



INL's Wireless Test Bed encompassed fix and mobile towers spread across 890 square miles of federally owned property.



Changing the World's Energy Future



Wireless Test Bed

Modern society relies on wireless systems, technology and infrastructure to facilitate communication, transfer information and speed data between consumers and businesses. This critical network requires a vast array of operators, computers, towers, sensors and spectrum all working together seamless.

As new wireless technology, protocols and regulations are introduced, and as society becomes further reliant on mobile services, a national need exists to validate and test systems at scale to ensure they are safe, secure and operate as designed.

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



accessible to academia, industry, and government organizations. Situated on 890 square miles of isolated federal land at the INL Site, the test bed offers the ability to test and demonstrate full-scale wireless systems and equipment with a range of controlled interference noise levels including terrestrial, subterranean and airborne. Users can demonstrate new and emerging wireless technologies and develop and train to tactics,

techniques, and procedures in an environment with configurations at real frequency and power levels.

Wireless capabilities

Situated in a naturally occurring caldera landscape, INL's wireless test bed is naturally shielded from outside radio frequency sources. This allows our engineers to test devices and hardware ranging from high frequency (HF), ultrahigh frequency (UHF), cellular, satellite, microwave, and everything in between.

Our capabilities include Long Term Evolution (LTE), Universal Mobile Telecommunications System (UMTS) and Global System for Mobile Communications (GSM) Tier 1 carrier grade networks.

We offer end-to-end second- and third-generation LTE and Code Division Multiple Access (CDMA) cellular networks with fixed and mobile towers, stand-alone WIMAX (mobile and fixed), Wi-Fi, Zigbee, and Bluetooth networks as well as miles of microwave and optical fiber backhaul.

Idaho's isolated, high-desert landscape provides an ideal location for open-air experimentation with wireless technology. Our low radio frequency noise floor exists in an environment with very limited urban or military communication congestion, typically providing greater than 120 decibel milliwatts over 10 kilohertz resolution bandwidth.

Additionally, our National Telecommunications and Information Administration (NTIA) experimental radio station status allows us to test on any frequency, and our range offers measured spectrum between 31 hertz and 10 gigahertz.

With a local spectrum manager located on-site, we provide users with rapid experimentation approval generally within one to four weeks. And we can offer maximum power, frequency test options, and remote spectrum monitoring on a case-by-case basis.

Wireless expertise

Equipment and capabilities are only part of the story at INL's wireless test bed. Users also have access to dozens of communication engineers with expertise in cellular, wireless and internet protocol design, implementation, programming and operations. Our researchers have real-world industry experience in design, installation, maintenance and operations of next-generation wireless communication systems from organizations including AT&T, Verizon, T-Mobile, Nokia, Lockheed Martin, Boeing, Motorola, Hughes, L-3 Communications, Nextel, Radix, and Edgerton, Germeshausen, and Grier.

Emerging research

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

The laboratory's experienced scientists are working in areas such as machine learning, advanced wireless spectrum security, multiband system and



dynamic spectrum sharing that could lead to more 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 on industrial processes.

As an internationally recognized authority in control systems cybersecurity, our researchers use the testing environment to mimic real deployed systems and provide analysis. 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 support the development of science-based policy that prevents cascading failures across multiple infrastructures.

For more information

General contact

Lynda Brighton

Program Manager

208-526-3908

linda.brighton@inl.gov

Scott Peterson

Test Bed Director

208-526-2783

scott.peterson@inl.gov

www.inl.gov

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Quick facts

1. INL's wireless test bed began operations in 2003
2. The test bed can conduct up to five simultaneous tests with nearly 300 participants
3. The test bed can be easily reconfigured to resemble the wireless environment of a large urban metropolis or a remote, rural village
4. The wireless test bed regularly hosts large federal exercises and demonstrations
5. The laboratory is investing in next-generation infrastructure including 5G capabilities
6. The wireless test bed is one part of INL's newly established Wireless Security Institute