UC Irvine
SSOE Research Symposium Dean's Awards

Title

UCI CANSAT

Permalink

https://escholarship.org/uc/item/3pn6h26w

Authors

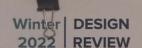Ngo, Dustin
Castro, Oscar
Fernandez, Camila
et al.

Publication Date

2022-03-01

Copyright Information

Peer reviewed

DESIGN

CanSat System

Tether Pulley System

Payload System

Tether Material

Acknowledgements

Special thanks to **Dr. Roger Rangel** and **Northrup Grumman** for making this project possible

MISSION SUMMARY

Launch & Ascent Phase:
The CanSat is mission ready inside the rocket. It is launched to an altitude of 670 - 725 meters for the Deployment Phase to proceed.

Deployment Phase:
The rocket separates via ejection charges causing the Cansat and nose cone to fall out. Here, telemetry begins and the Cansat descends at 15 m/s.

Descent Phases:
1. At an altitude of 400 meters, a larger parachute is deployed to reduce the Cansat's descent rate to 5 m/s.
2. At 300 meters, the Cansat releases a tethered payload to a distance of 10 meter for 20 secs. Said payload will record via a video camera oriented in the South direction at 45° downwards.

Landing Phase:
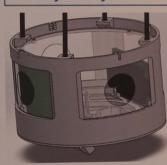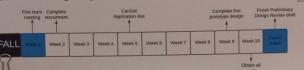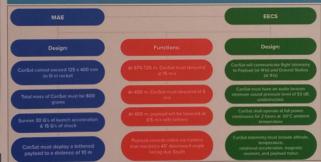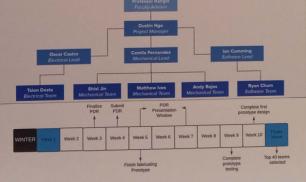CanSat and all internal components must land safely intact for recovery.

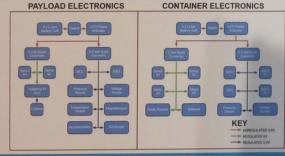Deployment Phase

Ascent Phase

Descent Phase 1

Descent Phase 2

Launch Phase

Landing Phase

OBJECTIVE TREE

MAE

EECS

Design:
- CanSat cannot exceed 125 x 400 mm to fit in rocket
- Total mass of CanSat must be 600 grams
- Survive 30 G's of launch acceleration & 15 G's of shock
- CanSat must deploy a tethered payload to a distance of 10 m

Functions:
- At 670-725 m, CanSat must descend at 15 m/s
- At 400 m, CanSat must descend at 5 m/s
- At 400 m, payload will be lowered at 0.5 m/s with tethers
- Payload records video via camera that maintains 45° downward angle facing due South

Design:
- CanSat will communicate flight telemetry to Payload (at 4Hz) and Ground Station (at 1Hz)
- CanSat must have an audio beacon minimum sound pressure level of 92 dB, unobstructed.
- CanSat shall operate at full power continuous for 2 hours at 60°C ambient temperature
- CanSat telemetry must include altitude, temperature, rotational acceleration, magnetic moment, and payload status

TEAM

Professor Rangel
Faculty Advisor

Dustin Ngo
Project Manager

Oscar Castro
Electrical Lead

Camila Fernandez
Mechanical Lead

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Software Lead

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Electrical Team

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Mechanical Team

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Mechanical Team

Andy Rojas
Mechanical Team

Ryan Chum
Software Team

PCB DESIGN

CIRCUIT OVERVIEW

PAYLOAD ELECTRONICS

- 4.2 Li-Ion Battery Cell
- Switch
- LED Power Indicator
- 5 Volt Boost Converter
- 3.3 Volt Buck Converter
- Servo #1
- Servo #2
- MCU
- XBEE
- Raspberry Pi Zero
- Pressure Sensor
- Voltage Sensor
- Camera
- Temperature Sensor
- Magnetometer
- Accelerometer
- Gyroscope

CONTAINER ELECTRONICS

- 4.2 Li-Ion Battery Cell
- Switch
- LED Power Indicator
- 5 Volt Boost Converter
- 3.3 Volt Buck Converter
- Motor #1
- Motor #2
- MCU
- XBEE
- Motor #3
- Motor #4
- GPS
- Audio Beacon
- Solenoid
- Pressure Sensor
- Voltage Sensor

KEY
- UNREGULATED 3.8V
- REGULATED 5V
- REGULATED 3.3V

SOFTWARE METHODOLOGY

[START] Check Current Flight State
- Also returns to correct state after unexpected restarts

Execute State Actions
- Deploy payload
- Begin/End telemetry interrupts

Read Sensors
- Temperature, Pressure, etc.
- Calculate some telemetry

Main Loop for Container & Payload (In C with STM32CubeIDE)

Save Mission Data
- To nonvolatile memory
- Current State
- Altitude
- Telemetry count

Update Flight State
- Based on calculated telemetry
- Launch, Ascent, Descent, Deployment, etc.

Container Interrupts

Transmission Interrupt
- Occurs on a 1.0 second timer
- Calculate or read telemetry based on stored sensor readings
- Sends telemetry to ground station

Reception Interrupt
- Occurs when the XBEE receives a message
- Parses both GCS commands and Payload telemetry

Payload Interrupts

Transmission Interrupt
- On a 0.25 second timer
- Calculate telemetry based on stored sensor readings
- Sends telemetry to container

Reception Interrupt
- Occurs when the XBEE receives a message
- Parses Container commands

FALL | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Week 10 | Finals Week

- First team meeting
- Complete recruitment
- CanSat Application due
- Complete first prototype design
- Finish Preliminary Design Review draft
- Obtain all parts

WINTER | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Week 10 | Finals Week

- Finalize PDR
- Submit PDR
- PDR Presentation Window
- Complete first prototype design
- Finish fabricating Prototype
- Complete prototype testing
- Top 40 teams selected

SPRING | Week 1 | Week 2 | Week 3 | Week 4 | Week 5 | Week 6 | Week 7 | Week 8 | Week 9 | Week 10 | Finals Week | Launch Week

- Submit CDR
- CDR Presentation Window
- Finish Final Design testing
- Complete Final Design
- Competition begins
- Finalize Critical Design Review (CDR)
- Finish fabricating prototype 2
- Post-launch presentations