Paper ID: 31349
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66th International Astronautical Congress 2015

SPACE PROPULSION SYMPOSIUM (C4)
Interactive Presentations (IP)

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SOLAR THERMAL PROPULSION REVIEW

Abstract

This review identifies and discusses the issues and problems that arose during the Robotic Asteroid Prospector (RAP) team's work on our Phase 1 NIAC contract. The central issue that arose concerns the technology maturity of the solar thermal propulsion (STP) system that is central to the concept. shows how An STP engine works by directing concentrated sunlight flux to its heating cavity or chamber to heat the propellant that undergoes a phase change to provide thrust out the nozzle.

For the purpose of RAP, an STP engine would ideally be a commodity item that our team could purchase off the shelf like any other mass-produced engine (e.g. RL-10). Our approach in Phase I was not to design an STP engine, but to design the spacecraft to accommodate a variety of potential STP engine designs. To identify these designs, we performed a literature search and commissioned our patent counsel to perform a patent search of STP engine designs. These searches turned up a several designs for solar thermal engines in a variety of configurations. Here, we review those patents and discuss their implications for the design and engineering of the RAP spacecraft. We devote particular attention to the Shooting Star STP engine that NASA tried to develop circa 1999-2001, but never fully integrated or tested.

The leading advantage of STP is that it can use a much wider variety of fluids for "propellant" than a solar electric engine for which rare xenon is the fuel of choice. STP engines can use water for propellant, which RAP can extract from asteroids, Phobos, or Deimos to fuel itself or to supply other spacecraft and propellant depots at Lagrange libration points.