



## Wireless Test Bed

*Premier open-air testing capabilities supported by leading wireless professionals*

**M**odern society relies on wireless systems, technology and infrastructure to facilitate communications and transfer of information between consumers and businesses. This critical network requires seamless coordination of operators, computers, towers, sensors and spectrum working together.

Wireless technologies, protocols and regulations have continued to evolve (even transform), and the United States and our allies have become more reliant upon these mobile services. The forces of freedom require space and infrastructure to validate and test systems at scale to ensure they are safe, secure and operate as designed.

Idaho National Laboratory offers one of our nation's premier wireless test beds

accessible to academia, industry and government organizations. Situated on 890 square miles of isolated federal land in Southeastern Idaho, the INL Site provides a test bed to test and demonstrate full-scale wireless systems and equipment with a range of congested and contested environments.

This large-scale, open-air controlled range includes full-scale communications networks, a low radio frequency noise floor and spectrum use authorization to support rich communications experimentation. INL has industry-experienced technical professionals who design, build and operate "real-world" networks for realistic testing and evaluation. This includes dynamic customization of network parameters to ensure operationally relevant testing.

### WIRELESS CAPABILITIES

Situated in a natural caldera, INL's wireless test bed is buffered from outside radio frequency sources. This allows our engineers to test devices and hardware ranging from high frequency, ultrahigh frequency, cellular, satellite, microwave, and everything in between.

We offer end-to-end wireless networks spanning cellular, Wi-Fi, Bluetooth, Digital Mobile Radio and high frequency systems, as well as telecommunications transport infrastructure leveraging microwave, satellite, copper and optical fiber mediums.

Our cellular network capabilities include the following Tier 1, carrier-grade cellular networks: 5G Standalone and Non-Standalone, 4G Long Term Evolution, 3G Universal Mobile Telecommunications

*INL's Wireless Test Bed employs fixed and mobile towers spread across 890 square miles of federally-owned property.*



System and 2G Global System for Mobile Communications. We also have the ability to monitor and record cellular interfaces during test events.

The INL site has limited urban or military communication congestion which enables more sensitive radio frequency reception. Typical noise threshold at the INL site is less than -120 decibel milliwatts over 10 kilohertz resolution bandwidth.

Additionally, our National Telecommunications and Information Administration experimental radio station status allows testing on most frequencies and offers a range of measured spectrum.

We provide users with rapid experimentation approval within weeks and offer maximum power, frequency test options and remote spectrum monitoring.

#### **WIRELESS EXPERTISE**

Equipment and capabilities are only part of the story. Wireless test bed users benefit from access to engineers with expertise in cellular, wireless, telecommunications and internet protocol system design, implementation, testing and evaluation.

Our researchers have diverse military experience, as well as leading industry experience in design, installation,



maintenance and operations of next-generation wireless communication systems from leading wireless companies such as AT&T, Verizon, Qualcomm, T-Mobile, Nokia, Boeing, Motorola, and others.

#### **CURRENT PROGRAMS**

As wireless communication systems expand, usage will increase, and available bandwidth will limit the amount and speed of data available. INL's researchers are working on ideas to increase network efficiency, improve security, make more effective use of available bandwidth, and give users more options.

The laboratory's scientists are working in areas such as machine learning, advanced wireless spectrum security, multiband system and dynamic spectrum sharing that could increase efficiency and security within the wireless spectrum by improving how bandwidth

is utilized, blocked, or manipulated.

As wireless devices, sensors and communications systems become integrated into privately owned critical infrastructure systems, the laboratory is studying, modeling and performing full-scale, integrated testing to illustrate the impacts of wireless failures.

As an internationally recognized authority in control systems cybersecurity, INL researchers use the testing environment to mimic and analyze deployed systems. Vulnerabilities, consequences and solutions can be created, explored and tested in a full-scale, open-air environment. This data can also be incorporated into training or used to develop science-based policy that prevents cascading failures across multiple infrastructures.

#### **FOR MORE INFORMATION**

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#### **WIRELESS TEST BED QUICK FACTS**

1. Began operations in 2003
2. Can conduct simultaneous tests with nearly 300 participants
3. Can be reconfigured to resemble the wireless environment of a large urban metropolis or a remote village
4. Regularly hosts large federal exercises and demonstrations
5. The laboratory is investing in next-generation infrastructure including 5G and beyond
6. The test bed is part of INL's Wireless Security Institute