Air Force SBIR STTR

CONCEPT ON THE HORIZON

A MORE RELIABLE WAY TO MITIGATE DANGER IN COMBAT SITUATIONS

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Modular Cubesat Architectures and Components

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SBIR COMPANY NAME:
Atmospheric and Space Technology Research Associates
Boulder, CO

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AFRL, Space Vehicles Directorate
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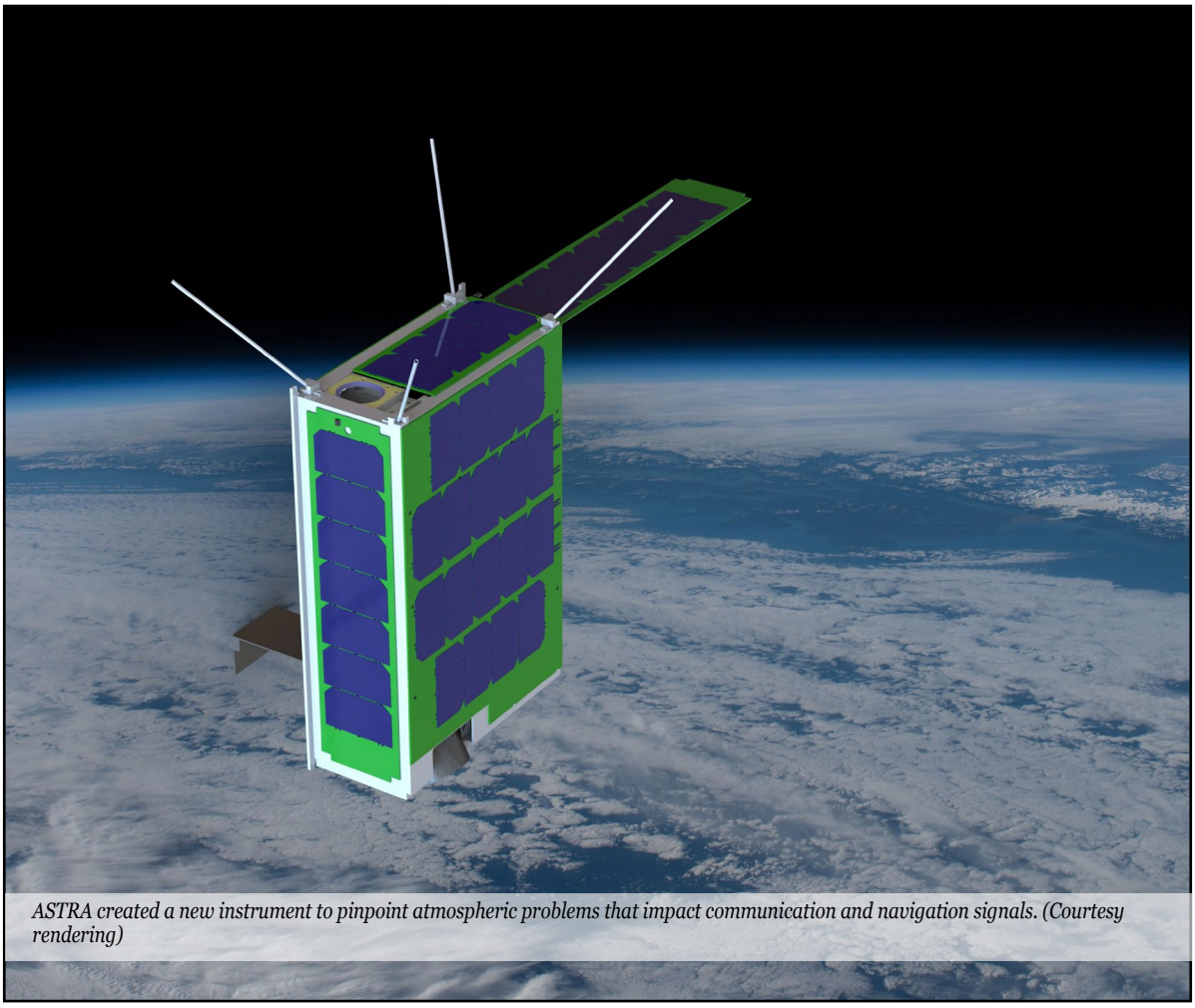

ASTRA created a new instrument to pinpoint atmospheric problems that impact communication and navigation signals. (Courtesy rendering)

NEW INSTRUMENT SHOWS

BIG POTENTIAL TO HELP MISSION PLANNERS

An innovative scanning technology developed by a Colorado-based small business may eventually save lives and boost the success rate of military missions.

Funding from the Air Force Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Program helped Atmospheric and Space Technology Research Associates – also known as ASTRA – to create a new instrument to pinpoint atmospheric problems that impact communication and navigation signals. This compact smart-scan mirror provides near real-time detection of “bubbles” in the Earth’s upper

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atmosphere, which can interfere with radio signals used by the Department of Defense.

Armed with the data, military planners could avoid performing operations in areas where the irregularities are occurring.

THE DOWNFALL OF EXISTING METHODS

Current technology cannot be used to predict bubbles in the ionosphere or provide real-time measurements with adequate precision. While imagers aboard Department of Defense weather satellites are available, for example, they are limited to coverage in the evening hours and only provide images at 100-minute intervals.

The goal of this Air Force SBIR project was for ASTRA to develop a smaller and more versatile instrument that can produce images of the nightside ionosphere by viewing ultraviolet light emanating from the atmospheric gases. Also known as SIPS, for Scanning Imaging Photometer System, the new instrument consisted of a UV detector and a scan mirror.

A similar concept has been flown on other satellites. However, each of those imagers was large, expensive and had a single simple scan-mirror mode, which was continuously repeated, so the signal was weak and overcome by background noise in areas of low ultraviolet intensity.

POTENTIAL FOR WIDESPREAD USE

One of ASTRA's advancements with this project is that SIPS is significantly smaller, lighter and cheaper than instruments flown previously, and requires only about a tenth of the power, so that it can easily be placed on small satellites called cubesats. A small group of SIPS-carrying cubesats could provide almost continuous imagery of the irregularities that cause poor UHF-based satellite communications and GPS positioning outages that can endanger lives in combat situations.

Another achievement of the project was the creation of a mirror with multiple scan modes. This allows useful measurements, even in low-signal regions of the Earth's ionosphere. The signal-to-noise ratio of SIPS is also about 10 times better than current technology, so structures in the ionosphere can be more readily identified. Additionally, the plug-n-play interfaces on SIPS trim months from the integration and test process of traditional satellite systems.

While the focus of SIPS has been on producing an instrument that can provide overhead images of the ionosphere, ASTRA officials say it also has the potential to provide other important ionospheric parameters. Those could be useful to the Air Force as well as other federal agencies for space situational awareness.

"The potential for transition into operations is enormous," said Dr. Geoff Crowley, CEO of ASTRA. "The SIPS instrument is so effective and low-cost that a few of them on small satellites would provide continuous mission-critical data on the locations where space weather effects are jeopardizing radio systems (for communication and navigation) and lives are being lost."