FLC – NE

Science Technology Engineering and Math

STEM

Initiative

CubeSat Club

In collaboration with

Princeton Satellite Systems, Inc.
Plainsboro, NJ

And

John Witherspoon Middle School
Princeton, NJ

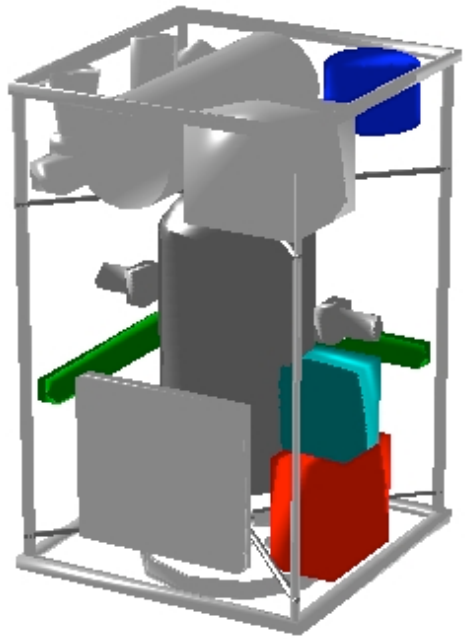
FLC-NE Princeton Satellite Systems – John Witherspoon Middle School

STEM – CUBESAT Project

Introduction
Project Organization
Project Participants
FLC – STEM Support
Design Areas

FLC-NE – Princeton Satellite Systems – John Witherspoon Middle School STEM Project

A CubeSat is a miniature spacecraft with a volume of 1 liter and has a mass no greater than 1 kg.



CubeSats provide an opportunity for students to learn about satellites and engineering.

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This program is to establish a CubeSat club at the John Witherspoon Middle School which would include participation of Princeton High School students, Retired Satellite Engineers, Researchers at the Plasma Physics Laboratory and Princeton University students.

To date CubeSat programs have resided in the universities. This program's goal is to allow junior high and high school students to work on a CubeSat project. These are the ages when children make career decisions and this project may help students decide to pursue careers in technical fields.

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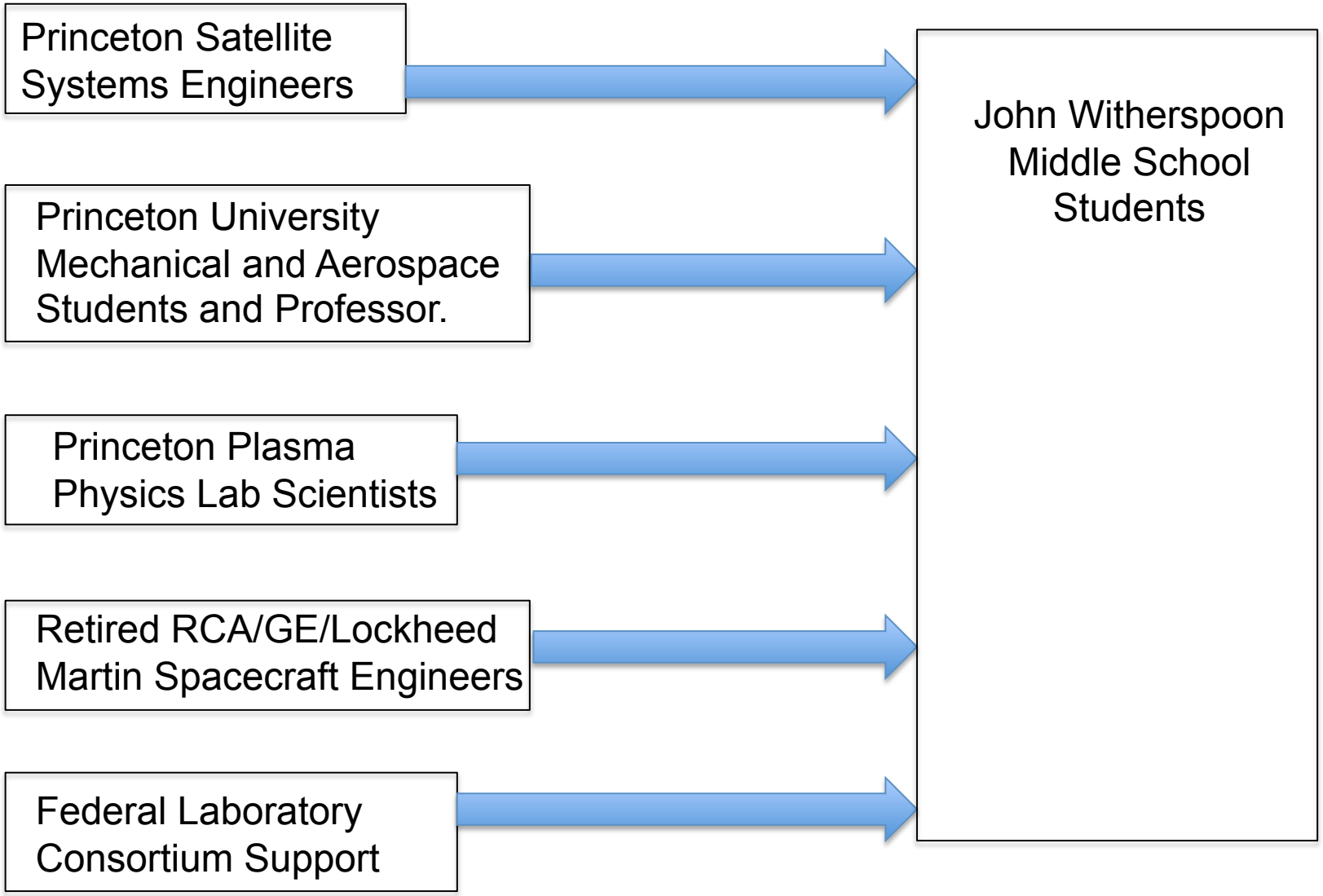
Project Participants



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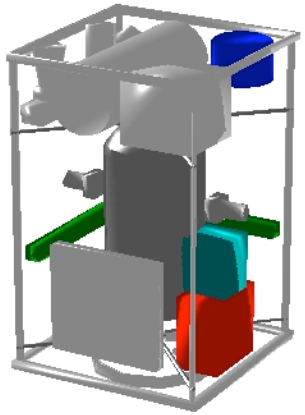
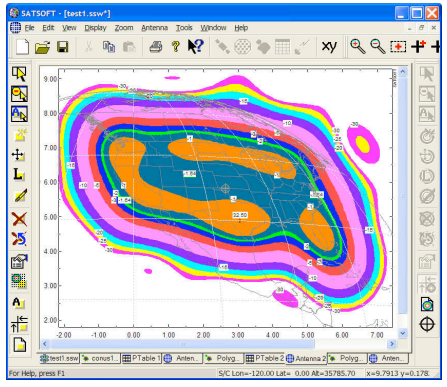
The FLC- NE Will Support the First Phase of the Project by supplying the software for the design of the spacecraft systems.

Design Tools

Student Edition of Matlab/Mathworks	20 copies @ $99.95	= $1999.00
Solidworks/Solidworks	4 copies @ $128	= $ 515.00
Cubesat Toolbox / PSS	20 copies at $49	= $ 999.00
	Total	$ 3513.00





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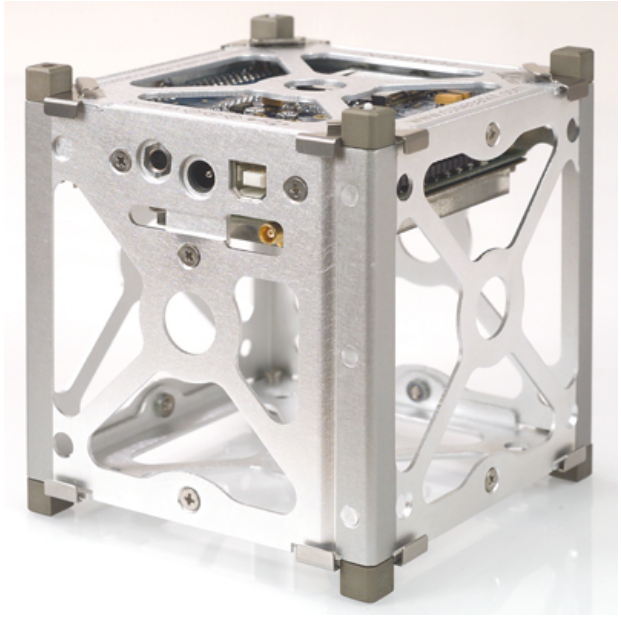
Organization

The CubeSat team will be organized by subsystem.
This is the traditional way of organizing a spacecraft project.
Each subsystem will be led by an experienced engineer.

A Princeton University student will lead the students on each subsystem.
However, all students will have access to an engineer.

Program Management - Mike Paluszek – PSS
Mission Planning – Stephanie Thomas – PSS
Software - David Hoerl – PSS
Mechanisms - Eloisa de Castro – PSS
Payload – Hantao Ji – PPPL
Telemetry & Communications – TBD / Retiree mentor
Power - TBD / Retiree mentor
Attitude Control - Pradeep Bhatta – PSS
Thermal - TBD / Retiree mentor
Structures - TBD / Retiree mentor
Science Experiment - Jay Johnson – PPPL



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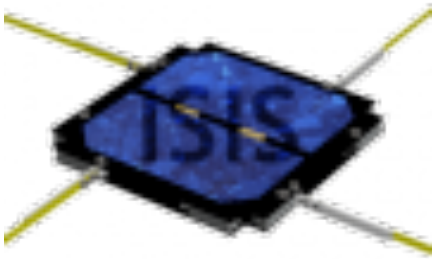
Mechanisms



The mechanisms subsystem will consist of

1. The separation mechanism
2. The reaction wheels
3. The solar array hinges

The students will

1. Learn the basic of mechanisms and electrical machines
2. Build mechanisms
3. Test the mechanisms

Mission Planning

Mission planning is the process of studying the orbits. Since this CubeSat does not have a propulsion system the students will not deal with orbit change maneuvers.

The students will

1. Learn about orbit dynamics
2. Compute the trajectory of the launch vehicle
3. Compute the trajectory of the CubeSat over its life time under the influence of atmospheric drag and solar pressure

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Payload

The payload will be a single instrument built by Princeton Plasma Physics Laboratory.

The students will

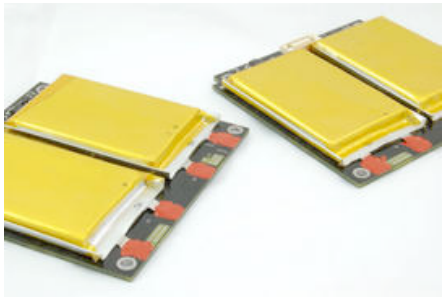
1. Learn about the physics of the measurements
2. Help build the instrument
3. Help test the instrument in the laboratory
4. Help operate the instrument during the mission

Power

The power subsystem consists of the Lithium battery, the solar panels and power supply board.

Students will

1. Learn basic electronics including solar power
2. Assemble the power system
3. Build the magnetic torquers
4. Help test the power system
5. Help operate the power system during the mission



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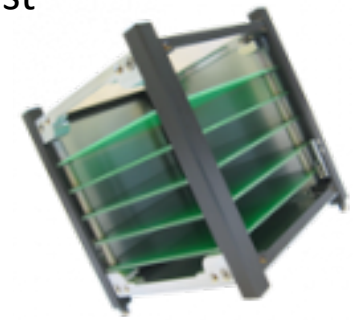
Software

The software subsystem will be responsible for all software. They will support the attitude control subsystem software work.

Students will

1. Learn C and C++
2. Write code in the Optical Navigation System framework
3. Conduct tests of the software
4. Conduct hardware and software tests during integration and test
5. Monitor the software during the mission



Structure

The structural subsystem will employ the CubeSat kit by Pumpkin

Students will

1. Learn the basics of structural design
2. Analyze the structure using SolidWorks
3. Build supporting assemblies to connect components to the CubeSat structure
4. Apply flight loads to test the structure in SolidWorks
5. Test the spacecraft structure with vibration and acoustic tests
6. Monitor the software during the mission All machining work will be done at the PHS machine shop.

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Telemetry and Command

The telemetry and command subsystem will employ the ISIS S-band transmitter board and ground station

Students will

1. Learn the basics of communications
2. Test the boards and ground station
3. Command the spacecraft during the mission

Thermal

The thermal subsystem will be responsible for computing the temperatures of the spacecraft. This will be an analysis task.

Students will

l Learn the basics of thermal design

2. Work with the attitude control engineers and mission planners to determine the attitude and orbit trajectories
3. Simulate the thermal aspects of the spacecraft
4. Monitor the spacecraft temperatures during the mission

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