EDSN - Edison Demonstration for SmallSat Networks

EDSN Overview
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Deborah Westley – Project Manager
James Chartres – Lead Systems Engineer
EDSN Overview

Project Office: NASA Ames Research Center

Industry Partners:
Montana State University – Science/Payload (EPISEM)
Santa Clara University – Ground Station/Mission Operations

Mission Goal: Demonstrate that a swarm of satellites is capable of collecting multi-point science data and transferring the data to the ground.

Science: Temporal and spatially distributed Energetic Particle monitoring at the South Atlantic Anomaly and Northern Latitudes

Launch: Oct 2015 on Super-Strypi (ORS-4)
Orbit: 430 km x 505 km @ 94.8° inc
Mission Lifetime: 60 days

Objectives:
1. Flight demonstrate one-way space-to-space data transfer whereby at least 2 satellites transfer data to a third satellite, which then transfers the data to the ground
2. Flight demonstrate a system to collect multi-point science measurements, transfer science measurements to another satellite and transfer to the ground
3. Flight demonstrate a reaction wheel based pointing system
4. Assess the viability of satellites built with Commercial Off The Shelf (COTS) components to operate for 60 days

Implementation:
- Eight identical 1.5U Cubesats with crosslink, downlink and science collection capabilities
- Tech Demo with risk reduction and redundancy through numbers
- Augmented Phonesat 2.0 architecture with Payload, GPS and enhanced FSW and fault management
Technology Demonstration

- Proof of concept for Swarms architectures
- Autonomous satellite operations without ground commanding
- Decoupled mission objectives
- Multiple attempts at technology demonstration
- Technology demonstration versus optimization/high efficiency
- Redundancy through number of units
- Consumer grade COTS components
- Tailored Class D approach with system level testing
- Focus on testing versus design analysis
- Redundancy in system architecture allows for individual satellite upsets
Baseline Mission

8x EDSN Satellites integrate into 2x NLAS Dispensers

The Sun

Operation are autonomous

Activities are either time or time & position based
EDSN Satellite Overview

1.5U solid Pumpkin Chassis

- 3 orthogonal reaction wheels
- MicroHard MHX2420 for S-band downlink
- 4x 18650 2800mAh Li-Ion Batteries
- StenSat UHF transmitter
- EPISEM radiation monitoring payload
- 9 electrical subassemblies inter-connected via a single backplane PCB
- Parallax P8X32A Propeller chip for data & command routing
- Nexus S Smartphone as main processor
- Novatel OEMV-1 GPS receiver
- AstroDev Li-1 UHF transceiver for crosslink
EDSN Satellite Overview

- 2x 1U Solar Panels with 15 cells
- UHF whip antenna for beacon transmissions
- 4x 1.5U Solar Panels with 35 cells
- UHF whip antenna for crosslink transmissions
- Triangular Advanced Solar Cells (TASC)
- GPS patch antenna underside
- Torque coils imbedded in solar panels
- Remove before flight inhibit
- 1.5U solid Pumpkin Chassis
- S-band patch antenna for downlink
Swarm Technologies

• Large Swarms of interacting satellites would enable an unprecedented amount of sensors, communications and computing capability in low-Earth orbit and beyond

• Swarm technologies have the potential to enable:
  – Flexible data correlation and distribution
  – System redundancy
  – Simplification of satellite operations
  – New multi-satellite science investigations
  – Distributed architectures
  – Sensor webs
  – Disaggregated systems

• Swarm missions can provide enhanced scientific data collection for industry, researchers and NASA scientists

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• SSTP is one of nine programs within NASA’s Space Technology Mission Directorate (STMD)