SU-Sat Team

Utah State University
– Dr. Don Thompson, Principal Investigator
– Dr. Jan Sojka, Co- Investigator
– Microgravity Research Team

Space Dynamics Laboratory
– Chad Fish, Program Manager
– Mark Wilkinson, Systems Engineer
– Bryan Bingham, Mission Design Engineer
– Robert Burt, Electrical Engineer
– Joel Nelsen, Communication Engineer
– Mike Watson, Structural Engineer
– Wayne Sanderson, Electrical Engineer
• Space Dynamics Laboratory
  – SDL is a not for profit corporation owned by Utah State University
  – Cooperative relationship with Utah State faculty
  – UARC – University Affiliated Research Center
  – Employs about 60 students in technical fields

• Utah State University
  – Located in Logan, Utah
  – Has flown more experiments in space than any other university
Mission Objectives

**Engineering**

Develop and demonstrate technologies for future CubeSat science missions. Provide mission experience for university students.

**Science**

To observe and resolve magnetosphere-ionosphere-thermosphere global electric field forcing, coupling dynamics and evolution over a wide range of spatial and temporal scales.
SU-Sat Mission Objective

SU-Sat will validate several CubeSat technologies, including:

• An instrumentation suite for measuring space dynamics
• Miniaturized attitude determination sensors
• Magnetorquer-based attitude control system
• Deployment mechanisms
• Communication software and hardware
SU-Sat Characteristics

- LEO, polar orbit, spin-stabilized science satellite
- SU-Sat is a standards-compliant 1.5U CubeSat
- Utilizes COTS components where possible
- Designed to deploy from P-POD
- Will utilize amateur radio communications (store and forward methodology)
SU-Sat Subsystems

A: Mechanisms Driver
   - VHF Antenna and Science Sensor Booms on Mandrel
   - UHF Antenna Deployment

B: Navigation
   - NovAtel GPS Receiver
   - Honeywell 3-axis Magnetometer

C: Command & Data Handling
   - Pumpkin FM430 Flight Module
   - SDL/USU Command and Data Handling Software
SU-Sat Subsystems

D: Science Sensors
   – Electric Field Passive Sensor Electronics
   – DC Probe

E: Electric Power
   – Clyde Space Power Control Card
   – Clyde Space GaAs Solar Cells
   – Clyde Space Lithium Polymer Battery
SU-Sat Subsystems

F: Communications
- Stanford Transceiver: UHF Transmit, VHF Receiver
- Amateur Frequencies with AX.25 Protocol

G: Structure
- Pumpkin chassis body
- SDL/USU mandrel
- Passive Thermal Control
SU-Sat Subsystems

**H**: Flight Software
- Salvo RTOS
- SDL/USU Mission-specific Software

**I**: Attitude Determination and Control
- AeroAstro Sun Sensor
- Honeywell 3-axis Magnetometer
- Gyroscopic Rate Sensors
- Horizon Crossing Indicator
- Solar Panel Embedded Magnetorquers
- SDL/USU Control Algorithms
Technology Demonstrations

• Deployment Mechanisms
  – Mandrel design
  – Resistive heater monofilament cutter
  – VHF antennas, E-field sensor, DC probe

• Science Sensors
  – E-field sensor, DC probe
  – Sensor electronics

• Attitude Sensors
  – Miniaturized Sun Sensor
  – Miniaturized Horizon Crossing Indicator

• Attitude Control Algorithm
  – Spin stabilized, magnetorquer controlled
  – Additional attitude sensors on SU-Sat will provide high fidelity understanding of control law for future missions.
Summary

• SU-Sat provides opportunities for Utah State students to participate in a satellite mission program.
• A future satellite constellation is being designed to obtain data on the Magnetosphere-Ionosphere-Thermosphere global electric field forcing, coupling dynamics, and evolution.
• The SU-Sat mission will validate technologies for future missions.

Questions?