LASER SYSTEMS REPORT

A cutaway view of the Laboratory for Laser Energetics at the University of Rochester is shown in Figure 1a, and the laser systems of the National Laser Users Facility at LLE are indicated in Figure 1b. The 24 beam, 12 TW OMEGA Laser System is nearing completion and is in the large laser bay at the rear of the building in Figure 1 with the OMEGA target chamber assembly to the left. The 3TW ZETA laser system is operational and is composed of 6 of the OMEGA laser beams. The single beam Glass Development Laser is also operational and, with reference to Figure 1, is located on the lower level.

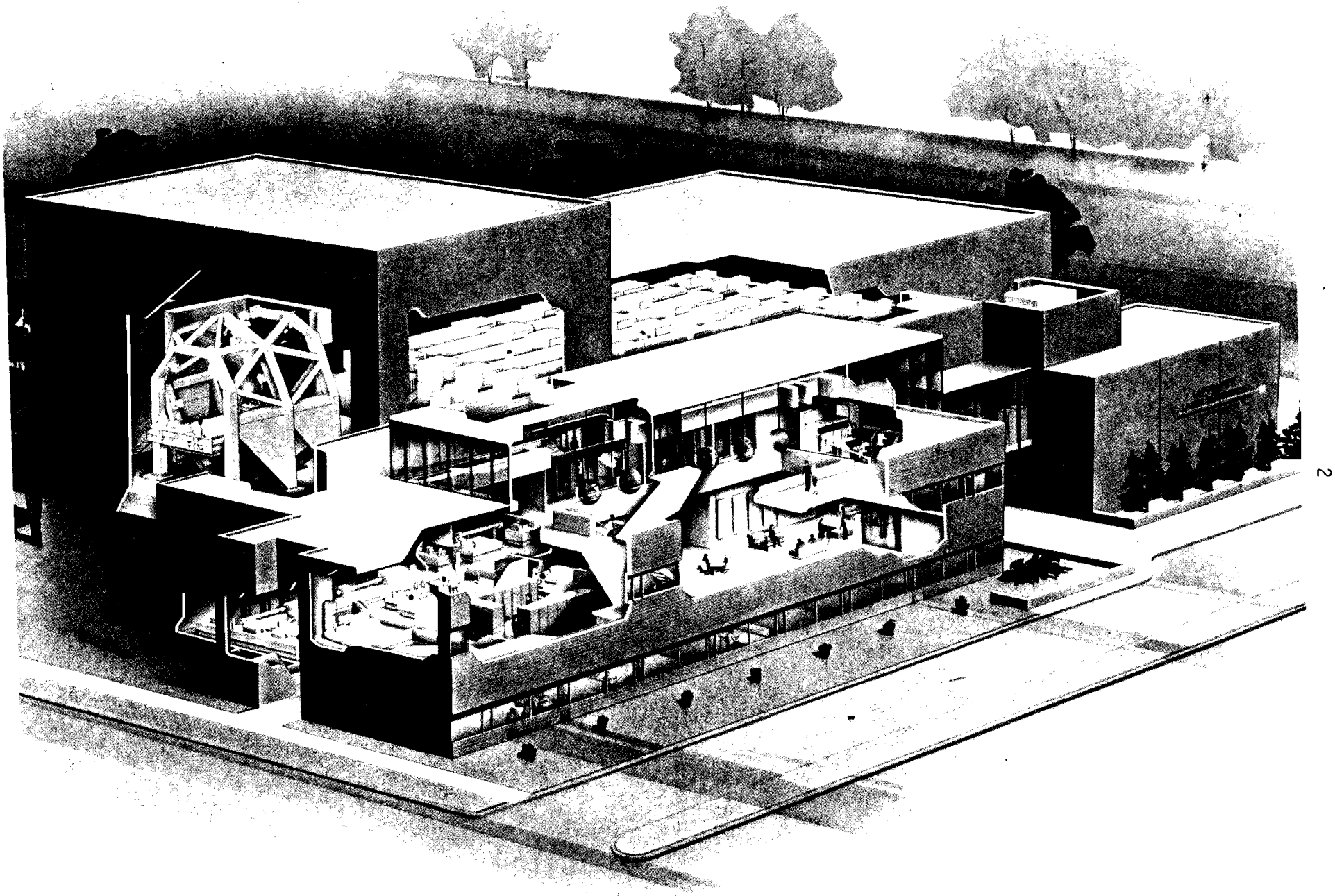

Figure 1a The Laboratory for Laser Energetics at the University of Rochester

University of Rochester
Laboratory for Laser Energetics

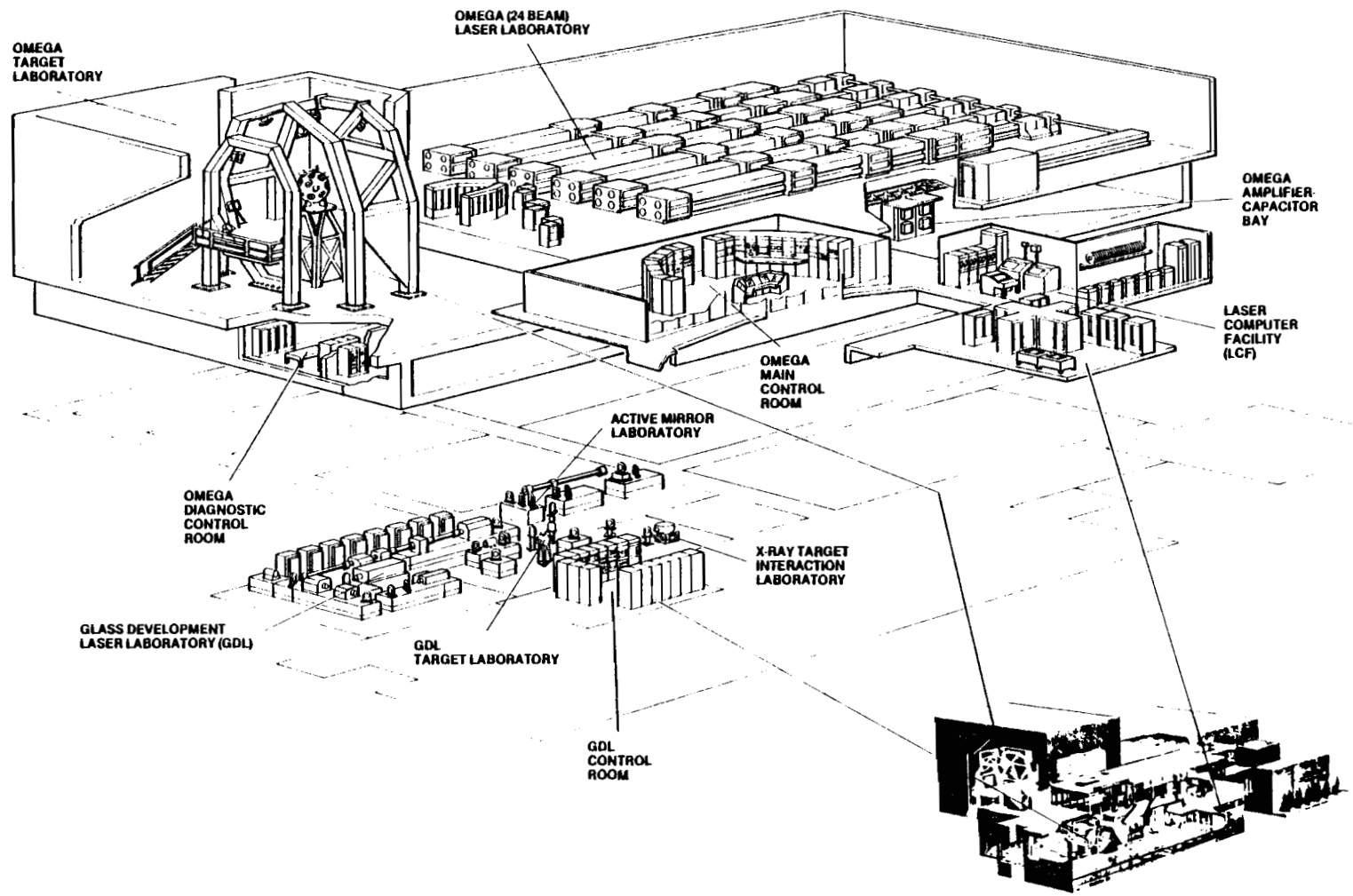

Figure 1b The laser systems at the National Laser Users Facility at LLE

ZETA Laser System

The ZETA laser system is composed of the first 6 of the 24 OMEGA laser beam lines. A separate ZETA target chamber has been utilized for symmetrical illumination target experiments beginning in October 1978. A total of 110 taret shots were executed on ZETA in the period from September 1 to November 7, 1979. A weekly log of ZETA target shots for all of 1979 is shown in Figure 2. During weeks 40-42, the wall separating the ZETA beams and the remaining 18 was taken down. The ZETA components were then cleaned and completely realigned. ZETA target experiments were temporarily suspended on November 7 in order to concentrate the efforts of the Engineering Division and the Operations

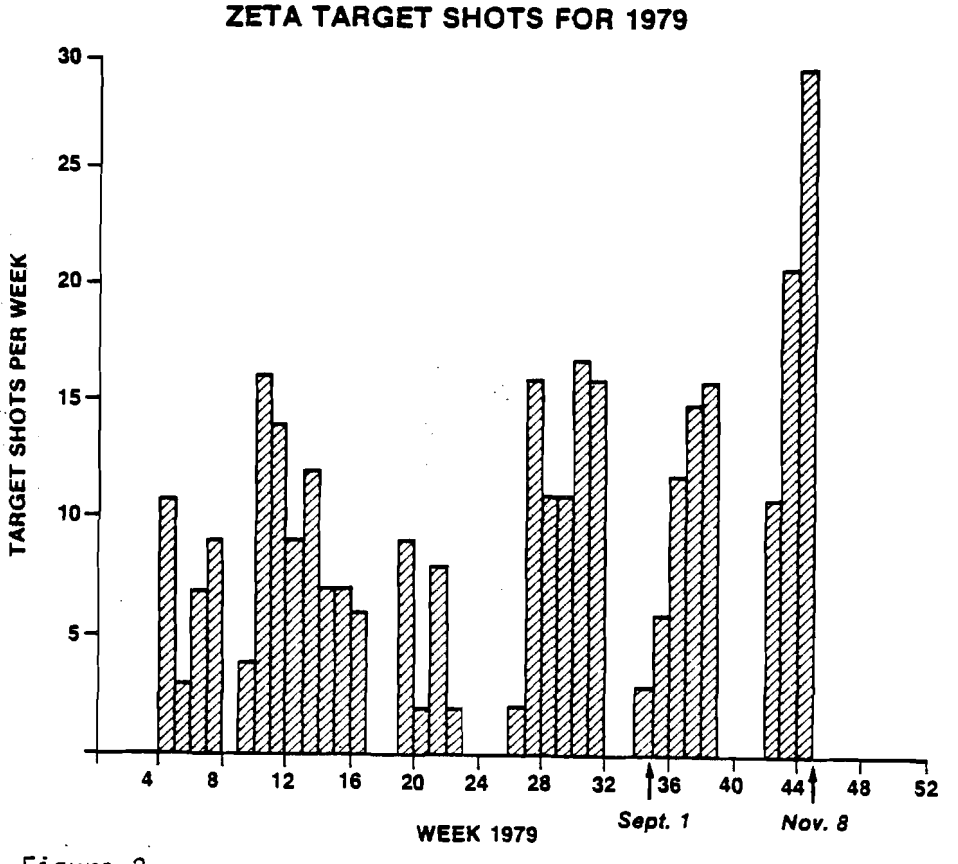

Figure 2

Group on the activation of the remaining 18 OMEGA beam lines. In the future, the 6 ZETA beam lines will serve a dual role as part of the full OMEGA 24 beam system, and when directed to the ZETA experimental area, as the ZETA laser system. This will allow the ZETA experimental program to continue indefinitely while the OMEGA experimental facility is developed.

For the target shots in this reporting period, the ZETA laser output was in the energy range of 50-150 J in 50-70 psec pulses. 50 shots were devoted to thin wall ($\sim$ 1 μm) exploding pusher experiments. 52 shots were carried out on targets with thick walls (up to 10 μm) in order to obtain high compressed densities; these targets were filled with DT, D_2, or Argon. In addition 8 target shots were utilized for diagnostic and laser system checkout. For these experiments, the beams were balanced in energy by an amount that varied from $\pm$6% to $\pm$15% and the arrival times of the beams on target were within 3-4 psec. Further details on the experimental results are given in Progress In Laser Fusion.

OMEGA Laser System

Progress has continued in the last quarter on the assembly and activation of the remaining 18 of the 24 OMEGA Laser System beam lines. This activity will culminate in the DOE laser performance test presently scheduled for mid January, 1980. The following milestones have been achieved:

1. All laser beamline hardware is now installed and aligned up to and including the end mirrors and beam diagnostic packages (Figure 3).

2. Two four beam clusters have been fully tested for gain, and have had high power beams propagated through them. All clusters are to be fully gain tested and characterized by January 1, 1980.

3. The target area structures and the primary personnel platform are now complete with the exception of final painting (Figure 4). A contract has also been let for a secondary personnel platform.

4. The first production assemblies of both the OMEGA focus lens mount and final turning mirror mount have been received and tested.

The OMEGA target chamber is now scheduled for delivery by February 1, 1980.

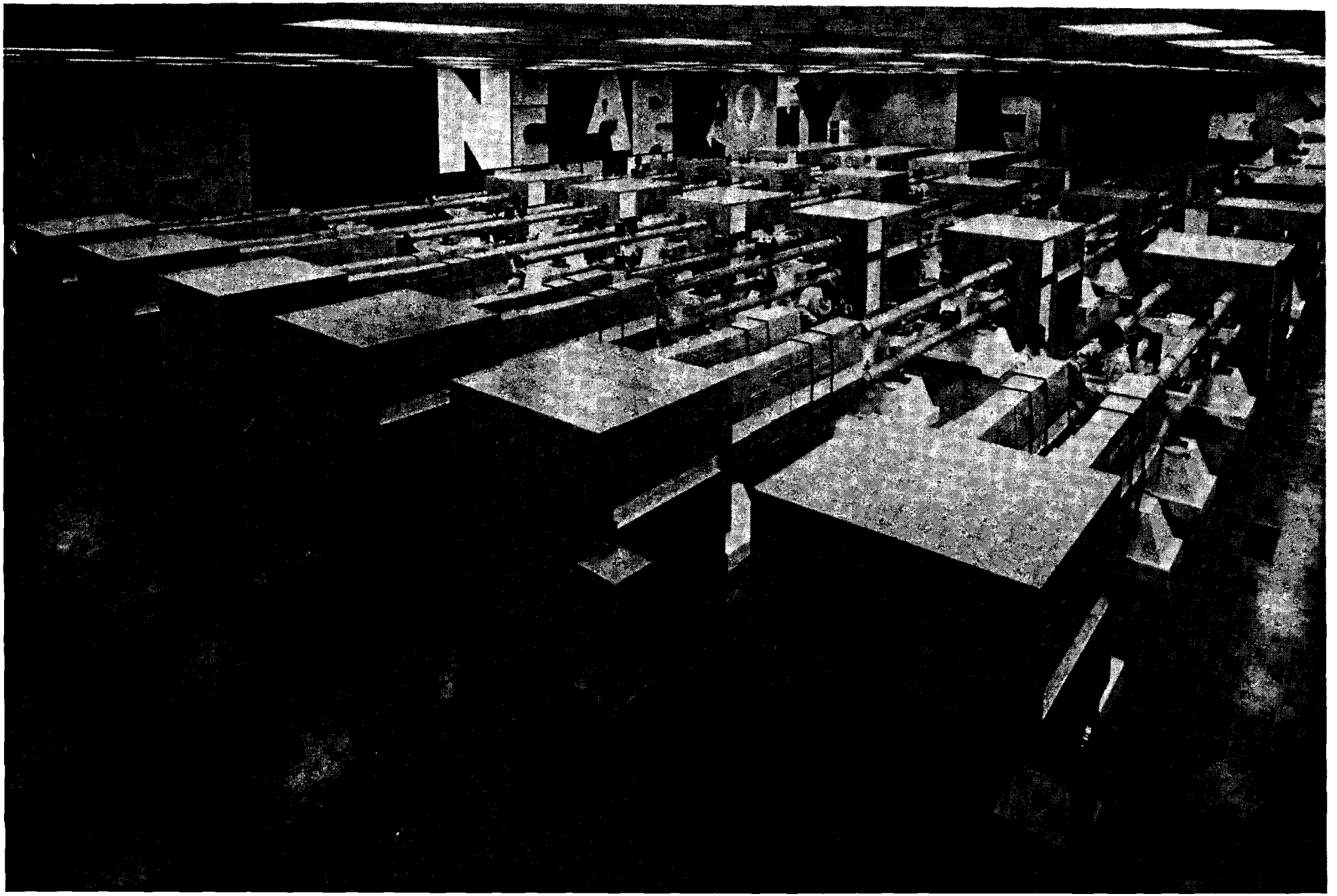

Figure 3 OMEGA laser bay 10/79

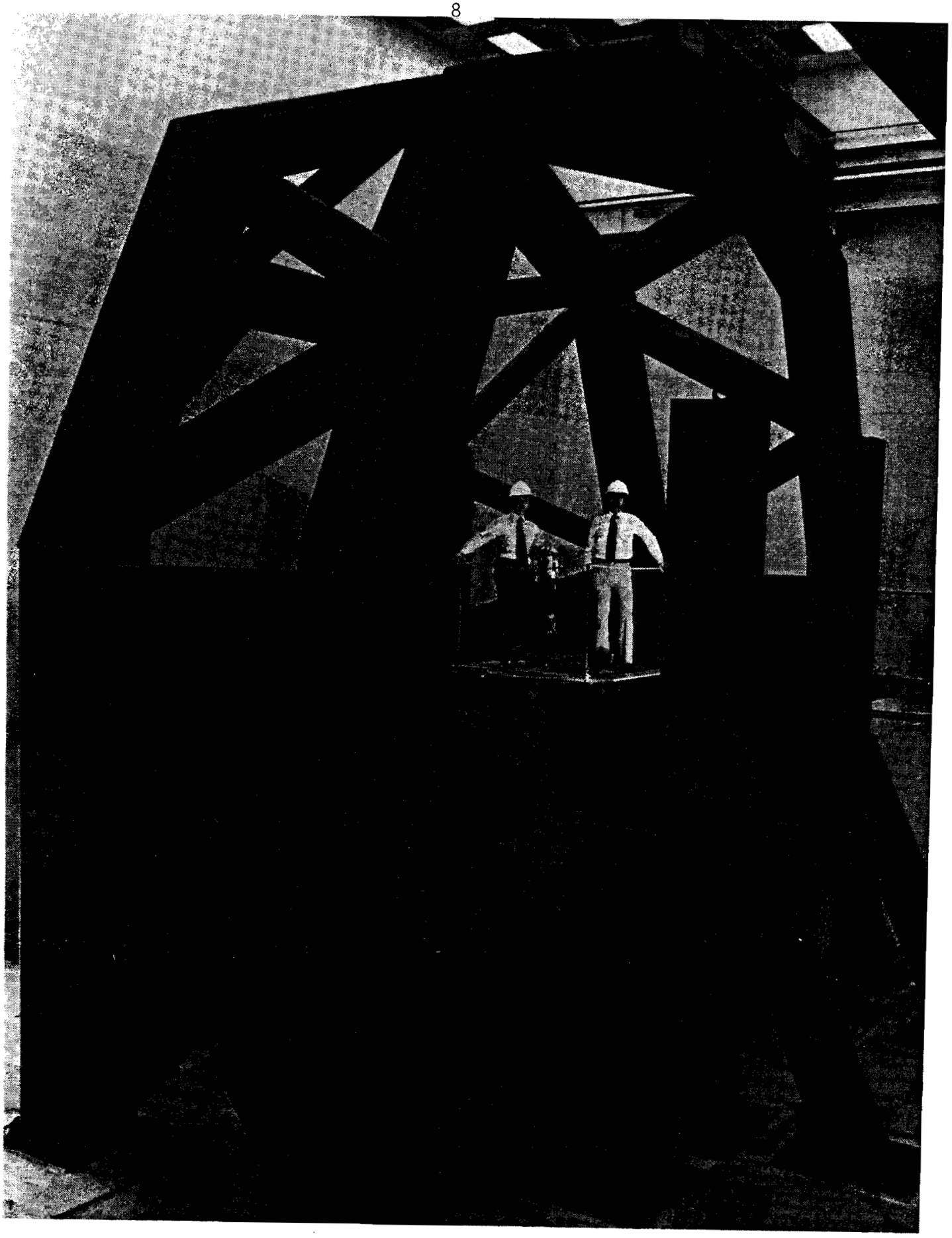

Figure 4 OMEGA target structure (9/79) before construction of primary personnel platform

Glass Development Laser (GDL)

The original OMEGA beam line prototype, which is comparable in laser performance to a single OMEGA beam line, has been utilized for a wide variety of target experiments since early 1978. The GDL beam can be directed into two separate laser plasma experimental areas or into the OMEGA Booster Program experimental area for active mirror studies. The beam can also be split into two beams for implosion experiments.

During the period September 1, 1979 through November 30, 1979, a total of 298 shots were taken on GDL for a variety of experiments.

1. INTERACTION EXPERIMENTS: A total of 78 shots were taken in support of research in the areas of fast ion production and high energy suprathermal electron generation.

2. TRANSPORT EXPERIMENT: 30 shots were for a preliminary phase of a joint SANDIA-LLE-KMS experiment. These shots examined the burn through of thin (1-3μm) plastic layers at incident laser intensities of 10^{13} - 10^{14} W/cm^2. Charge states of blow-off ions were analyzed (with a Thomson parabola) to determine when the boron substrate was heated significantly.

3. X-RAY GROUP: 32 shots were taken to support x-ray laser experiments, applications of laser produced x-rays in biophysics, and diagnostic development.

4. SHORT WAVELENGTH CONVERSION PROGRAM: 26 shots were used for efficiency and birefringence studies of laser frequency doubling with Type II KDP crystals.

5. DAMAGE TESTING: A total of 125 shots were taken in support of coating damage measurements in the damage test facility.

6. SURFACE ANNEALING BY LASER IRRADIATION: 7 shots were conducted for an outside user (Bell Laboratories) measuring the effects of high power laser irradiation on semiconductor materials.