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 Aeroscience Program (FHSAP).

Mission Profile

Telemetry Plan

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.

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
• PC bus

Sensors
• PC 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

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

Telemetry Plan

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<th>Sensor Type</th>
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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.

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