



*The Future  
is Now*

## Next Generation Wireless Test Bed

*Large-scale, independent, end to end testing of next generation communication infrastructure, including 3G/4G cellular, LMR and Wireless LAN systems.*

Idaho National Engineering and Environmental Laboratory



The next generation of wireless communication technology, including 3rd and 4th generation (3G/4G) cell phone systems, is on the horizon. These new systems will use emerging wireless cell technologies for both voice and data, increasing hand set band width from less than 14Kb/s to 2Mb/s. This increased band width could provide mobile “broadband” access to Internet, streaming video

functions on cell phones, and other futuristic hand held or mobile devices. The rollout of 3G/4G networks will involve deploying new technologies at every level: new handsets, frequencies, and antenna arrays; new cell configurations that are optimized for both data and voice coverage; massive upgrade of cell controllers’ “land-line” phone links from low band width connections to higher capacity fiber,

digital microwave, or freespace optics; and integration of voice switching and Internet network protocols (VoIP, SIP, Web Phones). Use of shorter range Wireless LANs is growing rapidly. Even land mobile radio (LMR) and emergency communications systems are shifting from proprietary systems to open software radios, cell-like protocols, and data rich technologies.

**INEEL and its cooperative partners are performing integrated testing of next generation wireless communications systems, including 3rd and 4th generation (3G/4G) cell phone systems and WLANs.**

3G/4G systems are expected to greatly transform our nation's communications infrastructure and the types of services it provides. There is no single source for all the telecom equipment needed for these technological upgrades, and no one entity is providing end-to-end testing or independent validation. The reasons are numerous and include rapidly changing technology, the lack of a single national or international transmission standard (TDMA, GSM, GPRS, EDGE, UMTS vs. CDMA One, CDMA 20001x-EV, EV-DO/DV, 3x, flash-OFDM™ with Bluetooth, 802.11 Wi-Fi, 802.16 MAN... at 800, 900, 1800, 1900, 2100 MHz or 2.4, 5 GHz), problems getting FCC frequency bands, finding geographically isolated and low-noise radio frequency (RF) test areas, and controlled access to isolated high-speed networks.

**INEEL has the Existing Infrastructure and Engineering Disciplines to Support a Premier Wireless Test Bed.**

As a large federal reservation and multi-program laboratory spanning an immense area, INEEL can provide all these capabilities in one isolated location. INEEL maintains independent status as a government laboratory and has over 50 years experience with independent validation and verification for military, Nuclear Regulatory Commission, and other government and commercial customers. This cooperative effort built a large-scale, end-to-end, Wireless Test Bed for independent testing of the next generation communications infrastructure. The INEEL provides vast physical infrastructure including large open geographical areas, RF experimental station status, isolated power grids, and access to existing high-speed data communications links and switchgear. INEEL can also support all aspects of designing, simulating, formal testing, and analyzing test results as well as supporting the test bed infrastructure. The INEEL is working with NCS, DTRA, DoD, Homeland Security and other government agencies to define their testing needs for interoperability, standards verification, priority access signaling, and other critical infrastructure concerns. This cooperative effort provides wireless carriers, vendors, and government agencies with *"one stop shopping" for an integrated test environment.*

**INEEL's Unique Advantages**

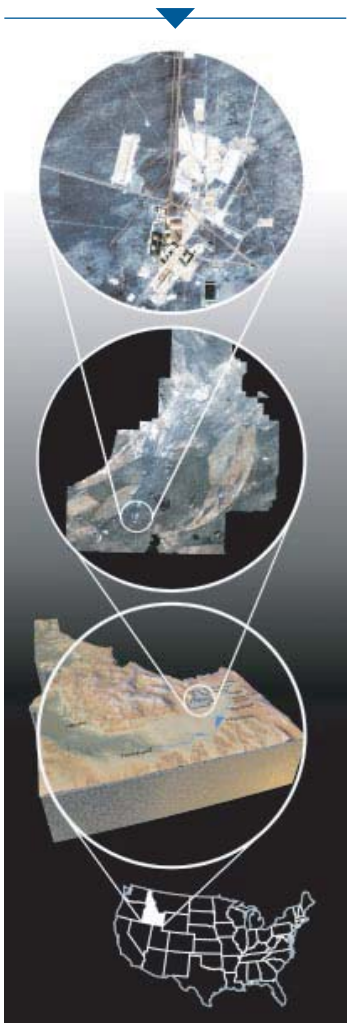
INEEL is a science-based, applied engineering national laboratory dedicated to meeting national environmental, energy, nuclear technology and national security needs. Bechtel BWXT Idaho, LLC, operates INEEL with the Inland Northwest Research Alliance of eight prominent universities. INEEL is one of the Department of Energy's nine multiprogram national laboratories. Head quartered in Idaho Falls, Idaho, the lab covers 890 square miles, an area roughly 85 percent the size of Rhode Island. It employs 6,000 people, with some 2,700 scientific, engineering and professional experts. As the only "engineering" focused national laboratory, INEEL has several unique capabilities to offer.

**Isolated Test Labs**

INEEL has several isolated networking and shielded RF labs where equipment can be mocked up, without impact to existing networks before building final test configurations. Test results can be protected from premature release, unlike public "beta tests."



*INEEL's facility complexes contain many of the critical infrastructure systems that are representative of those important to the operation of our country.*



## Isolated Power Grid

INEEL manages its own 50 MW power grid, including facilities and distribution systems that are currently in stand by, providing the perfect testing ground for new power line-based communications systems. The grid includes 61 miles of electrical transmission lines in a dual loop configuration.

## The Wireless Test Bed is an integral component of the INEEL Critical Infrastructure Test Range.

## LMR/Emergency Communications

Communications staff design and operate a state-of-the-art LMR and emergency response system that integrates radio, voice, text, and data using IP technologies and cell protocols. INEEL owns two major mountain-top transmission facilities and its own Class 5 SS7 switchgear.

## Supercomputing & Simulation

INEEL has parallel cluster and supercomputing capabilities that can be used in both simulation and visualization of analytical data. Vizlab personnel are also experienced in analyzing network traffic protocols for distributed computing clusters, high-speed net-working, next-

generation video streaming algorithms, and data security projects.

## Computer & Network Security Operations

INEEL's Computer Security Operations maintains a series of data firewalls, virtual private networks and multiple intrusion detection systems with personnel who have access and experience with the latest information on hacker methods and defense techniques.

## Test Frequencies & Geographic Isolation

As a National Telecommunications Information Administration certified experimental station, INEEL can test communications systems with a view towards science or technology. INEEL has 890 square miles of largely unpopulated areas with INEEL controlled use of radio frequencies, 1,110 miles of paved and dirt roads, and 14 miles of railroad tracks. A trained security force defends the site's perimeter from unauthorized access 24 hours a day.

## High-Speed Networks

INEEL manages its own OC-3 and OC-12 fiber links over a 170-mile-SONET/ATM backbone, including loops that can be isolated from other INEEL traffic, with individual hops up to 70 miles long. Future upgrades to INEEL's networks include the use of new Dense Wavelength Division Multiplexing

technology that sends multiple wavelengths through the fiber to increase capacity and isolate different data services.

## Information Protection & Security Research

In cooperation with Computer Security Operations, Information Protection and Security Research personnel are developing new distributed intrusion detection systems that improve the recognition of security attacks and forward critical alarms to centralized network operations centers. There is ongoing research into survivable systems, cooperative agents, digital

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signatures, and secure communications protocols for both Department of Defense and Department of Energy customers. Through the Information Security & Reliable Computing Alliance, INEEL researchers cooperate with regional universities, including two that are certified by the National Security Agency as Centers of Excellence in Information Assurance Education.

### **Secure Wireless LAN Trials**

INEEL's enterprise networks group is involved with trials of new authentication, VPN, and encryption layers to protect WiFi (802.11) systems connected to corporate networks.

### **Smart Antennas and Multipath**

INEEL researchers are investigating the use of smart antennas to improve data bandwidth, limit

unwanted signal propagation, and to utilize multipath signals for functional enhancements.

### **Independent Validation & Verification**

Large communications service providers seek vendor independent evaluations, especially in the areas of emerging technologies. In wireless systems, there is presently no single national transmission standard or clearcut technology choice. Government standards bodies and security agencies seek proof that critical wireless infrastructures are robust, reliable and secure. INEEL has an independent status as a national lab and broad historical experience with Independent Validation and Verification for the military, Nuclear Regulatory Commission, and other commercial customers. As such, the "best of breed" combination for each network element can be determined and recommended to customers for approval.

## **Personnel Resources**

INEEL has a broad base of technical personnel who can directly work on all aspects of a large integrated system independent test activities, engineering design, and scientific analysis. Many hold security clearances to support sensitive and classified government work.

### **For more information:**

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