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Space Transportation Solutions for Deep Space Missions (8-A5.4)

Author: Mr. Taylor Huneycutt
The Ohio State University College of Engineering, United States, huneycutt.7@osu.edu

Dr. John M. Horack
The Ohio State University College of Engineering, United States, horack.1@osu.edu
Dr. Elizabeth Newton
The Ohio State University, United States, newton.387@osu.edu
Mr. Stephen Ioas
The Ohio State University College of Engineering, United States, stephenioas@hotmail.com
Mr. Ryan Howard
The Ohio State University College of Engineering, United States, howard.1111@osu.edu
Mr. Skylar Dierker
The Ohio State University College of Engineering, United States, dierker.21@buckeyemail.osu.edu
Mr. Craig Heim
The Ohio State University College of Engineering, United States, heim.38@osu.edu
Mr. Zachary Allen
The Ohio State University College of Engineering, United States, zmallen794@gmail.com

AN ANALYSIS AND SELECTION OF LAUNCH WINDOWS AND ORBITAL TRAJECTORIES FOR THE JESSE OWENS THERMONUCLEAR PROPULSION INTERPLANETARY SPACEFLIGHT MISSION

Abstract

A time-based Simulink model is used to optimize the numerous orbital mechanics parameters associated with interplanetary spaceflight. More specifically, the thrust magnitude, duration, location, and frequency are all optimized with respect to the relative distance between a spacecraft's origin and its destination in order to dramatically reduce the time on transit between these two points. In this paper, a round-trip between Earth and Jupiter is considered, with comparisons being drawn between launch windows based on conventional propulsion and those based on this nuclear thermal propulsion (NTP). Based on the "optimal" combination of these parameters, it is demonstrated that this example of NTP (A reactor-nozzle combination characterized by 111 kN of thrust and Isp of 850 seconds) is a vastly superior approach to spacecraft propulsion in comparison to conventional chemical means. In employing nuclear thermal propulsive methods, the consequential reduction in time on transit would improve the accessibility of deep space destinations and enable future manned missions beyond the Earth's immediate neighborhood.