Laser reflector arrangement of the H2A-LRE satellite

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NASDA successfully launched the first H2A rocket on 29 August 2002. It released the LRE (Laser Reflector Equipment) satellite into the geostationary transfer orbit and it has been observed by optical tracking and by laser ranging from several terrestrial stations.

The LRE satellite carries 24 curved mirrors (radius of curvature 10 m) for reflecting sunlight, and 126 corner cube reflectors for satellite laser ranging. Most of its optical equipment is common to that carried on the AJISAI satellite launched in 1986. Of 126 reflectors, 66 are made of fused silica and 60 are made of BK7 which is expected to degrade in several months. The retroreflection of LRE becomes almost half after the degradation of the BK7 reflectors.

Since the laser ranging system does not have high sensitivity to the receiving intensity, it is difficult to monitor the BK7 degradation by measuring intensity. Therefore, we deviced reflector arrangement in which the two types of reflectors are not uniformly distributed on the surface. The concept is that the satellite spin rate and the BK7 degradation should be observed by the wobbling period of the laser range and the return rate.

The centre-of-mass correction changes after the BK7 degradation. We simulated the retroreflected pulse shape and the detection timing. The centre-of-mass correction becomes smaller: 210 mm to 205 mm for single photon systems (with 3-sigma filter), and 215 mm to 210 mm for multiphoton systems (with 200 ps FWHM system noise).