NASAfacts

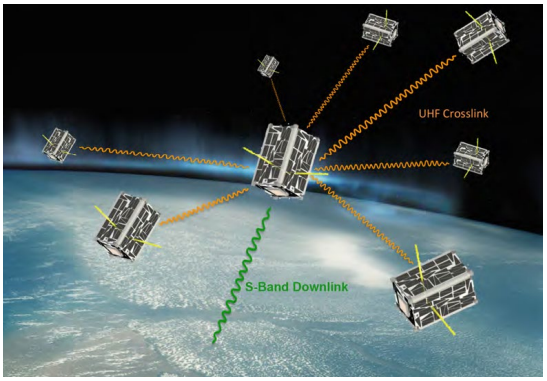
Edison Demonstration of Smallsat Networks

A Swarm of Advanced Nanosatellites that Enables Cross-Link Communication and Multipoint Scientific Measurements

The goal of NASA's Edison Demonstration of Smallsat Networks (EDSN) mission is to demonstrate interactive satellite swarms capable of collecting, exchanging and transmitting multi-point scientific measurements. Satellite swarms enable a wide array of scientific, commercial and academic research not achievable with a single satellite. The EDSN satellites will be launched into space as secondary payloads on a Department of Defense launch vehicle in late 2015.

EDSN consists of a group of eight satellites in a loose cluster arrangement that will be deployed approximately 280 miles (450 kilometers) above Earth. Each EDSN satellite is a 1.5-unit (1.5U) CubeSat measuring about 4 inches x 4 inches x 6.5 inches (10 centimeters x 10 centimeters x 16 centimeters) and weighing approximately 4.5 pounds (2 kilograms). EDSN satellites were developed to leverage recent advancements in small spacecraft and commercial off-the-shelf hardware and software to reduce cost and development time. The EDSN satellites employ a commercial smartphone processor first tested on a series of NASA Phonesat missions in 2013-14. EDSN uses the same Android smartphone technology to perform many of the spacecraft functions normally accomplished with expensive, customized electronics components. The satellites use time and orbital knowledge provided by GPS data to autonomously plan activities including recording sensor data, exchanging inter-satellite data and downlinking data to a ground station.

Aboard each satellite is a sensor that



EDSN Swarm with Highlighted Satellite Data Exchange Methods

measures the intensity of energetic charged particles in the surrounding space environment. The measurements from the whole swarm can be combined to characterize the radiation environment across a broad volume of space. Data is exchanged among the swarm using a hub-and-spoke network. Every 25 hours, the hub is switched to another satellite in the swarm, enabling the mission to continue in the event that any individual satellite experiences an upset or exceeds communication range.

The EDSN swarm has a planned mission duration of 60 days during which the inter-satellite distances will vary from a few miles to several hundred miles. The satellites will continue recording science data and downlinking to the ground station even after they exceed inter-satellite communication range.

The launch of tens (or someday hundreds) of interacting satellites would enable an unprecedented amount of sensors, communications and computing capability in low-Earth orbit. Swarm technologies have the potential to provide flexible data correlation and

distribution, system redundancy, simplification of satellite operations and the enabling of new multi-satellite science investigations through distributed architectures, sensor webs and disaggregated systems. These architectures can provide enhanced scientific data collection for industry, university researchers and NASA scientists.

The EDSN project is based at NASA's Ames Research Center at Moffett Field, California. EDSN project partners include NASA's Marshall Space Flight Center in Huntsville, Alabama; Montana State University; and Santa Clara University.

The EDSN project is funded by NASA's Small Spacecraft Technology Program (SSTP), which is chartered to develop and mature technologies to enhance and expand the capabilities of small spacecraft with a particular focus on communications, propulsion, pointing, power, and autonomous operations. SSTP is one of nine programs within NASA's Space Technology Mission Directorate.

For more information about the SSTP, visit:
http://www.nasa.gov/smallsats

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Completed EDSN Flight Units with Engineers Inspecting EDSN Flight Spares

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