NEVADA NATIONAL NNSS SECURITY SITE

Managed and operated by
Mission Support and Test Services

DOE/NV/03624--1008

Nevada National Security Site

Amy Lewis

Stewardship Science Academic Programs (SSAP) Symposium
February 2021

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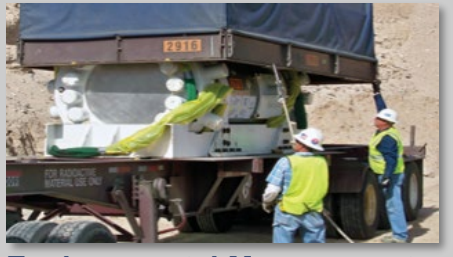
Proudly shaping the future of national security

Since 1951, the Nevada National Security Site has ensured the security of the US and its allies by supporting the stewardship of the nuclear deterrent, providing emergency response capability and training, and contributing key nonproliferation and arms control initiatives.

Stockpile Stewardship

Global Security



Environmental Management

Nevada National Security Site
Mercury, Nevada

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

Remote Sensing Laboratory - Andrews
Andrews AFB, Maryland

Livermore Operations
Livermore, California

Los Alamos Operations
Los Alamos, New Mexico

Remote Sensing Laboratory - Nellis
Nellis AFB, Nevada

Special Technologies Laboratory
Santa Barbara, California

North Las Vegas Operations
North Las Vegas, Nevada

Sandia Operations
Albuquerque, New Mexico

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Our workforce and infrastructure enable the nation to maintain and modernize an aging stockpile

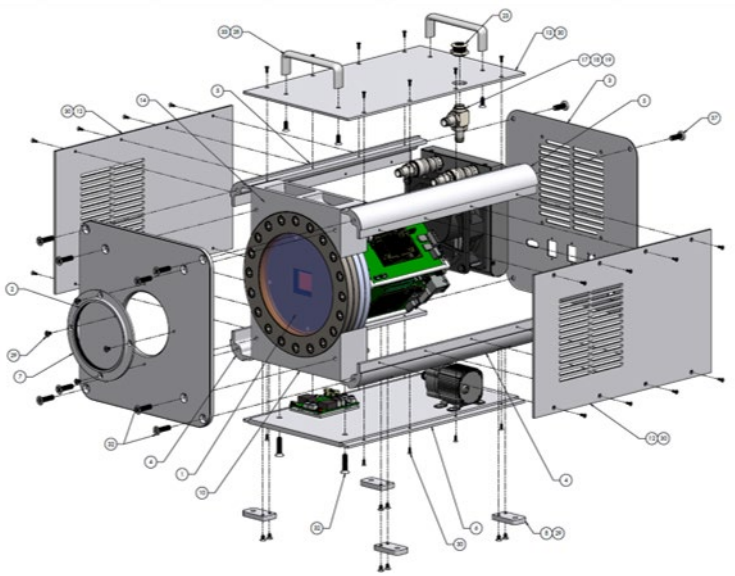
- Since 1992, subcritical experiments have been essential to the certification of the stockpile.
- An integrated team of engineers, technologists, and scientists from across the Nuclear Security Enterprise executes subcritical experiments at the NNSS U1a facility.
- We obtain critical data using multiple sophisticated diagnostics, designed and fielded by NNSS staff in collaboration with the laboratories.

The Vega Subcritical Experiment Team shown underground in the NNSS U1a facility

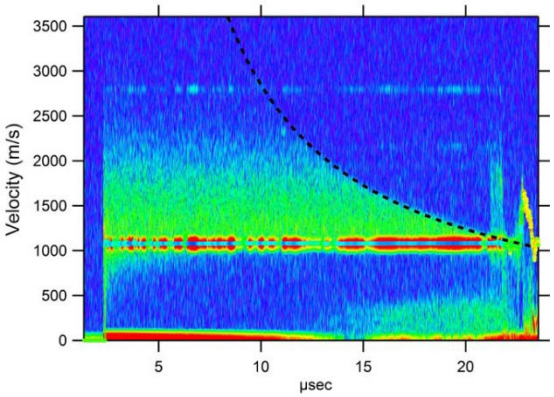
Subcritical experiment data are essential in answering questions on dynamic materials behavior needed for ongoing confidence in a safe, secure, and reliable US stockpile.

Stockpile Stewardship at NNSS

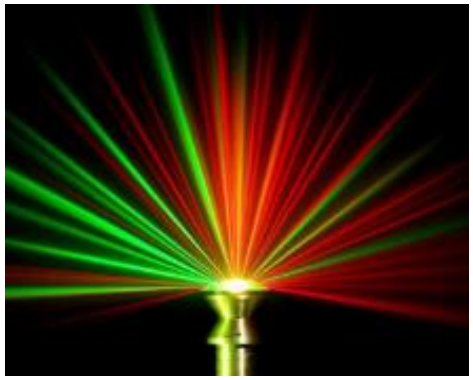
- The Stockpile Stewardship Program deploys a wide range of science and engineering technologies to execute dynamic weapons physics experiments on high-hazard experimental platforms.
  - Unique experimental platforms
  - Transformational diagnostics
  - Experiments, data, and results that enhance confidence in assessment and certification



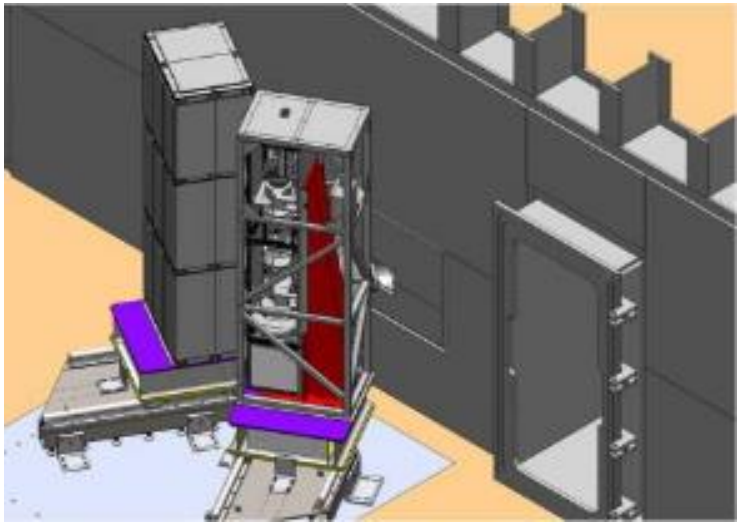
Kraken Camera Development



PDV Signal of Gold Ejecta



Next-Gen Optical Probe

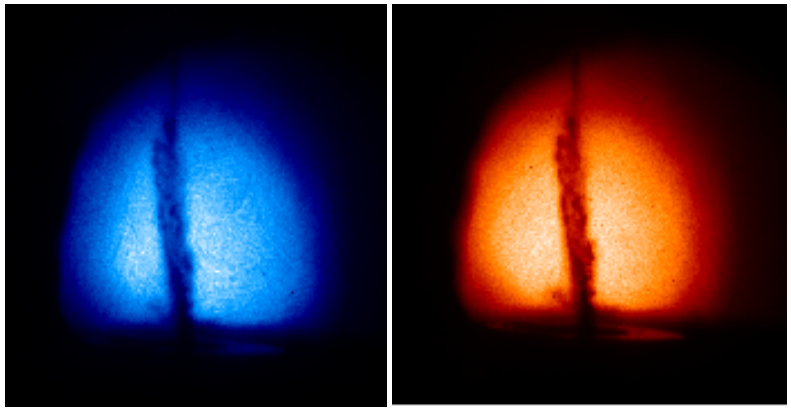


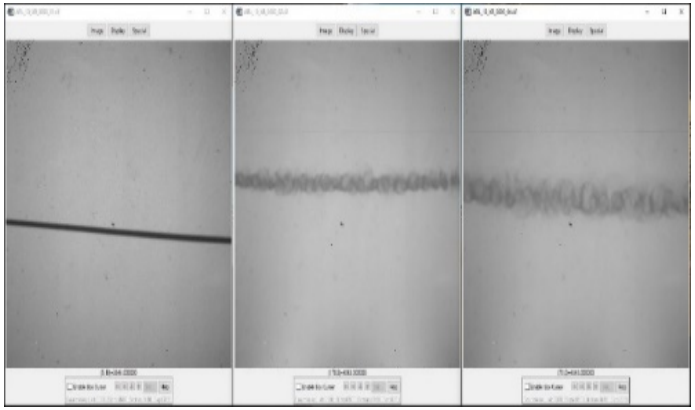
Cygnus Zoom Lens

Transformational diagnostics enable solutions to complex stockpile challenges

Wolfsbane two-color shadowgraph of ejecta

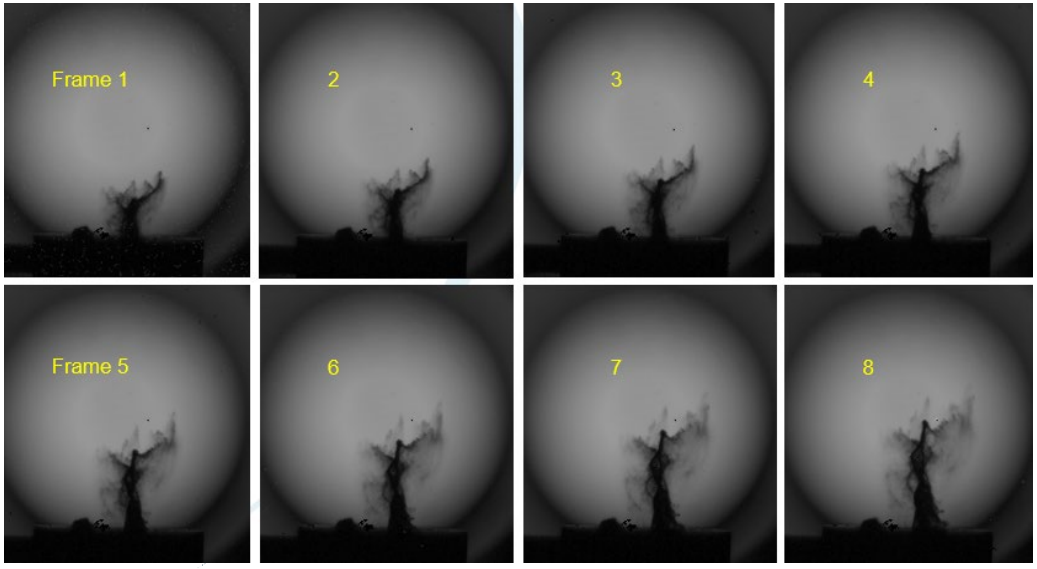
Development of a shadowgraphy diagnostic to capture image data at two different wavelengths along with density measurements to deduce new information about particle size.





Kraken image data from burst wire experiment

First execution of dynamic, multi-probe radiography at pRad with the NNSS-developed Kraken camera system and four-pulse x-ray source.

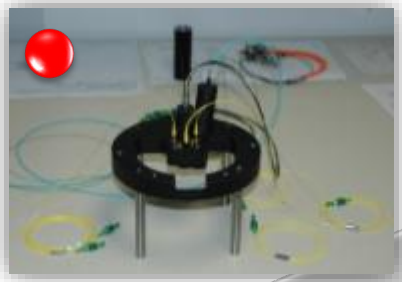


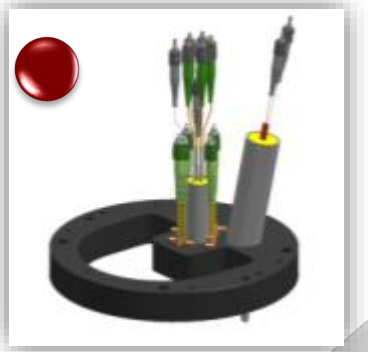
Eight frames of particle ejecta captured with Kraken

Laser-driven ejecta were captured with the Kraken digital eight-frame camera. A high-powered laser provides a shock impulse to a packet of 5 to 30 μm silica spheres placed below the scene. The laser impact sends the particles up into the field of view, and the result is recorded in an eight-frame time sequence on the Kraken camera.

Laboratory collaboration matures stockpile diagnostics

NNSS scientists and engineers help design and build technical answers to physics questions, through field support and data analysis.





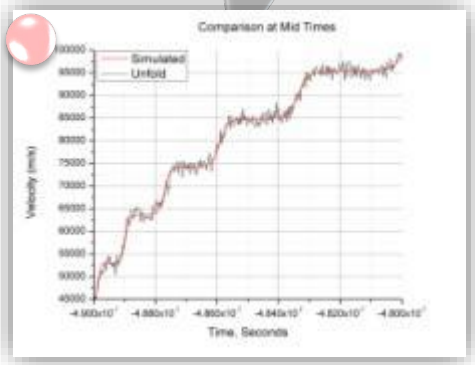
Data Analysis

Fielding

Fabrication

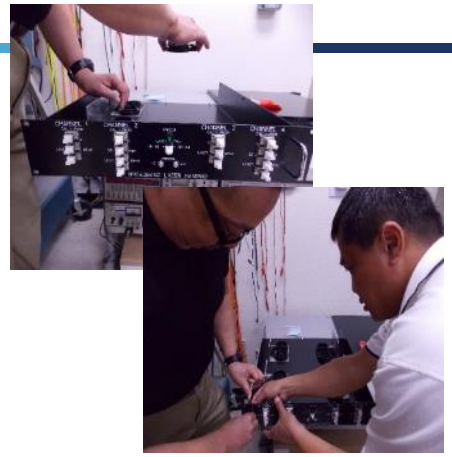
Design

Physics Questions

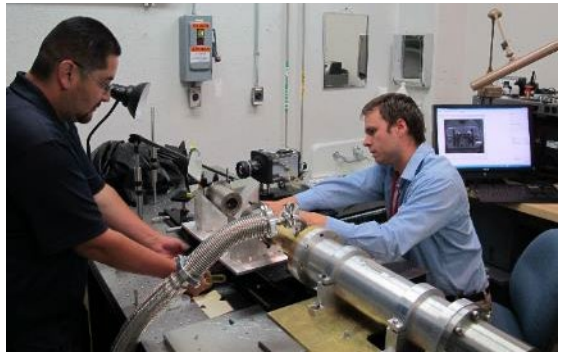


We team with national laboratories

- Experiment design and fielding (including plutonium, other actinides, and surrogates) in partnership with the three national laboratories
- High-reliability, high-fidelity data capture from hundreds of high-bandwidth signals
- Diagnostic research, development, and deployment of next-generation detectors and instrumentation systems for a suite of weapons science and dynamic materials applications, including characterization and, where applicable, absolute calibration capabilities
- Software and algorithm development for capture and post-processing of data for both legacy underground tests and modern experiments
- Development of experimental platforms for optical, x-ray, and neutron science applications



LLNL support: assembling the broadband laser ranging diagnostic critical to the Sierra Nevada experiments



LANL support: development of x-ray sources for soft radiography diagnostics for future subcritical experiments

Sandia support: deployment of MCP cameras at Z

Lawrence Livermore National Laboratory

Los Alamos NATIONAL LABORATORY EST. 1943

Sandia National Laboratories

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Helping move national security weapons science forward

Global Security Programs at NNSS

- NNSS has substantial efforts in programs related to global security. Our global security programs are dedicated to developing technical solutions underpinned by key tests and evaluations, training personnel, and operating in the following mission areas:
  - Nonproliferation: Treaty monitoring and compliance technologies
  - Counter-proliferation/counter-terrorism
  - Emergency response: Search and consequence management operations
  - Cyber security
  - Global security autonomous solutions/sensor development and integration: FAA-selected site for unmanned aerial system (UAS) testing
  - Quick response of applied technologies for specialized customers

NNSS conducts Source Physics Experiments (SPE)

- Underground chemical high explosives detonations of various strengths and depths designed to
  - Enhance the nation's monitoring and verification capabilities
  - Develop explosive source prediction capability

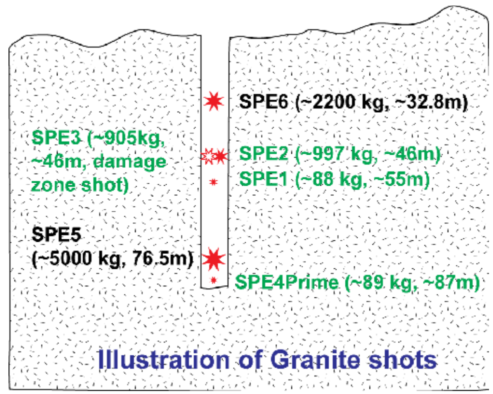
Source Physics Experiments Phase I (*left*) and Phase II (*right*)

Improving arms control and nonproliferation treaty verification

Dry Alluvium Geology (DAG) SPE shots are bigger, deeper and fired in relatively rapid succession

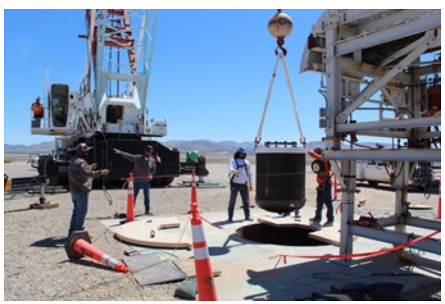
Bigger | Deeper | Faster

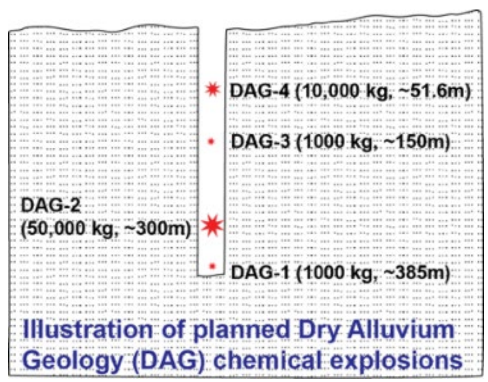
Phase I
SPE



SPE Phase I	
Num. of shots	Time window
6	FY10–FY16

Phase II
DAG





SPE Phase II (DAG)	
Num. of shots	Time window
4	FY17–FY19

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Our technical workforce, though small, is contributing to nationally recognized innovation

R&D 100 Awards

2009 Winner

High-Resolution UV Holography Lens

2012 Winner

Multiplexed Photonic Doppler Velocimeter

2013 Winner

KiloPower (with LANL)

2015 Finalist

Argus Fisheye Velocimetry Probe

2017 Winner

Geometrically Enhanced Photocathodes

2019 Finalist

Falcon Portable Dense Plasma Focus

2020 Winner

X-ray Polarizing Beam Splitter

Technical staff demographics

- Our technical staff contribute to the entire lifecycle of diagnostic development and experiment execution. Early career staff are given opportunities to lead construction, design, development, and fabrication efforts contributing to national security. Integrated experiments foster an environment of teamwork with many technical staff contributing to successful execution.
- PhD candidates are eligible for technical staff and limited term appointments. Job opportunities are listed at nnss.gov.