Replacement of Cryogenic Target System Linear Motor: In Q1 FY18, LLE installed and qualified a replacement linear motor and control system to remove the shroud on cryogenic target shots. This culminates a two-year effort to design, fabricate, and test a replacement for hardware that had been used for nearly 20 years (Ref. 1). Position feedback control had become unstable, and intermittently induced large target vibrations. This critical system was obsolete and unmaintainable, thereby jeopardizing LLE's cryogenic target campaigns.

The new system incorporates features to enhance reliability, maintainability, and system safety. It performed extremely well during its first use; all four targets were less than 10 μm from target chamber center. Shot 88314 had the best performance to date, with a yield of 1.25×10^{14}, ρR of 138 mg/ cm^2, and the highest χ (no α) of all cryogenic implosions. The motor assembly (Fig. 1) weighs 1100 lb and is installed as a single component. Removal of the old motor and installation of the new was completed in less than 8 h. The motor can traverse a distance of up to 1.1 m, develop 1000 lb of thrust, and is capable of >5-g acceleration and a velocity of 5 m/s.

During shot preparation, the motor grips the cryogenic shroud and maintains a 250-lb downward force so that the helium exchange gas does not leak out of the shroud seal. Several seconds before the laser is fired, the motor removes the shroud in three stages: (1) separate the shroud from the cryostat; (2) dwell several seconds until target vibrations damp out; and (3) rapidly pull the shroud. One immediate benefit was realized: dwell was eliminated and target vibration was less than 2 μm peak-to-peak when the laser fired. Eliminating dwell preserves the critical thermal environment around the target 2.8 s longer, thereby limiting self-heating of the core by DT decay.

The motor is housed in the upper pylon (Fig. 2), which is suspended from a bridge that spans the OMEGA Target Bay and is anchored to the shield walls. The only mechanical coupling between the pylon and target chamber is through a vacuum bellows. This arrangement minimizes transmissibility of the motor's energy to the target, thereby minimizing target vibration.

Omega Facility Operations Summary: The Omega Facility conducted 145 target shots in January 2018 with an average experimental effectiveness (EE) of 95.5%. OMEGA accounted for 83 of these shots with an EE of 95.8%, while OMEGA EP had 62 shots with an EE of 95.2%. The ICF program had 72 target shots for experiments led by LLNL, LLE, and NRL. Fifty-four target shots were taken for the HED Program by teams from LANL, LLNL, and LLE. Two NLUF experiments led by the University of California, Berkeley and Princeton University, respectively, accounted for 19 target shots.


U2321JD

Figure 1. The new linear motor is shown mounted in the lab test fixture (blue and white components). A 3-D coordinate measuring machine (tripod, lower right) was used to verify alignment accuracy during assembly.

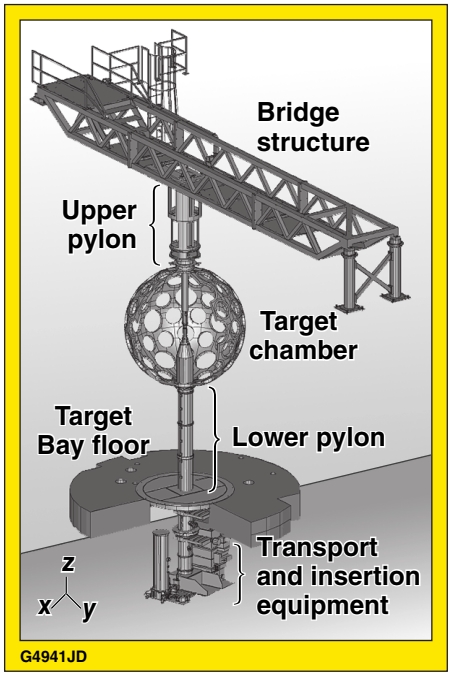

Figure 2. The linear motor is housed in the upper pylon, which is suspended from the target bridge.

1. *LLE Review Quarterly Report* **81**, 21 (1999).

Contact: John M. Soures (585) 275-3866; fax: (585) 256-2586; e-mail: jsou@lle.rochester.edu