Paper ID: 35020
student

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

Author: Mr. Matteo Aquilano
SES Engineering, Luxemburg, matteoaqui@gmail.com

ELECTRIC ORBIT RAISING MISSION SIMULATOR

Abstract

In the framework of the analysis of EOR strategies for telecommunication satellites transfers from GTO to GEO, various optimization software have been developed by all the actors involved in this type of missions. In this context the SES Engineering Flight Dynamics Department developed an in-house optimization tool as a starting point for the operational support to future missions. As all the mathematically optimal solutions, they are more or less sensible to different settings and they differ, at least in part, to the actually implementable strategies. In fact, some of the operational constraints cannot be directly taken into account in the optimizer, and are better modeled in post-processing phases. An evaluation of the level for which an optimal strategy can be performed is thus necessary in order to support an efficient implementation of the mission. In order to assess the feasibility of the operational solutions proposed, as well as setting the stage for the development of a reliable operational tool to be used in support of these type of missions, a MatLab interface between the optimizer and an orbital propagator has been developed. This interface represents the core of the mission simulator developed. Its main feature is the ability to reproduce a typical operational scenario consisting of the re-optimization of the trajectory after a certain amount of time based on the observed behavior of the spacecraft subjected to multiple constraints, applicable for the entire duration, or for part of the orbit transfer. The main questions addressed and the interdependency between the various aspects are, the differences among minimum time and minimum fuel optimization strategies; the influence of perturbative external forces: J2, Sun-Moon gravitational field, atmospheric drag and solar radiation pressure; the influences of additional external errors such as thruster's misalignment and tracking data availability and quality. This paper summarizes the problem involved and the reasons behind the necessity of this tool. Then it describes the logic, structure and methodologies used to simulate various parameters and it presents the results of typical test cases in order to highlight the tool performances and discuss the main limitations. Finally potential and previewed upgrades are also mentioned. The development of this tool has been the main objective of the International Space University, Master in Space Studies 2015, Internship Project of the author. This internship has been conducted in the SES Engineering Flight Dynamics Department of Betzorf, Luxembourg.