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Master Thesis Work

of Choose title Name, Surname

Analyse von Niedrigschub-Raumfahrzeugen für lunare, wissenschaftliche und Lagrangepunktmissionen

Analysis of low-thrust only spacecraft for Lagrange points, lunar and science missions

Motivation:

Many missions have been or will be launched towards the Sun-Earth Libration regions, into cis-lunar or interplanetary space. All such missions first have to be launched into a transfer trajectory. While today's launchers provide an extraordinary injection accuracy into these transfers, some inaccuracy in the separation state is inevitable. This so-called launcher dispersion must be corrected by the spacecraft after separation from the launcher. The correction manoeuver may be time-critical as its cost often increases strongly with the time from separation. Furthermore, for technical reasons related to the control of the ascent, a launch vehicle might not always be targeted directly at the required transfer. The payload must also compensate the resulting offset by appropriate manoeuvers. While for some missions the required size and timing of these correction manoeuvers has been considered prohibitive for electric propulsion, the current trend towards miniaturization of spacecraft and the ever-increasing accuracy of the launch systems have reached a point were all-electric low-thrust spacecraft may become feasible. Within this study the candidate shall investigate the limits for all-electric spacecraft. This thesis will be carried out in a cooperation between the European Space Operations Center (ESOC) and the Institute of Space Systems (IRS). Previous experience with C++ and python is beneficial.

Task description of the Master thesis work:

- Literature research focused on launch system limitations, typical low-thrust transfer trajectories, electric propulsion systems and numerical integration methods
- Familiarization with the existing transfer navigation design tools
- Code adaptation of impulsive maneuvers to feasible low-thrust trajectories
- Implementation and execution of a parametric analysis for a realistic low-thrust only spacecraft launch scenario
- Documentation

The thesis will be accomplished remotely with support from ESOC and IRS.

Internal supervisor: M. Sc. Markus Graß

External supervisor: Dr. Ing. Florian Renk

Starting date: Click for date

Submission until: Click for date

Acknowledgement of receipt:
I hereby confirm that I read and understood the task of the master thesis, the juridical regulations as well as the study- and exam regulations.

Date /	Date /	Date /
Prof. Dr. Reinhold Ewald	External Supervisor	Signature of the student
(Responsible Professor)		