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SUBJECT: Homework #2 (Orbit and Propulsion)

DATE: 6/21/2004

Homework #2
(Orbit and Propulsion Subsystems)

Given a mission objective, a satellite must be placed in its final destination orbit using some type of propulsion system. This requires an orbit transfer from the parking orbit to the final destination orbit. The mission may dictate the minimum allotted time to achieve the final destination orbit, and in general, minimal propellant mass is desired.

The desired objective of this problem set is to compare a set of feasible orbit transfer and propulsion system combinations for a given mission requirement. The mission requirement will be defined in terms of the parking orbit and the final destination orbit (using orbital parameters). The types of transfer orbit to consider are:

- Elliptical/Hyperbolic
- Hohmann
- Hohmann Transfer Segments
- Spiral

The types of propulsion system to consider are:

- Cold Gas
- Solid Motor
- Liquid
- Hybrid
- Electrothermal
- Electrostatic
- Electromagnetic

Note that the aforementioned types of the propulsion systems can be broken down farther (i.e. different propellants and the associated I_{sp}'s). For each pair of transfer orbit and propulsion system types, the following output must be computed for analysis:

- Time for orbit transfer
- Required propellant and tank mass

For all feasible designs, a set of plots/graphics should be provided for the purpose of comparison. Note that the type of transfer orbit depends on the propulsion system type, and the total required ΔV depends on the transfer orbit type. While this problem can become very complex depending on the accuracy of the computation and analysis, a right set of assumptions should be applied to minimize the computational complexity while maintaining the fidelity for comparison among various designs (e.g. assume fixed dry mass, but excluding the tank mass). Note that the mass of a power subsystem will be crucial when comparing an electric propulsion system to those that are not. For this problem set, however, the power subsystem will not be considered (i.e. assume the power subsystem to have a fixed mass, but do make a note of the fact that the propulsion system is/is not electrical).