

# Final Report

Southwestern Indian Polytechnic Institute

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# Team SIPI



Left to right: Alicia Montoya, Jaslynn Begay, Kyle Yazzie, Shelden Yazzie, and Martin Grace



# Mission Overview

- Our main objective was to build & test a Geiger Counter that gives audio & visual cues for radiation detection. This sensor was then integrated into our main payload to work in conjunction with temperature and pressure sensors and a 3-axis accelerometer, all located on the AVR board. The AVR board also houses the microcontroller, flash memory, and power regulation.
  - Geiger Counter:
    - Inert Gas is found in the Geiger Mueller tube
    - It's a non-reactive gas
    - It's used for chemical synthesis and chemical analysis
    - It's a compound gas
    - It's mostly used for Chemistry
    - The most common inert gas is nitrogen and argon.
    - The tube is filled with Argon gas.
    - The gas is used to collect the radiation. (Gamma, Alpha, and Beta)
- We expected to collect data samples from a sub-orbital flight, measuring the radiation levels, temperature, atmospheric pressure, and acceleration.
- Once the flight concluded, we intended to analyze our collected data. From our conclusions, we hope to contribute to future payload missions.

# Concept of Operations

- The entire flight of the rocket from lift-off to touchdown took about 15 minutes.
- We began by launching our payload in a can with other payloads.
- After launch, the g-switch was activated, which allowed the sensors to begin collecting data. That data was then to be stored to the on-board flash memory, where the data could later be retrieved and analyzed.
- The UpAerospace rocket reached its highest point at about 70 miles, after 2 minutes 40 seconds of flight.
- After descent into the Earth's atmosphere, the parachute deployed to allow a safe touchdown to the surface for retrieval of our payloads.

# Shared Can Logistics

- Southwestern Indian Polytechnic Institute was located in Can 1 and shared the can with SJCC, CNM, and T or C.
- SIPI's Payload was one of four stacked payloads in can
  - Our payload was located third in the can, and housed the master switch
  - Clocking and stand-offs were used for stacking
  - Payloads were integrated for activation

# System Requirements

- Our main subsystems include: Power, Sensors, and Command & Data Handling
- The Power subsystem handles activation, power and arming regulation of the entire payload.
- The Sensor subsystem includes the temperature sensor, pressure sensor, the accelerometers and the Geiger Counter.
- The Command & Data Handling subsystem handles in-system serial programming & data retrieval.
- 9V Power supply for power activation. Voltage regulation for power system.

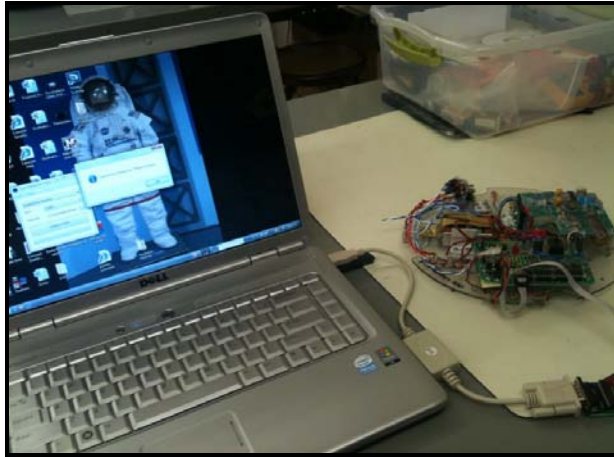
# System Requirements Cont.

- ATmega 32 Microprocessor
  - WinAVR, AVR studio, RealTerm, and hardware drivers are required for our system
- Subsystems: how they interface.
  - AVR Studio for interface from coding to programming
  - Data retrieval done using data board connected to AVR using ISP cable.
  - DB9 Serial Connector used for data board interface to computer
  - AVRISP connected to board and computer for programming
  - Geiger board interfaces with the AVR using the bread board space on the Main board.
  - Data board interfaced with main board using headers

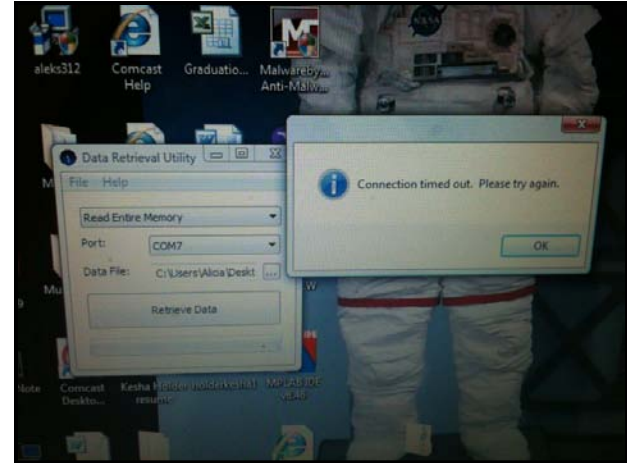
# Data Retrieval

- Programming
  - NMSG provided software w/ AVRISPmkII
  - In-System Programmer for 8-bit Microcontroller
- Data retrieval
  - Support Hardware: Data board for data retrieval (produced), keyspan (purchased), AVR (purchased)
  - Software: AVRISPmkII (In-System Programmer) (purchased) Includes programmer & debugger
  - We were unable to successfully retrieve any data from our payload. When using the data retrieval utility to “read entire memory,” an error message was received that read “Connection timed out. Please try again.” We continued to try to read the entire memory, but kept getting the same message. From there we checked the armed status to see if a successful connection was being made between the computer and the data board; there was a successful connection made because the green light was blinking and the payload was armed. We feel that one of two issues could be occurring: either data was not successfully written and stored to flash memory, or a component was damaged that is preventing the proper acquisition of any stored data.
- Potential points of failure were structural issues & data retrieval

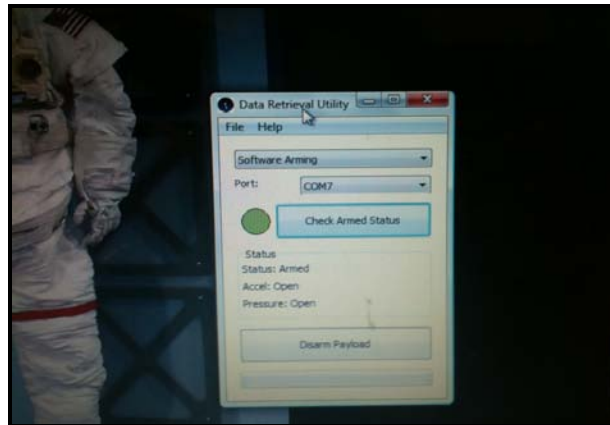
# Data Retrieval



Connecting the data board to the laptop



Error message



Payload is armed and has a successful connection

# Conclusions

- Some issues we came across were missing parts such as the accelerometer chips and the g-switch and a broken accelerometer chip.
- We also had to adapt quickly to gaining new team members.
- Data retrieval was not successful.
- We would like to thank the following contributors for making this project possible:
  - Dr. Nader Vadiiee
  - Aaron Perez
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  - NASA EPSCoR
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  - TCUP II Program
  - Dr. Sherry Allison