DEIMOS-2 INITIAL ORBIT ACQUISITION OPERATIONS

Mar Luengo Cerrón[(1)], Fernando Gonzalez Meruelo[(2)], Carlos Díaz Urgoiti[(3)], Annalisa Mazzoleni[(4)], Miguel Belló Mora[(5)]

[(1)]*Deimos Imaging, Parque Tecnológico de Boecillo, Edificio Galileo, Módulo Gris, Oficina 103, Boecillo – Valladolid (Spain) +34 983548923, mar.luengo@deimos-imaging.com*

[(2)] *Deimos Imaging, fernando.gonzalez@deimos-imaging.com*

[(3)] *Deimos Imaging, carlos.diaz@deimos-imaging.com*

[(4)] *Deimos Imaging, annalisa.mazzoleni@deimos-imaging.com*

[(5)]*Elecnor Deimos Space, miguel.bello@elecnor-deimos.com*

Keywords: *DEIMOS-2, Hall-Effect thruster operation, LEO.*

ABSTRACT

DEIMOS-2 is the only European fully-private satellite capable of providing sub-metric multispectral imagery. It is owned and operated by Deimos Imaging (Spain), a subsidiary of UrtheCast Corp. (Canada), and it was co-developed by Elecnor Deimos (Spain) and Satrec Initiative (South Korea). Successfully launched on June 19, 2014 from Yasny Launch Base (Russia), on board a Dnepr rocket together with other 32 satellites from 17 different countries, DEIMOS-2 is a very-high resolution, agile satellite capable of providing 75-cm pan-sharpened imagery with 4 bands (R, G, B, and NIR), with a swath of 12km.

The satellite was accurately placed into its nominal injection orbit, and first images were acquired and produced within 12 hours from separation. Within a week, LEOP was completed without any blocking issues, and Commissioning and CAL/VAL phases started.

On-board DEIMOS-2, a Hall Effect Propulsion Subsystem (HEPS) is in charge of providing manoeuvring capabilities. Its main task was to manoeuvre the satellite from the injection orbit to the target operational orbit, a Sun Synchronous frozen orbit (SSFO) with a mean altitude of 620 km, with LTAN at 10:30 and 14+13/16 orbits per day. This involved a 20-km altitude raising manoeuvring campaign and the corresponding significant change in inclination to maintain SSFO conditions.

During the first stages of Commissioning, an anomaly of the propulsion subsystem arose: detached micrometric particles where retained in cathode's orifices, also micrometric, allowing only a fraction of propellant to flow by. After an exhaustive theoretical analysis, followed by a set of bench and in-orbit tests, operational procedures were developed to operate safely and successfully the HEPS.

As a consequence of HEPS' anomaly, a re-assess of the strategy to reach the target operational orbit was performed. Following this analysis, a new strategy was developed that minimised the manoeuvring campaign while identifying a set of intermediate orbits that could be good (even if sub-optimal) orbit candidate for a commercial mission in case of a severe thruster malfunction.

This Initial Manoeuvring Campaign was aimed to decrease eccentricity and inclination while increasing semi-major axis, considering all orbital, platform, payload, power and operational conditions.

Complying with the aforementioned conditions, more than one thousand in-plane and out-of plane manoeuvres were performed, while successfully acquiring the first commercial images, upgrading on-board software several times and performing preventive and corrective propulsion system maintenance activities in a timespan of only three months.

This paper addresses the Commissioning phase of DEIMOS-2, and in particular, its Initial Manoeuvring Campaign. It analyzes the implications of HEPS anomaly and, considering as well the rest of the constraints imposed by payload, platform and mission, outlines both the re-assessed target orbit and the strategy to reach it.

Finally, this paper summarizes the results of the manoeuvring campaign, in terms of orbital parameters evolution, operational lessons learned and its impact on the mission.