



LANL's  
Kimberly  
DeFriend



Science and Technology Highlights from the DOE National Laboratories

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## Research Highlights . . .

*DOE Pulse* highlights work being done at the [Department of Energy's](#) national laboratories. [DOE's laboratories](#) house world-class facilities where more than 30,000 scientists and engineers perform cutting-edge research spanning DOE's science, energy, national security and environmental quality missions. *DOE Pulse* ([www.ornl.gov/news/pulse/](http://www.ornl.gov/news/pulse/)) is distributed every two weeks. For more information, please contact Jeff Sherwood ([jeff.sherwood@hq.doe.gov](mailto:jeff.sherwood@hq.doe.gov), 202-586-5806).

### Qbox revs BlueGene's performance

The world's fastest supercomputer, BlueGene/L (BG/L) at DOE's [Lawrence Livermore National Laboratory](#) is now officially even faster. Already ranked No. 1 by the Top500 organization for its peak speed capabilities, BG/L set a new record in June for sustained performance of 207.3 trillion floating-point operations per second (teraFLOPS), utilizing the "Qbox" computer code for conducting materials science simulations critical to national security. The performance of the Qbox code, specially designed to run on large-scale platforms such as BG/L, has implications for the broader research community and will likely enable the development of new materials of interest to many industries.

**[Don Johnston, 925/423-4902, [johnston19@llnl.gov](mailto:johnston19@llnl.gov)]**

### Fitness tool users tour the USA

Want to walk across America without leaving your hometown? A scientist at DOE's [Lawrence Berkeley National Laboratory](#) has launched an [online exercise log](#) that allows people to enter the number of miles they walk, run or cycle each day. The tool then tracks their progress as if they are traveling from Virginia to Oregon along the TransAmerica Trail.

To entice even the most stubborn couch potatoes into action, the website also allows participants to enjoy the scenery along the way, thanks to images that depict every quarter-mile of the 4,025-mile route.

"There's no lack of information about the benefits of exercise," says Paul Williams, a staff scientist in Berkeley Lab's Life Sciences Division who developed the tool. "What's lacking is motivation." The website was developed for an [ongoing exercise study](#), but it is available to anyone for free.

**[Dan Krotz, 510/486-4019, [dakrotz@lbl.gov](mailto:dakrotz@lbl.gov)]**

### Hydrogen separation membrane exceeds targets

Eltron Research, Inc., in partnership with DOE's [National Energy Technology Laboratory](#), engineered novel membrane materials for producing pure hydrogen from coal-derived synthesis gas. In bench-scale tests, the materials met DOE 2015 targets for sulfur tolerance, economic life, and operating conditions and surpassed those for hydrogen production rate, product purity, and cost. Scaled-up membrane materials and modules will produce 1.3 lb/day of hydrogen from simulated coal gas, and follow-on work will build and test a 220 lb/day sub-scale engineering hydrogen production prototype. Conceptual design of a 4 TPD FutureGen test module will be completed, establishing a benchmark of commercial-scale hydrogen separation modules for future coal-to-hydrogen plants.

**[Linda Morton, 304/285-4543, [Linda.morton@netl.doe.gov](mailto:Linda.morton@netl.doe.gov)]**

### NREL, universities form energy collaboratory

Colorado Governor Bill Owens recently signed legislation that provides funding to a new Colorado renewable energy research collaboration. DOE's [National Renewable Energy Laboratory](#), the Colorado School of Mines, Colorado State University and the University of Colorado have been working together since March to create the Colorado Renewable Energy Collaboratory. The Collaboratory will receive up to \$2 million per year for three years, beginning in fiscal year 2007. Although the formal establishment of the Collaboratory is still in process, NREL and the Universities have already joined forces to compete for a DOE contract for research on the utilization of solar energy.

**[Sarah Barba, 303/275-3023, [sarah-barba@nrel.gov](mailto:sarah-barba@nrel.gov)]**

# High-flying satellites give low-down on cheatgrass

Cheatgrass, a fast-growing, fire-fueling weed, has met its match. The Idaho Bureau of Land Management and several weed control boards are fighting back with new software that uses NASA satellite imagery and complex algorithms to show the location and growth of this noxious weed. The technology is available to local and state agencies through the **Pacific Northwest Regional Collaboratory**, the partnership of universities and national laboratories that developed the software.

Cheatgrass has little forage value, increases the frequency of wildfires and elbows out native species, promoting soil erosion and reducing the value of pasture lands across the West. Invasive plants such as cheatgrass cost land managers billions each year and have encroached upon more than 100 million acres in the United States.

Known by several names, including downy brome and June grass, cheatgrass is bright green in late fall and early spring and turns a rusty red at maturity. Its spiky seed heads are infamous for attaching themselves to socks, fur and animals' ears.

**Pacific Northwest National Laboratory's** Roger Anderson, collaboratory manager, explained that, although **NASA's Earth Observing System** satellites send terabytes of data every day to NASA stations on earth, the data have not been accessible to many resource managers because of the cost, time and training required to acquire and process the data.

The new software analyzes data across thousands of square miles and produces detailed maps that reveal the density of cheatgrass and shrub cover.

"It's a significant improvement over getting the pickup truck up to about 60 miles per hour and looking out the window," said Jeff Pettingill, superintendent of the Bonneville County (Idaho) Weed Board.

The collaboratory's mission is to turn data from satellites and other sources into information land managers can use to protect Northwest streams, forests, farmland and urban areas. Members are the Idaho National Laboratory, Idaho State University, Oregon State University, PNNL, the University of Idaho and the University of Washington.

**Submitted by DOE's Pacific Northwest National Laboratory**

## A NATURAL FOR SCIENCE

As the daughter of a Shell Chemical Company chemist and a frequent participant in school science fairs, DOE's **Los Alamos National Laboratory** Technical Staff Member Kimberly DeFriend found it natural to go into the sciences after high school. Her first interest was environmental chemistry, particularly issues related to water treatment and pollution removal.



**Kimberly DeFriend**

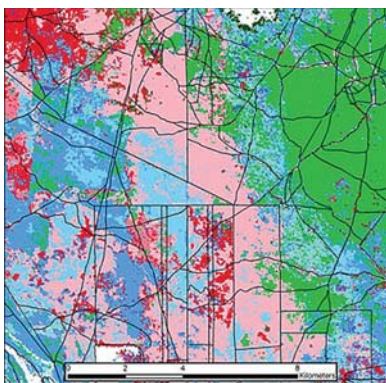
"I wanted to try and solve the real important problems," DeFriend says. "And at the time that involved environmental issues." Her work with ultrafiltration membranes eventually led her to a doctorate in inorganic chemistry at Rice University working with Andrew Barron and into a lifelong love of experimenting with materials in the laboratory.

Arriving at Los Alamos National Laboratory in 2002 as a postdoctoral research associate, DeFriend originally worked on the laser-assisted chemical vapor deposition processing of materials. Although she'd heard of aerogels before, she didn't know precisely how they were made or what their many applications could be. After discussing the Laboratory's aerogel research project with staff members Doug Loy and Kenny Salazar, DeFriend decided to join the team, which seemed more in keeping with her chemistry background than other opportunities.

Aerogels are highly porous, transparent, fragile materials composed of as much as 99 percent air. Extremely versatile, they can be used in a range of applications and products from thermal insulation and shock absorption materials to body armor and cometary dust capture agents.

Over the years, DeFriend has become the "aerogel person of Los Alamos." She does basic research and development focused on making stronger aerogels with controllable compositions combined with producing them for high energy physics experiments. Her recent efforts on the gas phase chemical modification of aerogels have already generated new intellectual property for the Lab that is already leading to new industrial collaborations. For DeFriend, nothing could be more natural.

**Submitted by DOE's Los Alamos National Laboratory**



**The PNWRC software details the distribution of cheatgrass and shrub cover.**