Space Flight Design Challenge

Full Mission Simulation Review | 05-08-2019
Design Overview

Electrical Diagram

PCB Design
Design Overview

- No major changes since ISTR
Design Overview

Optical Orientation

Si Particle Detectors
Design Overview

SBM20

SBM21

LND712

LND713
Hazardous Mechanical Items

• No hazardous mechanical items.
Hazardous Electrical Items

• Geiger circuits induce high voltage (300-600V) which is contained within each Geiger circuit board and located around the Geiger tube.
Special Requests

• High voltage (300-600V, small current \(\sim \mu A\))
Update on Partnerships

• No partnerships outside of SFDC
Si Particle Detectors and Microcontroller

Si particle detectors digital output has been tested with a microcontroller.

All testing succeeded, but software improvement is necessary.
Integrated Subsystem Testing Status

Geiger Counters and Microcontroller

All the tubes have been tested using an Arduino UNO and radiation source to record counts per second in order to verify the software is working.

We are currently waiting for PCBs to arrive.
Integrated Subsystem Testing Status

Optical Orientation and Microcontroller

Solar panels were tested with a microcontroller which was able to accurately read measured light levels.

All tests passed. Software improvement is needed.
Integrated Subsystem Testing Status

RPi CM 3 and Microcontroller

Microcontroller was tested with simulation software which outputs via UART to RPi CM 3 which is displayed in a terminal.

All tests passed. Software will be replaced with code from other subsystems.

We are currently waiting for PCBs to arrive.
West Virginia University
Design Overview

Changes Since ISTR:

• Changed mount of antenna deployer
  – New design is simpler
    – Shrinks footprint
    – Weighs less
  – Will not change any requirements
Design Overview: Antenna Holder

- Male Antenna Holder
- Female Antenna Holder

- 2 male holders used (1 displayed above)
- Each antenna fits within one side of female mount
Design Overview: Antenna

- Thickness 0.5mm
- 2 identical antennas used (1 displayed above)
Design Overview: Motor Mount

- Each will hold one a single motor to hold stowed antenna in place
Design Overview: Deployment

- Motor holds antenna until deployment
- Deployment Distance: 5 in
- Deployment Time: 1 sec
Functional Block Diagram

- **Servo**
  - Servo Control Lines
- **Antenna**
  - Co-axial Antenna Cable
- **GPS Patch Antenna**
- **Electronics Housing**
  - Raspberry Pi (3.3V pin)
  - XBee Transceiver
  - NavSpark-Mini GPS Unit
- **Transmission Data (SPI Bus)**
- **Telemetry Data (SPI Bus)**
- **Power Line**
- **Data Line**
- **Control Line**
Hazardous Mechanical Items

• Stored Energy within the Deployable Antenna
  – Will deploy 5 inches in 1 second
    • Net distance from payload is 1.53 inches

CAD Rendering
Special Requests

• Approval that antenna deployment speed can exceed the 1 in/s restriction

• RF Transmission
West Virginia Wesleyan College
Our systems will not be fully assembled until we get feedback on pins/our PCB and print our holder. This is a top down view of how our amplification circuit connects to the Geiger and data collection systems. The alligator clips are supplying power and ground.
Functional Block Diagram

Key –
- 5V power
- Analog data

Data collection system – inside canister affixed to PCB
Geiger counter – outside canister
*Power supplied by Wallops; UART going to telemetry system
Subsytem Testing Status

**Geiger Counter:**

The Geiger counter has been tested with the new amplification circuit and is able to detect radiation.

**Data Collection:**

The amplification circuit has been modified and complete. Data has been taken with the Arduino code and recorded to factor out background counts. The below picture is data from the Geiger counter both with and without a direct radiation source.

The Openlog has not been tested, nor has the Arduino pro micro directly with the system.

We are not expecting complications with either of these.
Integrated Subsystem Testing Status

1.0 Geiger Counter and data collection

The Geiger counter has already been tested in conjunction with parts of the data collection system (the amplification circuit and the Arduino specifically) and sample data has been obtained.

The next step is to use the Arduino pro micro and Openlog with the system.
Design Overview

• 3D model is slightly out of date. The UART being utilized is now the one built into the RPi 3B. The board has been shortened to 5 inches in length and 3.8 inches in width.
Electrical Schematic
3.0 Integrated Subsystem Testing Status
All systems were integrated at the same time.
There is a known issue with communication on the Rpi 3b ADC and 2 SPI devices. We are currently working on this issue. Independently, all accelerometers and the ADIS gyro are sending us usable data. After Walter and Justin write custom code for the SPI issue, we will calibrate and will then be ready for launch.
Here is the voltage and amperage readings for the full system with the HDMI port of the Pi enabled. Deactivating the HDMI interface should save us 200 mA, so we should be well below the estimated .7A max load will all systems running. After the code issue is addressed, we will be calibrating and then running final tests on the power requirements under simulated near flight conditions. The picture below shows 330 mA constant with spikes up to 500 mA.