High Output Maximum Efficiency Resonator (HOMER) Laser for NASA's Global Ecosystem Dynamics Investigation (GEDI) Lidar Mission

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The HOMER cavity is a positive branch unstable resonator (PBUR), employing a Graded Reflectivity Mirror (GRM) with a Gaussian reflectivity profile. This produces high beam quality (TEM00) and produces high pulse energies typical of master oscillator/power amplifier (MOPA) designs, but with higher efficiency. Less optics, less volume/mass, excellent pointing.

**Parameter** | **HOMER Output**
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Energy | 17 - 9 mJ
Pulse Width | 10 +/- 1 ns
Rep Rate | 250 - 100 Hz
LDA Duty Cycle | ~2%
LDA Current | 50 A
LDA Derating | 50%
TRL 6 Mass | 5 kg
Total QS Shots HOMER Design | 15+ Billion
Optical Efficiency | 17%
Elect Efficiency | > 7%

**Environmental Testing:**

**Vibration Testing:**
The General Environmental Verification Standard (GEVS) qualification specification was applied. The purpose of this test was to qualify the HOMER design through TRL6 vibration testing. Since no launch vehicle was selected at that time, the HOMER was designed for a 0°C to 40°C survival temperature range. Therefore, using GEVS component qualification standards, HOMER was temperature cycled to 0°C for 4 hours and then to 50°C for 4 hours at total of 8 times. HOMER’s performance was checked at regular intervals to assure proper laser output quality.

**TVAC Testing:**
HOMER was designed for a 0°C to 40°C survival temperature range. Therefore, using GEVS component qualification standards, HOMER was temperature cycled to 0°C for 4 hours and then to 50°C for 4 hours at total of 8 times. HOMER’s performance was checked at regular intervals to assure proper laser output quality.

**Final HOMER Design:**

Now that HOMER is the GEDI laser, it is being mechanically upgraded; incorporating a beam expander, improved optical bench, and a flight-like laser electronics box. The ETU and flight laser systems will be built in-house and will go through environmental testing.

**Optical Layout of the HOMER-2 Lifetest:**
A 1064nm fiber coupled laser diode is reflected off reference cubes mounted on the enclosure and the base plate. This determines any movement of the laser cavity vs. the outside environment.

**TEM00 HOMER Beam Quality:**
This CCD image simultaneously displays all reference beams and the HOMER-2 far field beam. The far field (largest beam) measures approximately 0.9 mR x 1.0 mR divergence.