66th International Astronautical Congress 2015

ASTRODYNAMICS SYMPOSIUM (C1)
Mission Design, Operations & Optimization (2) (2)

Author: Mr. Netanel Levi
Israel Aerospace Industries. Ltd, Israel, nlevi@iai.co.il

Mr. Yossi Elisha
Israel Aerospace Industries. Ltd, Israel, yelisha@iai.co.il
Mr. Avner Mouchnino
Israel Aerospace Industries. Ltd, Israel, amouchnino@iai.co.il
Mr. Liron Schliesser
Israel Aerospace Industries. Ltd, Israel, lschliesser@iai.co.il

ORBITAL CONTROL OF GEOSTATIONARY SATELLITES – DEVELOPMENT OF AN AUTOMATED MANEUVERING PLANNING SYSTEM

Abstract

Geostationary satellites are characterized by having a virtually standing suborbital point, which is located at a determined longitude over the equator. This feature makes them attractive for telecommunications purposes, because communication links can be established without requiring gimbaled antennas. Since the ideal geostationary orbit is not practical due to gravitational and solar pressure effects, station keeping is required, maintaining longitude, eccentricity and inclination inside their predetermined ranges. This is accomplished by activating the satellite's propulsion system. Traditionally station keeping maneuvers are conducted using chemical thrusters. New space propulsion architectures combine chemical and the much more efficient electrical propulsion systems. The inclination corrections, which in general are more than ten-fold as large as the in-plane corrections, are as a rule assigned to electrical thrusters. The in-plane correction requirements are in most cases still fulfilled activating chemical thrusters. As a matter of fact, the chemical propulsion option is readily available, since it is currently the straightforward option for the geosynchronous transfer orbit maneuvers. This paper presents key aspects of a maneuver-planning software platform being developed at IAI-MBT Space, which supports different propulsion architectures. The main drive for such a unified platform is facilitating the co-location assessment of satellites, which, due to the different propulsion configurations, have much distinct station keeping requirements. The software platform in development will have a cyclic operational working mode, in which orbit determination results serve as input for planning maneuvers up to the next orbit determination session, and subsequently the planned maneuvers translate into uplink format. In this mode, the development objective is of minimizing the operating workload, yet maintaining a clear picture of the station-keeping and co-location scenario. The ability of rapidly assessing close satellite encounters warnings and to provide enough insight to permit the re-evaluation of previously planned maneuvers in order to cope with minimum distance requirements will be delivered. The platform will also contain a strategy planning mode, to be used typically twice a year, providing the long term maneuver planning and orbit simulation. Such feature is of special importance when assessing the co-location between chemically maneuvered satellites, for which the inclination and the eccentricity operating ranges fill a large parcel of the orbital dead-band and plasma propelled systems, for which the inclination and eccentricity ranges are much more limited.