

# The CubeSat, Jr., Project

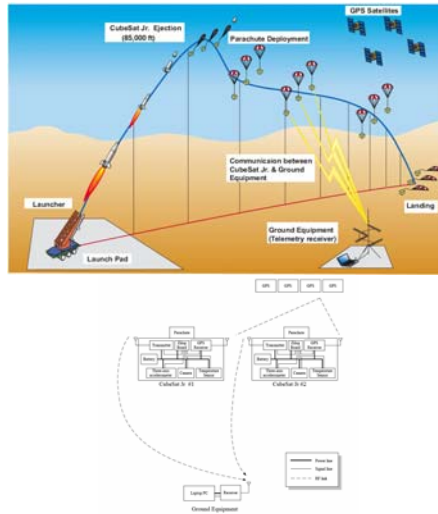
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## Abstract

CubeSat, Jr., an inexpensive satellite bus is being developed as part of the Space Systems Development Lab (SSDL). The CubeSat, Jr., relies on the ZiLOG Z8 Encore! microprocessor for computing; collects, stores and transmits temperature, three-axis acceleration, and GPS data over a 900MHz frequency-hopping radio; and monitors voltage and current supply status throughout the bus. On May 18, 2007, the CubeSat, Jr., will perform a parachute descent mission at White Sands Missile Range (WSMR) after ejecting at 85,000 ft. from a hybrid rocket developed by the Fredericksburg High School Aerospace Science Program (FHSAP).

## Mission Profile

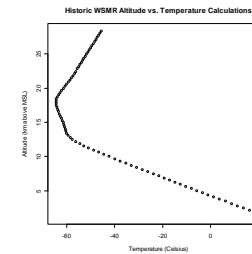


## Telemetry Plan

Sensor Type	Sampling Rate (Hz)	Bytes per sample
Accelerometer	1	2
Temperature	0.2	2
Current	0.2	2
Voltage	0.2	2
		Bytes per measurement type
GPS	0.2	2

GPS provides time, latitude, longitude, altitude, horizontal and vertical speed and heading

## Temperature Model

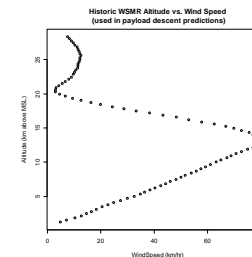


## Ejection System

- VHF-signal activates spring-release to eject nosecone
- Delay of CubeSat ejection by a timer circuit and solenoid
- Nosecone, ejection system and CubeSat

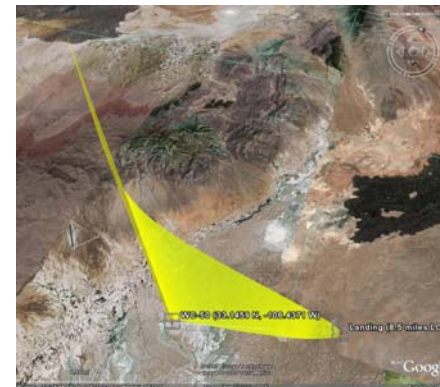


## Descent Model



Using historic wind data (including heading, not shown) above, increment changes in velocity as a function of gravity, air density and wind energy transfer efficiency.

Below is a predicted descent path from our WSMR launch pad using historic wind data.



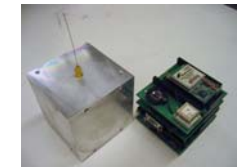
## Rocket Specs

- Redbird 11-H rocket provided by FHSAP
- 12.75" diameter, 15 foot length
- 1460 lbf thrust
- 7-port HTPB fuel grain
- Nitrous Oxide



## Results

CubeSats utilizing the Z8 Encore! have been developed and readied for a May 2007 parachute descent from 85,000 ft.



## Motivation

- Design a CubeSat for educational (K-12 and above) space system missions and demonstrations
- Low-cost alternative to commercial CubeSat product; utilize the ZiLOG microprocessor
- Space systems project based education for graduate students

## Subsystems

- Radio communication
- Circuit design & assembly
- Software & telemetry
- Structure design & manufacturing
- Payload ejection & recovery
- Ground station
- Testing
- Project management

## Circuit Boards

### Electronic Power System (EPS)

- Two 6V lithium batteries
- 3.3V and 5V supplies
- 1A capability
- Voltage and current sensors

### Command & Data Handling (C&DH) – Z8Encore!

- 20MHz, 8-bit microprocessor
- 64kB flash memory
- I<sup>2</sup>C bus

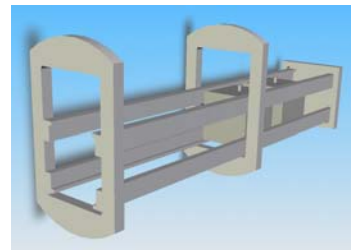
### Sensors

- I<sup>2</sup>C control
- Three-axis accelerometer
- Temperature sensors
- Two 1Mbit flash memories

### GPS/MaxStream Radio

- Trimble Lassen iQ GPS receiver
- MaxStream XStream 900 MHz radio, 19,200 baud, 100mW (20dBm) transmitter

- Ejection system and CubeSats



## Acknowledgements

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