John Shanklin
DOE's
Brookhaven
National
Laboratory

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DOE Pulse

Science and Technology Highlights from the DOE National Laboratories

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Research Highlights . . .

Berkeley Lab Creates Breakthrough in South Pole Communications

Researchers at DOE's Berkeley Lab have established the first M-Bone internet connection to the South Pole. Starting on March 29, researchers in Berkeley's Physics and Nuclear Sciences Divisions have been going on-line to chat with scientists at the U.S. Amundsen-Scott South Pole Station. M-Bone, which stands for Multicast Backbone, is a means of transmitting sound and pictures via computers using an efficient method of allocating internet resources. Developed at Berkeley Lab, the M-Bone is now mainly used at DOE's national labs. As more internet bandwith becomes available, the hope is to extend M-Bone to secondary schools as well.

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"Option White": Calculations by the Trillions-Per Second!

Energy Secretary Federico Peña announced an $80 million contract with IBM to supply DOE's Lawrence Livermore National Laboratory with the world's fastest supercomputer, capable of 10 trillion floating operations per second, in the year 2000. Supercomputer computations that would take *years* today, will be completed in *days*. "Option White" represents level three in the Accelerated Strategic Computing Initiative to simulate aging nuclear weapon operations. ASCI is essential to DOE's Stockpile Stewardship Program. It supports the Comprehensive Test Ban Treaty by maintaining our nuclear deterrent without underground testing. ASCI computers also will improve the ability to forecast global climate changes, design aircraft and automobiles, and introduce new drug therapies.

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New "Super" Life for Old Computers

To create a composite map of U.S. soil characteristics, environmental researchers at DOE's Oak Ridge National Laboratory needed a powerful supercomputer to analyze billions of bits of data from more than 8 million square kilometers of landscape. Problem was, the supercomputers on hand are usually booked solid. So the researchers did what every resourceful scientist learns to do—they built their own. They salvaged dozens of cast-off 486 computers, connected them in parallel and are solving problems they couldn't solve using serial workstations. The researchers expect their "poor man's supercomputer" to be useful for other applications, especially in testing new programs before running them on state-of-the-art supercomputers. For more information on the "poor man's supercomputer," see http://www.esd.ornl.gov/facilities/beowulf.

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A Picture Is Worth a Million Words

Modern technology has created the opportunity to access thousands of pieces of data but the abundance of information can be overwhelming to the information analyst. Starlight and SPIRE, two advanced computer visualization technologies, have been developed by DOE's Pacific Northwest National Laboratory to help solve the problem of information overload. The programs graphically display images based on verbal similarities and themes in text. Starlight and SPIRE can be applied to a variety of fields including medical data analysis, criminal investigations, environmental and national security, and current events monitoring.

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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*** is distributed every two weeks. For more information, please contact Jeff Sherwood (jeff.sherwood@hq.doe.gov, 202-586-5806).

Labs Team Up to Find Missing Link

"It is truly a team effort," says Jonathan Dorfan, project leader for SLAC's B Factory, which consists of the rebuilt PEP-II collider and the BaBar detector. "PEP-II has involved people from all divisions within SLAC as well as our DOE sister labs at Berkeley and Livermore."

Authorized by Congress in October of 1993, the PEP-II construction project is budgeted at $177 million and scheduled for completion in fall of 1998, when collisions between the Low Energy Ring (LER) and the High Energy Ring (HER) will begin. These two independent storage rings sit atop each other in the converted PEP tunnel and operate at different energy levels.

The project is on time and on budget, and much of the credit for this timeliness is attributed to the Department of Energy and Congress." The support from all levels has been a tremendous boon to this project," said Dorfan.

When completed, the B Factory will produce sub-atomic particles called B mesons which tend to come apart with more particles than anti-particles present. "This could reveal an important missing link to explain why there's more matter than anti-matter in the universe," according to Dorfan.

Berkeley Lab took the lead in the design and implementation of the Low Energy Ring. They were responsible for the design and fabrication of the LER magnets. The LER arc rafts (assemblies of magnets and vacuum chambers that were moved as units to SLAC) were built at Berkeley. They contributed to the beam damping systems, first tested on the Advanced Light Source at Berkeley. Physicists from LBNL will participate in the commissioning of the LER.

Livermore Lab managed the fabrication of the 24 radio frequency cavities for the two rings. They contributed to the fabrication of components of the vacuum chambers for both rings, in particular, the straight section drift chambers, the straight section bellows modules, and the distributed ion pumps (dips) for the High Energy Ring. They did the research and development on the dips.

SLAC personnel were responsible for the HER, the interaction region and the Control System. They provided the design and implementation of the required infrastructure, such as the cooling, power, and personnel protection systems. They are responsible for overall system integration and installation. On-site safety during construction and operation is the responsibility of SLAC. SLAC and LBNL personnel designed, constructed, and commissioned the RF system. The beam damping systems were a collaborative effort between SLAC and LBNL. The operation and maintenance of the machine is SLAC's responsibility.

Thanks to the team effort of these three labs, physicists will soon be able to gather data on what took place less than 10^{-34} seconds after the start of the Big Bang and thus fill in one of the mysteries of physics.

Visit the B Factory web site at http://www.slac.stanford.edu/accel/pepii/home.html

Submitted by the Stanford Linear Accelerator Center

The President's vision of American leadership in science and technology is being actualized in our national laboratories . . . Our scientists continue to lead the world in R&D awards and Nobel prizes.

Secretary Peña

Designer Genes for Plants

Gucci, Chanel, Calvin Klein. Most designers put their name or logo on their product. But not John Shanklin. His designer "genes" are far too small to write on. And, they're worn by plants, not people.

But Shanklin, a biochemist at Brookhaven National Laboratory, does leave a signature throughout the plants he works with: a tiny bend in each fat molecule that the plant makes.

By making gene alterations to change the structure of a fat-bending enzyme called desaturase, he and his colleagues have succeeded in persuading plants to insert extra bends in their fat molecules, called fatty acids. This miniscule difference on the molecular scale makes a world of difference when the plants are harvested for their oil. A single bend in a straight molecule can mean the difference between solid fat and liquid oil; multiple bends make an edible oil polyunsaturated, and less likely to aggravate heart disease. Some oils can be eaten but not digested, reducing the calories absorbed from the foods they're in.

So someday, Shanklin's research may help agribusiness companies do more for the figures of millions of Americans than a clothing designer ever could. Both foods and fibers made from oils - from margarine to nylon - could be improved using bioengineered plants like the ones Shanklin grows.

The oil crop industry is worth $80 billion annually, and many more millions are spent to convert non-renewable petroleum products into useful oils for manufacturing. Shanklin's work could help give these industries sustainable sources of oil.

Altering a plant's genes is not an easy task, but its rewards are great. Besides contributing to the world's quest for healthier foods and sustainable agriculture, Shanklin has been recognized by the White House with a Presidential Early Career Award for Scientists and Engineers, and by DOE with a Young Scientist Award.

Submitted by Brookhaven National Laboratory