SAND2013-1348P

Exceptional service in the national interest

Sandia National Laboratories

Division 8000 Capabilities

February 18, 2013

U.S. DEPARTMENT OF ENERGY | NNSA

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 NO. 2011-XXXXP

Division 8000

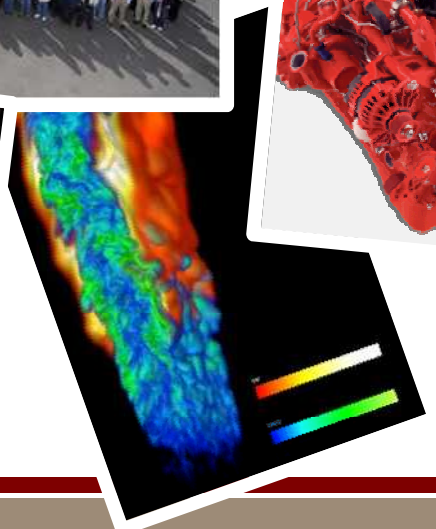






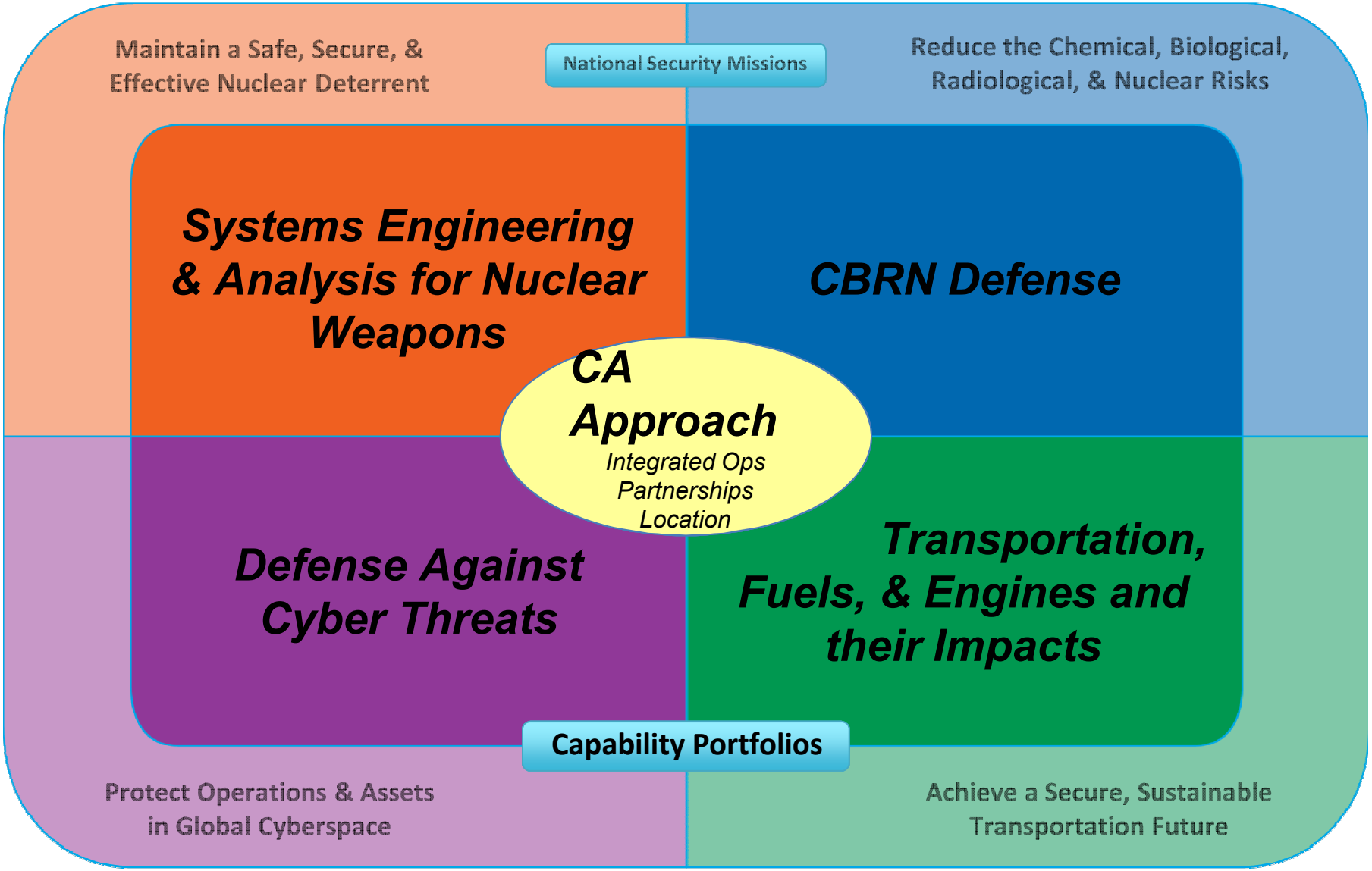




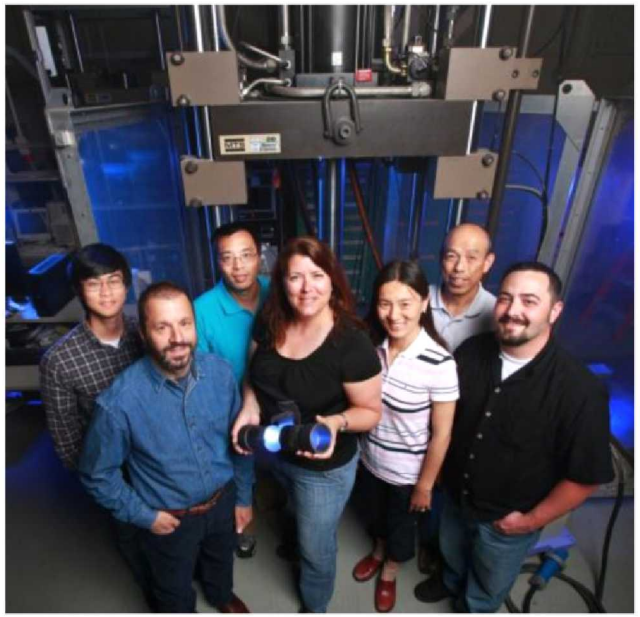
Division 8000 Supports Four National Security Missions

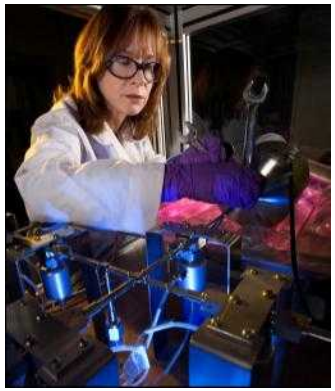
Division 8000 Capability Portfolios



Differentiating Capabilities for Systems Engineering and Analysis for **Nuclear Weapons** Portfolio

- Systems integrator for stewardship and development of CA nuclear weapon systems (W80, B83, W84, W87, W78)
- Solutions for security systems, gas transfer systems, and joint-test assembly telemetry systems
- World class expertise in hydrogen/tritium
- Cross-cutting cyber security expertise for secure weapon systems
- Systems analysis to inform NW policy decisions





Capabilities for the Systems Engineering and Analysis for **Nuclear Weapons** Portfolio

Sandia National Laboratories

Competencies

- Systems engineering and integration
- Stockpile stewardship
- Systems analysis
- Gas transfer systems (GTS) design and development
- Technical project management
- Hydrogen science: GTS, fusion environments, effects in metals, transportation energy
- Joint test assembly telemetry design and development
- Use-denial system design and development
- Handling Gear: Knowledge of DoT requirements and certification
- Transport modeling
- Solid mechanics
- Experimental mechanics
- Materials science
- Reliability quantification

Tools

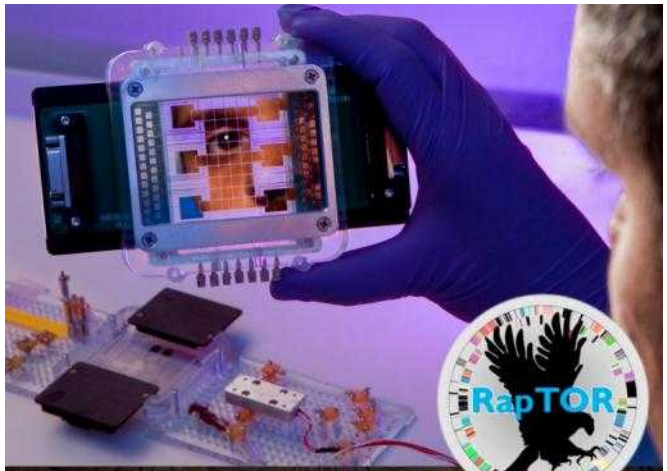
- Surface science diagnostics
- Robotic spray painter (nanocapable)
- Reaction chemistry diagnostics for energetic components
- Dynamic hydrogen material response at temperature
- Predictive models for GTS
- E-beam, GTA, laser, and inertia welding
- Gas: Pressure, flow, and compositional analysis
- Hopkinson bar
- Microscopy for materials evaluation

Facilities

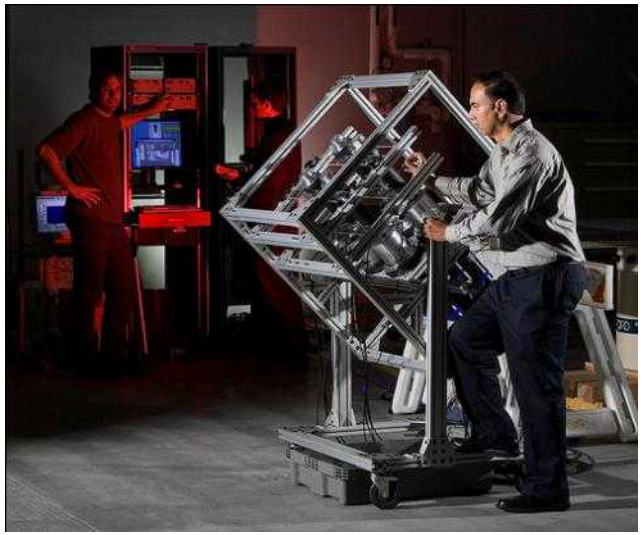
- Design definition and document control
- Classified machine shop
- Test Assembly Group
- Environmental testing
- Telemetry ground station
- Experimental mechanics lab
- High pressure facility for hydrogen exposure, testing, and validation
- Classified electrodeposition
- Facilities for classified materials synthesis and fabrication
- Radiography/non-destructive inspection

Differentiating Capabilities for CBRN Defense Portfolio

Sandia National Laboratories



- Systems analysis expertise
- Microfluifics for detection and diagnostics
- Definition and detection of signatures associated with biological and chemical materiel
- Radiation detection systems
- System and ConOp development and deployment for the detection of CBRN attacks
- Systems for neutralization and disposal of chemical munitions and agents
- 24/7/365 reachback for rad and bio events



Capabilities for CBRN Defense Portfolio

Sandia National Laboratories

Competencies

- Systems engineering and microfluidics for chemical and biological (CB) detection and diagnostic systems
- Experimental, analytical, and computational biology for host-pathogen interactions and signature discovery
- Systems analysis
- Radiation detector design and materials development
- Simulation and testing of radiation detectors and materials
- Design, test, and validation of impulsively loaded vessels
- Fiber laser science and technology
- Laser physics and optical detection

Tools

- State-of-the-art bioanalytical tools (genome sequencer, FTMS, FACS, hyperspectral and superresolution imaging systems, in vitro protein expression robot)
- Bioinformatics and computational biology tools (protein and small molecule simulation tools, bioinformatics pipeline)
- Advanced radiation detector and detector material characterization equipment (fast multichannel data acquisition, neutron and radio-isotopic sources, femtosecond lasers and fiber lasers)
- Decision analysis (DAC) computational tools to evaluate and optimize CB defense systems

Facilities

- Applied Bioscience Lab (ABL)
- BSL2 laboratories Biotoxin repository
- Classified biology lab
- Prototyping labs and high bay
- Detector characterization labs
- Radiography labs
- Explosives test capabilities
- Environmental fluorescence lab
- Fiber laser development lab
- Remote Sensing Development Lab

Differentiating Capabilities for Defense Against Cyber Threats Portfolio

- Internet-scale network emulation and analysis tools
- Communications systems that enable national security missions
- Threat and vulnerability analysis on information systems of national consequence
- Advanced security concepts for contested environments (operate in enemy territory)
- Algorithms and computing architectures for large-data analysis
- Formal methods for hardware/software verification
- LVOC internship program

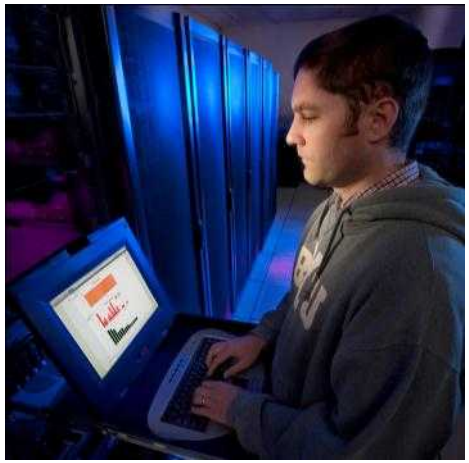
Capabilities for Defense Against Cyber Threats Portfolio

Sandia National Laboratories

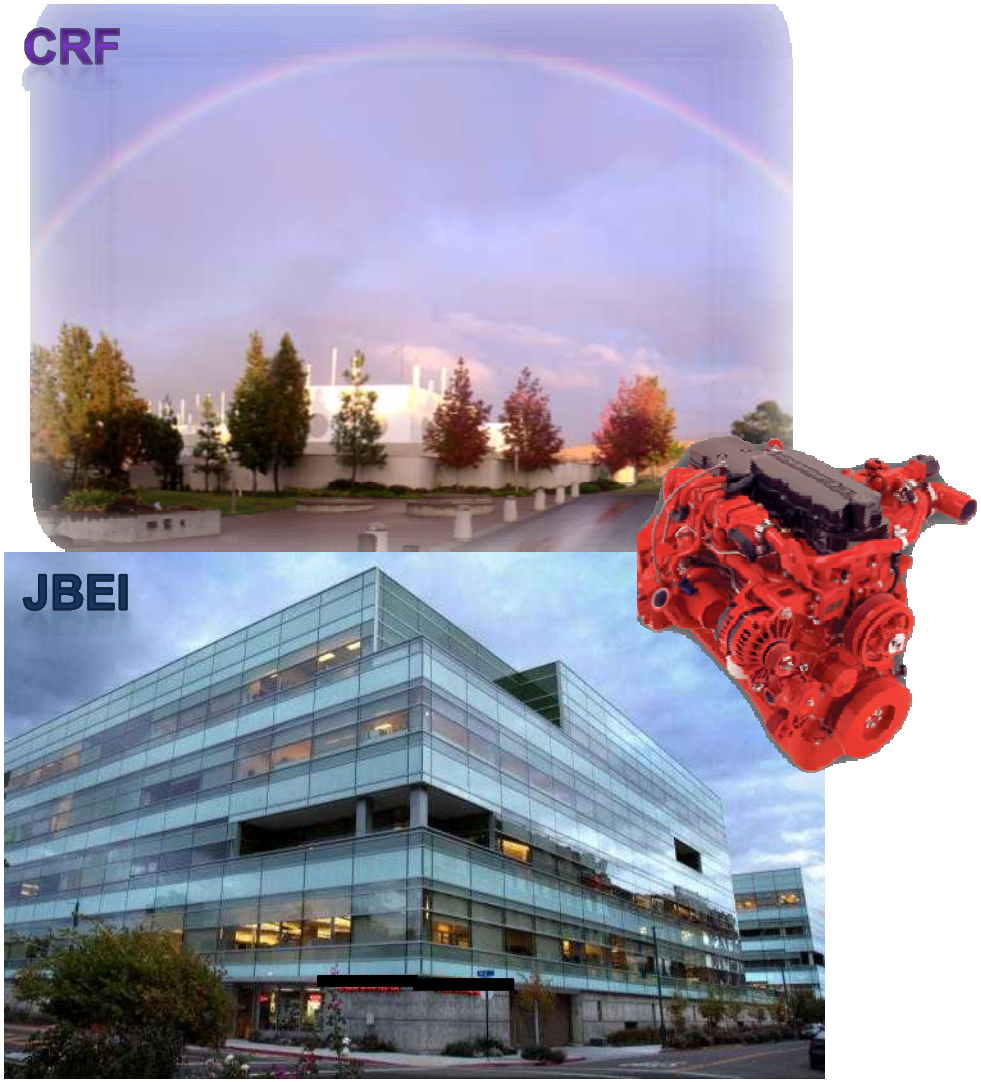
Competencies
- Systems engineering and applied and theoretical computer science
- Vulnerability assessment
- Informatics
- Multi-domain security design and implementation
- Network protocol analysis
- Cryptography
- Discrete math
- Certification and accreditation
- Formal methods analysis
- Quantum physics/communications

Tools
- Mega*: At-scale network evaluations
- FARM/ISLAND: Automated malware analysis
- High performance computing
- KANE: High performance computing clusters
- DNS visualization
- CodeSeal: Tools for countering reverse engineering of software

Facilities
- Sensitive compartmented information facility (SCIF)
- Network intrusion detection lab
- Cybersecurity Technologies Research Laboratory (CTRL)
- Mega* lab
- Distributed Information Systems Laboratory (DISL)
- Wireless lab
- Video teleconference lab



Differentiating Capabilities for Transportation, Fuels and Engines and their Impacts Portfolio



- Combustion Research Facility and the Joint BioEnergy Institute
- Deconstruction of cellulose and lignocellulose into usable fuels
- Deep, fundamental knowledge of engine/fuel behavior
- In-situ laser diagnostics applied to high-temperature and high-pressure chemically reacting flows
- Gas-phase combustion chemistry involving short lived intermediates
- Hydrogen in metals expertise for safe storage, transportation, and utilization

Capabilities for Transportation, Fuels and Engines and their Impacts Portfolio

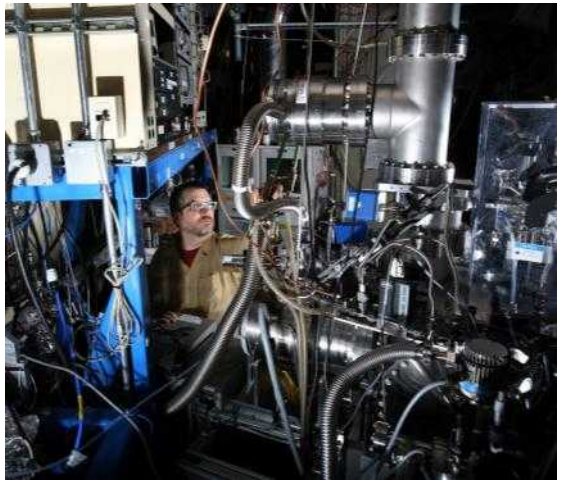
Sandia National Laboratories

Competencies

- Combustion science
- Gas-phase chemistry
- Chemically reacting flows
- Internal combustion engines
- Laser physics
- Hydrogen codes and standards
- Solid-state hydrogen storage
- Modeling and simulation
- Chemical kinetics
- Spectroscopy
- Materials science
- Systems analysis
- Biofuel engineering
- Atmospheric monitoring
- Coal combustion
- Theory
- Uncertainty quantification

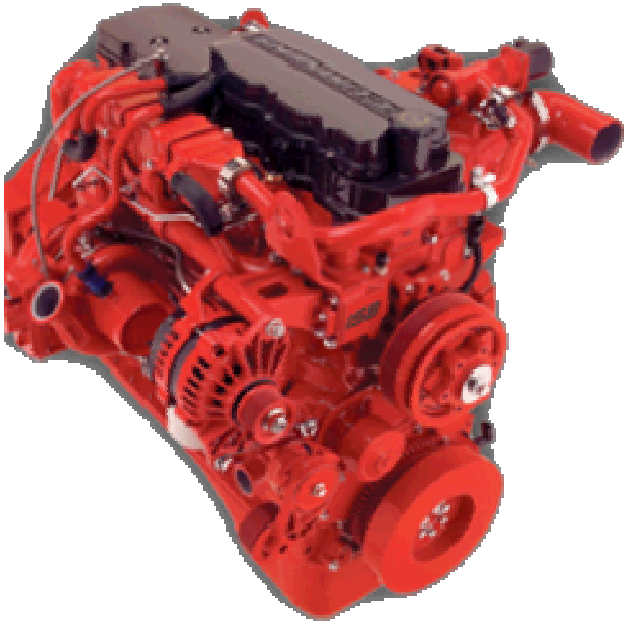
Tools

- High performance computing
- Optical diagnostics
- High pressure combustion vessels
- Advanced scientific software
- Emission benches
- Free-piston engine
- Portable experiments
- Mobile climate lab
- Optical engines



Facilities

- Combustion Research Facility
- Joint BioEnergy Institute
- Combustion research computational and visualization lab



CA Approach: Programmatically diverse, operationally integrated, and located in the San Francisco Bay Area

An ethic of partnerships borne of need… extends capabilities within and beyond the enterprise

- CA stewards Lab capabilities and partners with NM for mission success
- Mission & Operations partner for integrated operational models
- Collaborate with local, world-class, R&D institutions (LBNL, UC, Stanford, LLNL, NASA Ames…)

A SF Bay Area location, intellectually rich and culturally diverse… extends the Labs' reach and shapes our culture

- Enables world-class pipeline and progressive technical and business solutions
- Provides access to a broad base of political support
- Encourages relocation as global destination to live and work

A Site engineered to span an open to closed security spectrum… expands program capability and impact

- Promotes staff and resource movement between open and closed work
- Enables partnership engagements, embracing global ST&E communities
- Places work where it is best performed

Elaborations of the CA Approach

- **Cross-functional forums –** SSHEAC (safety and security), Space Committee, Inter-Disciplinary Team (IDT), Diversity and Inclusion (IDAPT), Division Operations
- **Matrix Models for Operations** Facility Management Coordinator (FMC), BuDS (Business Development Support), PM, Mission Partners, HRBPs)
- **A spectrum of operational competencies** is locally managed in one center, and readily accessible to the line… from HR to Business Development to physical operations, enabling rapid response to mission needs
- **15 of the 53 California congressional representatives are within 50 miles of Livermore** – broad set of stakeholders for the laboratory
- **Complete spectrum of controlled areas and programs** – GAA to SCIF
- **The State** is considered a world leader in driving energy policy. Partnership with CA Energy Commission.
- **Division 8000 piloted** No Smoking, 9/80, Division Support, Make/Buy Decisions, Farmers Market, etc.

Sandia National Laboratories