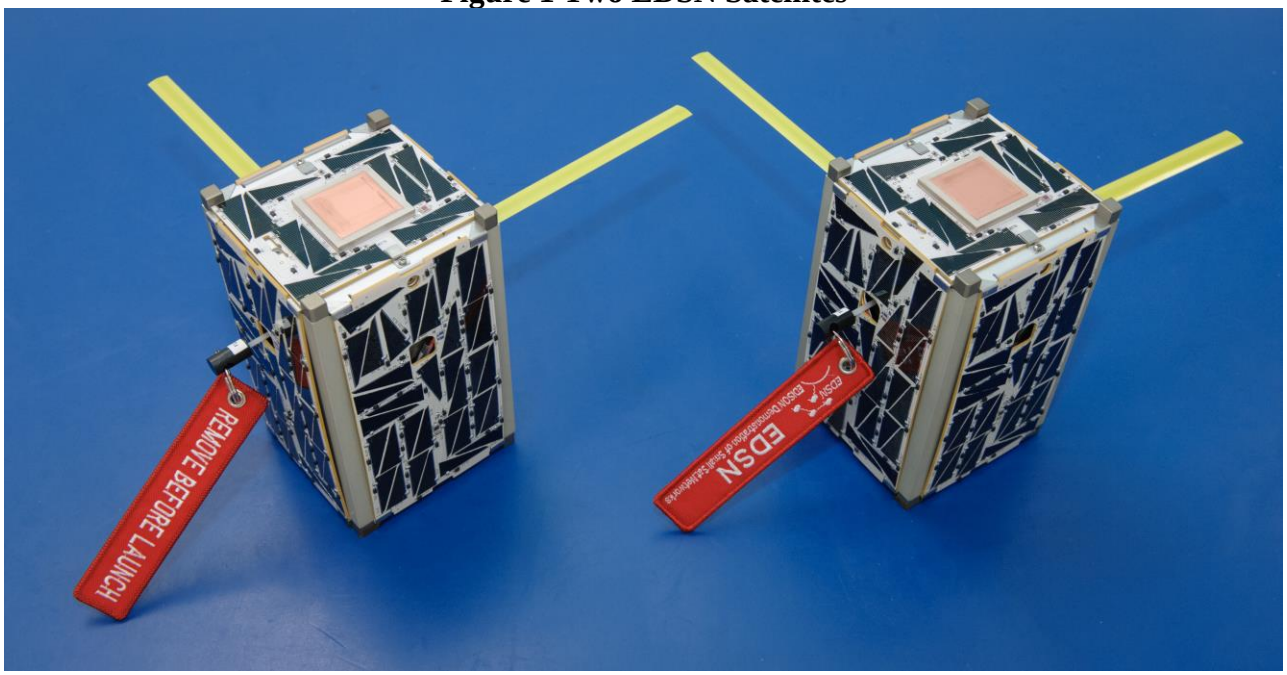
EDSN Satellite Technical Description

EDSN is a technology demonstration of a swarm of eight low-cost CubeSats in Low Earth Orbit (LEO) with cross-link and downlink communications capability, suitable as a platform for space science. These swarms can enable a wide array of scientific, commercial, or academic research. Networked swarms of small spacecraft have the potential to open new horizons in astronomy, Earth observations and solar physics. Their range of applications include the formation of synthetic aperture radars for Earth sensing systems, large aperture observatories for next generation telescopes and the collection of spatially distributed measurements of time varying systems, probing the Earth's magnetosphere, Earth-Sun interactions and the Earth's geopotential.

The EDSN mission is a group of eight 1.5U CubeSats. Each 1.5U CubeSat measures 10 cm x 10 cm x 15 cm in size. Each spacecraft weighs approximately 1.7kg and has identical hardware and software, excluding unique IDs. The mission operations phase is planned to be 60 days.

The EDSN swarm will be launched as a secondary payload from Kauai, Hawaii, October 17, 2014. It will be inserted into an orbit at 505 km apogee and 430 km perigee, on an inclination from the equator of 94.8 degrees. Radio transmission will commence 30 minutes after deployment from the launch vehicle. The planned operations phase is 60 days. Atmospheric friction will slow the satellite and reduce the altitude of the orbit, until de-orbiting occurs 496 days after launch. See the Orbital Debris Assessment Report for details.

Figure 1 Two EDSN Satellites



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The satellite includes the following subsystems:

Communications subsystem: This includes a UHF Stensat beacon transmitter capable of being received by amateur HAM radio stations on the ground, a Microhard S-Band transceiver for two way communication with Mission Operations, and a UHF Astrodev Lithium-1 transceiver for crosslink communication among the 8 spacecraft. There are three antennas - a monopole each for the UHF beacon and crosslink, and an S-band patch antenna for the downlink.

Control and Data Handling Subsystem: The C&DH uses a Nexus S phone as the main processor with additional distributed processors (Arduino Unos and Megas) for running other activity tasks such as polling sensor data or translating GPS data. A parallax propeller chip is used as a router for handling data communications and I/O to the phone and distributed processors. The C&DH also includes a watchdog timer to limit radio transmissions if command from Earth is lost.

Electrical Power subsystem: The power subsystem consists of the body-mounted solar arrays, rechargeable lithium ion battery storage capable of sustaining subsystems during operating loads and orbit eclipses, and the remove before flight and separation switch power inhibits.

Attitude Determination and Control subsystem: This system performs attitude determination, orbit estimation, orbit propagation and perform attitude control. Equipment includes on magnetometer, rate gyros, a GPS receiver, coarse sun sensors, magnetic torque coils and reaction wheels. The primary attitude control uses the magnetic torque coils for GPS acquisition and S-band downlink. The reaction wheels are only used during the pointing demonstration activity.

Science Payload: The science payload is the Energetic Particle Integrating Space Environment Monitor (EPISEM) that monitor variations in the location and intensity of energetic charged particles from the Van Allen Radiation Belts in low Earth orbit.