OMEGA Upgrade Status Report 10/1/93–9/30/94

The design effort for the OMEGA Upgrade project was finished and the project transitioned to the manufacturing phase during the first two quarters of FY94. The manufacturing of the OMEGA Upgrade consists of fabrication, assembly and testing of all components installed into the laser system, and then integration of all subsystems into a complete facility. The status of the project is indicated by the DOE milestones completed and started during FY94.

DOE project milestones completed this fiscal year are
- KD3′ design
- Operations readiness review, facility
- Laser drivers design
- Pulse-generation room activation
- Target chamber installation
- KD3a transition to operations (pending DOE approval)
- Delivery of
  - laser bay structures
  - target bay structures
  - disk amplifier power conditioning

DOE project milestones started this fiscal year are
- Assembly of rod and disk amplifiers
- Laser bay integration
- Power conditioning installation
- Target bay integration
- Installation of laser and target structures
- Target bay optomechanical assemblies (in-house mfg.)
- Laser optics installation
- Delivery of KDP crystals

A total of 104 mechanical structures are required to mount the optical assemblies on the OMEGA Upgrade laser facility. All of these laser and target bay structures and optical tables have been received, aligned, and grouted into their final positions. The 243 spatial filter tube sections were received, cleaned, and installed into their support frames.

The contractor delivered, assembled, and resistive load tested all 120 SSA (disk amplifier) power conditioning units (PCU's). These units are now ready for live-load testing and amplifier activation. The project received and assembled 11 of the 17 rod amplifier PCU's needed for the first three stages of amplification (stages A, B, and C), and completed mechanical assembly of all rod PCU's needed for the fourth amplification stage (stage D—the final rod amplifiers).

The hardware to transport the main driver pulse from the pulse-generation room (PGR) to the driver line (preamplifier section) was installed, tested, and activated. The main-pulse driver line construction and testing was completed and has delivered a 10-J laser pulse at the output of the driver line ready for injection into the power amplifier section of the laser. Transport from the PGR and driver line for the foot pulse is in work and is scheduled for completion by the end of FY94. These tasks include the construction and testing of large-aperture ring amplifiers (LARA's) used in both the main- and foot-pulse driver lines.

The design for the rod and disk amplifiers resulted in approximately 500,000 parts. The fabrication procurements for these parts were placed and nearly over-subscribed the local machine shops. There are 97 rod amplifiers, 60 15-cm SSA amplifiers, and 60 20-cm SSA amplifiers needed for the OMEGA Upgrade laser system. We have installed 38 rod, 15 15-cm SSA, and one 20-cm SSA amplifier assemblies into their structures on the laser bay floor.

The Thin Film Coating Group has processed through their facility 1047 of the 2430 optics required for the laser system. The remaining 1383 optics are due for delivery to the installation teams by mid-December. The optics are being supplied on an as-needed schedule to minimize the need for clean room storage space.

For FY94 the laser bay integration alignment progress follows closely behind the installation of optical components delivered to the facility. This effort began in early March with the installation and activation of a continuous IR laser source and the optics required for a full-aperture alignment beam. Laser beamline alignment requires the installation of several alignment diagnostics, including a collimation sensor capable of measuring the system collimation at any point in the IR laser between the 243 Upgrade spatial filters. All optics are installed and aligned through the stage-C alignment sensor packages (ASP's) at the conclusion of FY94. The stage-C ASP is mid-chain alignment diagnostic installed just prior to the final beam splitters (C-D splitter). The C-D splitter is currently under alignment as are beamlines starting at the stage-D rod amp and propagating to the stage-F alignment sensor packages (F-ASP's). Most optics have been installed in the ten-beam cluster-3 assemblies, and alignment is progressing smoothly in this cluster.

The target bay integration alignment has concentrated on the ultraviolet alignment table (UVAT), periscope mirror assembly (PMA), and the F-ASP. These three subsystems are required to establish the baseline alignment for all optics in the laser and target bays. The UVAT is fully operational, as are the PMA's. The F-ASP's have all 60 primary and secondary grouting frames installed and aligned. The cluster-3 F-ASP has all ten alignment relay subsystems installed and is fully supported by a control system and alignment image processing.

The activation process of a system stage closely follows the integration alignment of that stage. The driver line is fully activated and calibrated and is operational to support the daily activation requirements. Cluster-3 beamline 9 (39) was selected as the first line to be activated. Amplifiers A3, B34, and C34 have been test fired, fully activated, and calibrated to support the activation of this beam line. All the splitters in beam line 34 have been optically balanced with ratiometers. Full activation for beam line 39 is to be completed by mid-October. Lessons learned from beamline 39 will increase the efficiency of activation for the remaining 59 beamlines.

The project schedule called for the delivery of an Acceptance Test Plan by the end of the third quarter of FY94 and a Final Safety Analysis Document by the end of the second quarter of FY95. These are related to a final operations readiness review and the Key Decision #4 "Project Complete Start Operations" milestone. These are embodied in two project documents that were completed and submitted to DOE in advance of the Acceptance Test Plan milestone.

The Operational Readiness Review Plan (S-AA-M-11) sets up an LLE "Operations and Safety Review Committee" that will conduct an extensive, independent review of the safety aspects of the design and operation of the OMEGA facility. The committee will prepare a report summarizing its activities and findings that will be provided to DOE in advance of the DOE Final Project review.

The Acceptance Test Plan (S-AA-M-08) sets up a system performance review process that is similar to the operations review: An LLE "System Performance Review Committee" will monitor the activation of the system and review test data to verify that the project performance baselines have been met. The committee's report will be provided to DOE in advance of the DOE Final Project review.