

A Technology Validation Mission to Demonstrate Acceleration of Sails by Thermal Desorption of Coatings

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In 2000, experiments performed at JPL demonstrated liftoff of a carbon-microtruss solar sail material under microwave illumination. The tests showed unexpectedly high acceleration of the sail material – several times higher than that expected from photonic pressure alone. A possible mechanism for this phenomenon is additional thrust from ablation of contaminants in the carbon-microtruss, a theory supported by subsequent analyses. These show that thermal desorption of coatings by microwave illumination could yield sail accelerations from $\sim 10^0$ to 10^3 m/s², enabling missions to the outer planets or beyond the solar system in a fraction of the time now needed using conventional propulsion.

We discuss the physics underlying thermal desorption propulsion and present a plan for a flight validation mission before ~ 2010 . This would allow launching of a sail with payload into an interplanetary trajectory from low Earth orbit. We address key implementation issues for such a flight system: configuration, packaging, deployment, stability, control, and performance.