LIVERMORE LAB REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, July 16-20, 2012

TIME

CRANKING IT UP

The preamplifiers of the National Ignition Facility are the first step in increasing the energy of laser beams as they make their way toward the target chamber. *Photo by Damien Jemison/LLNL*.

"Watt" in the world has happened at the National Ignition Facility? A record-breaking 500 trillion watts of energy.

Fifteen years of work by the Laboratory's National Ignition Facility team paid off recently with this historic record-breaking laser shot. The NIF laser system of 192 beams delivered more than 500 trillion watts (terawatts or TW) of peak power and 1.85 megajoules (MJ) of ultraviolet laser light to its target.

Five hundred terawatts is 1,000 times more power than the United States uses at any instant in time, and 1.85 megajoules of energy is about 100 times what any other laser regularly produces today.

The shot validated NIF's most challenging laser performance specifications set in the late 1990s when scientists were planning the world's most energetic laser facility.

To read more, go *Time*.

COMPUTERWORLD

LOOK MA, I'M ON TOP OF THE WORLD

The Sequoia supercomputer

When it comes to the most powerful supercomputer in the world, the United States has to look no further than it's home turf.

Once again the United States has gained a hold on the world with the No. 1 spot on the latest Top500 list of supercomputers. The Lab's Sequoia has gained that spot by using 16-core processors running at 1.6GHz, and mostly relies on architecture and parallelism to achieve speeds of 16.32 sustained petaflops.

To read more, go to *Computer World*.

San Francisco Business Times — TO THE MARKET AND BEYOND

A jet engine fan blade that is being peened by a laser shot.

A Livermore company is using high-powered laser technology developed at the Laboratory to make metal parts like airplane wings and steam turbine blades stronger, safer and more energy efficient.

Collaborations like this could have the same effects on the Tri-Valley economy.

Metal Improvement Co. uses a process called laser peening to pre-stress metal and make it less susceptible to cracks. The process also can help bend and stretch metal into a curve or other complex shapes, while strengthening it, which allows more efficient designs of titanium, aluminum and steel parts.

Commercialization is exactly the kind of thing the Lab has heading toward -- to transfer its discoveries to the market so companies can make use of the science discovered there. And it's exactly the kind of thing that economic development groups in the Tri-Valley want to see more of -- Lab technology spinning out of the labs and into companies that grow jobs and pay taxes that boost the area.

To read more, go to the *San Francisco Business Times*.

Photonics Online

DIVING INTO THE MICROSCOPIC

Soot particles are typically only a micron in size.

For the first time, Laboratory researchers have peered into the makeup of complex airborne soot particles so small that it can be transported into human lungs -- usually without a trace.

The discovery reveals the particles' surprisingly complex nanostructures and could ultimately aid the understanding of atmospheric processes important to climate change, as well as the design of cleaner combustion sources, from car engines to power plants.

The new research, using intense coherent X-ray pulses from the Linac Coherent Light Source free-electron laser at Stanford, demonstrates a new *in situ* fractal method for imaging

individual sub-micron particles (tobacco smoke and oil smoke particles are typically one micron in size) to nanometer resolution in their native environment.

To read more, go to *Photonics Online*.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance.

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