NEVADA NATIONAL
NNSS
SECURITY SITE

Managed and operated by
Mission Support and Test Services

The Ground Truth for the Nation's Innovation

Overview of NNSS Capabilities

DHS CWMD T&E Week, 20-29 July 2021

28 July 2021

A Premier High-Tech Enterprise
Serving the National Security

► The NNSS is multi-mission complex providing testing and diagnostic services, applied science, and development engineering

► Home to largest facility for open air testing of hazardous materials and biological simulants in the world!

► ~ 1,150+ of highly specialized technical experts

Counter Terrorism Operations Support (CTOS) Program
Edgewood, New York

Nevada National Security Site
Mercury, Nevada

Remote Sensing Laboratory - Andrews
Andrews AFB, Maryland

Livermore Operations
Livermore, California

Los Alamos Operations
Los Alamos, New Mexico

Special Technologies Laboratory
Santa Barbara, California

Remote Sensing Laboratory - Nellis
Nellis AFB, Nevada

North Las Vegas Operations
North Las Vegas, Nevada

Sandia Operations
Albuquerque, New Mexico

Core Competencies
At the Nevada Site

NPTEC is the largest facility for open air testing of hazardous materials, C/B simulants in the world. Used for sensor technologies evaluation and signature identification

JASPER a two-stage gas gun is used to explore surrogate materials and plutonium performance while safely containing nuclear material

BEEF provides data, through conventional (5000 pounds) high-explosive pulse and laser power experiments

DAF is a highly secure facility designed and built to provide safe structures for high-explosive and nuclear-explosive assembly operations

UAS/cUAS Testbed is an extensive and agile outdoor testbed that allows for rapid validation of prototype sensors, information aggregation and analysis, and identification of requirements and flexible concepts of operations

RNCTEC complex provides the necessary facilities and capabilities to validate the performance of systems. Sponsored by DHS CWMD

T-1 Training Center is 47 acres of a unique, realistic, and training venues, allowing more than 100 participants to be trained simultaneously

Tunnels are NNSS underground laboratories used for subcritical experiments, chemical high explosives, detections and special training

Special Technologies Laboratory
Santa Barbara, CA

- ► Center of excellence for the
- ► design, development, and fielding of special-purpose devices, measurement instruments, and analysis methods
- ► Imaging experiments and analysis
- ► High-band width instrumentation and communication

Los Alamos Office
Los Alamos, NM

- ► High-speed electro-optical instrumentation
- ► Optics and fiber-optic systems
- ► Modeling and data analysis
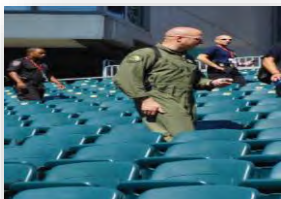- ► Photonics and electronic imaging

Remote Sensing Laboratory
Nells & Andrews AFBs

- ► Center of excellence for nuclear incident response.
- ► RDT&E for emergency communications
- ► Deployment services for Rad/Nuc response operations
- ► Provides force and facility protection to U.S. domestic and international assets

Livermore Operations
Livermore, CA

- ► NIST accredited x-ray, optical, and high energy laser calibration
- ► Sole U.S. capability for custom photomultiplier tube fabrication
- ► Calibration source development
- ► Modeling and data analysis

Counter Terrorism Operations Support (CTOS)

- ► Develops and delivers training for emergency responders
- ► CBRNE enabled Training
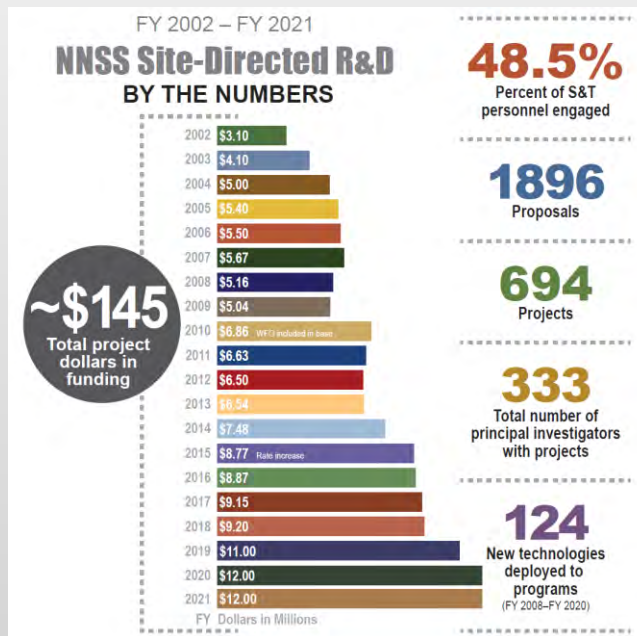- ► Virtual Training Capabilities for Rad/Nuc

Sandia Office
Albuquerque, NM

- ► Radiographic source development
- ► Shock physics diagnostic development
- ► Velocity Interferometer System development and fielding

Core Capabilities

► SCADA lab with flexible and scalable infrastructure to emulate unique configurations without the potential to disrupt operations on customer cyber networks

► Test, Evaluation, Verification, and Validation

► Sensors, Measurements, and Advanced Diagnostics Development Physics

► Laser, Optical, Pulsed Power, and Accelerator Science and Technologies

► Nuclear Physics, Nuclear Chemistry, and Nuclear Engineering

► Electrical and Mechanical Design and Engineering

► Specialized machining and secure fabrication

► Long and short distance explosive monitoring

► Monitoring, assessment and analysis of RF spectrum and anomalous behavior

► Turbulence enhancement gas imaging and chemistry and spectroscopy lab

► Long range exfoliation of data in unique and extreme environment

Innovations are Critical Part to our Mission

FY 2002 – FY 2021
NNSS Site-Directed R&D BY THE NUMBERS

Year	$ (Millions)
2002	$3.10
2003	$4.10
2004	$5.00
2005	$5.40
2006	$5.50
2007	$5.67
2008	$5.16
2009	$5.04
2010	$6.86 WFTII included in base
2011	$6.63
2012	$6.50
2013	$6.54
2014	$7.48
2015	$8.77 Rate increase
2016	$8.87
2017	$9.15
2018	$9.20
2019	$11.00
2020	$12.00
2021	$12.00

FY Dollars in Millions

~$145 Total project dollars in funding

48.5% Percent of S&T personnel engaged

1896 Proposals

694 Projects

333 Total number of principal investigators with projects

124 New technologies deployed to programs (FY 2008–FY 2020)

- SDRD is the innovation pipeline for our programs spanning low technical readiness basic science to development of high TRL "ready to deploy" solutions

- Examples of exploratory and directed research projects:
  - CBRNE event signatures
  - Advanced algorithms and development for sensor networks
  - ML/AI

Strategic Response Toward National Security Sponsors Needs

Stockpile Experimentation		Global Security	
NNSS Centers of Excellence	Radiographic Systems Imaging and Analysis	User-Centered Remote Testing & Operations	Neutron Technologies and Measurements
Accelerator Beam Science and Target Interactions	Enabling Technologies for Autonomous Systems & Sensing	Dynamic Experiment Diagnostics	Communications and Computing

Goals
- Strengthen existing technical capabilities

- Develop new technical capabilities

- Prepare the NNSS for agile response to future national security threats

Recognizing Perseverence, Innovation, & Disruption

R&D 100 AWARDS

Seven Awards and Counting

Sponsor Driven Capabilities

- Ability to make and detonate large quantities of homemade explosives and perform large-scale chemical releases → WMD Research, testing and system evaluation

- Ability to create realistic improvised chemical device events → ICD Experimental Threat Assessment

- Maintain multiple chemical training venues → Chemical Incidence Response

- Engineered locations for ICD research → Demonstrate the effectiveness of remote sensing detection and characterization

- A large "ground truth" ICD sensor test bed → EOD clearing operations and Improvised Mortar Shell Handling

- Permitted and equipped to test a variety of multiple-release sources → Large-scale testing of remote sensing systems and operations

- Elevated stack chemical releases with embedded diagnostics → Simulation of OCONUS WMD facilities

- Portable release systems with wireless diagnostics → Rapid scenario testing of remote sensing systems using existing NNSS as surrogate infrastructure

Summary

► Home to largest facility for open air testing of hazardous materials and biological simulants in the world

- ■ 1,360 square miles: One of the largest restricted access areas in the United States
- ■ Capable of complex, simultaneous high hazard tests at secure, guarded ranges

► Ideally suited for test sponsors to conduct field verification/validation of their technology in a realistic environment using our CBRNE test beds

► State-of-the-art field diagnostics for CBRNE testing and training

► Extended CBRNE laboratory capabilities at other NNSS facilities (especially STL and RSL)

► Topography, wind predictability, and location offer a secure, controlled environment for small and large-scale hazardous materials testing and training:

- Secure test beds
- Calibrated release systems
- Weather data instrumentation
- Dedicated embedded staff

- Logistics & site-wide communications
- 2 airstrips and 10 heliports
- Test design and execution support
- Housing, med services, & fire protection

The Ground-Truth For The Nation's Innovations

Questions?

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BACKUP

NNSS By The Numbers

$900 million Annual Nevada Enterprise spend	**$6 million** State and local taxes	**$190 million** Awarded annually to small businesses
3,100 Well-paying jobs	**1,500** Subcontract jobs in Southern Nevada	**200** Users visit NNSS daily
1,150 Highly skilled technical positions	**1,050** Highly skilled professional positions	**900** Skilled craft and laborer positions

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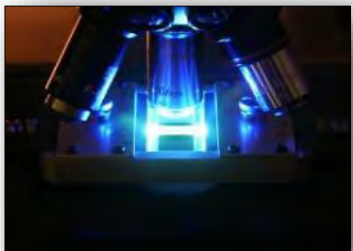
Examples of NNSS T&E Capabilities

Gas Effluent Target Bags
A new method to replace open air releases for optical system calibration

Chemical Test Beds

Allow for the study of large quantities of toxic material – safely and without damaging the environment

System Integration

Provide system integration, diagnostics, development, and support for fieldable equipment

Sensor Payloads for UAS

Successful chemical sensing/sampling on various platforms. Tackling weight, size and power challenges

NNSS Centers of Excellence

►Phase 1 centers (in blue) and Phase 2 centers (in gray)

Dynamic Experiment Diagnostics	Radiographic Systems Imaging and Analysis	Neutron Technologies and Measurements	Accelerator Beam Science and Target Interactions	Communications and Computing	Enabling Technologies for Autonomous Systems and Sensing	User-Centered Remote Testing and Operations
Advancements in electro-optical interferometry	Source and detector modeling, shielding, and collimation	Neutron diagnostics, readiness, and responsiveness	Advanced pulsed power systems	RF comms – 5G/WiFi-6, beyond line of sight, software-defined radio	Miniaturization, SWP, electronics/firmware, high density energy source	National/international database format with advanced analysis
Novel camera and optical systems	Scintillators and x-ray diagnostics	Reactivity detectors, neutron imaging, and analysis	Accelerator and beam diagnostics	Cyber ML, secured comms, real-time threat prediction and attribution	Advanced chemical and radiation detection for UAS and airborne payloads	Real-time remote data interfaces and experiment control
Dynamic temperature and other advanced EOS diagnostics	Imaging systems for x-ray and neutrons with advanced data analysis	Neutron source development and advanced portable sources	Accelerator beam science and target interaction	AR/VR for hybrid field missions/training, AI/ML performance analytics	Sensor fusion analysis – AI/ML for edge computing and event identification	Underground and remote location technical operations and management
Ultra-fast imaging systems	ML radiography analysis methods	Advanced neutron detection, imaging, and analysis methods	Advanced accelerator controls and data acquisition configurations	Switch at NNSS – Data Center, classfied HPC, self-healing networks AI/ML, millimeter wave	cUAS technologies, blocking/swarming, neutralization of jamming and RF intrusion	Geophysics sensors and HPC for automated data analysis of large datasets
Integration of quantum sensing for advanced diagnostics and imaging	Advanced radiographic systems and HPC for automated data analysis	Advanced neutron sources with 100x brightness/energies	Integrated test stand as technology development and maturation platform	AI/ML for autonomous signal classification and response	Integration of quantum sensing technologies into autonomous systems	Advanced fiber-optic and quantum sensing technologies