National Aeronautics and Space Administration

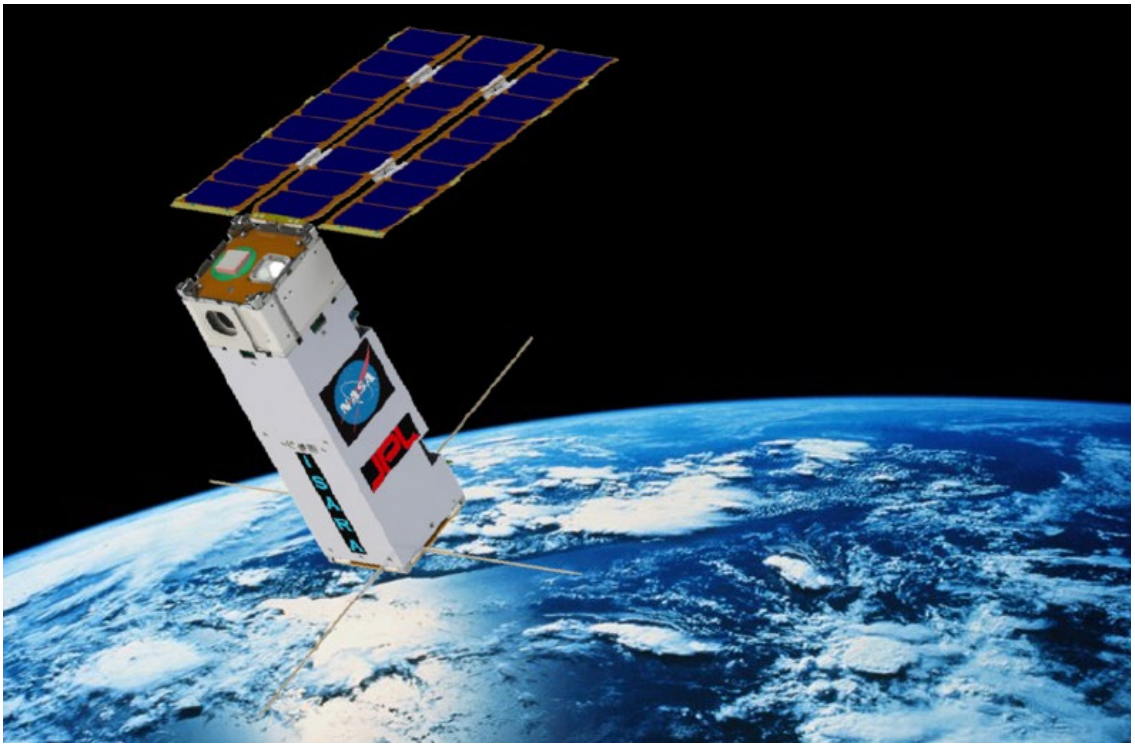
NASAfacts

Integrated Solar Array and Reflectarray Antenna (ISARA) for High Bandwidth Cubesats

Increasing Cubesat Downlink Data Rates to 100 Mbps

The Integrated Solar Array and Reflectarray Antenna (ISARA) for High Bandwidth Cubesats mission will demonstrate a reflectarray antenna that will increase downlink data rates for cubesats from the existing baseline rate of 9.6 kilobits per second (kbps), to over 100 megabits per second (Mbps). For a modest increase in mass, volume, and cost, the high data rate this technology enables will pave the way for high value science missions and formation flying missions that utilize distributed cubesats and small satellites. ISARA is being developed by the Jet Propulsion Laboratory of Pasadena, California.

The data rate of 100 Mbps, comparable to the combined rate of 20 home high speed internet connections, would allow you to download an entire music CD in 5 seconds or a high definition movie in 5.5 minutes. The key to this technical advance is the integration of the reflectarray antenna into a deployable solar array panel that is commercially available for a three-unit (3U) cubesat measuring approximately 14 inches long, 4 inches wide and 4 inches high. This antenna is designed to reflect a narrow radio signal from its surface toward the precise location of a specified receiver. The 3U cubesat platform was selected to fly the reflectarray antenna technology demonstration due to the wide range of available commercial off-the-shelf (COTS) components, low development costs, and opportunities to launch as a secondary payload.



Conceptual 3U Cubesat and Solar Array with Integrated Reflectarray Antenna

ISARA will be validated in space during a 5-month mission to measure key reflectarray antenna characteristics, which include peak gain (correlation of antenna directivity and electrical efficiency); main lobes (direction of maximum signal strength), and side lobes (signal in unwanted directions). At the end of the validation mission, the reflectarray antenna technology will be available for use on fractionated spacecraft sensors and radar/radiometry science missions, which need high bandwidth telecommunications. The ISARA technology will enable cubesats and other small satellites to serve as viable platforms for performing missions that were previously only possible on larger and more costly satellites.

Concept of Operations

The ISARA mission will launch its 3U cubesat fitted with a solar array that includes the integrated reflectarray antenna, a transmitter, and an avionics subsystem that features a high precision attitude control system needed to accurately point the antenna in a desired direction relative to an Earth ground station. After deployment, ISARA will deploy its solar array/reflectarray antenna and ultra-high frequency (UHF) telemetry antenna, and then use the Attitude Determination and Control System (ADCS) to de-tumble and stabilize. The UHF system will be used to establish initial communications with the satellite and perform on-orbit checkout procedures.

In the on-orbit test, the ISARA reflectarray antenna will transmit a signal which will be received by a ground station located at the Jet Propulsion Laboratory (JPL). The received power vs. time will be combined with spacecraft location and spacecraft orientation telemetry data to reconstruct the antenna signal pattern, which will then be compared against pre-flight ground measurements.

ISARA was recently selected for a flight opportunity as part of the CubeSat Launch Initiative in NASA's Human Exploration and Operations Mission Directorate. ISARA's 3U spacecraft will be launched and deployed as an auxiliary spacecraft on a rideshare mission arranged by the Launch Services Program at NASA's Kennedy Space Center. The ISARA spacecraft is slated for delivery in late 2015.

The ISARA mission is funded through NASA's Small Spacecraft Technology Program (SSTP), a program within the new Space Technology Mission Directorate which was formed as a catalyst for the creation of technologies and innovation needed to maintain NASA leadership in space, while also benefiting America's economy. The SSTP was created specifically to develop and demonstrate new technologies and capabilities for small spacecraft.

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