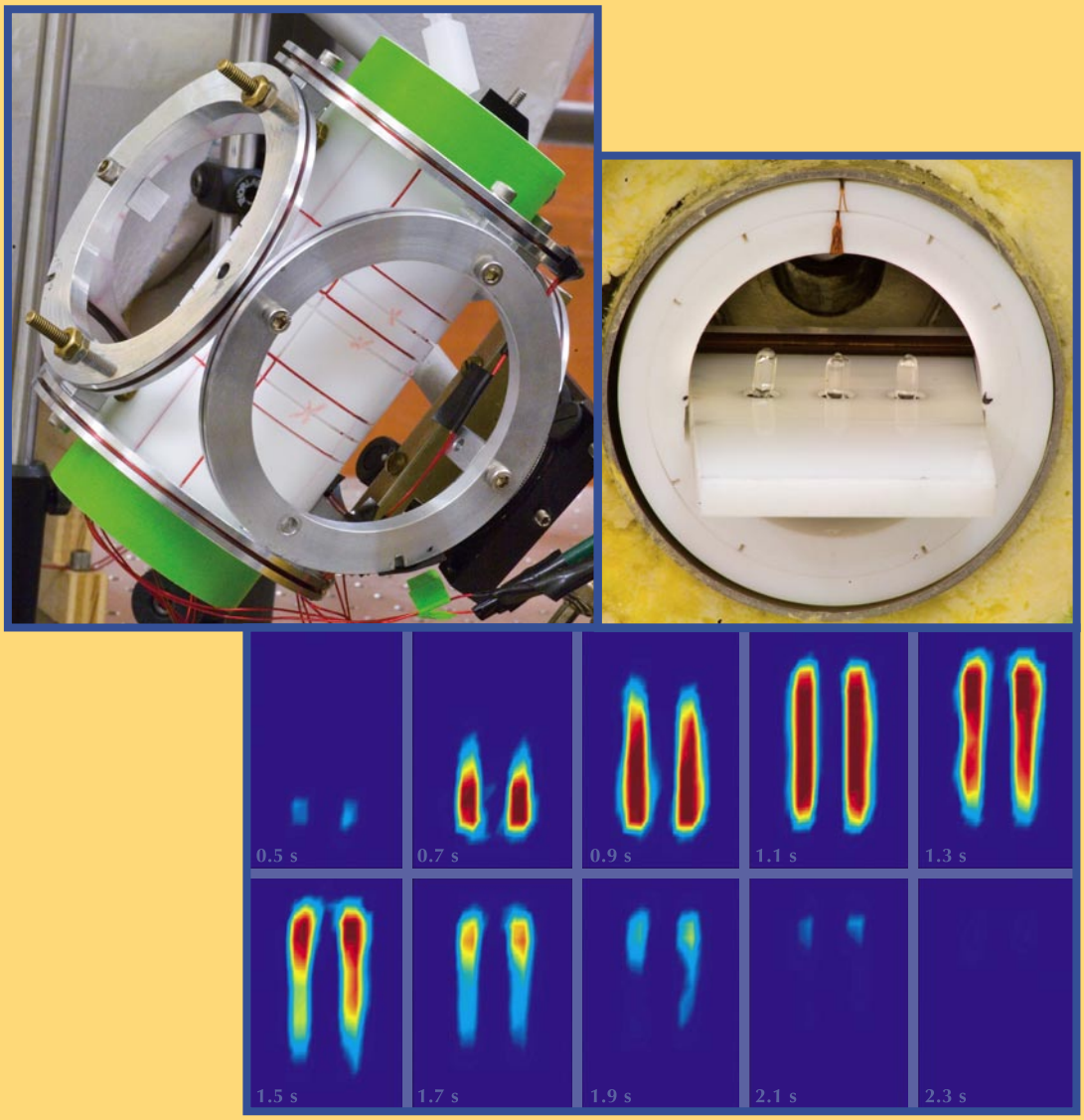
2007 R&D 100 Award Entry

Laser Detected MRI



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RESEARCH NEWS
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Berkeley Lab Wins Three Prestigious 2007 R&D 100 Awards for Technology Advances

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BERKELEY, CA — Three of R&D Magazine's prestigious R&D 100 Awards for 2007, which recognize the 100 most significant proven technological advances of the year, have gone to researchers at the U.S. Department of Energy's Lawrence Berkeley National Laboratory and their colleagues.

The awards bring the total of Berkeley Lab's R&D 100 awards — also called the "Oscars of Invention" — to 44, plus two Editors' Choice Awards over the years.

The 2007 award designees are:

- Laser-Detected MRI — a major breakthrough in the Magnetic Resonance Imaging (MRI) field that eliminates the need for a high-field magnet, making the technology accessible to new users and applications. The system uses an optical atomic magnetometer to provide much more sensitive detection.
- Low Swirl Injector for Fuel-Flexible Near-Zero-Emission Gas Turbines — a technology that significantly reduces greenhouse gas emissions and pollution from gas turbines used to produce electricity, or from any stationary combustion system in which it is incorporated.
- Berkeley Unexploded Ordnance Discriminator — an electromagnetic system that can determine the location, size, and shape of unexploded buried weapons or explosives. The technology brings unprecedented speed and accuracy to the task, and could greatly reduce the time and cost of remediation and provide a valuable humanitarian service throughout the world.

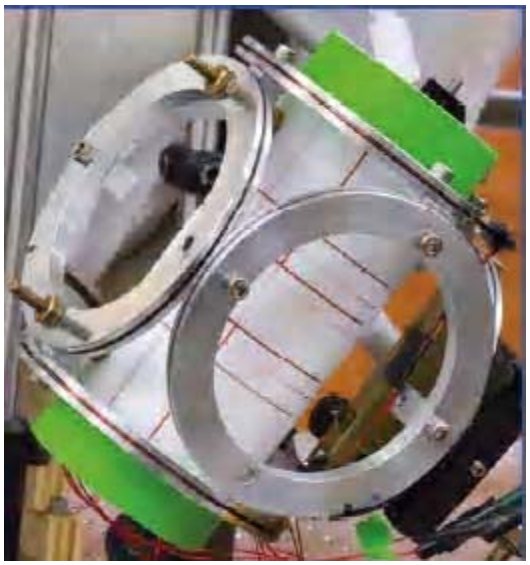
"Once again, DOE's labs are at the cutting edge of innovation with new technology developments to enhance America's economic and national security," said U.S. Secretary of Energy Samuel Bodman. "My heartiest congratulations to the DOE researchers and scientists who have won R&D Magazine's prestigious awards this year."

Cheryl Fragiadakis, who heads Berkeley Lab's Technology Transfer and Intellectual Property Management Department, says, "Winning three awards is a tremendous achievement that speaks very highly of the strength of our science and its relevance to solving complex global problems. I am particularly pleased to note that some of this year's winners are already being further developed by partners in the private and the government sectors."

Laser-Detected MRI

This new technology could soon enable MRI to image a wide range of phenomena, from petroleum

reservoirs and other samples to very small objects such as tissue samples and microfluidics. It was developed under a collaborative effort between the groups of Alexander Pines of the Lab's Materials Sciences Division and Dmitry Budker of the Nuclear Science Division.



Laser-Detected MRI

MRI is one of the most powerful, non-invasive imaging techniques, in which a patient is placed inside a huge magnet that generates a powerful magnetic field. But its limitations are significant. A large, very expensive magnet is required. The equipment needs cryogenic cooling and other expensive support systems. And the sample needs to fit in the bore of the magnet, which limits the size of the samples that can be imaged.

Laser-Detected MRI, however, eliminates the need for a high-field magnet, making the technology accessible to new applications, from petroleum reservoirs and other huge samples to very small tissue samples, as well as patients with metal implants. In addition, because the design is simple, no cryogenics are needed and its power needs are low. In contrast to a typical high-field MRI system that might cost $1 million and weigh 10,000 pounds, the Laser-Detected MRI might sell for $30,000 and weigh less than 100 pounds. Other Berkeley Lab scientists involved in developing the technology include Marcus Donaldson, Simon Rochester, Shoujun Xu, and Valeriy Yashchuk.

Low Swirl Injector for Fuel-Flexible Near-Zero-Emission Gas Turbines

The Low Swirl Injector significantly reduces greenhouse gas emissions and pollution from gas turbines that produce electricity or from any stationary heating system. It was developed by Robert Cheng and David Littlejohn of Berkeley Lab's Environmental Energy Technologies Division, along with scientists from San Diego-based Solar Turbines.

In the 1980s, new combustion technologies reduced nitrogen oxides (NOx) from more than 100 parts per million (ppm) to the current standard of less than 25 ppm. Now, the Low Swirl Injector emits less than 2 ppm. It is the only technology that can affordably reduce NOx emissions to this near-zero level.

Low Swirl Injector

The technology is potentially scalable to turbines of all sizes and can burn almost any gaseous hydrocarbon, including landfill gases, biomass, refinery gases, and pure hydrogen. It requires no substantial redesign of gas turbines, nor does it need expensive catalysts. With further development, the technology can also be used in turbines designed for coal-derived syngas and hydrogen, commonly referred to as clean-coal power plants. In short, the Low Swirl Injector dispels the long-held notion that reducing emissions is inherently costly and complex.

Berkeley Unexploded Ordnance Discriminator

The Berkeley Unexploded Ordnance Discriminator is a highly innovative system that can determine the location, size, and shape of unexploded buried weapons and explosives. In the United States, there are more than 28 million acres of land that cannot be used because they contain buried unexploded ordnance (UXO). Buried UXO is also found in Northern Europe, throughout the Pacific Rim, and in Vietnam, Afghanistan, and Iraq, among other countries.

Berkeley Unexploded Ordnance Discriminator

The technology offers a critical advantage over current methods because it can detect the size and shape of an object from a single measurement that only takes a few seconds, allowing for real-time discrimination of objects. It does this by simultaneously obtaining the object's electromagnetic properties in three dimensions in response to a generated current. Other systems need to take multiple measurements and cannot determine an object's size in real time.

In this way, the Berkeley Unexploded Ordnance Discriminator brings unprecedented speed and accuracy to the task and could greatly reduce the time and cost of remediation, providing a valuable humanitarian service throughout the world. It was developed by several scientists and engineers from the Lab's Earth Sciences Division and Engineering Division, including Jean-Francois Beche, Alex Becker, Larry Doolittle, Erika Gasperikova, Jim Greer, Robin Lafever, Frank Morrison, Alessandro Ratti, J. Torquil Smith, and Harold Yaver

The R&D 100 Award-winning technologies were nominated by Berkeley Lab's Technology Transfer and Intellectual Property Management Department. All winners of the 2007 award will receive a plaque at R&D Magazine's formal awards banquet in Chicago on October 18.

Berkeley Lab is a U.S. Department of Energy national laboratory located in Berkeley, California. It conducts unclassified scientific research and is managed by the University of California. Visit our website at www.lbl.gov.

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