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SPACE PROPULSION SYMPOSIUM (C4)
New Missions Enabled by New Propulsion Technology and Systems (6)

Author: Mr. Grant Bergstue
University of Alabama in Huntsville, United States

Dr. Richard L. Fork
University of Alabama in Huntsville, United States

ADVANCING THE BEAMED ENERGY ABLATION DRIVEN PROPULSION ENGINE CONCEPT

Abstract

We continue to develop the novel space-based ablation driven propulsion engine concept utilizing beamed energy in the form of a series of ultra-short optical pulses. This involves the generation of the pulses at the transmitting spacecraft and the safe delivery of that energy to the receiving spacecraft for propulsion. By expanding the pulses in time and space during transmission, the energy can more safely propagate with lower intensities and be refocused as well as distributed to create an array of ablation sites at the receiver. The ablation array strategy allows greater control over flight dynamics and eases thermal management. Our recent research efforts have further refined strategies for this transmission and reception of ultra-short optical pulses. This includes: (1) optical system design; (2) electrical system requirements; (3) thermal management; (4) beamed energy transmission safety. The optical system design must minimize the thermal load on any one optical element. Initial specifications and modeling for the optical system is slated to be produced using geometrical raytracing software to give a better understanding of the optical requirements. In regards to safety, we have begun early preparations for the construction and testing of a new and more robust small scale retro-reflective beam locking strategy to ensure the safe transmission of beamed energy. This includes the testing of optics, electrical system hardware, and overall system safety. This project leads to not only better characterization of the retro-reflective beam lock system capabilities, but also the initial testing of safe and effective transmission of ultra-short pulses as a means of creating thrust. Modifications to the laser source, the optical systems at the transmitting and receiving sites, as well as the measuring apparatus can be made to collect data on the amount of thrust generated by the ultra-short optical pulses. We plan on characterizing and developing a force measurement device capable of tracing to NIST standards. We also continue to address the use of an ultra-short pulse beaming system in providing additional thrust to an ascending spacecraft for a Horizontal Lift to Orbit strategy. Because the research is in early development, it provides an opportunity for both novel and valuable advancements in the area of beamed energy in near-Earth space as well as encourages positive joint efforts involving participants from around the world. Researchers from different countries can cooperate in order to find constructive and safe uses of beamed energy propulsion for future space-based missions.