

Science.

Technology.

Innovation.

Radio Frequency Tags:

- Passive
- Battery-Assisted Passive
- Fully Active

Applications:

- Lost Item Recovery
- System Sensing and Activation
- Inventory and Operation Control
- Security Monitoring and Tracking
- High Value Asset Management
- End-to-End Supply Chain Tracking
- Security and Safety Management
- Rapid Inventory Management

One Call Does It All

Pacific Northwest National Laboratory currently is seeking government, industry, and private research partners for further systems applications development of passive, battery-assisted passive and fully active RF tags. For information, call 1-888-375-PNNL or visit our web site at: www.pnl.gov

Pacific Northwest National Laboratory

Operated by Battelle for the U.S. Department of Energy



Sense It Wirelessly

Advanced Radio Frequency Tags Technology at Your Fingertips

Managing It All with RF Tags

Advances in RF tag technology enables government and industrial clients to adopt this technology for a broad spectrum of tagging, tracking, locating, monitoring, and controlling applications. High-value item inventory and tracking, environmental monitoring, and system performance analysis are a few of the ways RF tags are being used. Pacific Northwest National Laboratory's contributions have resulted in size reductions, cost reductions, and improved performance by advancing antenna and electronic design. The potential applications are endless—enabling clients to realize significant cost savings.

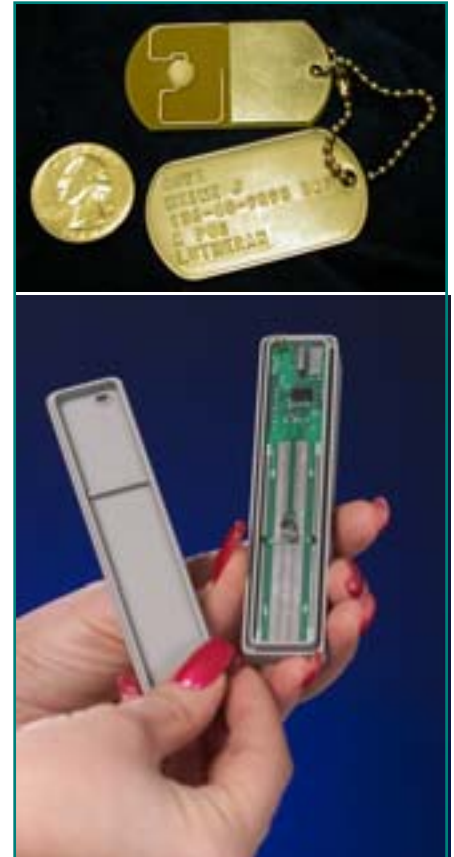
Small & Mighty . . . Passive Tags Packing Powerful Benefits

PNNL's miniature passive tags, used to track the location of everything from large shipping containers and rail cars to clothing, provides an inexpensive method of tracking vital commodities. Laboratory scientists have modified commercially available tags that use a tiny microchip with micro-antennae to store information about an item. The tag, which has no battery, is attached to an item and then can be read by a reader and special software.

PNNL's tags effectively allow a variety of new functions, including enhanced read-and-write range. Multiple tags can be located in a radio frequency field. The user reads tags with an interrogator—without even opening a container or box—making them ideal for military warehouses or industry manufacturing facilities.

These tags also are great for high-priority, high-security items, such as ammunition and weaponry, night vision goggles, or clothing. The features include

- Miniaturized size
- Small read-and-write memory
- Multiple tag interrogation capability
- Passive operation, no battery
- Range—up to 5 meters
- Least expensive tag.



Researchers at the Pacific Northwest National Laboratory are developing miniature radio frequency tags—from passive to fully active—that are ideal for tracking, inventorying, and monitoring a variety of items.

Long-Range, Battery-Assisted Passive RF Tags

The addition of a very small battery gives PNNL's battery-assisted passive tags over a 100-meter read-or-write range. The battery-assisted passive RF tags allow inventoried items to be enabled or disabled. The user scans items, singles out the desired tag, and then writes a command to the tag, disabling or activating the equipment. Another application involves the use of the tag to sense whether a switch is opened or closed.

The military, for instance, could install the tags on night vision goggles, which are expensive items that could be misplaced. To find their location, Army personnel could fly over a camp in a helicopter and identify tags using an interrogator over 100 meters away. Hand-held interrogators also can be used to identify and write to tagged items. Other added features include

- Ability to monitor external inputs, such as temperature, pressure, chemicals, and tamper detectors
- Unlicensed FCC operation
- Long battery life.

These tags are ideal for tracking items that could be lost or stolen and perishable food or medicines that have to be transported from one location to another. A user could activate or deactivate items by monitoring the input and controlling the output with the battery-assisted passive tags, making them ideal for alarms, military ammunition, thermostats in buildings or homes, or blood plasma.



RF Tag Digital Electronics Board

RF Tag Performance

Passive Tags

- Short range – less than 5 meters
- Low cost
- Simple.

Battery-Assisted Passive Tags

- Range – 10 to 100 meters
- Input monitoring and output control
- Long battery life.

Active Tags

- Range – more than 150 meters
- Multiple sensor input suite
- Sensor networking—peer-to-peer
- Microcontroller/neural network decision-making capability
- Long battery life.

Currently, our battery-assisted passive RF tags are monitoring smolt-eating habits of pelicans as the smolt pass through the Columbia River dams. In addition, the same technology is being tested for monitoring wildlife habitat near environmental cleanup areas. This work is part of a project funded by the Army Corps of Engineers.

A Powerful Tool . . . RF Tags as Fully Active Transmitters

Imagine the power of locating items miles away or monitoring the temperature, humidity, pressure, and breakage of complete military weaponry systems, from the engines found on planes, tanks, and naval ships to the weapons systems they carry. Using existing cordless and cell phone technology, PNNL is developing complete systems that include predictive sensors, RF tags, and transmitters that “transmit” data.

Predictive sensors can be engineered for use by the armed forces to monitor the health and integrity of an entire weapons system—including individual components (bearings or wiring), fuels and lubricants, engines, and the structure that houses the weapons system itself. With these chemical and physical sensors, the Army, Navy, and Air Force could assess the operability and functionality of equipment on a real-time basis.

A network of predictive sensors and RF tags located throughout a weapons system would regularly collect and evaluate data that would support “real-time” decisions in the field by an operator. Also, collected information could be transmitted to a remote site for command and control functions or in support of maintenance and repair activities, which would include automated logistics support.

The RF tags would be embedded in the system and play a vital role in inventory tracking and monitoring of these high-valued items. They even can be used on rocket motors and rocket propellant to ensure the functionality and operability of the “readiness of munitions.”

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