Observation of Lunar Topography by Laser altimeter (LALT) on board SELENE

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Three selenodetic experiments are planned in Japan's SELENE (Selenological and Engineering Explorer) mission. Laser Altimeter (LALT) is one of the experiments which measures the distance between the main orbiter and the lunar surface for the lunar topography. The second is four-way range-rate measurement by using a sub-satellite (RSAT) and the last is differential VLBI measurement of the two sub-satellites which are equipped with radio sources of S and X bands (VRAD). RSAT and VRAD contribute to the lunar global gravity field measurement. As of early 2005, SELENE is scheduled to be launched in 2006 and various tests are now being conducted.

LALT incorporates Q-switched Nd:YAG laser whose wavelength is 1064nm, a pulse width 15ns, and pulse energy is 100mJ. Q-switch consists of $LiNbO_3$ Pockels cell. The output beam divergence is 0.4 mrad after passing through the 7.5cm Galileo refractor. Beam spot size on lunar surface is typically 40m when main orbiter altitude is 100km. Return pulses are captured by 10cm Cassegrain-type reflector and detected by Si-APD detector with 10nm band pass filter for high S/N observation. Manufacture of the flight model of LALT had been completed by the end of March 2003. The first integration test with SELENE main orbiter had been carried out successfully for checking specifications and functions of\LALT by March 2004. LALT takes final check-out in the manufacturer to join the final PFM\(proto-flight model) integration test.

LALT will measure lunar global topography with the range accuracy of ±5m with 1 or 2 km foot\print spacing in the equatorial region for 1 year mission period. Science objective of LALT is to obtain\the more accurate lunar topographic model than GLTM-2 by the Clementine-LIDAR. The model will\contribute to precise determination of lunar global figure including COM/COF offset, understanding\internal structure and surface processes of the Moon, exploration of the lunar pole regions, and for the\reduction of lunar occultation data.

Keywords: LALT; RSAT; VRAD; SELENE; laser; altimeter; selenodetic; lunar; topography.

Figure 1: (left) LALT on SELENE main orbiter (First integration test).
Figure 2: (right) SELENE main orbiter (First integration test).