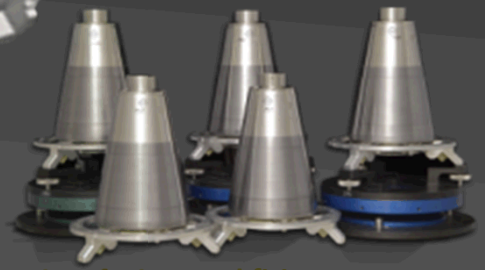
Sandia's Current Nuclear Weapons Activities

Sandia National Laboratories

Warhead Systems Engineering and Integration

Design Agency for Nonnuclear Components

Gas Transfer systems

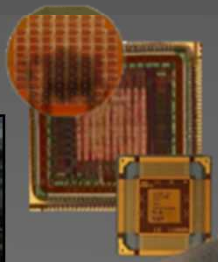


Arming, fuzing, and firing systems

Safety systems

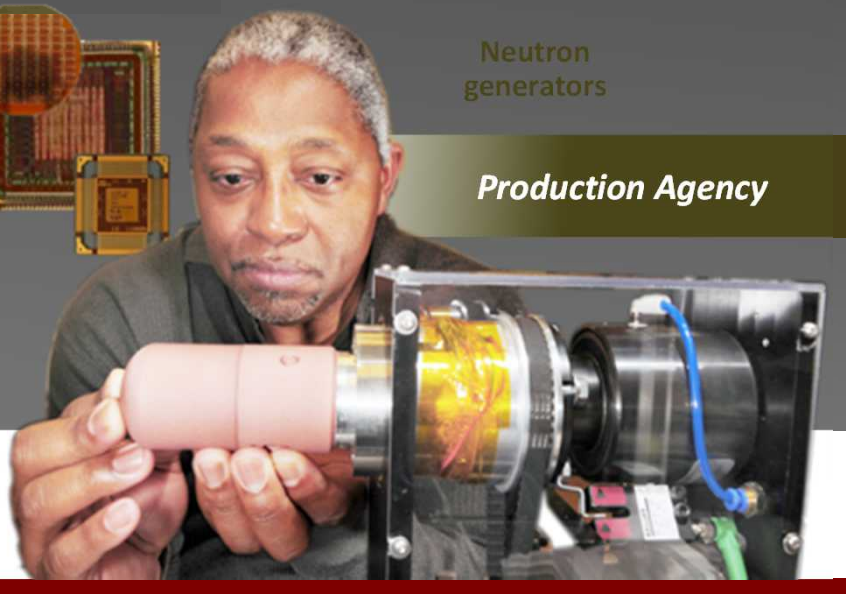
An extensive suite of multi-disciplinary capabilities are required for Design, Qualification, Production, Surveillance, Experimentation / Computation

MESA Microelectronics



Neutron generators

Production Agency



Major Environmental Test Facilities and Diagnostics

Z Machine

Light Initiated High Explosive

Annular core research reactor

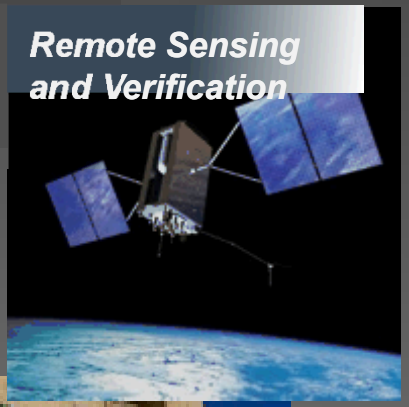
Defense Systems & Assessments Programs

Sandia National Laboratories

Information Operations

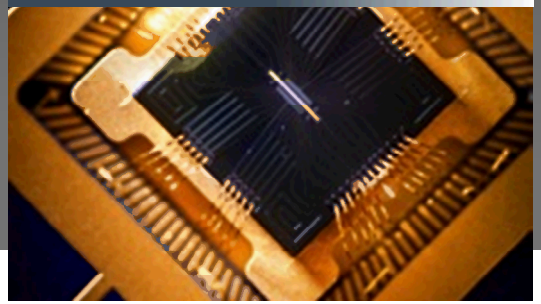
Surveillance & Reconnaissance

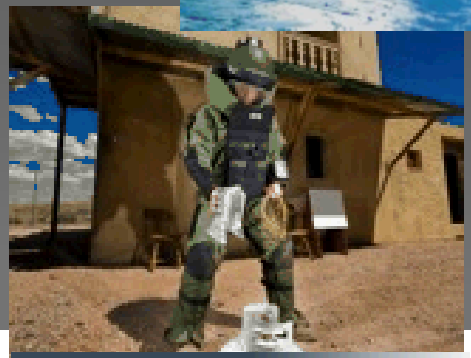
Remote Sensing and Verification



Space Mission

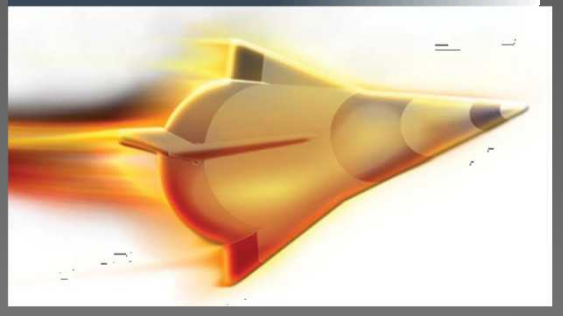
Science & Technology Products





Proliferation Assessment

Integrated Military Systems



Energy & Climate

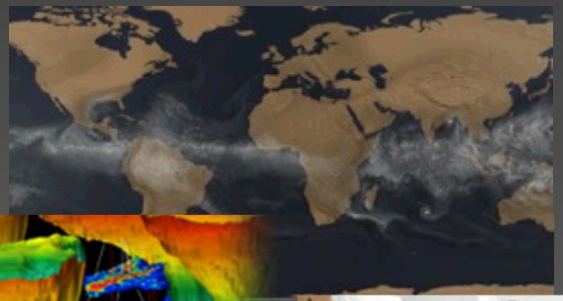
Sandia National Laboratories

Energy Research

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

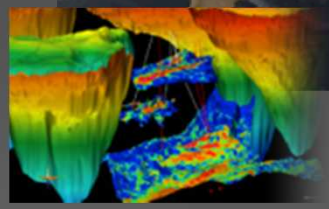
Climate & Environment

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

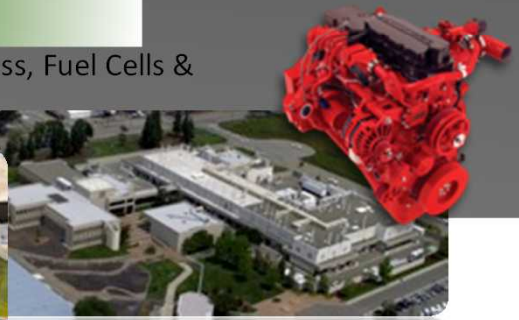


Renewable Systems & Energy Infrastructure

Renewable Energy, Energy Efficiency, Grid and Storage Systems

Transportation Energy & Systems

Vehicle Technologies, Biomass, Fuel Cells & Hydrogen Technology

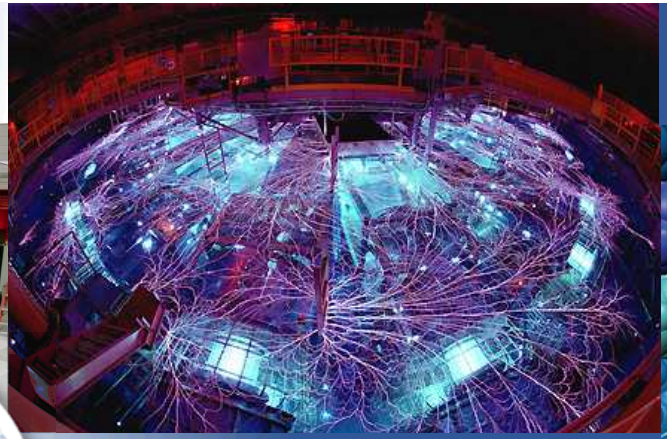


Our Research Framework

Strong research foundations play a differentiating role in our mission delivery

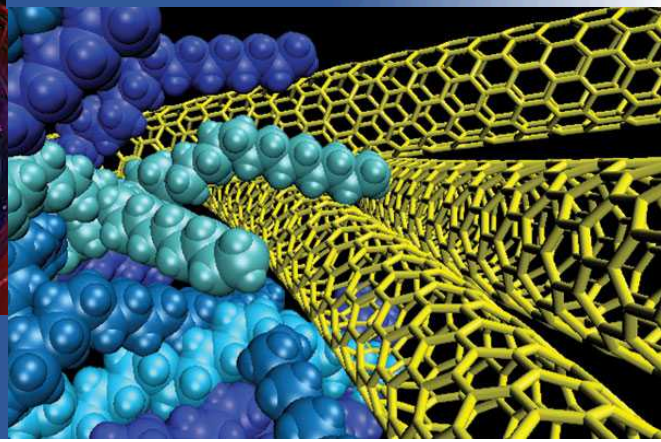
Sandia National Laboratories

Computing & Information Sciences

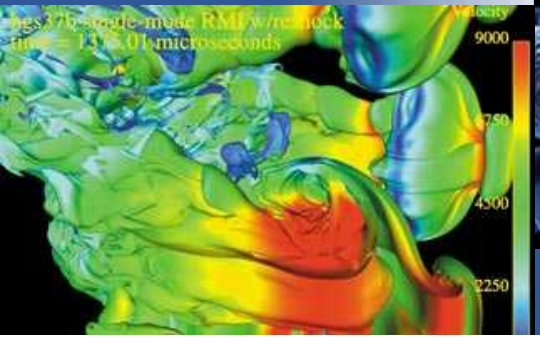


Radiation Effects & High Energy Density Science

Materials Sciences

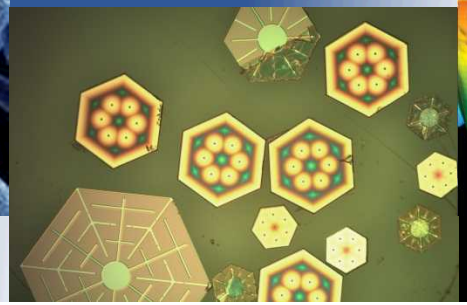


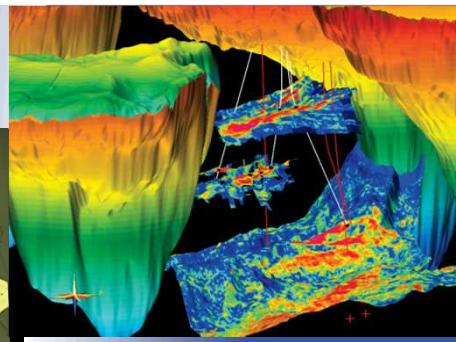
Engineering Sciences



Bioscience

Nanodevices & Microsystems





Geoscience

Sandia National Laboratories

International, Homeland, and Nuclear Security

Program Areas

- Global Security
- WMD Counterterrorism and Response
- Homeland Security
- Cyber and Infrastructure Security
- Homeland Defense and Force Protection

Capabilities

- *Nuclear, radiological, biological, explosives, and chemical science and engineering*
- *System analysis, engineering, and integration*
- *Physical and cyber security methods, technologies, and systems*
- *Predictive modeling and simulation of interdependent systems*
- *Decontamination and restoration approaches and technologies*
- *International security technologies and policy*

IHNS Program Management Unit Directors

Sandia National Laboratories

Global Security
Rodney Wilson

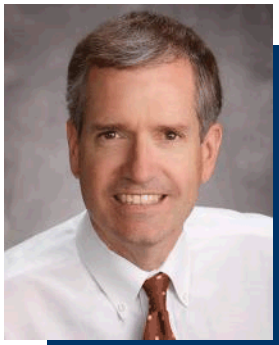
SNL/NM

WMD Counterterrorism and Response
Billy Marshall

SNL/NM

SNL/CA

Homeland Security Programs
Duane Lindner

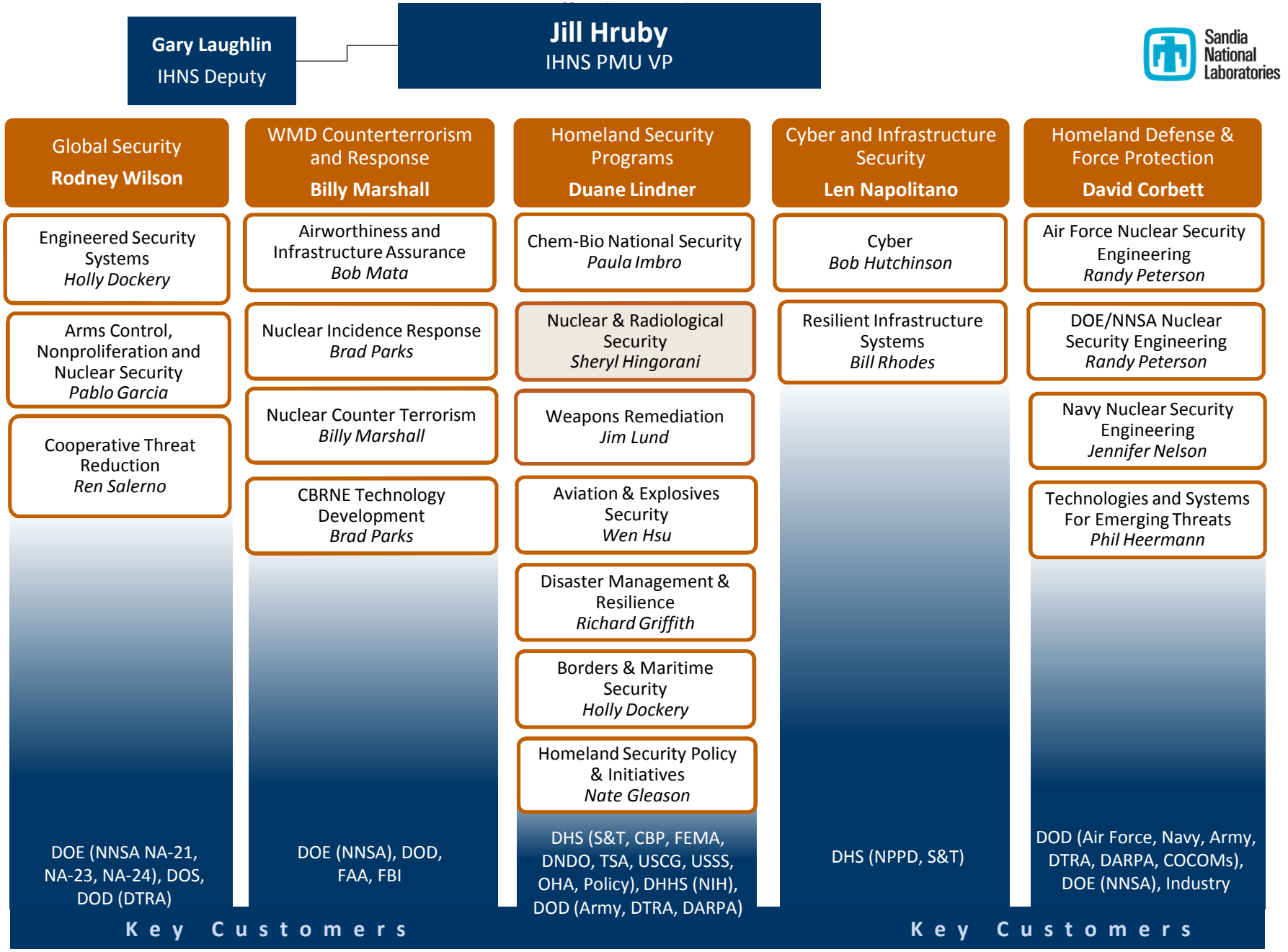


SNL/CA

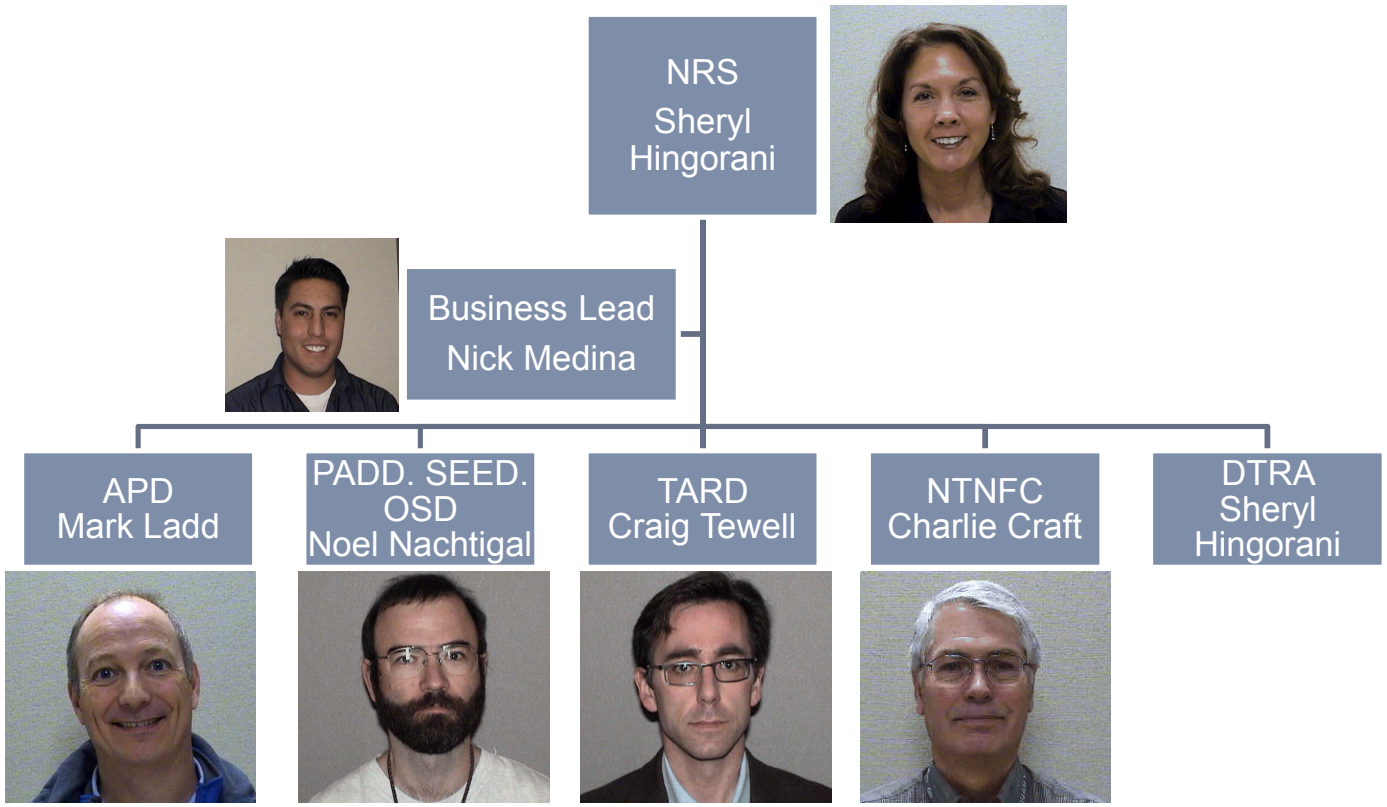
Cyber and Infrastructure Security
Len Napolitano

SNL/NM

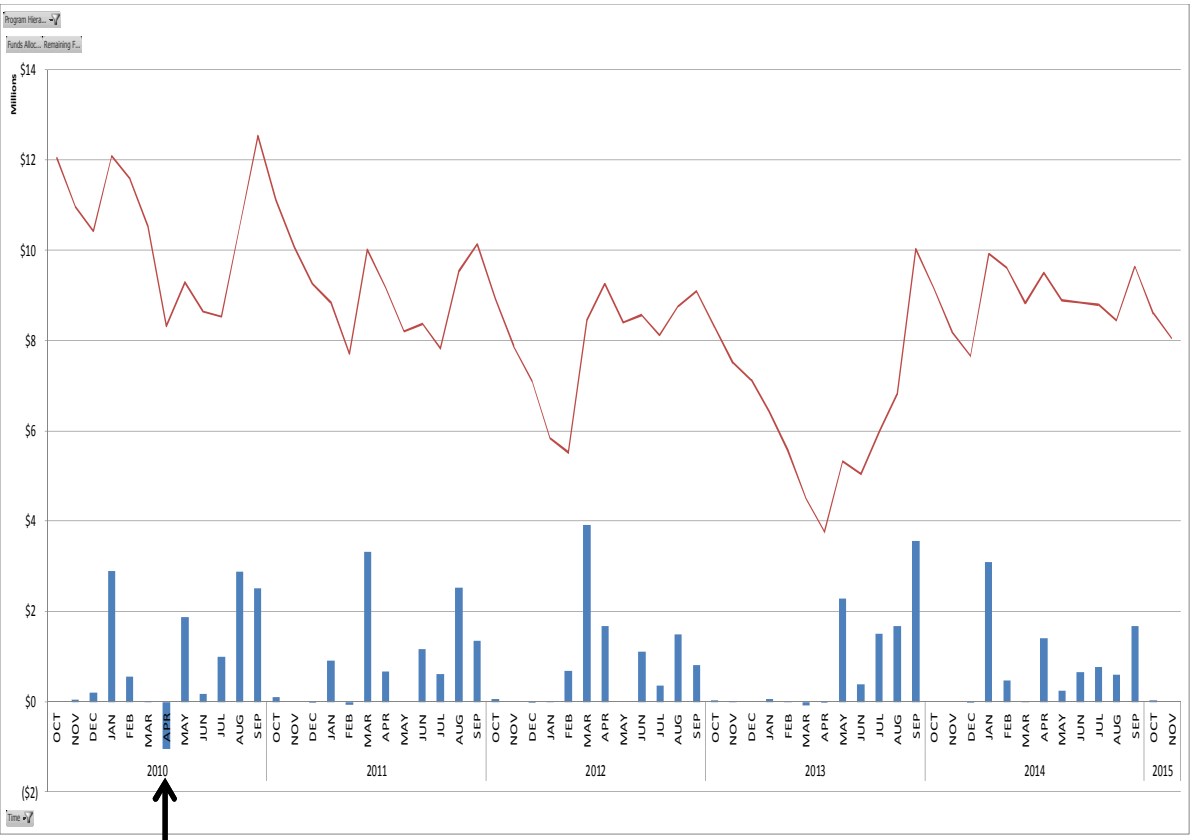
Homeland Defense and Force Protection
Dave Corbett


Gary Laughlin
IHNS Deputy
Jill Hruby
IHNS PMU VP
Sandia National Laboratories
Global Security
Rodney Wilson
Engineered Security Systems
Holly Dockery
Arms Control, Nonproliferation and Nuclear Security
Pablo Garcia
Cooperative Threat Reduction
Ren Salerno
DOE (NNSA NA-21, NA-23, NA-24), DOS, DOD (DTRA)
WMD Counterterrorism and Response
Billy Marshall
Airworthiness and Infrastructure Assurance
Bob Mata
Nuclear Incidence Response
Brad Parks
Nuclear Counter Terrorism
Billy Marshall
CBRNE Technology Development
Brad Parks
DOE (NNSA), DOD, FAA, FBI
Homeland Security Programs
Duane Lindner
Chem-Bio National Security
Paula Imbro
Nuclear & Radiological Security
Sheryl Hingorani
Weapons Remediation
Jim Lund
Aviation & Explosives Security
Wen Hsu
Disaster Management & Resilience
Richard Griffith
Borders & Maritime Security
Holly Dockery
Homeland Security Policy & Initiatives
Nate Gleason
DHS (S&T, CBP, FEMA, DNDO, TSA, USCG, USSS, OHA, Policy), DHHS (NIH), DOD (Army, DTRA, DARPA)
Cyber and Infrastructure Security
Len Napolitano
Cyber
Bob Hutchinson
Resilient Infrastructure Systems
Bill Rhodes
DHS (NPPD, S&T)
Homeland Defense & Force Protection
David Corbett
Air Force Nuclear Security Engineering
Randy Peterson
DOE/NNSA Nuclear Security Engineering
Randy Peterson
Navy Nuclear Security Engineering
Jennifer Nelson
Technologies and Systems For Emerging Threats
Phil Heermann
DOD (Air Force, Navy, Army, DTRA, DARPA, COCOMs), DOE (NNSA), Industry
Key Customers
Key Customers

Sandia NRS Program Management Structure



NRS Program Funding History



SEED program deobligation in April 2010 in the amount of $1.9M.

.	Project Name
NUCLEAR & RAD SECURITY	
ARCHITECTURE & PLANNING	
172742	GNDA OUTREACH 3T
174481	APD SUPPORT
174482	GNDA ANALYTIC ROADMAP
174483	GNDA BASIS & HISTORY
174485	SALVAGE FUZING ANALYSIS
181622	CITY-LEVEL PLANNING
181804	E&R STUDY
OPS SUPPORT	
174198	SRB FY13 3T
177642	PRND 3T
TAR	
174675	ML QR SCINTILLATORS - 3T
180149	DOMAIN AWARENESS-TARD
NTNFC	
165595	FELLOWSHIP EFFORT
169482	FY13 MULTIVARIATE ALGM
169484	FY13 FUEL CYCLE MODELING
169638	FY 13 TNF EXERCISES
174116	FY13 SCIENCE PANEL 3T
176704	FY14 PLUTONIUM SIGNATURES
176705	FY14 FUEL CYCLE
179525	FY14 SCIENCE PANEL
179526	FY14 TNF
179527	FY14 MULTIVARIATE ALGM
179528	FY14 FELLOWSHIP EFFORT
SYSTEMS ENG & EVALUATION	
171483	PVTIMP
174167	PVTIMP/T&E (3T)
182054	Rad Detect Tech Analysis
PRODUCT ACQUISITN & DPLYMNT	
152035	DHS ISOTOPE ID SUPPORT
165183	BENCHMARK COLLECTION
173396	TECHNICAL ANALYSIS- 3T
174343	BENCHMARK COLLECTION 3T
DTRA	
173600	GADRAS 3T
180612	GADRAS 3T 2
OTHER	
167429	NEW 3HE REPLACEMENT
174727	DOJ - RICHTER

NRS Program Management Assurance

Sandia National Laboratories

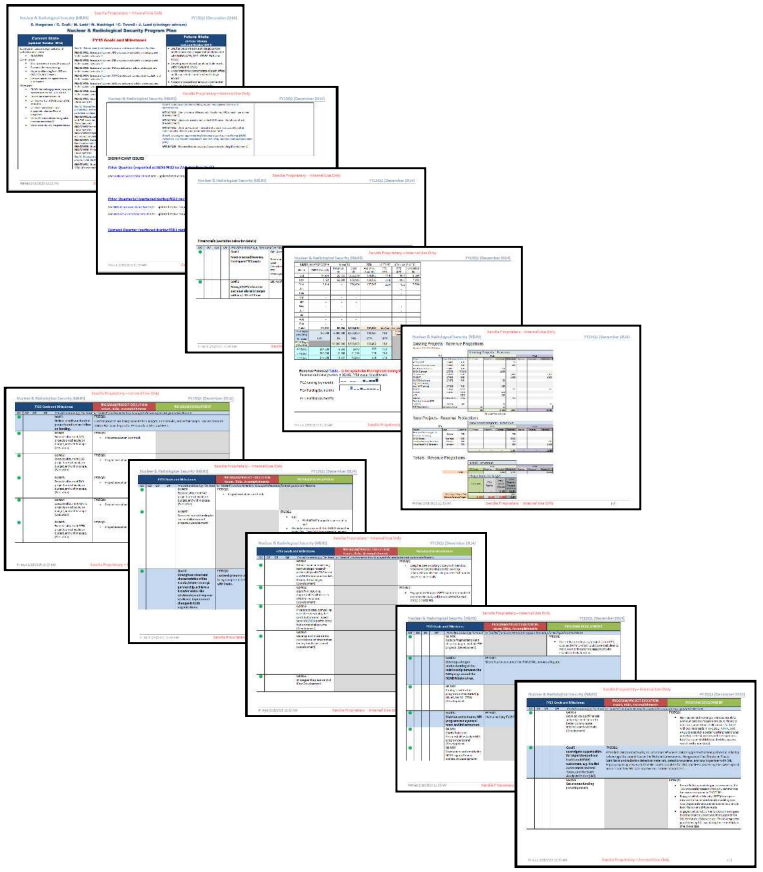
Goal 1: Deliver results on funded projects and secure follow on funding.

Goal 2: Strengthen structural characteristics of the Sandia/DNDO strategic partnership, achieve a broader FFRDC-like relationship and improve resilience to personnel changes in both organizations.

Goal 3: Develop a deeper understanding of the relationship between the NRS program and the RGND Mission Area.

Goal 4: Stabilize and enhance the NRS program management team and infrastructure.

Goal 5: Investigate opportunities for impact beyond our traditional DNDO customers, e.g. the Net Assessment and Red Team, and the Joint Analysis Center (JAC).

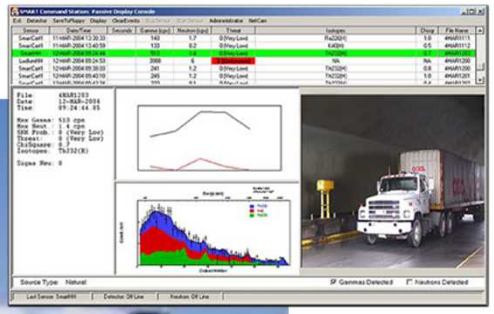


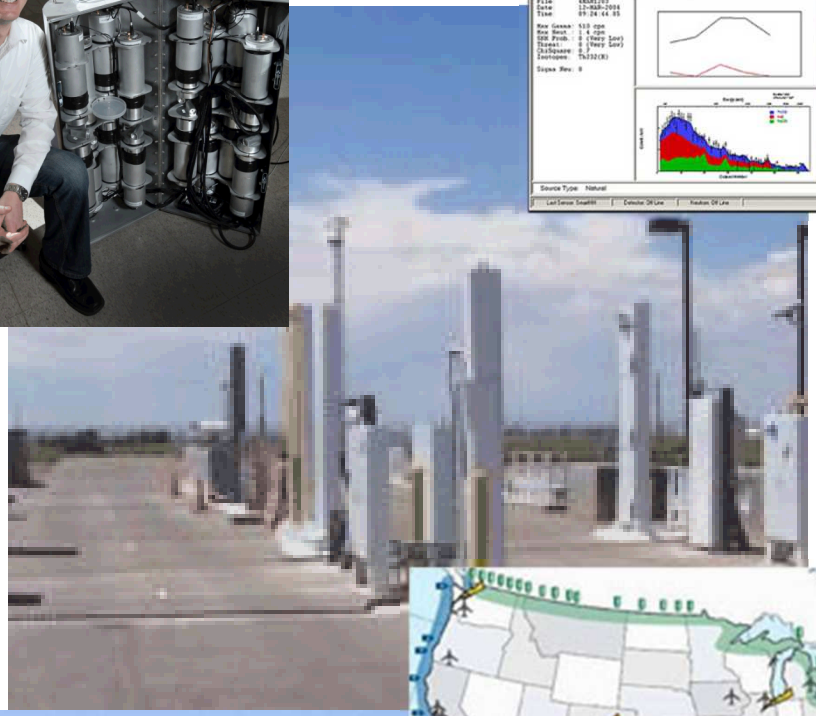
Discussion points

- IPAs
- Interlab collaboration

Nuclear and Radiological Security Activities include…

- Systems analysis
  - Understanding threats for both INDs and RDDs
  - Analyzing & recommending national and global architectures
    - Land, sea, and air
    - Working closely with CBP, TSA, international community
- Detector system deployments and testing
  - Field test before large-scale procurement
- Modeling and simulation
  - Validated and verified source terms
  - Spectroscopic identification codes
  - Secondary reachback analysis
- Advanced detection R&D
  - New materials
- Training and exercises





APD: Mark Ladd

Sandia National Laboratories

mdladd@sandia.gov

- SNM Acquisition Pathway Overview
  - Assess feasibility to steal SNM under MPC&A thresholds
- GNDA Basis/History Project Overview
  - Video documentary on the history of US efforts to detect clandestine nuclear threats with interviews of key figures.
- E&R Futures Study
  - Assessment of the future prospects for non-state actors to acquire SNM through E&R.
- Analytic Roadmap Study
  - Review and suggest directions to improve APD processes and products
  - Propose new GNDA strategic end states and actionable steps toward those
- PM/APD Support
  - Provide SME support for quick turn-around requests.
- GNDA Outreach
  - Draws on both the systems analysis expertise in 8110 and the international nuclear security expertise in 6800 to develop guidance documents, workshops, courses, and other engagements to help countries develop their own RN detection capabilities.
- City Level Planning
  - Perform a requirements and needs analysis to better determine how the R/N mission can be incorporated into city-level policy and planning decisions for risk analysis and emergency response.

PADD: Noel Nachtigal

Sandia National Laboratories

- Benchmark Collection
  - The Department of Homeland Security (DHS) Domestic Nuclear Detection Office (DNDO) has identified the need to generate a validated set of benchmarks for isotope identification. These benchmarks will serve many functions related to the DNDO mission as well as the policy on Commerical First: (1) augment the commercial sector's awareness of the isotopes and range of performance needed in a gamma radiation detection system, (2) provide the necessary benchmarks to develop new algorithms, (3) develop the software tools needed to collect data in one detector and convert it to the output of another, (4) provide DHS with an accurate scientific method to score algorithms proposed for gamma radiation systems , and (5) provide a frame work and common reference to engage with the commercial sector on the requirements needed to develop high performance algorithms to address the Global Nuclear Detection Architecture (GNDA) goals. The algorithm Improvement Program (AIP) Team members will be Brookhaven National Laboratory (BNL), Sandia National Laboratory (SNL), and Los Alamos National Laboratory (LANL).
- DHSIsotopeID
  - GADRAS related- Perform regression testing and modify DHSIsotopeID as needed to maintain quality in support of DNDO missions.

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TAR

- Metal-Loaded and Quench-Resistant Plastic Scintillators
  - Produce metal-containing plastic scintillators for low-cost gamma-ray spectroscopy.
- Domain Awareness
  - Develop a technological roadmap for US Non-Port of Entry Domain Awareness.

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OSD

- Technical Reachback Program
  - Provide data analysis / data trending capability to DNDO for studies and products that inform GNDA situational awareness
  - Support info sharing by enabling access to analysis tools and products for a broad range of JAC stakeholders
    - Web- and mobile-enabled analysis tools, for first responders, reachback analysts, to include expert users
  - Develop analysis capabilities (both people and tools)
  - Support DNDO's partnership with the DOE Triage program
- Program Assistance
  - Develop RND programs across FSLTT stakeholders / partners through the execution of prioritized and strategically-selected RND capability development efforts in both the interior and maritime environments;
  - Strive to have all states with viable, sustainable RND capabilities by the end of FY2018; and,
  - Standardize RND Capability Development Assistance processes and products through the delivery or templates, guides, best practices, and lessons learned.

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SEED

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- AIPT
  - Derive empirical flux files to support evaluation of vendor algorithms.
- PVTIMP
  - Characterize PVT detectors and perform inject calculations to be used in algorithm evaluations
- PVT Improvement Program T&E
  - Act as independent assessor for PVT Tech Refresh testing at PNNL and Field Demonstration (Pilot)
- Rad Detect Technical Analysis
  - The Subject Matter Expert (SME) provides critical support to many of PADD's radiation detection and identification efforts. Assessment of the scientific quality of data, data analysis, and reports that support DNDO (PADD) in its acquisition of radiation detection instrumentation.

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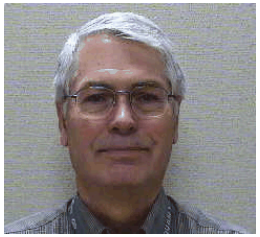
NTNFC: Charlie Craft

Sandia National Laboratories

- Multivariate Algorithms
  - Develop mathematical methods for articulating group membership or exclusion for a questioned nuclear material.
- Fuel Cycle Modeling
  - Multi-year project to evaluate existing computer codes that model the different stages of the nuclear fuel cycle
- Post-doctoral Fellow & Undergraduate Scholar
  - Explore alternative detection techniques for advancing the nation's technical nuclear forensics capability
- Plutonium Methodology
  - Identify signatures of Pu material that can be related to the processing conditions used to produce them
- Science Panel and SME Support
  - Provide technical expertise to Nuclear Forensics Science Panel
  - Provide technical guidance for TNF exercises



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DTRA

- Analysis software for various sensors
  - Work with commercial and government detector developers to run GADRAS algorithms
- Detector response for SWORD application
  - Interface GADRAS Detector Response Function (DRF) with external radiation transport codes.

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Microsystems and Engineering Sciences Applications (MESA)

Sandia National Laboratories

We are a trusted research, development and production capability that converts concepts into working hardware.

We deliver innovative products for a diverse customer set:

- Nuclear Weapons Mission
- Department of Defense
- Intelligence Community
- Energy Security
- Homeland Security

We design, develop, fabricate, and qualify:

- Integrated circuits
- Optoelectronics
- Photonics
- Micromechanical systems
- Sensors and Actuators
- Advanced packaging
- COTS Products

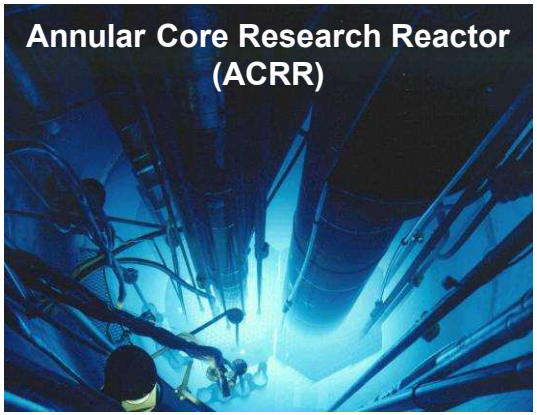
Key infrastructure:

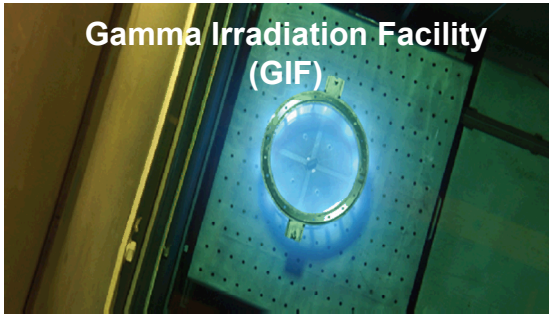
- 112,000 sq. ft. Silicon Fab
- 89,100 sq. ft. MicroFab
- 124 Light Labs
- Complete IC design and simulation
- Packaging, test, failure analysis
- ISO registered quality system

We partner with industry, universities, and government laboratories.

TA-V Nuclear Facilities
Unique Capabilities

A Complete Range of Nuclear and Radiation Facilities for Research, Testing and Production





State of the Art Dosimetry

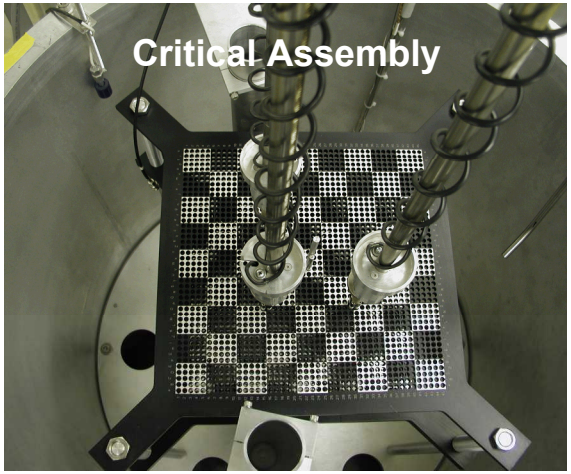
Criticality Benchmarks

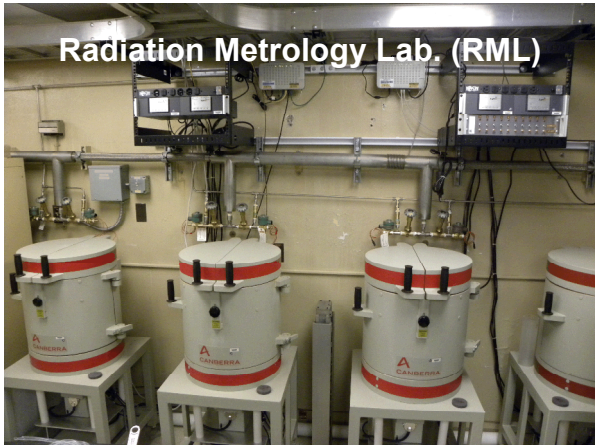
Radiation Effects Testing

Reactor Safety Experiments

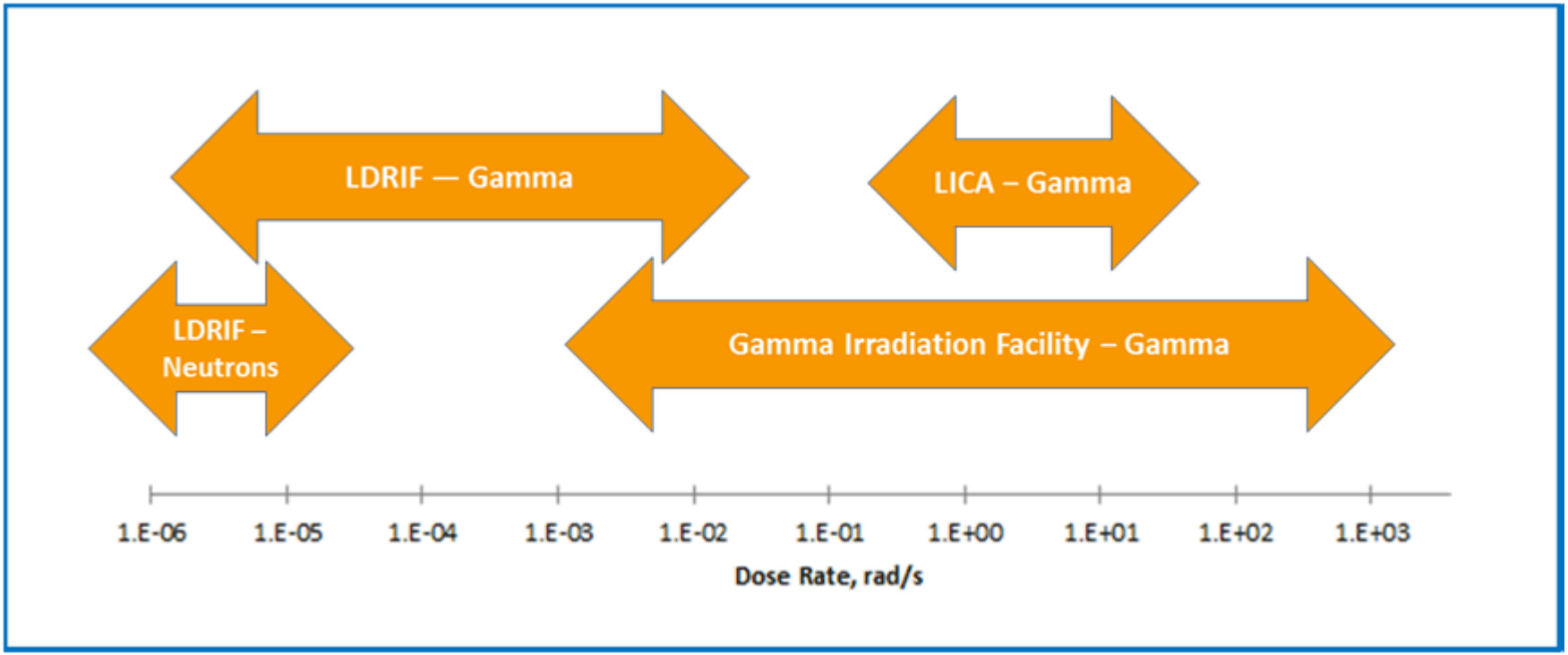
Fuel Cycle Research

Space Nuclear Power



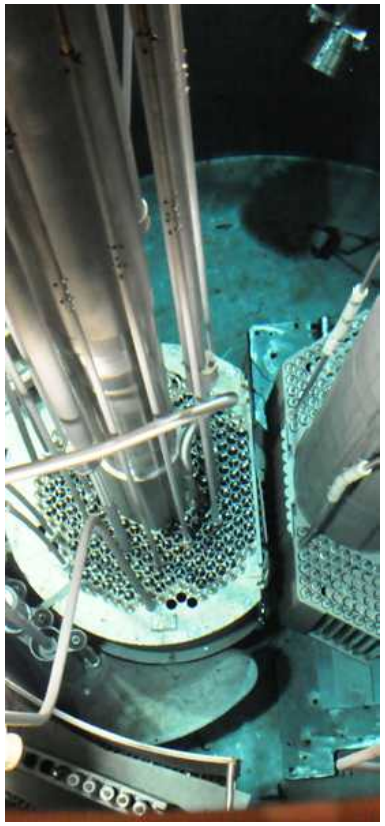


Irradiation Facilities Dose Rate Capabilities

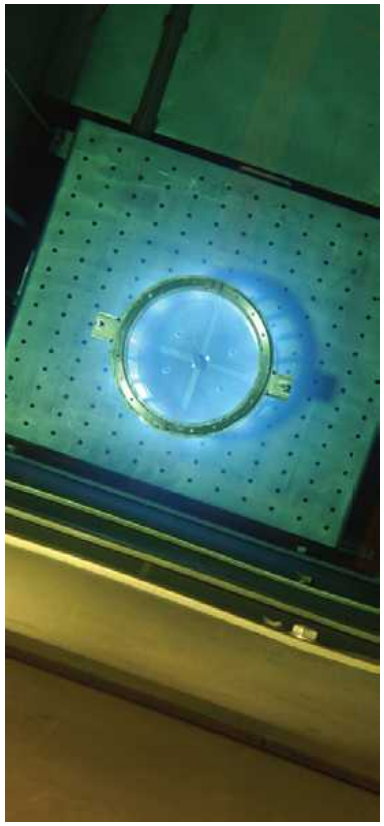


Unique Nuclear Environments

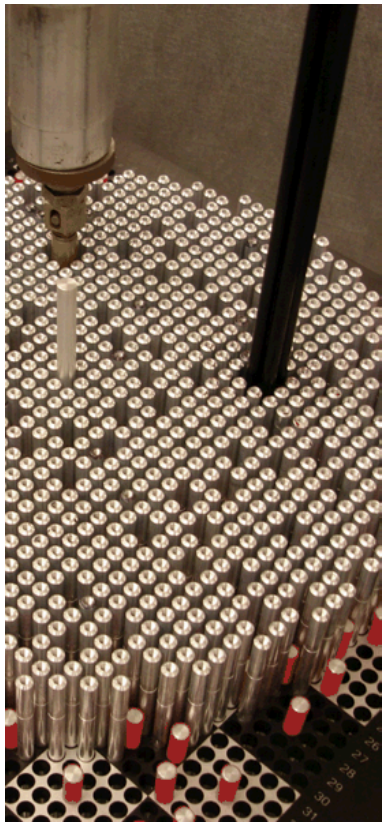
Sandia National Laboratories



Annular Core Research Reactor (ACRR)



Gamma Irradiation Facility (GIF)



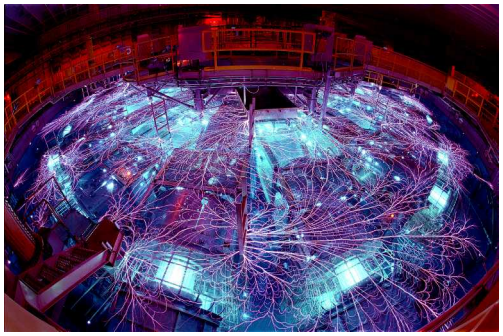
Sandia Pulsed Reactor Critical Experiments (SPR/CX)

Radiation Metrology Lab (RML)

Pulsed Power Sciences Capabilities

Sandia National Laboratories

Z Accelerator



Delivers 20-26 million amps of current; 2-3 million joules of electrical energy; 100-400 ns pulse-width

Z Backlighter

A kilojoule class pulsed laser system coupled to the Z Accelerator to radiograph experiments

Shock Thermodynamic Applied Research (STAR)

Experimental test facility that can cover full range of pressure (bar to multi-Mbar) for material-property studies utilizing gas/propellant launchers, ramp-loading pulsers, and ballistic applications.

Radiographic Integrated Test Stand

Deliver 11 MV, 125 kA, 60 ns pulses for flash X-ray radiography source development