Interplanetary Trajectory Optimization Program for Electric Propulsion Spacecraft

Brief description of Research Project (1 page preferably, maximum 2 pages)

The goal of this project is to develop a robust, flexible mission design tool that will solve the coupled trajectory-and-vehicle optimization problem for electric propulsion (EP) spacecraft. The robust low-thrust trajectory optimization program is capable of handling an extremely wide variety of specific constraints, mission flight options, and spacecraft system designs. The proposed algorithm will be tested on several demanding interplanetary mission designs, including missions to outer and inner planets with multiple thrust/coast arcs and multiple planetary gravity assists. The final product of the project will be an operational program capable of computing optimal interplanetary transfers for a wide range of performance indices, constraints, orbital boundary conditions, and EP configurations. The operational program will be a useful design tool for EP mission designers at NASA Glenn Research Center.

Capabilities/objectives:

- The code should be robust and able to compute the optimal interplanetary transfer for a fairly simple, intuitive initial guess for the control parameters.
- The program should be able to simultaneously optimize both the trajectory (dynamics) and spacecraft system parameters (such as power, mass-flow rate).
- The code should be able to generate optimal solutions without overwhelming computational burdens (i.e., long run times).
- The code should be flexible so that mission designers can alter the desired performance measure, boundary conditions, and constraints without additional programming.

This work is applicable to researchers and engineers at NASA and aerospace companies in the satellite industry. In particular, this optimization program will allow a user to assess the performance of a particular electric propulsion (EP) technology and how it can (or cannot) be used for a particular scientific space mission. It is likely that the optimization program will be used to design the satellite and mission for an upcoming Discovery proposal (proposal to NASA HQ for new interplanetary space missions).

Point of contact: Craig A. Kluever, Associate Professor MAE, klueverc@missouri.edu