

# Protecting the Nation's Infrastructure

**INL's Critical Infrastructure Test Range allows for scalable physical and cyber performance testing to be conducted on real-world infrastructure systems.**



## Idaho's Test Range

Every day American lives are at risk to acts of foreign and domestic terrorism. Protecting and defending our homeland is the reason the Idaho National Laboratory works closely with agencies such as the Department of Homeland Security and the Department of Defense to develop, test and validate technologies, systems and policies that protect the nation's infrastructure.

Leveraging the Laboratory's more than 50 years of nuclear research and testing and its associated complex infrastructure, the INL developed a Critical Infrastructure Test Range, where full-scale infrastructure systems can be analyzed and tested under real-world conditions.

Given the increasing interconnections and interdependencies of systems - such as our communications, power distribution and transportation infrastructure - it is essential that we understand their vulnerabilities, so we can correct or compensate for them. By understanding vulnerabilities - from the component level to the system level - we can develop engineered systems and tools that will ensure the survivability of our critical infrastructures when they are challenged by terrorism or natural disasters and aging.

The complexity of the systems that make up our critical infrastructures requires that actual systems be tested. These tests will give us an

understanding of the complex interaction of a real integrated infrastructure. The Critical Infrastructure Test Range provides a capability that complements current efforts to model equipment and systems with numerical simulations. It allows organizations to visualize, analyze, and test their infrastructure systems in a domain that is more realistic than computer simulations, yet safe and secure.

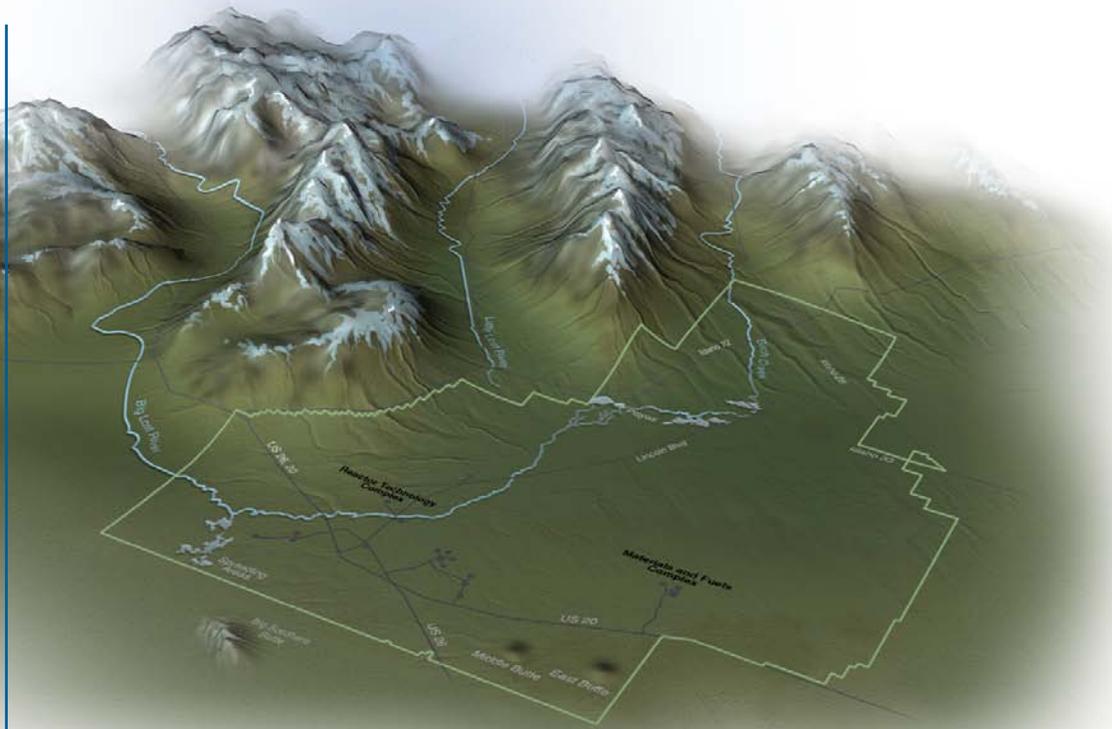
The INL Critical Infrastructure Test Range encompasses a collection specialized test beds and training complexes that create a centralized location where government agencies, utility companies and

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*The Energy of Innovation*



The INL location – 32 miles west of Idaho Falls, Idaho – is remote and secure yet still convenient to airport, interstate and rail. The Site contains six clusters of facilities – similar to six small cities.



*The INL Test Range is a collection of specialized test beds where technologies, systems and policies that protect the nation’s critical infrastructure are developed, tested and validated under real-world conditions.*

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equipment manufacturers can work together to find solutions to many of the nation’s most pressing security issues.

**Expertise**

INL engineers have designed, built and continue to run the complex critical infrastructures supporting operations on the 890-square-mile site – home, over the years, to more than 52 nuclear research and test reactors. The laboratory’s scientific expertise ranges from chemical, biological and nuclear materials detection research and development to control systems, cyber security and wireless connectivity. INL national security products and personnel have been used in response to the terrorist attacks of 9/11, disaster response training exercises during the Olympic Games and during energy industry exercise support. We provide

technical training to National Guard Civil Support Teams. Our employees, with environmental cleanup expertise second to none, understand plume patterns, environmental interactions and containment methods. This diverse and comprehensive professional work force offers customers expertise they need to understand and test complex, integrated infrastructures, vulnerabilities and solutions.

**Natural Attributes**

The INL location – 32 miles west of Idaho Falls, Idaho – is remote and secure yet still convenient to airport, interstate and rail. The Site contains clusters of facilities – similar to several small cities. The remainder of the land is native rolling landscape.

- High desert plain
- 5000’ elevation, arid
- 890 square miles

- Subsurface aquifer
- Relatively flat
- River beds
- -30° to 100 °F
- Grasses, sagebrush, desert vegetation
- 94% undeveloped
- National Environmental Research Park

**Facilities**

INL has operated research and development, manufacturing and waste management programs for more than 50 years, resulting in a complex internal infrastructure containing facilities representative of the nation’s critical infrastructure. Many of these facilities – active and inactive – are available for isolatable tests.

- INL-controlled autonomous research and operational campuses
- 288 buildings
- 569,600 acres

- Power distribution
- Nuclear Reactors
- Material Production
- Chemical processing and treatment
- Waste management
- Analytical and research laboratories
- Inactive coal-fired plant
- Live-fire weapons and test range
- Fire training facility
- Support facilities – fire, medical, emergency response

**Infrastructure Test Beds SCADA/Control System**

INL possesses capabilities and expertise in a number of control system applications. INL researchers perform assessments on systems for the chemical, water and oil and gas industry, as well as other systems that make up the nation’s critical infrastructure.

One type of system is known as a Supervisory Control and Data Acquisition (SCADA) system. This system’s primary function is to operate the nation’s electric power supply. SCADA systems are digital automation devices that perform and relay physical changes in infrastructure systems to technical operators. Originally designed for reliability and efficiency, they are capable of monitoring millions of data points and are at risk to physical or cyber attacks. The U.S. departments of Energy and Homeland Security selected the INL to lead the nation in SCADA and control system vulnerability reduction.

INL’s infrastructure Test Beds combine deployed field-scale

SCADA components with laboratory-installed, industry-provided systems. Engineers have extensive experience in design, development, integration, systemization, testing and demonstration of multiple SCADA and process control systems in real-time use at the laboratory.

Here, control system and cyber experts systematically examine the components of a functioning system and look for inherent vulnerabilities. Industry and government customers can bring their remote terminal units, intelligent electronic devices and programmable logic controllers to the Test Bed and connect them to our full-scale electrical power grid for further testing and tool development.

Additionally, in collaboration with Sandia National Laboratories, INL operates the DOE-sponsored National SCADA Test Bed.

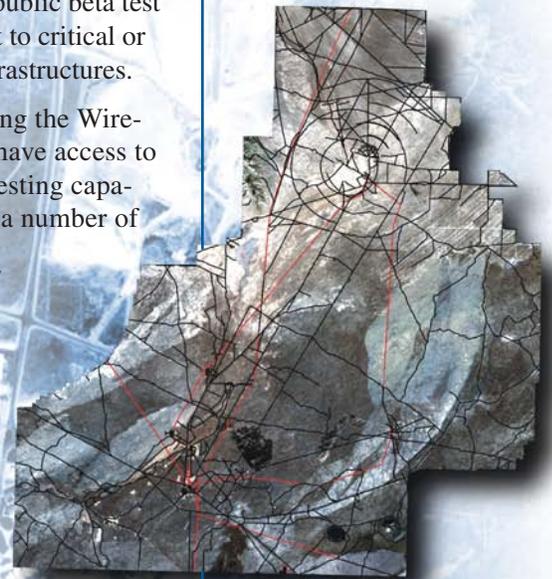
**Telecommunication Test Bed**  
INL offers large-scale, end-to-end testing of 3G/4G cellular, land mobile radios, wireless local area network and

backhaul (microwave, FSO, satellite) systems to industry and government. The laboratory is authorized by the National Telecommunications and Information Administration (NTIA) to operate as an experimental radio station. As a result, INL can test communications systems with a view toward science or technology.

With its cell tower infrastructure, low RF noise, and access to INL’s experienced telecommunications design staff and test engineers, customers can test in an isolated environment without public beta test risks or impact to critical or emergency infrastructures.

Customers using the Wireless Test Bed have access to research and testing capabilities across a number of

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**Idaho National Laboratory’s complex internal infrastructure contains facilities representative of the nation’s critical infrastructure, many of which are available for isolatable tests.**



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TCP/IP, ATM, 802.11, GSM, and modem communication signals. This Test Bed includes 170 miles of fiber – OC-3, OC-12 fiber links over an SONET/ATM backbone, testing capabilities for 2-way radio systems, cell phones and hard-wired systems. Additionally, the test bed includes testing capabilities for intranet systems, intrusion detection, firewall and secure communications.

#### **Powergrid**

INL operates its own electrical power transmission and distribution system, 24/7. The grid, which is linked with state-of-the-art SCADA, communications and cyber testing capabilities, is operated under a full range of climatic conditions (temperature, wind, snow, ice, ozone). We can safely isolate sections of the grid and associated infrastructure to conduct full-scale testing of technology, components, systems and processes.

This functioning power grid consists of 61 miles of 138 kV transmission loop distribution that feeds power to the INL, and allow our expert staff to configure numerous network topologies to meet any customer's needs. Within the loop there are multiple feeders, transformers, and seven

independent substations. These resources allow us to bring testing out of the theoretical, and into the real world.

Our Powergrid Test Bed includes advanced designs of conductors and towers. We have experience in modeling and system planning tools

and monitoring technologies in frequency, voltage, VAR, phasors and line sag. We house transmission lines and towers in excess of 10 miles long, and we provide customers access to a robust group of SCADA and cyber security researchers with backgrounds in multiple operating systems, hardware, configurations and industry sectors. Engineering support for full-scale testing is also available.

#### **Cyber Security**

INL maintains multiple layers of firewalls, intrusion detection systems, hybrid systems and encryption links

**INL offers large-scale, end-to-end testing of 3G/4G cellular, land mobile radios, wireless local area network and backhaul (microwave, FSO, satellite) systems.**



for unclassified network operating centers, classified environments and geographically distributed high-speed scientific networks. INL staff has experience with and access to the latest information on hacker methods and defense techniques and performs vulnerability assessments for other national laboratories, federal agencies, utilities and commercial companies. INL experts are certified in multiple areas under the System Administration Networking

and Security Institute's Global Incident Analysis Center training program.

The INL Cyber Security Test Bed is the only testing facility of its kind located within a national laboratory. It gives customers access to multiple classified and unclassified test facilities and Test Range components, and is capable of providing a customized intrusion detection system, vulnerability assessment and exploit and mitigation development. Employees have working re-

lationships with international security resources.

The INL's Cyber Security Test Bed has the flexibility to replicate any customer's control system specifications. We can use those specifications to run simultaneous attacks on multiple systems, or we can perform individualized full-scale cyber attacks, in a controlled setting, on an exact replica system. The Cyber Security Test Bed is also capable of connecting to any number of related test beds located at the site on our Test Range.

INL cyber security researchers leverage the methods and ideologies that cyber adversaries and hackers possess so we can instruct our customers to protect themselves, their business, and their clients that depend on efficient, reliable, and secure control system and network operation.

**Contraband Detection Test Beds**

**Explosive Detection**

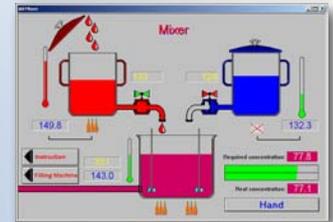
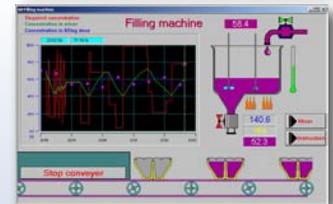
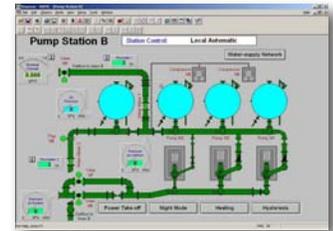
INL scientists, experts in ion mobility and secondary ion mass spectrometry, are conducting research and performing testing on trace explosives detection systems for the Transportation Security Administration, the Federal Aviation Administration and other federal agencies. They perform explosive forensic analysis and develop detection testing standards. INL maintains a Class II, Division I Operations Room for explosives assembly and a BATF-certified magazine for explosives storage.

INL scientists and engineers also have extensive expertise

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**INL operates its own electrical power transmission and distribution system, which is linked with state-of-the-art SCADA, communications and cyber testing capabilities.**



**INL's Cyber Security Test Bed has the flexibility to replicate any customer's control system specifications.**



**INL is conducting research and performing field-testing on remote standoff explosive detection technologies.**

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in bulk explosives detection technologies and are involved in the development and demonstration of the Idaho Explosives Detection System (IEDS) for cargo truck inspections at entry points to Department of Defense facilities. INL is also developing other bulk explosives detection technologies for DHS and DoD customers.

#### **Active Interrogation Research and Test Facilities**

INL is conducting research, development and testing of active interrogation technologies focused on the detection of weapons of mass destruction including nuclear materials, chemicals and explosives. Facilities support field-testing of laboratory-developed technologies including digital radiography, neutron-based non-destructive analysis and linear accelerators. INL maintains a controlled test environment for large-scale

staging and demonstration of active interrogation technologies including a cargo container inspection mockup. The facilities allow for rapid reconfiguration for broad contraband detection research in low-to-medium-energy nuclear science using accelerator-produced radiation.

Our scientists are experts in radiography, tomography and nuclear techniques for non-destructive assay.

In collaboration with Idaho State University, INL scientists conduct research at the Idaho Accelerator Center, located in Pocatello, Idaho. In its three large facilities, the IAC maintains 10 operating accelerators including 20-MeV LINAC, 25 MeV LINAC, 30-MeV Short Pulsed LINAC, ISIS 3.5 MeV 15kA pulse accelerator, 18 MeV LINAC, 2 MeV Positive Ion Van de Graaff, North Star 1.2MeV DC electron/proton accelerator and D/T Neutron Generator.

#### **Biotechnology Center**

INL conducts real-time detection quantification of pathogens in wildlife and the environment.

Laboratory scientists have supported state of Idaho and regional surveillance for *Bacillus anthracis* spores and have developed human antibody profiling for forensic applications. The Biotechnology Center includes BSL-1 and-2 laboratories, environmental chambers, pilot-scale bioprocess high-bay, modular Class 100 clean room, open and classified greenhouse space, walk-in incubators and cold rooms, flow hoods, biosafety cabinets and autoclaves. Instrumentation includes gas, ion, liquid chromatographs; spectrophotometers; mass spectrometers; electron microscopes; high throughput DNA sequences; robotic DNA workstation, microarray facility, multiple real-time PCR instrument platforms, distributed bioinformatics network, and X-ray fluorescence spectrometer.

#### **Physical Security Test Beds**

##### **Unmanned Aerial Vehicles/ Unmanned Ground Vehicles**

With its access-controlled boundary, high-desert terrain and sparse population, INL is in a unique position to offer unmanned aerial vehicle and unmanned ground vehicle collaborative operational testing and demonstration.

INL's UAV program focuses on unique applications and missions for a wide variety of customers looking for affordable, field-deployable airframe technologies with meaningful payload and endurance.



**INL maintains a controlled test environment for large-scale staging and demonstration including a cargo container inspection mockup.**



**Laboratory scientists have supported state of Idaho and regional surveillance for *Bacillus anthracis* spores and have developed human antibody profiling for forensic applications.**

The INL UAV program includes small, hand-launched systems, unmanned rotorcraft and larger UAV craft. The larger craft weigh approximately 55 pounds and can carry up to 20 pounds. A larger payload, combined with longer flight times, enables these aircraft to perform more complex and beneficial missions. INL pos-

sesses numerous UAV payload packages and ground-control-supported equipment.

The laboratory maintains a dedicated UAV 1000' x 100' airfield and tactical support facility.

INL's UAV team continues to demonstrate firsts in its efforts to increase performance, usability and productivity, and

to manage risk. INL UAV personnel have demonstrated their operations expertise by simultaneously flying five, small UAVs autonomously in the same confined airspace. INL integrated the rapid development of a durable, affordable, composite endurance autonomous UAV with customized sensor capabilities for client requirements.

**Live Fire Test Range**

The complex consists of eight indoor and outdoor ranges, and tactical training facilities located on 330 acres of isolated, desert-type terrain. The facilities support research and development testing and training and testing of handguns, rifles and heavy weapons such as machine guns, precision rifles, grenade launchers and shoulder-fired, anti-armor weapons. Explosive training and testing, including breaching, is also conducted.

*INL is conducting research, development and testing of active interrogation technologies focused on the detection of weapons of mass destruction*

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 National Laboratory**



**INL is in a unique position to offer unmanned aerial vehicle and unmanned ground vehicle operational testing and demonstration.**

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**Incident Response Training and Exercise Center**

INL's site is representative of U.S. critical infrastructure with power distribution, transportation (road and rail), communication (wired and wireless) and urban and rural terrains. We provide radiological training for WMD incident response field exercises and we are approved for chem/bio simulants and radiological sources for realistic, scenario-based training. This training is supported by onsite fire department, hazmat emergency response, medical, physical security and craft support.

**Material Protection Control and Accountability Interactive Evaluation and Training Center**

INL serves as the U.S. Department of Energy lead laboratory for nuclear energy and fuel cycle technologies. As such, the laboratory is steward to an impressive host of nuclear energy and

fuel cycle operations and expertise, including two operating nuclear reactors, fuel processing facilities, fuel and nuclear materials storage, operating hot cell facilities, and a variety of irradiated and unirradiated nuclear materials.

Since 1994, INL has used this first-hand experience to provide instructional and hands-on nuclear material protection, control and accountability and emergency management training to personnel responsible for security at commercial nuclear reactors, research reactors

and facilities worldwide.

Beginning in 1997, this training has been conducted at the Material Protection, Control and Accountability (MPC&A) Interactive Evaluation and Training Center located within the Materials and Fuels Complex on the INL. The training is provided in conjunction with an operating environment, allowing students to learn standardized techniques and approaches to safeguards and security employed within the DOE complex, in a real-world environment.

**Conclusion**

With our vast pool of experienced experts, technologies and full-scale testing capabilities to draw on, the Idaho National Laboratory's Critical Infrastructure Test Range provides customers with real-life solutions to some of the nation's most significant security concerns.



**The Live Fire Range Complex supports research and development, and training and testing of handguns, rifles and heavy weapons.**