Section 4
LASER SYSTEM REPORT

4.A GDL Facility Report

During the third quarter of FY89 the experimental program in GDL consisted of four separate efforts. Laser shots were dedicated to continuance of the following projects: shine-through, x-ray laser, and x-ray microscopy. This quarter also marked the deployment of a short ($\sim$20-ps) pulsed probe beam. The shine-through experiments continued investigation of early-time phenomena in laser-produced plasmas, in particular the transmission of light through a target before the generation of plasma. The x-ray laser program continued investigating both the collisional excitation laser and a resonant photopumping scheme. In addition, one shot day (six shots) was dedicated to a joint experiment with the University of Maryland for plasma spectroscopy for x-ray lasers. The x-ray microscopy experiments are aimed at identifying a biological source of pure silicon. The probe beam that has been directed to the GDL target-irradiation facility will be used in two ways: first, as a backlight source (= 527 nm) for an imaging system that will investigate plasma generation and expansion; second, as a pump beam for Thomson-scattering experiments.

The engineering and technical staff in GDL have continued their support of the OMEGA fusion campaign. One aspect of that support was the characterization of 24 KDP conversion cells for the OMEGA laser. During this quarter, an acousto-optic Q-switch was installed in the GDL oscillator providing more stability to the laser operation. Lastly, some film-calibration studies were performed in GDL.

A summary of the GDL operation is as follows:

Beamline Test, Calibration, Tuning and Laser Alignment Shots	96
Target Shots	
Shine-through	28
X-Ray Laser	47
X-Ray Lithography	13
KDP Characterization	53
Film Calibration	5
TOTAL	242

4.B OMEGA Facility Report

During this quarter, the OMEGA laser facility returned to full-time operation as a target-irradiation facility. In addition, the programs for spatial smoothing by spectral dispersion (SSD) and power balance were continued. The SSD subsystem is now routinely operational, and a comprehensive beam characterization program was carried out to optimize the beam-smoothing parameters. A number of system modifications were implemented to improve the beam energy and power balance.

To assure optimum performance, each target-shooting day a pointing test shot was taken and was followed by frequency-conversion tests. Laser-to-target pointing accuracy was measured using x-ray pinhole camera photography from high-energy target shots on 800-μm gold-coated glass microballoons. On a typical pointing shot, six re-entrant cameras were deployed giving views of all beams on the target. All six images were immedately developed, digitized, and analyzed to determine the positions of the beam on target. Actual positions were compared to the calculated locations by a software routine that determined the beam positions to ± 5 μm. Beams further than 10 μm from the calculated best position were adjusted using the final transport mirror. The pointing data reduction was normally accomplished in 1 h.

In summary, the laser has delivered a large number of well-characterized and uniform irradiation shots on target. The following shot summary reflects the increased number of laser test shots currently required to achieve the high level of precision and uniformity, but steps are being taken to reduce the system time required for laser tuning and calibration.

A synopsis of laser shots for this quarter follows:

Driver Line	139
Laser Test	317
Target	138
Software Test/Other	84
TOTAL	678