Livermore lab nears launch of fusion quest

September 23 2010, By Suzanne Bohan

Within the next week at a high-security building in Livermore, Calif., the size of a football stadium, scientists will hunker down to conduct an experiment backed by billions of dollars and promises to change the world's energy supply.

The scientists at the National Ignition Facility, or NIF, at Lawrence Livermore Laboratory are preparing to meet an end-of-month deadline for the first set of experiments in the final stretch of a national effort to achieve the long-sought goal of fusion -- a reaction in which more energy is released than put into it.

Lab officials promised congressional funders that before Sept. 30, the end of fiscal year 2010, they would start "credible ignition experiments" in the enormous facility, which officially opened in spring 2009.

The facility's primary mission is to ensure the safety and reliability of the nation's aging nuclear weapons stockpile through fusion experiments. If fusion is achieved, it also would open the door for research into unlimited sources of energy, such as using seawater as fuel, and would allow scientists to study celestial phenomena such as supernovas in new ways.

"And credible means that we have no reason to believe it's not going to work," Thomas D'Agostino, administrator of the National Nuclear Security Administration, which oversees the Livermore lab, told Sen. Dianne Feinstein during Congressional testimony in March.

However, most independent experts doubted that these first experiments this month would result in fusion ignition, according to a Government Accountability Office report released in the spring. Even Lynda Seaver, a lab spokeswoman, said this week that, in fact, there's no expectation of achieving ignition this month, given the composition of the fuel capsule at the heart of the experiment.

"This is not ignition. It will take a year or two to get ignition," she said.

Fusion ignition results when extreme pressures and temperatures force two or more atoms together, releasing helium atoms, neutrons and enormous amounts of energy -- far more than the energy required to generate the ignition. If all goes well, a burst of fusion energy in a lab setting would, in turn, fuse nearby atoms in a self-sustaining process known as thermonuclear burn. Fusion is the same process that gives hydrogen bombs their awesome explosive energy, and it also powers the sun and the stars.

For years, the Livermore lab has declared fiscal year 2010 as the year it would first attempt fusion ignition. In a 2005 Livermore laboratory newsletter, Ed Moses, now NIF's principal associate director, said, "There is more agreement and commitment to the goal of ignition in 2010 among our sister labs and the National Nuclear Security Administration than ever before."

In 2006, while requesting funding from Congress, Linton Brooks, then an undersecretary with the National Nuclear Security Administration, said that $423 million of the requested funds would go "to achieve the ignition milestone" in 2010 at NIF.

The Livermore lab's public affairs office did not respond to requests to explain the discrepancy between promises of a bona fide attempt at ignition this month with plans to in fact run experiments at the facility

that would fall short of that. Seaver wrote in an earlier e-mail that "these experiments put us further down the pathway to ignition."

For Marylia Kelley, the director of Tri-Valley CAREs, a Livermore laboratory watchdog group, the fact that the facility will not be attempting fusion ignition this month is "actually shocking," she said.

"Its scientific goal was ignition," she said. Funding from Congress for the $3.5 billion facility -- a figure that Kelley disputes, saying it's closer to $5 billion -- was based on assurances of success within a certain time frame.

"They've been getting it funded based on that certainty," she said. "So they're abandoning any date certain for ignition, and that's notable."

Jonathan Gill, an assistant director with the Government Accountability Office and one of the authors of the agency's report, said, "There has always been this skepticism about can they do this by Oct. 1, 2010. I think over the long term there was more confidence they would be able to achieve ignition."

These experiments that start this month put the facility on the final stretch of the "National Ignition Campaign." The campaign is headed by the Livermore lab and includes partnerships with the University of Rochester, Los Alamos National Laboratory and Sandia National Laboratories. It started in 2005, and by 2012 the campaign aims to not only achieve ignition and reap excess energy from the reaction, but also to reliably repeat the fusion experiments.

One major milestone with the upcoming September experiments will be the fact that it's the first time NIF has used deuterium and tritium -- the two forms of hydrogen behind the powerful fusion reactions in hydrogen bombs -- in the peppercorn-sized fuel capsule upon which the facility's

192 powerful lasers direct their energy. NIF scientists will continue using the two hydrogen isotopes in their quest to achieve ignition.

But during these September experiments, there will not be enough deuterium and tritium in the fuel capsule to trigger fusion ignition, said Chris Deeney, assistant deputy administrator for Stockpile Stewardship Programs with the National Nuclear Security Administration.

Taking a stair-step approach toward ignition "was deemed a better way to get into the operating space where you would expect ignition to occur," he said.

The GAO report, published in April, focused on the daunting scientific and technical challenges that remain in the way of successful ignition. The glass optics, for one, are prone to damage from the powerful lasers, and it is unclear if it would be practical economically or technically to continue replacing damaged optics during fusion operations.

Instabilities between the laser beams and the plasma in a cylinder that holds the fuel capsule can thwart success, as energy for driving the fusion reaction can be lost. A loss of perfect spherical symmetry in the tiny fuel capsule as it compresses can prevent ignition, the report stated.

The GAO report also faulted lab officials for waiting until 2009 to form a scientific review committee, as suggested in 2005, to identify potential pitfalls. The GAO also advised having this committee report to the nuclear security administration, rather than the Livermore lab director, to increase candor in assessments about NIF. The report also detailed management weaknesses by the National Nuclear Security Administration that led to increased costs and delays in ignition-related activities.

The Livermore lab public affairs office declined to provide comment on

the GAO report's findings. Deeney praised the report.

"We basically appreciated the GAO study," he said. "It was very thorough and very well done." His agency is implementing all of the GAO's recommendations, Deeney said. That includes forming a separate NIF scientific review panel that reports to the nuclear security administration.

(c) 2010, Contra Costa Times (Walnut Creek, Calif.).
Distributed by McClatchy-Tribune Information Services.