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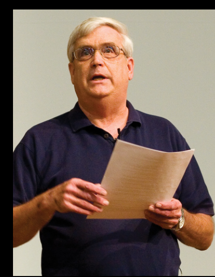

SCIENCE NEWS

Commission for world's most energetic laser

By Bob Hirschfeld
Newsline staff writer

Q: What do you get when you multiply 22 kilojoules by 96 laser beams?

A: A fully commissioned laser bay in the National Ignition Facility (NIF).

"With the success of this test, NIF is now the world's highest energy laser." – Thomas D'Agostino

NIF's overnight "owl" shift participated in the control room activities marking completion of commissioning activities for Laser Bay 2.

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In the early hours in late July, a handful of control room operators fired a series of laser shots in a group of eight beams known as Bundle 44.

The last shot lasted about 25 billionths of a second, a tiny fraction of the time it takes to blink an eye. The infrared energy output of each beam measured approximately 22 kilojoules, more than enough to meet NIF's operational and performance qualification requirements.

The achievement successfully brought to a close this phase of sequentially testing all 96 beams in one of NIF's two laser bays, a process that has taken about two years.

Firing these 12 bundles required operation of 2,300 high-quality optics and instrumentation modules, and nearly 400 computers running a million lines of code.

According to NIF Associate Director Edward Moses: "A total energy of more than 2.1 megajoules has now been fired in the first laser bay. This is about 40 times what the Nova laser (NIF's predecessor) typically operated at the time it was the world's largest laser."

The tests also measured the quality of each beam's spatial profile and temporal pulse shape. Even though each shot is exceedingly short in time, its energy output and frequency is designed to vary significantly throughout its duration, depending on the type of experiments being conducted.

Chris Haynam, the physicist responsible for modeling and testing the quality and performance of the lasers, pointed out that only about a dozen people on NIF's overnight "owl" shift participated in the control room activities marking completion of commissioning activities for Laser Bay 2.

"This is a good thing," Haynam said. "In fact, physicists and chief engineers do not have to be there. The details were worked out far ahead of time. We gave them the plan. The operators executed the plan per the schedule. And it went off without a hitch."

"This is a significant event as we move toward completion of the National Ignition Facility," said NNSA Administrator Thomas D'Agostino. "With the success of this test, NIF is now the world's highest energy laser. The day is coming soon when we will be able to simulate the conditions of extreme temperature and pressure approaching those existing in nuclear explosions."

The next step is to repeat the process in NIF's other laser bay.

"Installation of optics and other components in Laser Bay 1 is now about 90 percent complete, and preliminary testing is already under way. Overall commissioning is scheduled for June 2009," said Bruno Van Wonterghem, NIF's commissioning manager.

Meanwhile, a series of experiments called "Eos" (for the Greek goddess of the dawn) will utilize the first set of beams from the completed laser bay, traveling to the center of the10-meter diameter target chamber. One goal of "Eos" is to validate the performance of NIF's targets.

When NIF is operating, the infrared energy from its 192 laser beams will be converted to 1.8 million joules of ultraviolet energy and delivered to millimeter-sized targets at the center of its target chamber, creating conditions similar to those in the core of stars and giant planets and inside exploding nuclear weapons.

The laser beams will compress a hollow shell filled with the hydrogen isotopes deuterium and tritium to 20 times the density of lead. In the resulting conditions – temperatures of 100 million degrees Celsius and pressures greater than a billion times the Earth's atmosphere – the fuel core will ignite and thermonuclear burn will quickly spread through the compressed fuel, releasing ten to a hundred times more energy than the amount deposited by the laser beams.

Along with supporting NNSA's stockpile stewardship program, NIF will provide unprecedented opportunities to conduct fusion energy research and to explore regimes of high energy density physics in the laboratory.

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On the cover: Looking down the corridor of the fully commissioned Laser Bay 2. CREDIT: JACQUELINE MCBRIDE, NEWSLINE