SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Going To and Beyond the Earth-Moon System: Human Missions to Mars, Libration Points and NEO's (8-A5.4)

Author: Prof. Stéphanie Lizy-Destrez
SUPAERO- Ecole Nationale Supérieure de l'Aéronautique et de l'Espace, France

Mrs. Chloe AUDAS
ISAE, France

SCENARIOS OPTIMIZATION FOR A SERVICING INHABITED SPACE STATION AT EARTH-MOON LAGRANGIAN POINT (EML2)

Abstract

Human Space exploration is nowadays at a turning point of its history. Space agencies collaborate in order to determine next steps in this context, through for example, the International Space Exploration Coordination Group (ISECG), Agreement has been reached to identify that in the upcoming decades will be to send human beings to Mars, Moon or asteroids surface. Among all the selected scenarios, locating a deep-space habitat in the vicinity of the Earth Moon Lagrangian (EML) points has been designated as being a cornerstone of the human space exploration strategy.

This paper examines how to design a low cost mission, using the natural dynamics for Station integration, crew rotations, cargo delivery and disposal. Moreover, it focuses on the impacts of the station architecture on the global optimization (in term of duration and delta-v) of the trajectories from LEO departure to rendezvous in EML and return. Several scenarios have been studied to compare transfer strategies (direct, indirect, lunar flyby, weak stability boundaries) and modeling types (four bodies problem, restricted circular three bodies problem, ephemeris). Actually, optimization criteria strongly depend on the mission phase. When crew transit is considered, mission duration has mainly to be minimized, while cargo transportation will minimize the global delta-v. The main contribution of this paper lies in the rendezvous dimensioning encompassing both the architectural point of view and the dynamics point of view. This is the first time a study optimizes mission duration and delta-v over all phases of the journey for Human exploration.