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NIF progress and facility allocations through Q4FY2012

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To: Distribution
From: E.I. Moses, Director, National Ignition Facility (NIF)
Subject: NIF progress and FY2012 facility allocations

The National Ignition Facility (NIF) has had a highly successful operational period in the first three quarters of FY2011. This memorandum describes NIF progress through June 30, 2011, and provides an update to NIF facility allocations discussed in my memorandum of March 30, 2011 (see Attachment 1).

FY2011 activities at NIF to date have focused on the National Ignition Campaign (NIC) and high energy density stewardship science (HEDSS) experiments in support of the National Nuclear Security Administration (NNSA) Stockpile Stewardship Program (SSP). Fundamental science and preparatory nuclear counterterrorism experiments have also been conducted. The facility's capability has also increased, with a wide variety of diagnostics installed and continuous improvements in laser performance demonstrated. An overview of NIF accomplishments in Q3FY2011 is presented below:

- 77 system shots were conducted on NIF in the 3rd quarter. This includes 35 target physics experiments and 42 shots devoted to laser performance testing. For the first three quarters of FY2011, 221 system shots were conducted including 122 target physics experiments and 99 laser performance tests.
- The NIC made significant progress in a number of areas in Q3FY2011:
    1. *Early time symmetry*: The ability to control capsule implosion symmetry in the early portion (first few nanoseconds) of the NIF ignition laser pulse was demonstrated. In these experiments, x-ray emission from a bismuth sphere placed in the same position as an ignition capsule was used to verify that early-time implosion symmetry behaves similarly to computational predictions and meets ignition requirements.
    2. *Shock timing*: The NIC ignition target achieves the areal density and temperature required for ignition by adjusting the timing and amplitude of four shocks launched within the ignition capsule by the radiation drive. The NIC team demonstrated the ability to see all four of these shocks with existing diagnostic techniques. Furthermore, the team has largely demonstrated the ability to adjust the timing and the merger position of these shocks within the NIF ignition capsule via precision adjustment of the laser pulse shape, which is a critical step in the ignition tuning campaign.

3. *Deuterium-tritium cryogenic implosions:* The NIC team demonstrated, for the first time, the ability to perform cryogenic implosions with the 50-50 mix of deuterium and tritium planned for ignition targets, another important step in demonstrating the ability to conduct ignition experiments with significant neutron yield on NIF. Three of these experiments have been conducted, with one achieving a record indirect-drive neutron yield (4.5×10^{14} neutrons). The compressed fuel convergence ratio was observed to be between 30 and 40, and peak compressed capsule areal densities were approximately double that previously achieved.

- Experiments other than NIC in support of Stockpile Stewardship and the Predictive Capability Framework continued in Q3FY2011. Additional radiation transport experiments in support of a major NNSA deliverable have been completed. Equation of state measurements have continued and initial experiments to examine material strength effects, as well as several experiments led by Los Alamos National Laboratory, were successfully conducted. In addition, scientists conducted the first experiment to yield classified data, demonstrating an important new facility capability. The results in the past quarter build on the highly productive period of non-ignition experiments executed in Q2FY2011 and further demonstrate that NIF's precision and reproducibility allow the demonstration of major new scientific capabilities in a relatively small number of shots.
- NIF experimenters continued to probe fundamental materials science at conditions never previously available in the laboratory. The University of California (Berkeley), Princeton University, and LLNL high-pressure materials science team conducted two more experiments in Q3FY2011 aimed at compressing diamond isentropically to high pressures. Peak pressures exceeding 50 Mbars—nearly twice that achieved several months ago on NIF and nearly eight times ever achieved elsewhere—have been demonstrated. The team plans to complete diamond studies later this year before moving on to study iron, a key element for the study of planetary interiors.
- A productive facility maintenance and reconfiguration (FM+R) period was conducted on NIF from March 20 to April 22, 2011. In this period, a number of new neutron and x-ray diagnostic capabilities (some in preparation for experiments with significant neutron yield) were installed. New Diagnostic Insertion Manipulator (DIM) hardware was installed that will allow a faster diagnostic exchange time between experiments. Laser performance improvements in support of higher peak power operation were also implemented. Finally, installation of new software releases and other upgrades and maintenance activities were performed. Overall, this maintenance period prepared NIF for the next steps in the NIC tuning campaign, higher yield operations, and a variety of non-ignition experiments in support of national security and fundamental science.

FY2012 facility allocations

In my previous memorandum dated March 30, 2010, I asked the NIF Experimental Facilities Committee (EFC) to discuss NIF allocations with the user community and provide a recommendation regarding facility allocations through Q2FY2012. The EFC met on April 21, 2011, and discussed the status of current and planned experiments with user community representatives. Based on this input, I have allocated much of the remaining contingency for FY2011 and made preliminary allocations for Q1FY2012 and Q2FY2012. Allocations for the remainder of FY2011 (Column D) and the first two quarters of FY2012 (Column E) are summarized in the table below. Note a laser performance category has been added; diagnostic commissioning time has been charged to the primary responsible program.

Category	Initial FY2011 allocation (Days) (Column A)	Days used (through 5/31/2011)[1] (Column B)	Plan-remainder of FY2011 (days) (Column C)	Revised FY2011 allocations (days) (Column D= Column B+ Column C)	Initial Q1/Q2FY2012 allocation (days) (Column E)
Stockpile Stewardship-National Ignition Campaign	168	112	53	165	80
Stockpile Stewardship-HED Stewardship Science	60	37	23	60	30
Fundamental Science	10	4	6	10	5
Other National Security	10	1	6	7	6
Laser Performance		37	14	51	22
Facility Activities	65	46	16	62	27
Holidays	12	4	1	5	3
Contingency	40	2	3	5	10
TOTAL	365	243	122	365	183

[1]Information for actual days used is through May 31, 2011.

The allocation of FY2011 contingency to laser performance (Column D), including time devoted to calibrations, precision pulse shaping, and operation at high energies and peak powers, and reflects the continuing demand for users to prepare the NIF for experiments in support of NIC and other programs.

Allocations for the first half of FY2012 (Column E) are very similar to those in FY2011. This reflects the established priorities of NIC, non-ignition experiments in support of Stockpile Stewardship, fundamental science, and other national security activities.

I have asked the EFC to consider allocations for the remainder of FY2012. I will report on this in my next memorandum. I anticipate Q3FY2012 and Q4FY2012 will see a continued strong focus on NIC.

Thank you for your interest in NIF, and please feel free to contact the Director of the NIF User Office, Dr. Christopher Keane (keane1@llnl.gov, 925-422-2179), or me if you have any questions or comments. I look forward to continued strong progress from the NIF experimental program.

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Attachment:
March 30, 2011 Allocation Memorandum (including memorandum of November 1, 2010)