ABSTRACT

Preliminary Design of Orbit Transfer from Low Earth-Orbit to Geostationary-Earth Orbit

by

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There is a demand for Indonesia to launch its own satellite to the Geostationary Earth-Orbit, as using own satellite can increase national technology capability, strengthen national security, and various other benefits for the advancement of the country. However, so far Indonesian efforts has been focused on satellites on the Low Earth-Orbit. This jump from Low Earth-Orbit to Geostationary Earth-Orbit is no trivial, a baseline mission must first be studied to know the effort needed, which later can be expanded to fit specific purpose.

The main focus of this research is to know the amount of propellant needed, expressed in terms of Δv, to go from an initial Low Earth-Orbit to a Geostationary Earth Orbit. Three techniques (Hohmann, Bi-elliptic, and Lambert Solution Solver) and three scenarios (orbit enlargement first, inclination change first, and direct Lambert solution) are studied to see which one result in the lowest Δv. Launch Vehicle selected is a Epsilon LV, and then the the satellite is launched to its initial parking orbit according to LV specification. Beside Δv, the time of flight is also counted. Based upon the result, an example mission is then created to estimate the payload mass that can be brought to Geostationary Earth-Orbit.

The results shown that the Lambert Solver provides the lowest Δv cost at expense of additional time. Between Hohmann and Bi-elliptic maneuver, for this case the Hohmann method is more efficient - the Bi-elliptic method not only consume more energy, but more time as well. Then, enlarging the orbit first and then change the inclination later has much lower energy requirement than the other way around. Based upon Epsilon LV's specification, it is possible to launch a useful payload to GEO using solution provided by Lambert Solver.

Keyword: *Satellite, Lambert Problem, Two-Body, Hohmann, Mission design*