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Interplanetary Radiation and Fault Tolerant Mini-Star Tracker System

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Sponsoring Program(s)

Marshall Space Flight Center/Center Management and Operations
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Project Description

The Charles Stark Draper Laboratory, Inc. is partnering with the NASA Marshall Space Flight Center (MSFC) Engineering Directorate's Avionics Design Division and Flight Mechanics & Analysis Division to develop and test a prototype small, low-weight, low-power, radiation-hardened, fault-tolerant mini-star tracker (fig. 1). The project is expected to enable Draper Laboratory and its small business partner, L-1 Standards and Technologies, Inc., to develop a new guidance, navigation, and control sensor product for the growing small sat technology market. The project also addresses MSFC's need for sophisticated small sat technologies to support a variety of science missions in Earth orbit and beyond. The prototype star tracker will be tested on the night sky on MSFC's Automated Lunar and Meteor Observatory (ALAMO) telescope.

The specific goal of the project is to address the need for a compact, low size, weight, and power, yet radiation hardened and fault tolerant star tracker system that can be used as a stand-alone attitude determination system or incorporated into a complete attitude determination and control system for emerging interplanetary and operational CubeSat and small sat missions.

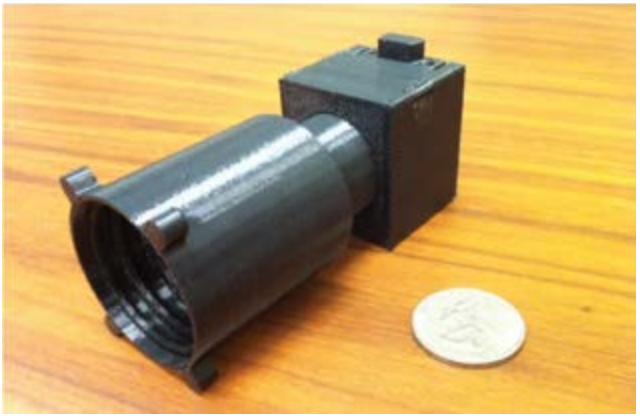

Figure 1: Model of mini-star tracker.

Anticipated Benefits

This star tracker will provide an affordable option for precision attitude determination (~10 arcseconds) and navigation on small spacecraft. Its small volume will fit into microsatellites and CubeSats. Its radiation tolerance will enable long-duration small sat missions in low-Earth orbit and beyond.

Potential Applications

This star tracker could support constellations of Earth-observing, precision nadir pointing spacecraft with mission durations >1 year. It will be well suited to polar orbits where radiation doses are higher. The star tracker will be valuable for future interplanetary CubeSat missions requiring fine pointing for science observations, communication, and navigation state updates.

Notable Accomplishments

The project kickoff was completed in August 2014 and performance requirements have been defined. Prototype design is underway including electronics, optics, and software. A bracket has been designed and fabricated for mounting the prototype on the ALAMO telescope (fig. 2).

Figure 2: Star tracker mount on ALAMO telescope.