

IAF SPACE PROPULSION SYMPOSIUM (C4)
New Missions Enabled by New Propulsion Technology and Systems (6)

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GEO TELECOMMUNICATION SATELLITE: NEW OPPORTUNITIES ENABLED BY A 20KW
CLASS HALL THRUSTER

Abstract

Nowadays, the telecommunication satellite market in geostationary orbit (GEO) is suffering of a plummeting in the order rate of new GEO satellites. Compared to the average rate of launch between 20 and 25 satellites per years of the last decade, only five orders for large communication satellites were placed in 2018. Apparently, no real solutions can be implemented in near terms to revitalize GEO market. According with the opinions of several large integrators, the new trend in the development of large constellations in lower orbits is the main cause of the customer's uncertainties in the GEO market. At the same time, they are waiting for new, cutting-edge technologies in order to further increase GEO satellite capabilities in terms of payload size, satellite operational lifetime and performance. One of the technologies that may enhance the competitiveness of GEO telecom satellites is high power electric propulsion (HP-EP). Different applications could benefit from its adoption, allowing for more sustainable and affordable mission scenarios. The combination of HP-EP technology and the exploitation of reusable platforms in the field of GEO telecom satellites can bring to two different mission concepts. The first one consists of a reusable space tug that performs GEO on-orbit services, such as orbit raising manoeuvres, orbit refuelling and orbit relocation. The second mission concept consists of an integrated reusable platform as GEO telecom satellite that utilizes HP-EP to perform the above mentioned on-orbit services, in addition to its nominal mission operations. The paper presents a comparison between these two concepts, in order to investigate the technical feasibility of GEO on-orbit services and to assess the corresponding new market opportunities. Starting from the establishment of mission requirements and constrains, mission scenarios' alternatives are defined and analysed and the architecture of both platforms, which integrate HP-EP as baseline, is presented. Among different thruster technologies, Hall thrusters appears to be the most promising, owing to their extended performance envelope, their intrinsic reliability as well as their operational flexibility. After selecting the propulsion subsystem architecture, both platforms are sized for different mission scenarios thanks to the software Mission and System Sizing tool (MISS), an ad-hoc developed tool for mission and system design. Eventually, main conclusions about advantages and disadvantages of both mission concepts are drawn.