



# USU's CubeSat Project- The Return of Sputnik

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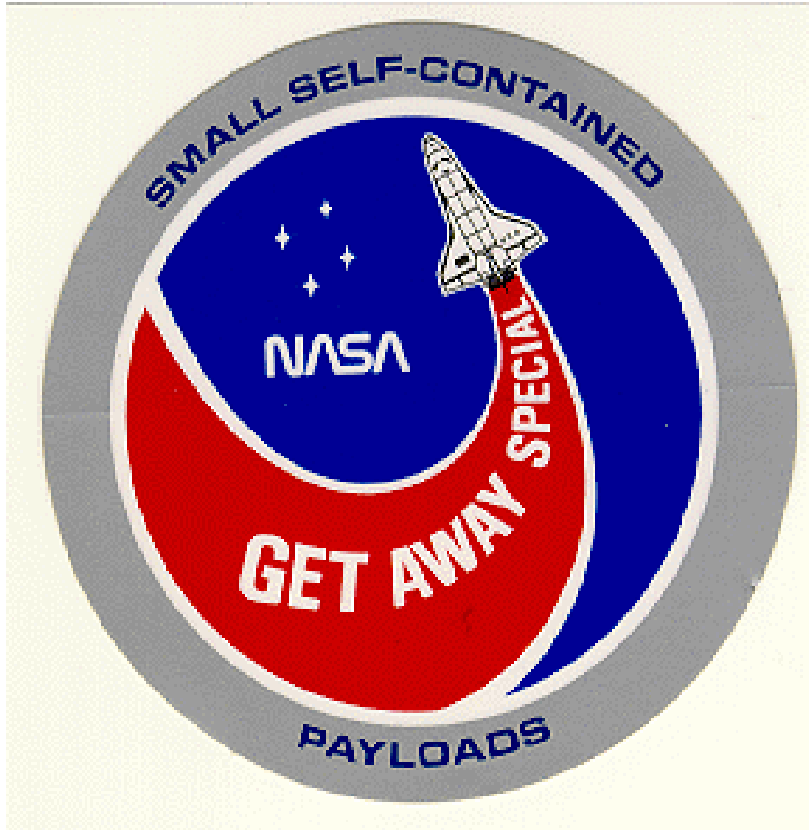
CubeSat Summer Workshop

“Building on Success”

August 2007

# About Us: The Microgravity Research Team

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Our team was created 30 years ago when NASA introduced the Get Away Special program.

Members of the GAS team at USU built 11 payloads of experiments that have flown on the space shuttle.

Unfortunately, NASA cut the GAS program in 2003.

The Cubesat Program has given our team a way to return to space.

# From Get Away Special to CubeSats

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	<u>Get Away Special</u>	<u>CubeSat</u>
Volume	3 cubic feet	10x10x10 cm
Mass	30 -100 kg	< 1 kg
Lifetime	10 Days	1 year +/-
Experiment Data	Stored and Returned with payload radio	Transmitted via



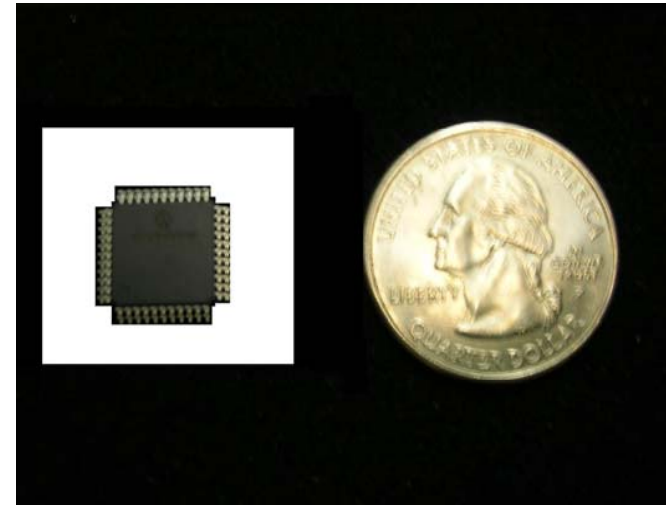
# CubeSats and the Changing World of Space Research

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An exciting era of space research:

- Technology is allowing spacecraft to become smaller and more useful

- Information is more easily communicated and obtained (CubeSat community)



The PIC 18 microcontroller

# CubeSats and the Changing World of Space Research

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A modern-day space race is occurring.

Students from around the world are participating in the CubeSat program.

- CanX-1 (Canada)
- DTUusat (Denmark)
- CUTE-1 (Japan)
- UWE-1 (Germany)
- NCUBE (Norway)
- QuakeSat (USA)

Each project is bringing more diversity, experience, and success to the Aerospace industry.

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# USU's CubeSat: The Return of Sputnik

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October 4 1957

Sputnik I became the first artificial satellite to orbit the earth.



Diameter: 57 cm  
Antenna Length: 2.5 m  
Inclination: 65.1°  
Perigee: 215 kilometers

Mass: 84 kg  
Eccentricity: .05201  
Orbital period: 96.2 minutes  
Apogee: 939 kilometers

50 years later

Undergraduate Students at USU are commemorating this accomplishment by building a CubeSat version of Sputnik

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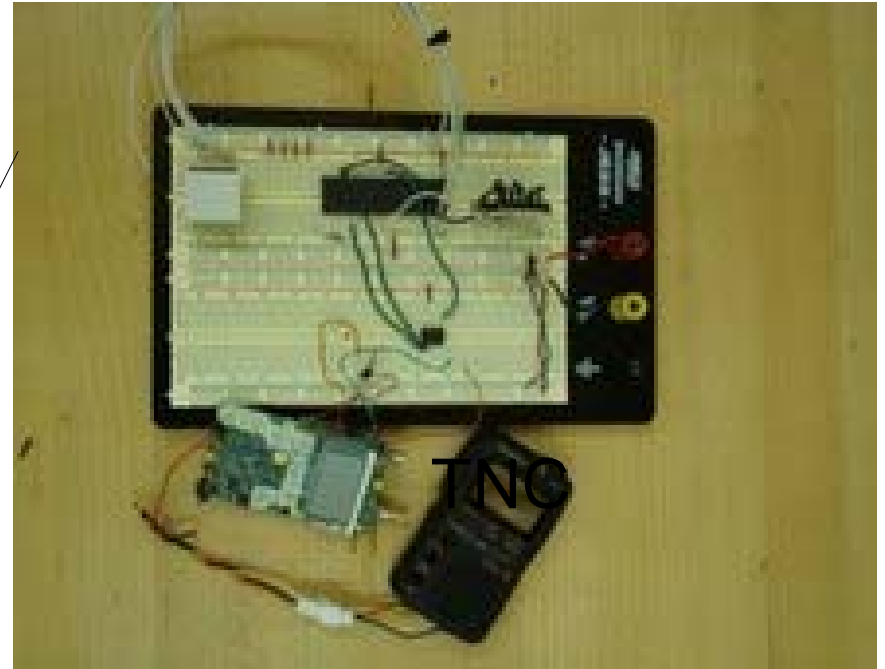
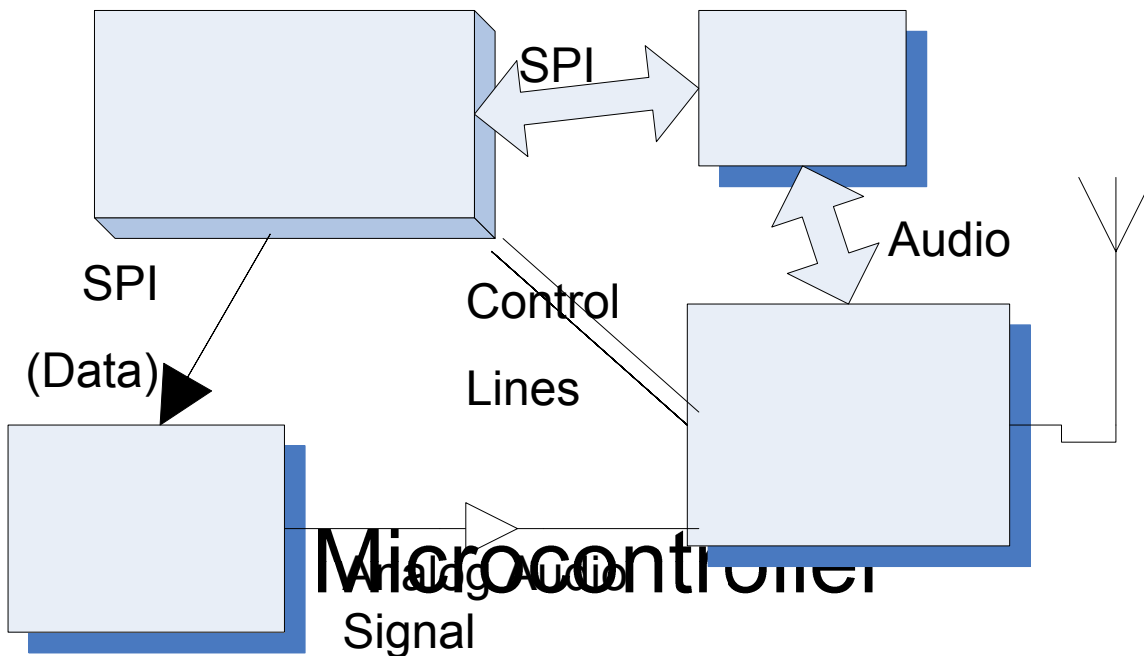
# USU's CubeSat: The Return of Sputnik

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Our Mission: To Design, Build, Test, and Operate our team's first CubeSat.

- Provide a building block to future CubeSat missions
- Gain real experience in aerospace engineering
- Recognize the successful history of space research
- Inspire people to look forward to a successful future in space.

# USU's CubeSat: Communications Subsystem



Our satellite will transmit the original Sputnik message on the 2-meter amateur radio band.



# USU's CubeSat: Power Subsystem

Components	I(min)	I(max)	Duty Cycle	I(avg)	Power (@5 V)
Transceiver	50 mA	500 mA	6% (max) 94% (min)	77 mA	.385 W
TNC	1 mA	5 mA	6% (max) 94% (min)	1.24 mA	6.2 mW
Microcontroller	150 $\mu$ A	25 mA	100% at max (worst case)	25 mA	.125 W
Payload	1 $\mu$ A	15 mA	6% (max) 94% (min)	.9 mA	4.5 mW
<b>TOTAL:</b>	51.2 mA	545 mA		104.1 mA	.521 W

# USU's CubeSat: Power Subsystem

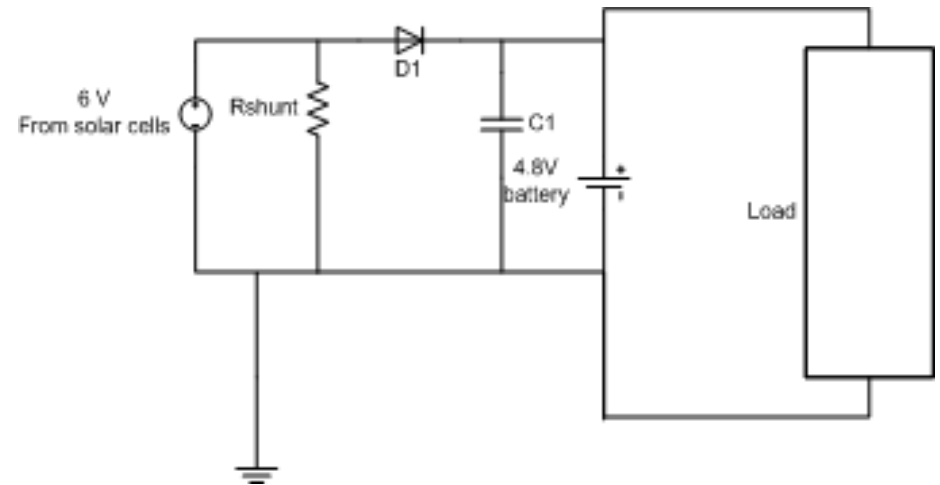
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## Batteries

Soft Nickel-Cadmium VT AAH

1.2 Volts / 700 mAh

- Long Flight History
- High Temperature range  
(-20 C to 70 C)
- 2000 Recharge Cycles
- Simpler Charging Circuit



## Solar Cells:

We've experimented with several options....

Assembling our own panels

Using cells from garden lights

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# USU's CubeSat: Structure

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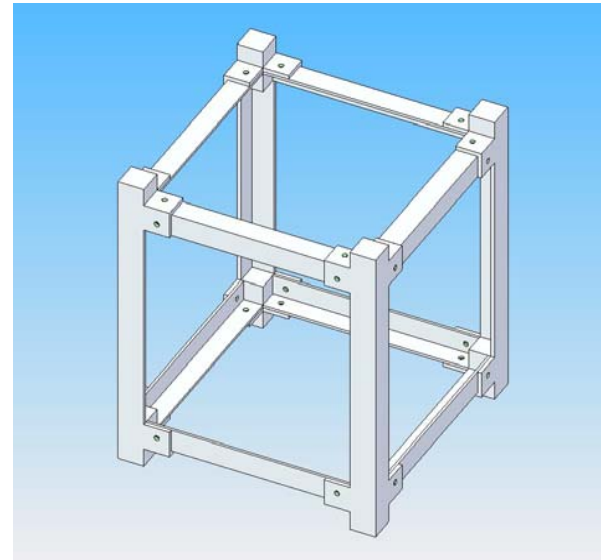
We are designing, machining, and assembling the structure of our CubeSat.

Prototype #1



75 grams

Prototype #2



55 grams

# Education: The Big Success of CubeSats

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The CubeSat program is a priceless educational opportunity.

- Students can participate in a complete CubeSat project from start to finish.
- It is a unique opportunity to work in an academic setting.
- Success is measured by learning, not by \$.
- A new dimension to what is learned in the classroom.
- Students gain real hands-on experiences.

# Education: The Big Success of CubeSats

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