National Aeronautics and Space Administration

NASAfacts

Integrated Solar-Panel Antenna Array for Cube Sats

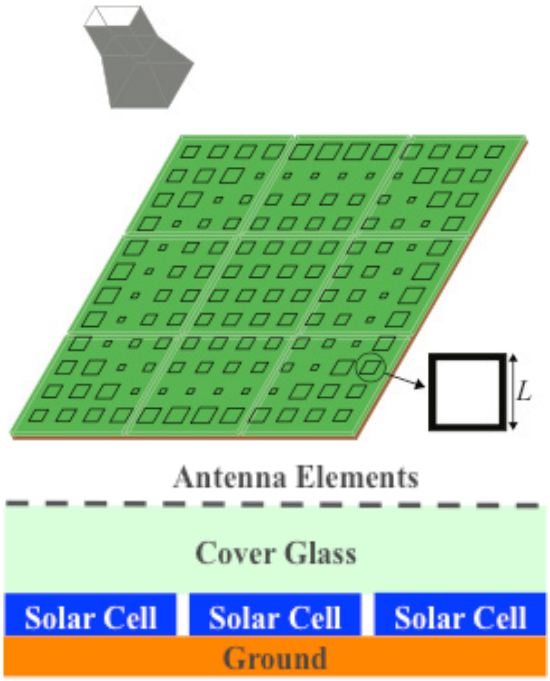
Design and demonstration of an optically transparent, high-gain X band antenna array

The goal of the Integrated Solar-Panel Antenna Array for CubeSats (ISAAC) project is to design and demonstrate an effective optically transparent, high-gain, lightweight, conformal X band antenna array that is integrated with the solar panels of a CubeSat. The targeted demonstration is for a Near Earth Network (NEN) radio at X-band, but the design can be easily scaled to other network radios for higher frequencies. ISAAC is a less expensive and more flexible design for communication systems compared to a deployed dish antenna or the existing integrated solar panel antenna designs.

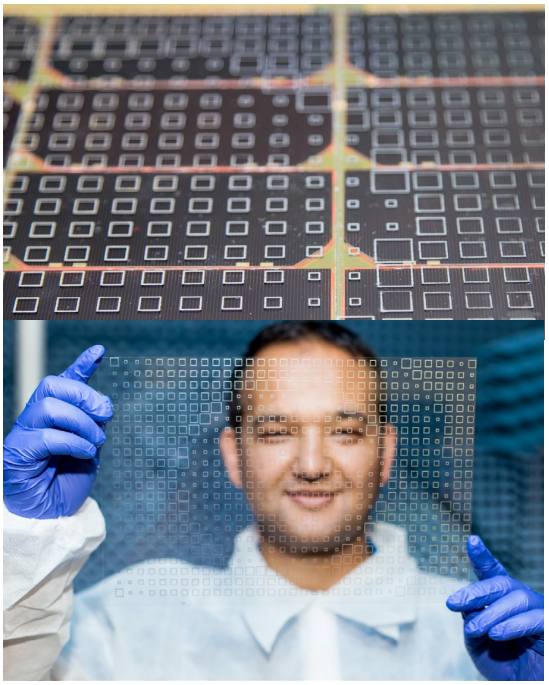
The project team designed for an optimal X band transparent reflectarray and printed it on glass measuring 20 centimeters (cm) by 30 cm using an in-house inkjet printer. The antenna has a gain greater than 24 decibels (dB) and optical transparency of greater than 95%. These values are higher than reported results for other reflectarray antenna designs of comparable size, including transparent antenna technology. The reflectarray is integrated onto a 6-unit (6U) solar panel for a series of rigorous tests. Test results of the integrated design have the antenna showing a yield of more than 22 dB gain with only slightly hindered solar panel functionality.

Traditional low-gain antennas have limited communication capability. For higher gain design, today's approach is either a deployed dish or integration of the antennas on the backside of a solar panel. ISAAC does not need deployment, which means low cost, and it is not limited to locations of solar cells. The ISAAC concept is not limited by the geometry of the small spacecraft.

Utah State University (USU) in Logan, Utah is the lead institution for the ISAAC project and is responsible for leading the antenna design, printing, and measurements. The university is working in collaboration with NASA's Goddard Space Flight Center (GSFC) in Greenbelt, Maryland. GSFC successfully assembled a functional 6U solar panel with all space-certified material. In addition to solar panel as-



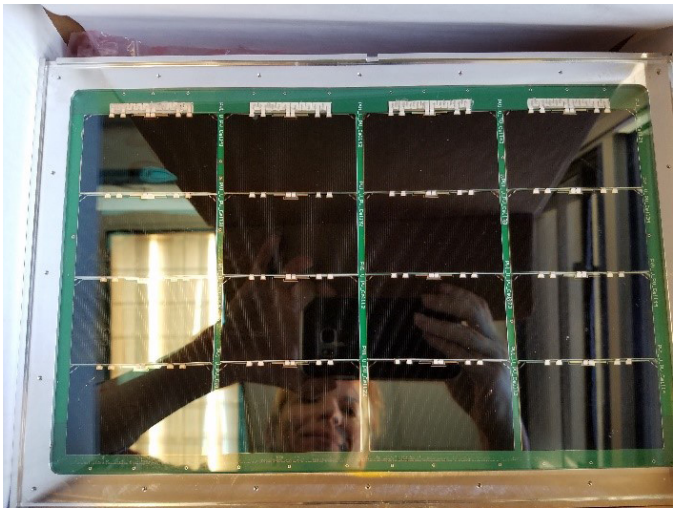
Integrated Solar Panel Antenna Array for CubeSats (ISAAC) Concept



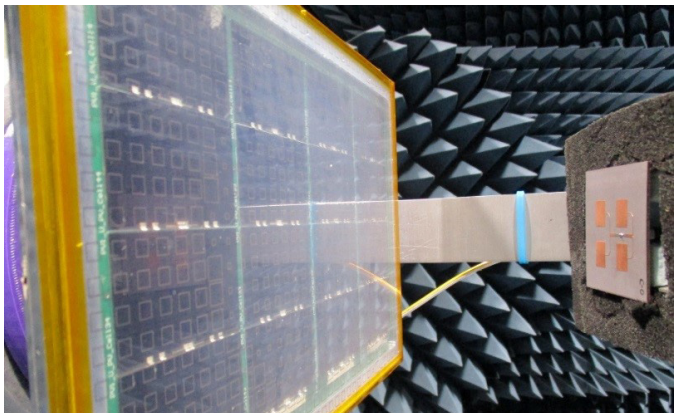
Integrated Solar Panel Antenna Array for CubeSats (ISAAC) Antenna Printed on Glass

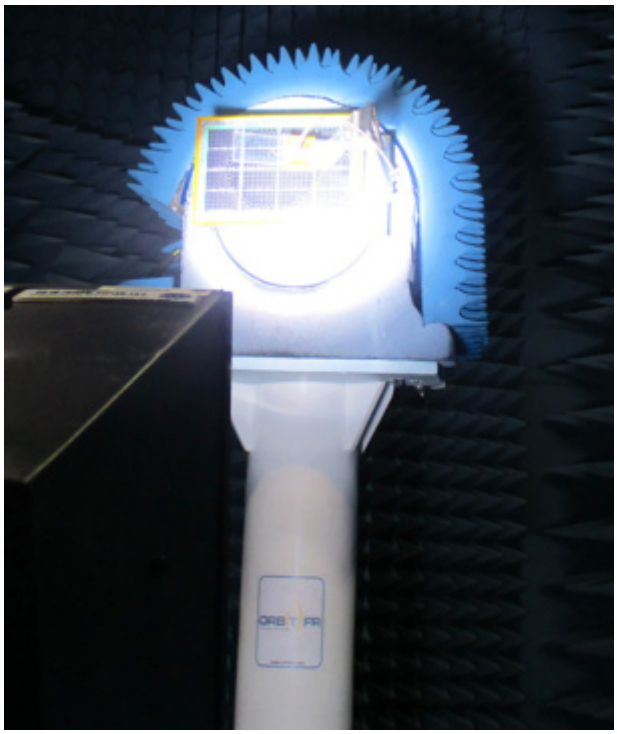
sembly and testing at GSFC, GSFC recruited engineers at Wallops Flight Facility to further verify ISAAC performance through detailed tests.

The ISAAC project is managed and funded by the Small Spacecraft Technology program (SSTP) within the Space Technology Mission Directorate. The SSTP expands U.S. capability to execute unique missions through rapid development and in space demonstration of capabilities for small spacecraft applicable to exploration, science, and the commercial space sector. The SSTP will enable new mission architectures through the use of small spacecraft with goals to expand their reach to new destinations, and challenging new environments.



A 6U Solar Panel Assembled and Tested at NASA Goddard Space Flight Center





Integrated Solar Panel Antenna Array for CubeSats (ISAAC) Final Measurement at Wallops Flight Facility

For more information about the SSTP, visit:
www.nasa.gov/directorates/spacetech/small_spacecraft/

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