

## NASA SBIR/STTR Technologies

T8.01-9837 - Ultra-Miniaturized Star Tracker for Small Satellite Attitude Control

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### Identification and Significance of Innovation

Creare and Embry-Riddle Aeronautical University (ERAU) propose to design, develop, test, and deliver an ultra-compact star tracker specifically intended for small satellites such as the CubeSat platform. Our design is based on proprietary “folded optics” and is superior to conventional refractive optics in miniature star trackers because (1) the compact footprint is achieved without sacrificing accuracy; (2) the light-gathering aperture is much greater, leading to better sensitivity; (3) the aperture geometry makes the shielding baffles smaller; and (4) the imaging sensor can be shielded efficiently from cosmic radiation. During the Phase I project, we demonstrated a pointing accuracy of the order of 1 arc second testing a brassboard model of our design. In Phase II, we will fabricate the optimized design, test the prototype in the laboratory and in the field, and deliver the prototype to NASA so that NASA can fly the prototype on a high-altitude balloon mission.

**Expected TRL Range at the end of Contract (1-9): 7**

### Technical Objectives

Verify that the star tracker has the required accuracy, light sensitivity, and resolution to provide highly accurate spacecraft attitude.

Test the tracker ruggedness to the space environment.

Deliver a flight-ready star tracker for high-altitude balloon missions

### Work Plan

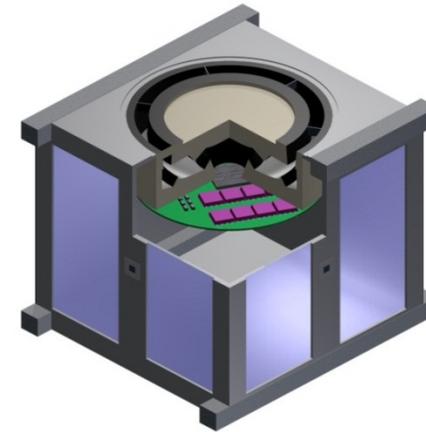
Task 1. Design and Build Optical System

Task 2. Design and Build Sensor System

Task 3. Develop and Implement Processing Algorithm

Task 4. Test Star Tracker Performance and Enhance TRL

Task 5. Manage and Report



Creare's Ultraminiaturized Star Tracker Integrated in a 1 U CubeSat

### NASA Applications

Many NASA science missions are exploring the use of pico- and nano-satellites as alternatives to expensive, large satellites. In order to enable many mission profiles, these satellites need precise attitude determination sensors. Our star tracker will enable highly precise attitude determination (1 arc second or better) in a package that is significantly smaller and much lower in mass, and uses less power than any alternative star trackers on the market.

### Non-NASA Applications

Both the military and commercial ventures are looking to small satellites to provide a cost-effective space mission platform. However, the majority of missions still require high altitude accuracy. Furthermore, the military is looking at star trackers for high-altitude UAV attitude determination. These typically need to provide arc-second accuracy in a small form factor with low power demands.

### Firm Contacts

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**NONPROPRIETARY DATA**