

SMALL SATELLITE MISSIONS SYMPOSIUM (B4)
Design and Technology for Small Satellites - Part 2 (6B)

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FACET NANO, A MODULAR STAR TRACKER CONCEPT FOR HIGHLY MINIATURIZED
SPACECRAFT

Abstract

Accurate attitude determination is perhaps the most important design aspect for micro- and nanosatellite missions. For remote sensing applications and formation flying missions, the attitude of the spacecraft must be known and controlled with a high accuracy.

ISIS is developing a modular and scalable attitude determination system based on a multi-aperture miniature star sensor. Based on a patented concept, the Multi-Aperture Baffled Star sensor, the attitude sensor integrates several apertures into a single star tracker. The main advantage of this concept is that it eliminates the need for large baffles as there is a redundancy of independent apertures. Even when several apertures are obstructed, for instance by the Earth and the Sun simultaneously, the star tracker will still have apertures available with a 'free' field of view and will be able to determine star positions.

The sensor system consists of an optical head that can include up to 9 miniature star cameras, and an electronics system that combines the star camera inputs and determines and outputs the spacecraft attitude vector. The star tracker provides a moderate accuracy up to approximately 30 arcseconds. One of the innovative applications is the possible use of a version of the star tracker with reduced performance (e.g. 0.1 degrees), as a replacement for a sun sensor / earth sensor suite for applications in low earth orbit.

A preliminary feasibility study has led to a multi-aperture star tracker concept, for which a development project up to a working prototype has been initiated. The major design goal of this two-year project is to develop a plug-and-play sensor with a high reliability and availability in a highly miniaturized system.

This paper will describe the design goals and philosophy of the star tracker project, and will provide an overview of early development results and current status of the project. Also, the important aspect of validating the sensor performance will be dealt with in the paper.