FY02 Laser Facility Report

Increased user demand was met in FY02 by expanding the available shot time during select weeks. Ten weeks were extended to four shot days by shooting one 8-h day, two 12-h days, and one 16-h day. This adjustment raised the total executed shots by 11%—from 1289 in FY01 to 1428 in FY02 (see Table 92.V). Shaped-pulse cryogenic implosions highlighted the ongoing development of direct-drive cryogenic capability. A total of 21 spherical cryogenic D_2 targets were shot on OMEGA. Some of the cryogenic target shot time was devoted to characterization and system reliability improvements. Planar cryogenic target capability was also activated, and many shots were executed under LLE's Stockpile Stewardship Program (SSP) campaign. Highlights of other achievements and active projects as of the end of FY02 include the following:

- An IR streak camera with pulse-shape analysis software became a key operational tool to optimize pulse-shape performance. Combined with some changes to the control system for pulse-shape setup and upgrades to the regenerative oscillator hardware, the changes have resulted in dramatic improvements to delivered-pulse-shape performance.

- Infrared amplification occurs across a large variety of gain stages. By far, the highest gain stage is the regenerative (regen) amplifier, with 1×10^5 gain. One of the flash-lamp-pumped laser regens for OMEGA was replaced by a diode-pumped version that operates consistently without feedback stabilization. This diode-pumped laser improves pulse-shape performance. The remaining regens on OMEGA will be changed over to the new design in FY03.

- The distributed polarization rotator (DPR)—one of the key optics for beam smoothing on target—was modified for remote removal and reinstallation. The cassette-style removal system retracts the optic from the UV beamline into a protective housing. Having the capability to insert or remove these components improves flexibility for reconfiguring to indirect-drive setups. The full 60-beam complement of actuators will be completed early in FY03.

- The OMEGA laser is designed to provide a high degree of uniformity and flexibility in target illumination. The ability to impose a controlled assymmetric on-target irradiation pattern was developed and used extensively. This capability is used to benchmark multidimensional hydrodynamic simulations by imposing known nonuniform compression conditions on spherical targets. It is also used to modify laser-irradiation conditions for beam-to-beam x-ray yield balance.

- Modifications to the stage-A alignment sensors on OMEGA have streamlined an item of flexibility frequently exploited by LLE principal investigators. The backlighter driver alignment handoff to the OMEGA beamlines was re-engineered to expedite configuration setups that require the use of this source.

- Scientists and engineers from Lawrence Livermore National Laboratory along with LLE collaborators successfully implemented a green (second harmonic, 527 nm) target irradiation capability on one of the 60 OMEGA beams. This capability utilizes the existing OMEGA frequency-conversion crystals with the tripler detuned so that maximum 527-nm conversion is achieved.

- A revised set of direct-drive phase plates was designed and is being fabricated to further optimize irradiation uniformity for spherical implosions. These optics are going to be available in mid-FY03 and are expected to have improved smoothing characteristics in the mid-spatial-frequency range.

Table 92.V: The OMEGA target shot summary for FY02.

Laboratory	Planned Number of Target Shots	Actual Number of Target Shots
LLE	755	720
LLNL*	405	413
LANL	130	132
SNL	20	24
NLUF	120	118
CEA	20	19
Total	1450	1426
LLE ISE		306
LLE SSP		204
LLE RTI		66
LLE LPI		44
LLE Astro		46
LLE Cryo		21
LLE DD		18
LLE PB		15
LLE Total		720

*Includes ten in collaboration with LANL and seven with SNL.