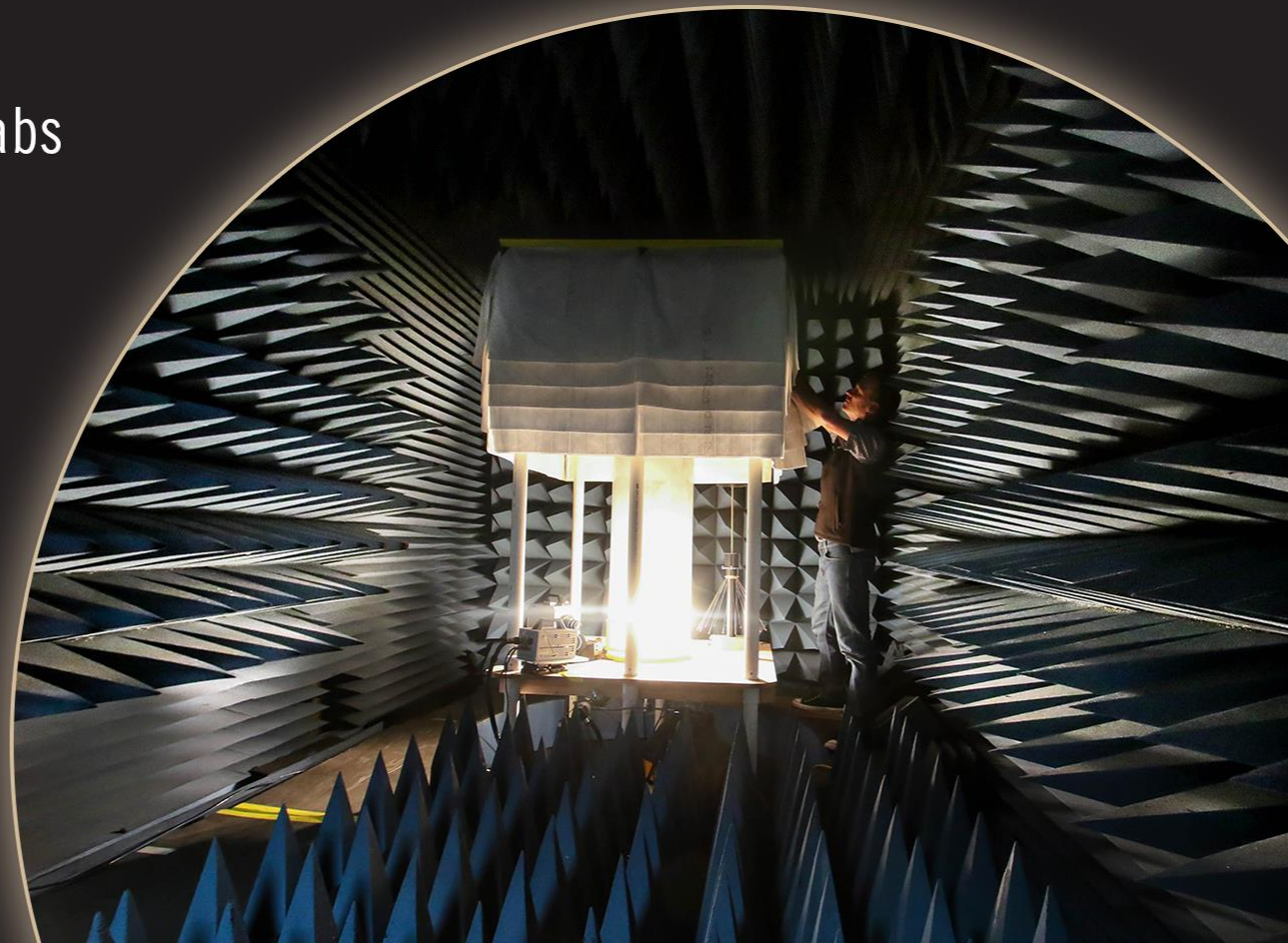
Spotlight on National Labs

Nevada National Security Site

Thursday, August 26



ANS Events

American Nuclear Society

Thursday, Aug. 26, 2021

Spotlight on the

Nevada National Security Site

The Nevada National Security Site is managed and operated by MSTS under contract number DE-NA0003624

Welcoming Remarks

Roger Rocha

Vice President and
Chief Operating Officer
Mission Operations

NEVADA NATIONAL
NNSS
SECURITY SITE
Managed and operated by
Mission Support and Test Services LLC

NNSS overview

- We are a $900 million/year enterprise, with more than 3,000 highly skilled, well-paid employees
- We enable the local economies surrounding our locations by awarding $190 million/year to small businesses and 1,500 subcontracting jobs in Southern Nevada
- As the Ground Truth for the nation's innovation, the NNSS was established in the 1950s to prove the concept and designs of our nation's nuclear stockpile
- As the threats to our nation evolved over the years, so did we. We continue to:
  - Support the stewardship of the nation's nuclear deterrent
  - Provide nuclear and radiological emergency response capabilities and training;
  - Contribute to key nonproliferation and arms control initiatives
  - Work with national security customers and other federal agencies on important national security activities
  - Provide long-term environmental stewardship of the NNSS' Cold War legacy

Nevada National Security Site
Locations

Nevada National Security Site
Mercury, Nevada

Livermore Operations
Livermore, California

Special Technologies Laboratory
Santa Barbara, California

03180031

Remote Sensing Laboratory - Nellis
Nellis AFB, Nevada

North Las Vegas Operations
North Las Vegas, Nevada

Sandia Operations
Albuquerque, New Mexico

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

Remote Sensing Laboratory - Andrews
Andrews AFB, Maryland

Los Alamos Operations
Los Alamos, New Mexico

Stockpile Experimentation and Operations

James Wallace

Senior Director
Stockpile Experimentation and Operations (SEO)

NEVADA NATIONAL NNSS SECURITY SITE

Managed and operated by
Mission Support and Test Services LLC

From Underground Testing to Science-Based Stockpile Stewardship

- In 1989, the United States halted the manufacture of new nuclear weapons.
- In 1992, the United States conducted its last full-scale, underground nuclear weapons test (UGT).
- In 1994, Congress established the science-based Stockpile Stewardship program.
  - Maintains the continued safety, security and reliability of the nation's nuclear weapons in the absence of nuclear explosive testing.
  - Increases scientific understanding of nuclear device performance, as well as the aging behavior of weapon materials and components.
  - Annual stockpile assessments and certifications rely on computer simulations. To accurately model system performance, models require integrated weapons tests:
    - **Hydrodynamic experiments** are integrated experiments in which high explosives (HE) drive metals in weapon-like geometries, using non-fissile surrogate materials.
    - **Subcritical experiments** gather crucial data on plutonium driven by high explosives without a self-sustaining reaction (aka subcritical).

NNSS experiments conducted at:

BEEF

U1a

Subcritical Experiments (SCEs) at the NNSS (Current State)

The NNSS is the only location in the US authorized to conduct experiments with both high explosives and weapons-relevant quantities of Plutonium

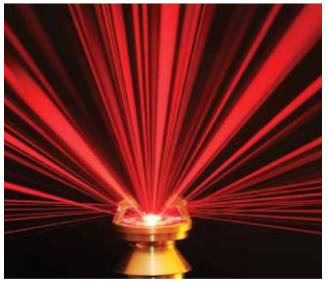
- CEs are conducted in the U1a underground laboratory (963')
- SCEs started in 1997 and continue today with 16 planned over the next 5 years
- Proximity to Device Assembly Facility (DAF) enables efficient and flexible SCE component assembly
- SCEs are:
  - Conducted in vessels to safely confine the Pu
  - Imaged by Cygnus, a dual axis, 2.25 MeV X-ray machine
  - Recorded using state-of-the-art diagnostics
- Data collected by today's SCEs quantify the **early-time behavior** of weapon materials in the nuclear explosive package

U1a Hoist

Cygnus X-Ray Machine

Vessel

X-Ray Image



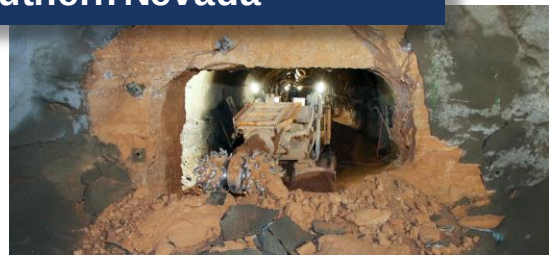
Laser Diagnostics

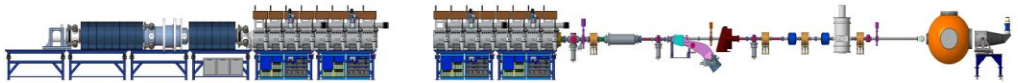
Preparing for Additional SCE Capabilities at the NNSS (Future State)

Enhanced Capabilities for Subcritical Experiments will enable three decades of experiments for the NNSS and hi-tech employment opportunities for Southern Nevada

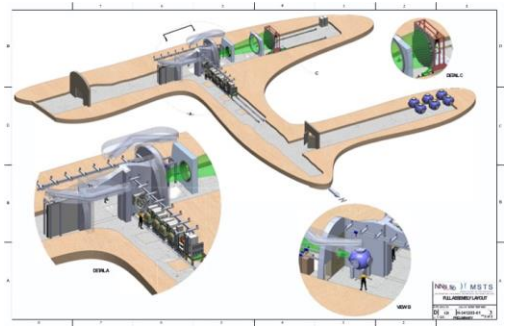
- **UCEP** is a line item mining and construction project that is developing infrastructure needed for new critical capabilities in U1a.
  - "Breakthrough" milestone in March 2021
- **Scorpius** is a Major Item of Equipment that consist of the design, build, and operation of a 20 MeV accelerator that will take x-rays of implosions.
  - Preparing a surface facility to enable an Integrated Test Stand prior to accelerator being moved underground
  - Hiring the resources to operate and maintain the accelerator
- **Neutron Diagnosed Subcritical Experiments (NDSE)** will provide the capability to image SCEs with neutrons
  - Design and construction of a new U1a testbed
  - Design, assembly and functional testing of the neutron source (called ZEUS)
  - Diagnostic and detector wall development

Breakthrough for the UCEP Project





Scorpius X-Ray Machine Design



NDSE Testbed Design

NDSE Source (ZEUS)

U1a: Benefit to Nevada and the Nation

STEM Workers
60

Nuclear Operations
20

Craft
105

Additional Support
20

FY21

Experiments and Operations
$78M

Expansion Costs
$76M

Expected 1.5x increase in budget and personnel to support three national security testbeds

Stockpile Operations and Environmental Management

Mark Krauss

Senior Director
Stockpile Operations &
Environmental Management Program

NEVADA NATIONAL
NNSS
SECURITY SITE
Managed and operated by
Mission Support and Test Services LLC

Environmental Management – Waste Disposal

MSTS operates the RWMC, disposes low-level radioactive, mixed low-level radioactive, and classified waste from on-site activities, and various DOE- and Department of Defense-related activities.

Global Security

Bart Jones

Senior Director
Global Security

NEVADA NATIONAL
NNSS
SECURITY SITE

Managed and operated by
Mission Support and Test Services LLC

Global Security Overview

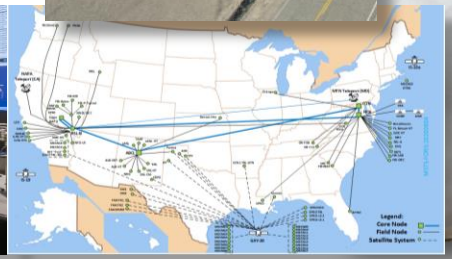
Focused on:

- Non-proliferation: Treaty monitoring and compliance technologies
- Counter-Proliferation/Counter-Terrorism: Full spectrum (CBRNE)
- Emergency Response: Search and Consequence Management Operations
- Cyber Security
- Autonomous Solutions/Sensor development and Integration – FAA selected site for Unmanned Aerial System (UAS) testing
- Quick response of Applied Technologies for specialized customers
- Emergency Communications








Defense Nuclear Nonproliferation

Melissa Hunt

Director
Applied Technology

NEVADA NATIONAL
NNSS
SECURITY SITE
Managed and operated by
Mission Support and Test Services LLC

Defense Nuclear Nonproliferation Programs

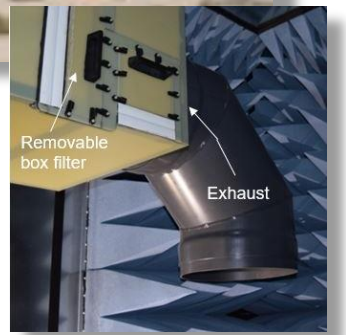
NNSS supports NNSA on nuclear nonproliferation, reduces threats, and responds to incidents around the world, in many ways discussed today. A major underpinning is R&D, often in partnership with National Labs, to detect and monitor:

- Nuclear fuel cycle and production
  Are we able to detect production of material for a nuclear weapon?
- Weapons development activities
  Are we able to detect nuclear weapon development or testing?
- Nuclear material
  Are we able to detect if material is being accumulated?
- Nuclear explosions
  Are we able to detect and characterize explosions as nuclear/radiological?

Research spans physics, chemistry, engineering, data science, geology and more – and usually culminates in realistic field collections.

Innovative Detection in Field Test Environment

State-of-the-Art
Diagnostics
Fielding and Testing



Nuclear Response Division
Remote Sensing Laboratory

Dr. Alexis Reed

Director
Nuclear Response

NEVADA NATIONAL
NNSS
SECURITY SITE
Managed and operated by
Mission Support and Test Services LLC

Remote Sensing Laboratory Locations and Programs

- **Nuclear Incident Response** – Aerial Measuring System, Nuclear Search Program, Consequence Management Response Team/Home Team, Disposition Forensics Evidence Analysis Team (DFEAT), Render Safe Programs – ARG, JTOT, Stabilization
- **International training and collaborations**
- **High-TRL software and hardware development**

RSL – Nellis Air Force Base and Joint Base Andrews

- 24/7/365 Nuclear Incident Response Assets
- On-Call Teams for Radiological Emergencies
- Deployable Field Teams / Home Team Reachback
- Aircraft – Unique Aerial Detection Capabilities

Counterterrorism Rad/Nuc Training

George Stamper

Manager II
Counterterrorism Department

NEVADA NATIONAL NNSS SECURITY SITE

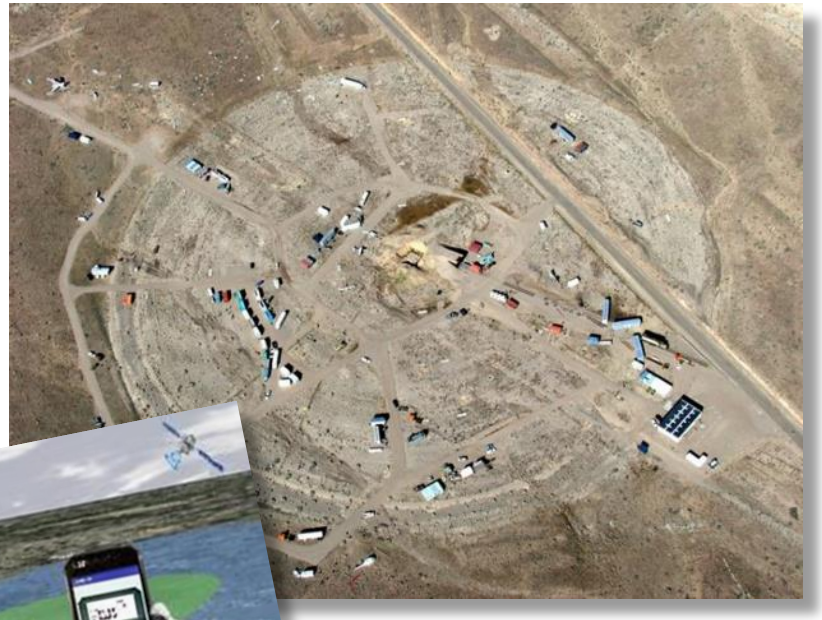
Managed and operated by
Mission Support and Test Services LLC

Counterterrorism Operations Support (CTOS)

- Established in 1998
- DHS/FEMA: National Domestic Preparedness Consortium (NDPC)
  - Train first responders: State, Local, Tribal, and Territorial
  - Chem/Bio/**Rad-Nuc**/Explosive, Natural Disasters, Incident Command, Trans
  - Mobile Training Teams, Resident, Virtual, Web, and Blended
  - CTOS total: 270,000 certificates
- DHS/CWMD: Securing the Cities
- Other customers
  - Federal and International partners
  - National Guard: All-hazards

Counterterrorism Operations Support (CTOS)

- Comprehensive Curriculum
  - Awareness, Preventive, Response, Planning/Operations, Train-the-Trainer
  - Rad Exposure/Dispersal Devices, Improvised Nuclear Device (10 kiloton)
  - Law Enforcement, Fire, Emer Medical, Planners, Rad Ops Support Spec
  - Practical exercises, employment
- T-1 Training Site
  - Established in 2004
  - Apple II, 29 kiloton test, 1955
  - Realistic training scenarios
- Virtual Radiation (VIRTUS)
  - Simulates hazards, Emulates detectors



Special Technologies Laboratory

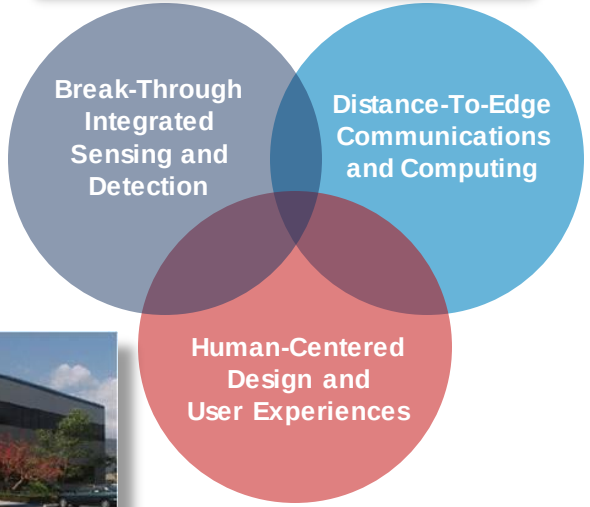
Pamela Rangel

Manager III
Special Technologies Laboratory

NEVADA NATIONAL
NNSS
SECURITY SITE
Managed and operated by
Mission Support and Test Services LLC

Special Technologies Laboratory

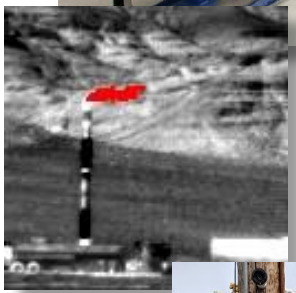
- The STL has a rich history on the Central Coast of California supporting the DOE and NNSA, as well as OGAs.
- Part of the NNSS, and have been supporting the Site since 1959, and are part of the Applied Technology Directorate under Global Security.
- We are a multi-mission laboratory, focused on mitigating threats to our nation.
- The STL is designated a Field Intelligence Element.
- We have six teams working in partnership:
  - Experimental Physics
  - Information Sciences
  - Nonproliferation Research
  - Services & Fabrication
  - Systems R&D
  - Facilities, Security, ES&H

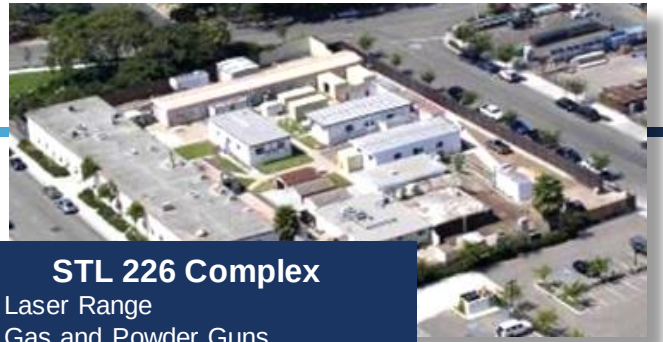


NEVADA NATIONAL NNSS SECURITY SITE
SPECIAL TECHNOLOGIES LABORATORY

Special Technologies Laboratory

- **Experimental Physics**
  - Shock physics
  - Pulsed radiography
  - Pulsed radiation sources
  - Classical optics and fiber laboratories
  - Laser systems
  - Electronics laboratories
  - Prototype shop
- **Nonproliferation Research**
  - Remote Sensing
  - Test bed ground truth
  - Mass Spectroscopy and Ion Mobility
  - Platforms exploitation
  - Data analytics/AI/ML
- **Information Sciences and Systems R&D**
  - Systems Integration Development
  - Rapid Development Cycles and Field Support
  - Custom packages, low power electronics
  - Test and evaluation
  - Cyber assessments
  - DOE IN Infrastructure
  - DOE AU-52, Physical Security support





STL 226 Complex
- Laser Range
- Gas and Powder Guns
- Explosives Facility
- Febetron Lab
- Chemistry, Optics, Metrology Labs

STL 5520
- Engineering Development
- Electronics Manufacturing
- SCIF
- Secure IC Communications
- Mission Support

STL 5540
- Science Laboratories
- Mission Support

Mission Assurance

John Contardi

Senior Director
Mission Assurance

NEVADA NATIONAL NNSS SECURITY SITE

Managed and operated by
Mission Support and Test Services LLC

Mission Assurance Overview

Mission Assurance is a service center for safe and compliant mission enablement, comprised of:

- Environmental, Safety, and Health
  - Radcon, IH, Environmental mgt, Hazmat, and Occupational medicine
- Quality Services & Support and Contractor Assurance System
  - Quality assurance
  - Material testing and calibration laboratory
  - Records/document management
  - Issues management, assessment, lessons learned
- Security and Emergency Services
  - Safeguards and security
  - Emergency management and response
  - Material control and accountability
- Operations Assurance
  - Formality of Operations
  - Regulatory Compliance
- Nuclear Assurance
  - Nuclear Safety
  - Criticality Safety

Science & Technology

Dr. Jose Sinibaldi

Chief Scientist/Program Director
Science and Technology

NEVADA NATIONAL
NNSS
SECURITY SITE
Managed and operated by
Mission Support and Test Services LLC

Science and Technology Thrust Areas Initiative
Goals and Objectives

- Strengthen existing technical capabilities
  - Deepen our scientific and engineering benches in identified thrust areas
  - Broaden exposure to our S&T staff and provide them with opportunities across stockpile, global security and strategic program missions
- Prepare the NNSS for agile response to future national security threats
  - Attract and retain topnotch talent
  - Enable cross training across Stockpile and Global Security organizations
- Enhance University collaborations
  - Inject innovation into program missions and
  - Develop STEM pipelines with critical SKAs

Science and Technology Centers – Thrust Areas

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

Phase 1 thrust areas (in blue) and Phase 2 thrust areas (in gray)

Internships to Early Career

Brent Baker

Manager II
Talent Acquisition

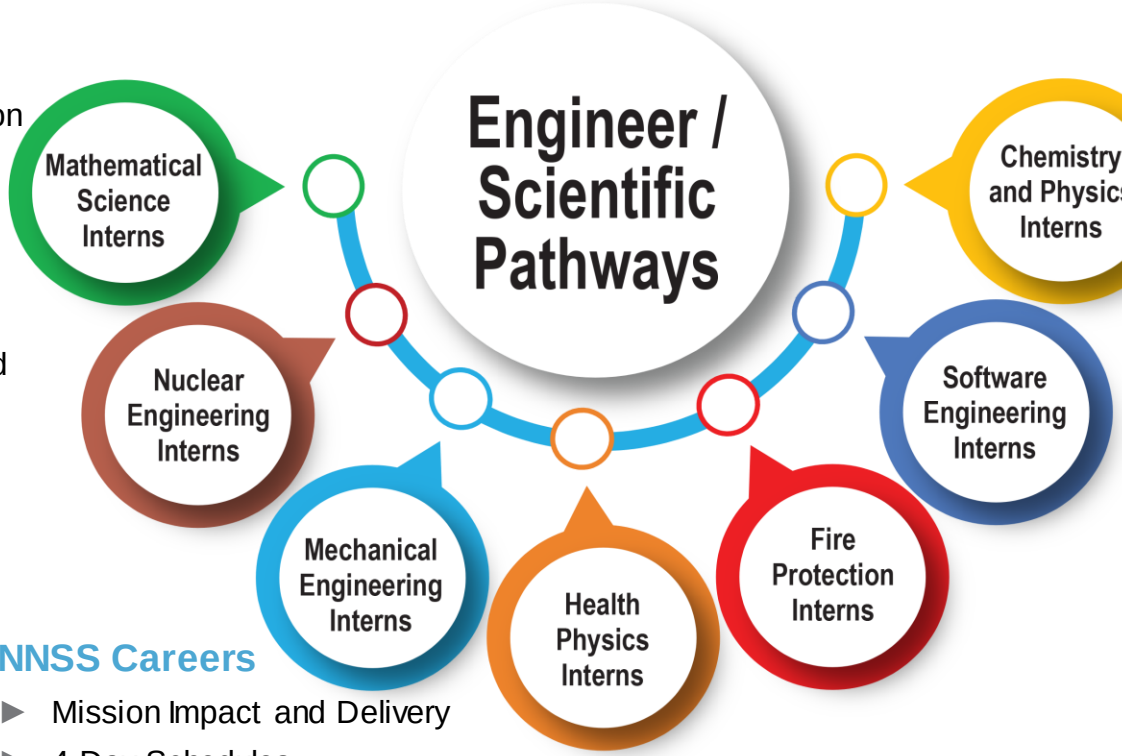
NEVADA NATIONAL NNSS SECURITY SITE

Managed and operated by
Mission Support and Test Services LLC

Internships to Early Career

Internships

- Hands-On Application
- Meaningful Program
- View of Potential Career
- Mentorship and Relationships
- Student Projects and Presentations



NNSS Careers

- Mission Impact and Delivery
- 4-Day Schedules
- Comprehensive Total Rewards
- Development, Research and Specialization Opportunities

Early Career Paths

- Cyber Security
- Engineering
- Physical Sciences
- Intelligence Research
- Scientist
- Project Management
- Emergency Response
- Information Technology

Questions?

For more information, visit NNSS.gov or follow us at @NNSANevada

NEVADA NATIONAL NNSS SECURITY SITE

Managed and operated by Mission Support and Test Services LLC