Space Situational Awareness Working Group

Improving LEO Space Object Detection and Analysis

Please contact USGIF at WorkingGroups@usgif.org to join the Space Situational Awareness Working Group and assist in related efforts.

WHAT

Star tracker sensors are made by a variety of companies, including Ball Aerospace, and Rocket Lab.

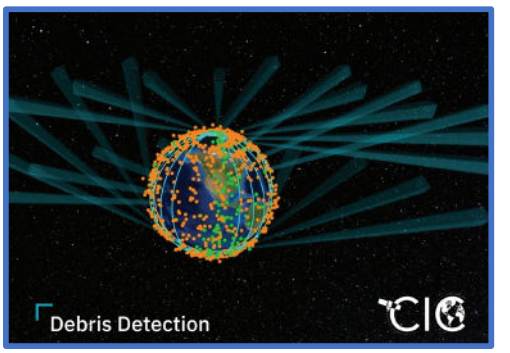
These companies specialize in aerospace and defense technology and have the resources and expertise to develop and manufacture star trackers. Also, with the advent of commercial remote sensing many commercial data providers (CDPs) are creating their own.

Star trackers are used in several applications, including satellite navigation, autonomous space vehicles, and space exploration.

For satellite navigation, star trackers are used to determine the position of a satellite in space. Autonomous vehicles use star trackers to determine their position and orientation in relation to the stars. Finally, star trackers are used in space exploration to help spacecraft navigate and orient themselves in space.

WHY

The United States and our allies are heavily reliant on space capabilities and must ensure the reliability and continuity of critical space services. Current space situational awareness (SSA) networks cannot adequately detect and track the rapidly growing population of small resident space objects (RSOs) and space debris having the potential to damage or disable satellite systems. Developing new space-based sensing technologies is imperative to meet SSA challenges for detecting, tracking, and characterizing smaller space objects across all orbital regimes.



This figure depicts a notional concept of the NorthStar Earth & Space Inc. constellation (in teal) imaging known space debris (with blue sensors) in LEO orbit from Cosmos 1408 (in green) and Cosmos 2251 (in orange). Sensor cones depict line-of-sight (LOS) from the simulated NorthStar EO LEO constellation to the space debris. NorthStar is launching the first dedicated on-orbit EO SSA sensor constellation intended to greatly improve RSO collection opportunities.

HOW

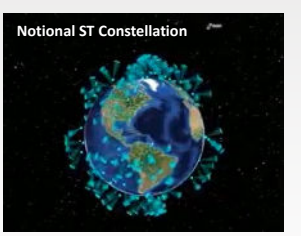
The objective is to exploit ordinary Star Tracker (ST) sensors that fly on most satellites and capitalize on their sensing capacity to provide for the detection, tracking, and identification of RSOs.

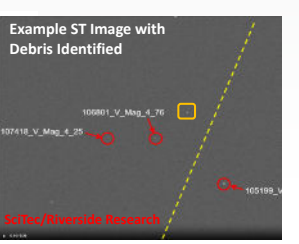
STs are optical sensors that detect bright objects (e.g., stars and planets) that shine against the dark backdrop of the cosmos. The satellite is programmed to know the position of those stars so that it can use measurements of these detected stars to determine and maintain its own position and attitude relative to Earth. Satellites and space debris may pass within the view of the ST and enable the detection, tracking, and characterization of these objects.

The objective of using STs on satellites is to help fill gaps in space object detection owing to the limited number of SSA sensors by leveraging resources and capabilities of ubiquitous space assets already on orbit.

IMPACTS and BENEFITS

- **Low cost:** Star trackers are relatively inexpensive compared to other types of sensors, making them a cost-effective option for detecting RSOs/debris.
- **Wide field of view**: Star trackers have a wide field of view, allowing them to detect objects over a large volume.
- **High accuracy**: Star trackers can detect objects with a high degree of accuracy, making them ideal for detecting RSOs/debris.





- **Low development cost:** Re-purposing existing satellite ST capabilities eliminates major system acquisitions.
- **Existing infrastructure utilization:** Builds on current network and data repositories (e.g., UDL).
- **Industry innovation:** Although space debris collection is a challenging topic, the industry continues to explore innovative solutions for persistent collection.