INEEL RESEARCH CENTER

Researchers at the INEEL Research Center (IRC) conduct fundamental and applied research and development (R&D) in science and engineering areas crucial to U.S. Department of Energy national missions: science and technology, environmental quality, energy resources and national security. This research underpins the leadership and technical infrastructure for the subsurface science initiative, supports Department of Energy Environmental Management, Office of Science, and other programs, provides applied science support to INEEL Operations organizations and finds science-based solutions to challenging technical problems.

The IRC facility supports R&D for government agencies, private companies, universities and non-profit organizations. Since 1995, 12 IRC research projects have won the prestigious R&D 100 Award. This competition, sponsored by *R&D Magazine*, recognizes the 100 most significant new technologies each year. This year, two INEEL technologies earned prestigious Department of Energy awards.

INEEL biologist Frank Roberto is one of many INEEL scientists working on biotechnologies to speed environmental cleanup, harness biological processes to make new products and continue basic science research into living organisms and life processes.

INEEL's **lithium battery solid electrolyte** topped a list of over 100 technologies nominated by the DOE laboratories. Chemists Mason Harrup, Joe Delmastro, Alan Wertsching, Frederick Stewart, Eric Peterson and Thomas Luther received the top Energy@23 and Bright Light Awards for a novel battery electrolyte. The INEEL solid electrolyte is a clear, non-toxic flexible membrane made from mixing a liquid polymer and a ceramic powder that promises safer, more versatile and longer-lasting rechargeable batteries.

Also winning in the Energy@23 category were researchers Kevin McHugh and Bruce Wickham for **Rapid Solidification Process (RSP) Tooling™**. The process uses a high-velocity inert gas to spray molten metal onto a pattern—creating a near net-shape mold in a few minutes that can then be used to make other tools.

"I'm extremely proud of the work of these two teams and the positive attention they have brought to this laboratory," said Laboratory Director Bill Shipp.

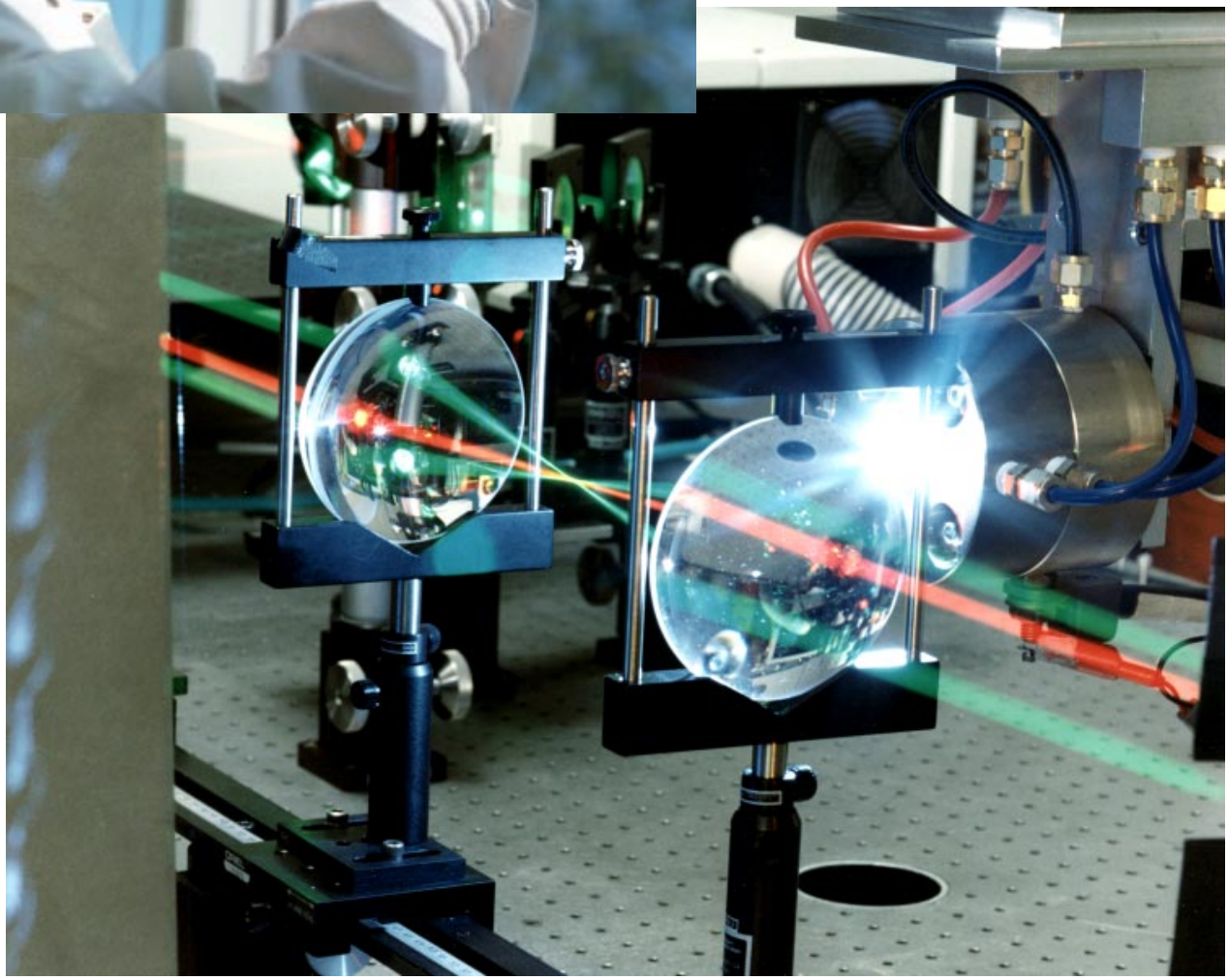
"We're pleased that the DOE has recognized the value of the research at our Lab."

INEEL research takes place in these disciplines:

- **Subsurface Science and Environmental Engineering** – Researchers are working to understand the complex interactions of the subsurface—soils, microbial populations, fluid flow, contaminants, temperature and pressure—to develop improved environmental remediation technologies. The INEEL emphasis is on middle-scale and field-scale experiments that help scientists predict how contaminants move in the subsurface. This year, the INEEL received DOE's approval to pursue conceptual design on a new Subsurface Geosciences Laboratory that will be the central location for the laboratory's coordinated research in subsurface science. The facility will be located in Idaho Falls.
- **Biotechnology** - Researchers are harnessing nature's diverse populations of microbes to solve environmental problems and to improve industrial competitiveness. For example, researchers are using naturally occurring microbes to break down soil contaminants in place, and are using microbial byproducts to etch contamination off the surface of concrete in DOE buildings. By understanding the natural metabolic activity of microbes, researchers are able to improve ore recovery in mining operations and investigate the feasibility of tapping pockets of biogenic methane for energy.
- **Physical Systems Modeling** – Researchers are creating physical, mathematical and computer models to learn more about the world around us—and how to better predict complex behavior such as the effects of contaminant flow in the subsurface, or the long-term impact of Department of Energy operations or other development along a river.
- **Systems Engineering** – Researchers are addressing

This hand-held device can give instant, accurate gamma and neutron radiation measurements to workers in the field, increasing personal safety in the nuclear industry. INEEL scientist Rahmat Aryaeinejad invented the device, which garnered an R&D 100 award as one of the 100 most important technological inventions in the year 2000.

traditional problems such as improving the efficiency of industrial processes and are using the principles of systems engineering to create decision support tools. For example, managers of watersheds can use systems engineering to help them balance the needs of heavy industry, the public, fishermen, and wildlife to



Science, technology and safety go hand in hand at INEEL. Above, a scientist wears gloves and safety glasses routinely as a work precaution. Below, red and green laser beams cross paths in a research experiment.

evaluate different options for protecting rivers and streams and controlling pollutant loads.

- **Intelligent Automation and Remote Systems** – Researchers are developing robotics to do the kinds of work humans can't—working in high radiation, confined spaces, and other hazardous environments. One emphasis is on multiple robotic devices that can communicate with each other remotely.
- **Applied Engineering –** INEEL researchers are applying engineering principles to address national problems such as the country's aging infrastructure of roads, buildings, and bridges. Through better building design and maintenance and the development of new battery systems, the longevity and energy efficiency of structures can be improved. Also, metal components are being artificially aged and analyzed to determine the actual lifetime of certain structures such as bridges or pipes.
- **Nuclear Science –** Nuclear scientists and engineers are putting 50 years of nuclear reactor development to work on new problems, ranging from national security issues to radiation protection. Using nuclear expertise, they are developing tools to identify the contents of old, potentially explosive munitions and unmarked gas cylinders, and are developing medical treatment therapies that exploit novel nuclear isotopes. They are also pursuing a new generation of nuclear reactors that will be more proliferation resistant, safer, create less waste, and will be able to compete economically with natural gas.
- **Materials Processing –** New and improved materials and processes are needed for a variety of applications ranging from stronger tank armor to hardier nuclear reactor coolants to faster methods of manufacturing. INEEL researchers combine science and engineering to find new ways to join different materials, such as metal and ceramics, to develop and characterize stronger metals through thermal plasma processing and physical simulation, and to speed up the time from prototype to mass production of products for industry.
- **Chemical Separations and Processing** – INEEL chemists and engineers are working to solve chemical separations and processing problems, such as removing contaminants from water supplies, or reducing the volume of liquid hazardous waste. Using novel polymers, they are developing more durable membranes for chemical separations. They are also experimenting with environmentally friendly catalysts that can replace current noxious chemicals, and are developing new processing methods that minimize waste generation.
- **Sensing and Diagnostics –** INEEL engineers use optics and lasers to address real-time manufacturing quality control problems, such as material imperfections, and temperature variation during production. Using lasers and ultrasound, researchers are designing new nondestructive evaluation techniques to test the integrity of buried waste containers and the long-term effects of radiation on nuclear reactor components. INEEL microbiologists are also developing biosensors for environmental applications such as the cleanup of subsurface and river contamination from industrial, nuclear, and mining activities.

Resources

The IRC houses more than 350 researchers working in 66 different laboratories. The complex, located on a 35-acre site in Idaho Falls, was built between 1982 and 1984 to

The INEEL Research Center is one of several INEEL facilities located in Idaho Falls, the home base of INEEL's multi-faceted operations. Scores of research and development projects are carried out at this modern facility.

consolidate research activities previously located at various sites at the INEEL. A major future initiative of the INEEL is to secure or build additional laboratory space to support the burgeoning R&D work of both the Laboratory and the region.

Facilities

Seven facilities make up the IRC:

- A single-story structure (IF-601) includes offices and light laboratories with low power requirements.
- A three-story office building (IF-602) houses IRC technical and support personnel. A small amount of space is used for light laboratories, including equipment used to monitor seismic activity in southeast Idaho.
- The Laboratory Building (IF-603) is the primary laboratory facility in the IRC complex, and also contains office space and mechanical support areas.

Of 58 laboratories in IF-603, the 20 on the east corridor are wet-laboratory modules. They contain fume hoods, sinks and other equipment, and house such activities as chemical analysis, materials research, geochemistry, biotechnology and other small-scale projects.

Another 20 modules on the west corridor are for heavy-duty experiments with larger power requirements. Included are laboratories for welding research, instrumentation and engineering development, ceramics research, thermal fluids experiments, lasers and electric vehicle testing.

The remaining 18 general-purpose modules on the central corridor are for electronics design, optics, lasers or materials testing,

and nondestructive examination research and development.

A biotechnology laboratory/ greenhouse addition on the east side is designed for research with microorganisms. The building is capable of supporting all types of work; listed below are some current projects and some from the recent past.

- The Energy Storage Technology Laboratory (IF-605) contains experimental electric vehicles, components and batteries.
- The Systems Analysis Facility (IF-627 and IF-611) houses classified projects, including some light electronics work.
- The Physics Building (IF-638) contains office space, a computer laboratory and a heavy-duty magnet laboratory.
- The INEEL Engineering Demonstration Facility (IF-657) houses several prototypical-scale research and development projects that support programs in military munitions assay, advanced sensor systems, environmental restoration, subsurface investigation, and materials science.

Media Contact:

John Walsh

Idaho National Engineering and Environmental Laboratory

(208) 526-8646

jhw@inel.gov