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CURRENT STATUS OF THE ON-GOING ORBIT TRANSFER OF SUPER LOW ALTITUDE TEST SATELLITE (SLATS)

Abstract

Super Low Altitude Test Satellite (SLATS) nicknamed "TSUBAME" was successfully launched on December 23, 2017. The purposes of SLATS are 1) Test of keeping satellite's altitude with its own ion engine against high atmospheric drag at super low altitude (below 268km altitude), 2) Data acquisition of atmospheric density and atomic oxygen, and 3) Test of optical earth observations. As SLATS was a sub payload of the launch, SLATS was released into a high elliptical orbit (640×450 km altitude) which is an undesirable orbital plane (LST: local sun time of descending node 10:30). Therefore, SLATS is performing orbit transfer now. This transfer is divided into two phases. The first phase is an initial orbit control phase. SLATS in this phase transfers from 640×450km elliptic orbit to 393km circular orbit using a chemical gas jet system (RCS) for three months. The second phase is a long orbit transfer phase. SLATS in this phase transfers from 393km altitude to 270km altitude using atmospheric drag and RCS for about 1 year. At the same time, its orbital plane is changed from LST 10:30 to about 16:00 using effect of non-sun-synchronous orbit. LST 16:00 orbit plane is required to ensure sufficient solar power for an ion engine to keep the satellite at super low altitude. SLATS will finish the initial orbit control phase by March 2018. After April, SLATS will enter the long orbit transfer phase. SLATS has aero attitude mode which is divided into "Aero-brake mode" and "Aero-through mode". Aero-brake mode is to maximize atmospheric drag. In this mode, SLATS maintains its attitude that the cell plane of its solar array panel faces to the satellite flight direction. Aero-through mode is to minimize atmospheric drag. In this mode, SLATS maintains its attitude that the edge plane of its solar array panel faces to the satellite flight direction. In the long orbit transfer phase, SLATS will descend right on schedule against the atmospheric density changing by solar activity and cut down the fuel consumption of RCS for altitude control using this aero attitude control mode. The atmospheric drag of all attitudes was computed by the Direct Simulation Monte Carlo method. And the results are used in the ground-based orbit prediction and determination system of SLATS. This paper shows the results of the initial orbit control phase, and the current status of the long orbit transfer phase including aero attitude mode effects.