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MISSION DESIGN AND ANALYSIS FOR THE DEIMOS-2 EARTH OBSERVATION MISSION

Abstract

Following the successful operations of the medium-resolution wide-swath DEIMOS-1 satellite, a new Earth Observation (EO) mission of the Spanish DEIMOS series is currently being designed and it is slated for launch in the third quarter of 2013.

The DEIMOS-2 mission is aimed at operating an agile mini-satellite for high-resolution EO applications. The agile spacecraft can be steered to accurately point the pushbroom-type payload, which can provide 1-m panchromatic and 4-m multi-spectral images with a swath of 12 km at nadir at an orbit altitude between 580 km and 650 km.

The S/C off-nadir tilting capability is intended to improve the revisit time performance and the operational flexibility, by significantly reducing the time interval to take images on target areas. While the across-track tilt angle for nominal image acquisitions is 30°, the satellite can be configured to achieve 45° off-nadir pointing capability, i.e., an extended Field of Regard (FoR) for data collection with short revisit time in emergency situations. Moreover, high-quality observations can be performed close to nadir (small FoR) to enable background mapping.

The key drivers for the DEIMOS-2 orbit selection are the optimisation of the revisit time with the nominal and extended FoR, the image resolution and the mission robustness (mainly in terms of orbit decay) with respect to potential failure scenarios (injection errors, propulsion system availability and reliability).

The mission analysis addresses the orbit evolution assessment, the planning and implementation of the orbit manoeuvres (correction of launcher injection errors, orbit maintenance, collision avoidance and end-of-life disposal), based on the use of an electric propulsion system with thrust in the mN range and specific impulse around 1000 s. Mission scenarios with orbit maintenance during the mission lifetime and with free-decaying orbit have been analysed and the corresponding impact on the mission return has been assessed.

The definition of the operations scenario is also driven by the contact opportunities with the primary ground station (Puertollano) allocated to TTC (S-band) and data download (X-band), and with the

secondary ground station (Svalbard) used to enhance the available data download time. The volume of images collected and the ground delivery intervals, combined with the on-board mass memory and data transmission rate, have a key impact on the mission capacity and exploitation.

To exhaustively characterise the mission performance, extensive coverage analyses have been carried out, encompassing such figures of merit as revisit time, number of acquisitions, observation viewing geometry and cumulative coverage vs. time.