IAF SPACE OPERATIONS SYMPOSIUM (B6)
Mission Operations, Validation, Simulation and Training (3)

Author: Ms. Ayesha Sharafi
Mohammed Bin Rashid Space Centre (MBRSC), United Arab Emirates

Mr. Omar Hussain
Mohammed Bin Rashid Space Centre (MBRSC), United Arab Emirates

ALTITUDE MAINTENANCE OF A 500KM LOW-EARTH ORBIT SATELLITE

Abstract

Various forces contribute to changing the altitude and orientation of a given orbit including Earth's oblateness (non-sphericity), atmospheric drag, solar radiation pressure (solar flux), and other gravitational effects (such as solar and lunar gravitational forces). In this paper, an orbit maintenance study is conducted on a Low-Earth Orbit satellite in a 500 km circular orbit and with a total mass of 700 kg. The Payload and GPS system of the satellite are highly affected by the altitude, hence maintaining a 500 km altitude orbit is critical. The two orbit perturbation factors that are considered in this study are atmospheric drag and solar radiation pressure (solar flux). Earth's oblateness mostly affects the orientation of an orbit and does not influence its altitude. Thus, it will not be considered as a contributing decay factor in this study. Additionally, lunar and solar gravitational forces are more prominent in high altitudes and in highly elliptical orbits. Since a 500 km orbit is considered low altitude, lunar and solar gravitational effects will not be considered in this study. In order for the satellite to maintain a constant altitude of 500 km, it should mainly counteract the forces of atmospheric drag and solar flux by an equivalent opposing thrust force. The propulsion system considered in this study is an electric propulsion system with a thrust force of 17 mN and a specific impulse of 1300 seconds. This paper provides information on the delta-V needed to maintain an orbit of 500 km, the fuel mass required to produce that delta-V, and the time duration of operating the electric propulsion thrusters to maintain the orbit. Also, the study will cover the most suitable locations to fire the thrusters in order to maintain the 500 km Orbit without effecting the mission's operations.