HASP Student Payload Application for 2007

Payload Title:
CajunSat III

Payload Class: (circle one)	Institution:	Submit Date:
Small ~~ ~~ (Large)	University of Louisiana-Lafayette	

Project Abstract

The CajunSat III team seeks to build a reusable CajunSat platform that will be able to house many different sensors, a computer that has LabView controlling all the experiments, removable LabView sensors, GPS device, and compartments for different experiments. This will allow for future students to be able to concentrate on experiments instead of having to keep building housing for their experiment. This should lead to a better understanding of how a NASA research program works, and should allow for them to spend more time learning their experiment. The experiments that will be flown for HASP 2007 will be a cosmic ray flux measurement using Geiger counters placed on top of, between, and on bottom of layers of aluminum.

Team Name:	Team or Project Website:
CajunSat III	

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Project Summary

The CajunSat III team will take part in HASP 2007. We seek to build a reusable large payload platform that will have many built in sensors. The sensors will include temperature sensors, pressure sensors, ozone detectors, and a GPS device. We will also have removable compartments that will have various other sensors that can be added as needed. These sensors might include things such as Geiger counters, light sensors, or accelerometers. The last things that will be included on this platform is compartments that house a computer running Linux and Labview as well as a place to house the current experiment. This permanent design will allow for students to concentrate on designing and testing the experiment rather than starting from scratch every time.

In addition to the reusable platform and computer, the CajunSat team will design a modified nuclear stack. This nuclear stack will contain sheets of Kodak TMAT- H film as well as Geiger counters and thermoluminescent dosimeters (TLD).

Project Narrative

Introduction

The scientific goals of CajunSat III are as follows:

1. Complete the analysis for the CajunSat II film.
2. Develop a reusable CajunSat platform that contains sensors and computer built in to it.
3. Obtain a flux of cosmic rays as a function of altitude using Labview Geiger counters.

The reusable CajunSat platform will weigh approximately 4 kg. It will have dimensions of 11x2 inches with a height of approximately 12 inches. See Figure 1. Due to the enormous weight of the aluminum, the computer will be placed on the side of the aluminum along with most of the sensors. This computer will contain the following:

- AMD processor
- Power supply
- 120 GB hard drive
- 1 GB of RAM
- USB ports
- Serial port
- Scientific Linux
- LabView for Linux
- Laptop battery for backup power

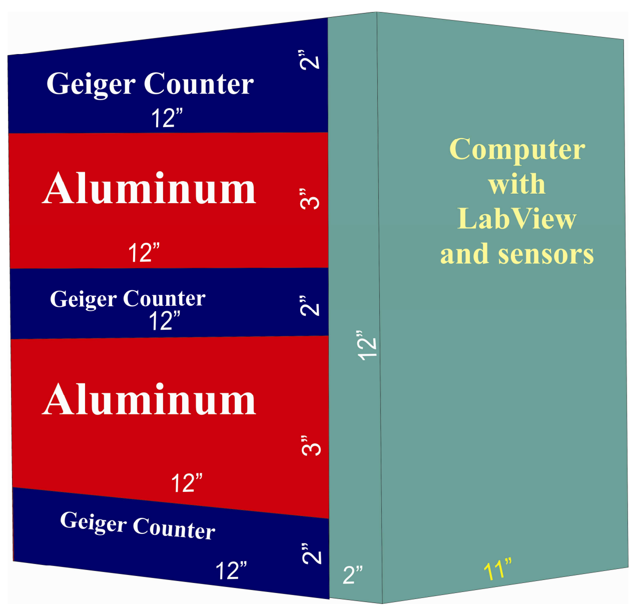


Figure 1
This is a figure of what the CajunSat platform will look

On the top, middle, and bottom the platform, we will have Geiger counters. The middle and bottom Geiger counters will be protected from the mass of the aluminum by spacers. These spacers will hold the aluminum in place. By having Geiger counters onboard, we will be able to obtain a flux of the cosmic rays as they enter and leave the aluminum.

Objectives

The objectives of this experiment are as follows:

1. Finish analyzing the data for CajunSat II.
2. Design a reusable CajunSat platform that can be easily integrated to.
3. To design a portable computer platform that can be flown on all future flights.
4. To design a LabView program that can control and record all experiments.
5. Install Labview sensors into the platform that can be used on all future flights.
6. To measure the cosmic ray flux using Labview Geiger counters.

CajunSat II

Due to an enormous amount of data, we were unable to fully analyze all of the data for the CajunSat II payload. Therefore the first thing that we will do is finish analyzing the data for CajunSat II. Our preliminary results are shown in Table I.

Table I: Preliminary CajunSat II Results

Film #	1	2	3	4	5	Total layers of Al above	Depth	Approximate Energy Loss
Event 1	x	x	x	x		4	1.04 cm	50 MeV
Event 2		x	x	x		3	0.78 cm	40 MeV
Event 3		x	x	x	x	9	2.34 cm	70 MeV
Event 4		x	x			3	0.52 cm	32 MeV
Event 5			x	x		2	0.52 cm	32 MeV
Event 6			x	x		2	0.52 cm	32 MeV

Thus far we have only been able to identify and track six different events. The maximum energy that we have observed is approximately 70 MeV. This energy is the estimated energy using a program called SRIM 2006 (Stopping Range of Ions in Matter) by James F. Ziegler. We have only done energy approximations using the aluminum thickness and have not taken the bag, screen, and air density.

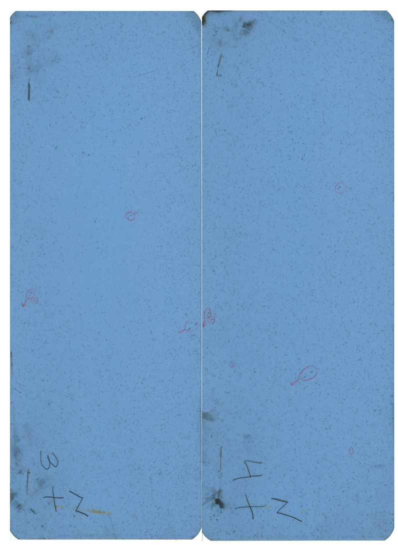


Figure 2
Films flown on CajunSat II

CajunSat Platform

Once we have completed the CajunSat II analysis, we will start building a reusable platform that house experiments and contains sensors already built into in. This is the primary goal of CajunSat III: build and fly a reusable platform that can contain control and record experiments and be completely portable. This design will future students to use a platform that is already built and tested thereby leaving them with more time to build and test their own experiment.

Sensors

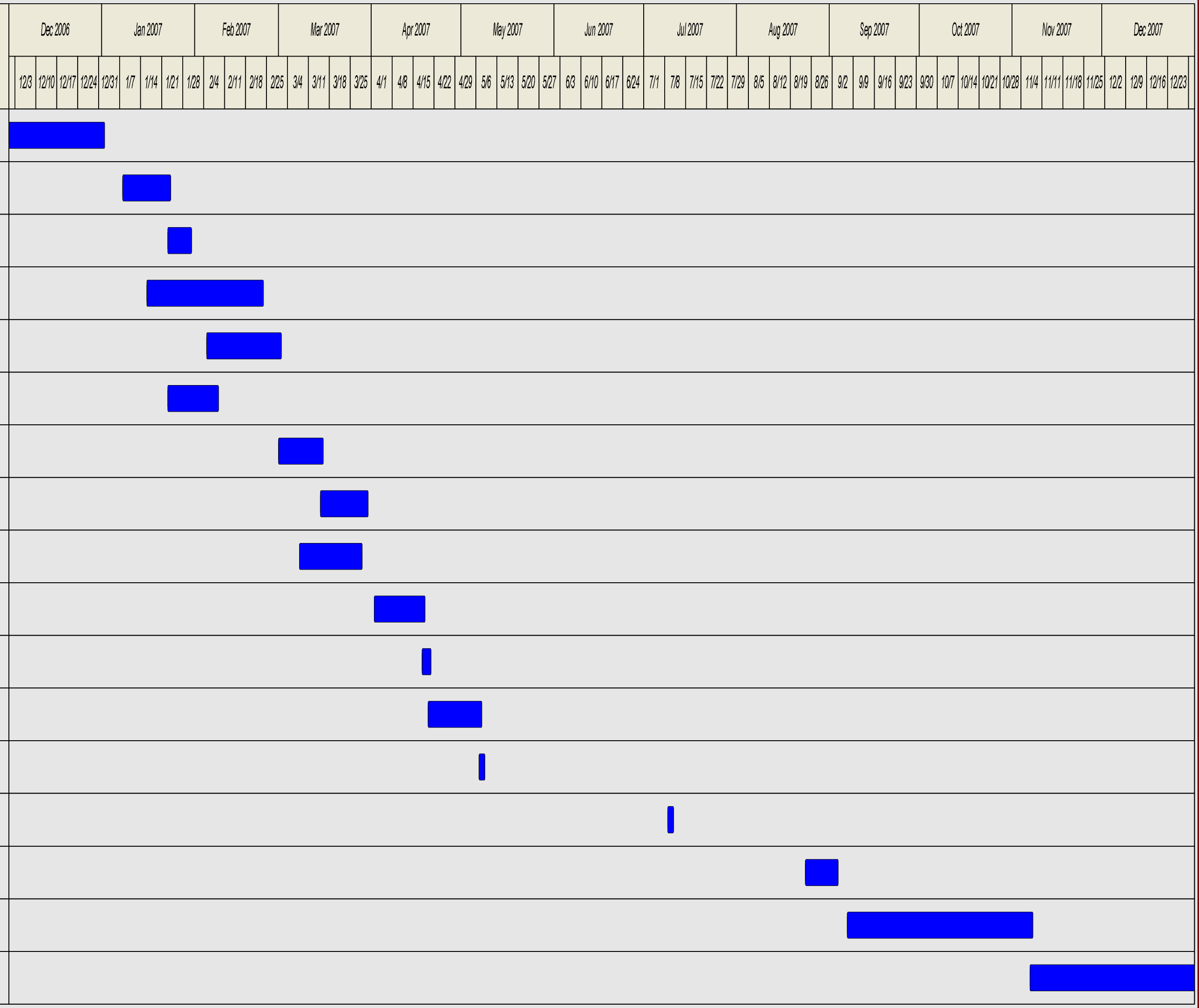
The sensors that will be flown on HASP 2 will include at least three Geiger counters, a pressure sensor, a temperature sensor, and possibly a GPS device. The Geiger counter will allow us to measure the flux of the cosmic rays while the aluminum will allow us to have an estimate of the energy of the cosmic rays. We should also be able to determine when the cosmic rays entered out aluminum stack. This will be accomplished by either using syncing our data to the HASP platform data or by using our own GPS device.

Timetable

CajunSat III will be supervised by Andy Hollerman, Ph.D. Ross Fontenot will be the graduate student in charge. He will also be designing the CajunSat platform, designing the computer, installing sensors, and writing LabView program. The undergraduate students will be primarily responsible for designing and testing the Geiger counter experiment. There will be weekly meetings to discuss progress and fix problems with designs or testing. We hope to have this payload finished by early May and integrated into HASP in early July. Once the payload is flown, we will spend the rest of the year analyzing the data, writing the final paper, and creating presentations for conferences, talks, or poster presentations.

The major milestones will first be to get the CajunSat platform built. We anticipate this to be done by early February. Next we must build and test the computer. This should be complete by late February. March will be spent writing the LabView program and integrating all the sensors. By early April we will have the Geiger counter experiment complete. Then by mid April, we expect everything to be integrated into the CajunSat platform. Once this is complete we will run day long tests to simulate a long balloon flight. All of this is summarized in the CajunSat time table that is shown in the following figure.

ID	Task Name	Start	Finish	Duration
1	Begin Payload Design	12/1/2006	1/1/2007	4.4w
2	Build Reusable CajunSat payload	1/8/2007	1/23/2007	2.4w
3	Stress test Reusable Design	1/23/2007	1/30/2007	1.2w
4	Build speed of sound	1/16/2007	2/23/2007	5.8w
5	Build Computer	2/5/2007	3/1/2007	3.8w
6	Cold Test speed of sound	1/23/2007	2/8/2007	2.6w
7	Write LabView Program	3/1/2007	3/15/2007	2.2w
8	Integrate Sensors	3/15/2007	3/30/2007	2.4w
9	Vacuum test speed of sound	3/8/2007	3/28/2007	3w
10	Build and test phosphor thermometry experiment	4/2/2007	4/18/2007	2.6w
11	Complete Integration	4/18/2007	4/20/2007	.6w
12	Start 20 hour tests	4/20/2007	5/7/2007	2.4w
13	Prepare for HASP Integration	5/7/2007	5/8/2007	.4w
14	Integrate into HASP	7/9/2007	7/10/2007	.4w
15	Attend HASP Launch	8/24/2007	9/3/2007	1.4w
16	Analyze Data	9/7/2007	11/7/2007	8.8w
17	Write report and Prepare Presenations	11/7/2007	12/31/2007	7.8w



Team Structure

Andy Hollerman: Principle Investigator and Supervisor

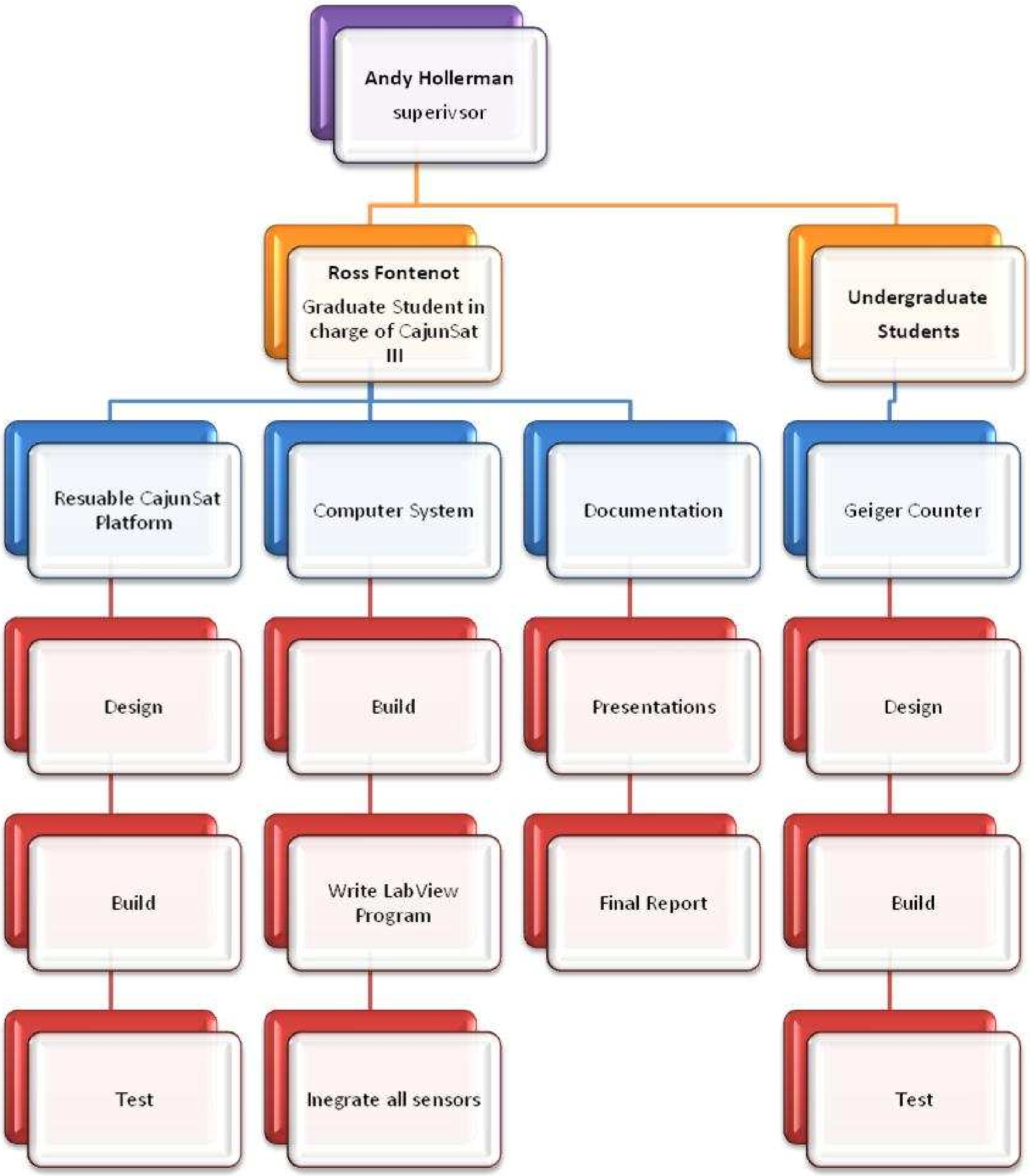
Andy Hollerman an Associate Professor of Physics at the University of Louisiana at Lafayette. He has done research dealing in the following:

- Phosphor Materials and Fluorescence
  - Triboluminescence
  - Thermometry
- Space Physics
  - Radiation Effects and Environments
  - Hypervelocity Impacts
- Environmental Physics
  - Trace Element Analysis
  - Pollution Remediation Analysis
- Accelerator Physics and Engineering
  - Operations
  - Materials Analysis
- Hazardous Materials and Environments
  - Engineering and Remediation
  - Analysis

Andy Hollerman has supervised CajunSat I and CajunSat II. He also has worked at various NASA facilities and at Oakridge National Laboratory.

Ross Fontenot: Graduate student in charge of CajunSat III

Ross Fontenot has worked on CajunSat I and II. He has lots of experience dealing with computers and helped build a Geiger counter for LaACES I and a nuclear emulsion stack for HASP 2006.



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Payload Specifications

The CajunSat team will require the following from HASP.

Number of Positions need:	1 Large Student Payload
Approximate weight:	10 kg
Approximate dimensions:	11” x 14”
Approximate height:	12”
Voltage needed:	28 V
Approximate Amps needed:	2.5 Amps
Serial Downlink:	Yes
Serial uplink:	Yes
Serial interface:	Yes
Analog downlink:	Yes
Discrete command:	2 commands

We expect the reusable platform to be about 2 kg. The computer with all the sensors should be another 2 kg. This leaves approximately 6 kg for all future CajunSat experiments. We will convert the 28 V to the needed amount for all components. We do not expect to go over the 2.5 Amps budget. We will communicate with our payload. We expect to use two commands. One to turn on and off our payload and another command to control some LabView functions. Labview will control everything onboard and we will have backup power via a laptop battery.

We expect to integrate into HASP in early July. The integration procedures will be to mount our payload to the HASP structure and then run tests to see if our payload will work on HASP. The orientation or HASP position will not matter.

The flight line operations will be to turn on our payload and to make sure our computer and LabView are running. Once HASP is recovered all that will be required is for us to get the data off of the computer and then start analyzing the data. Once this is complete we will write the final report and then prepare any sort of presentations or posters that will be needed.

Preliminary-Drawings

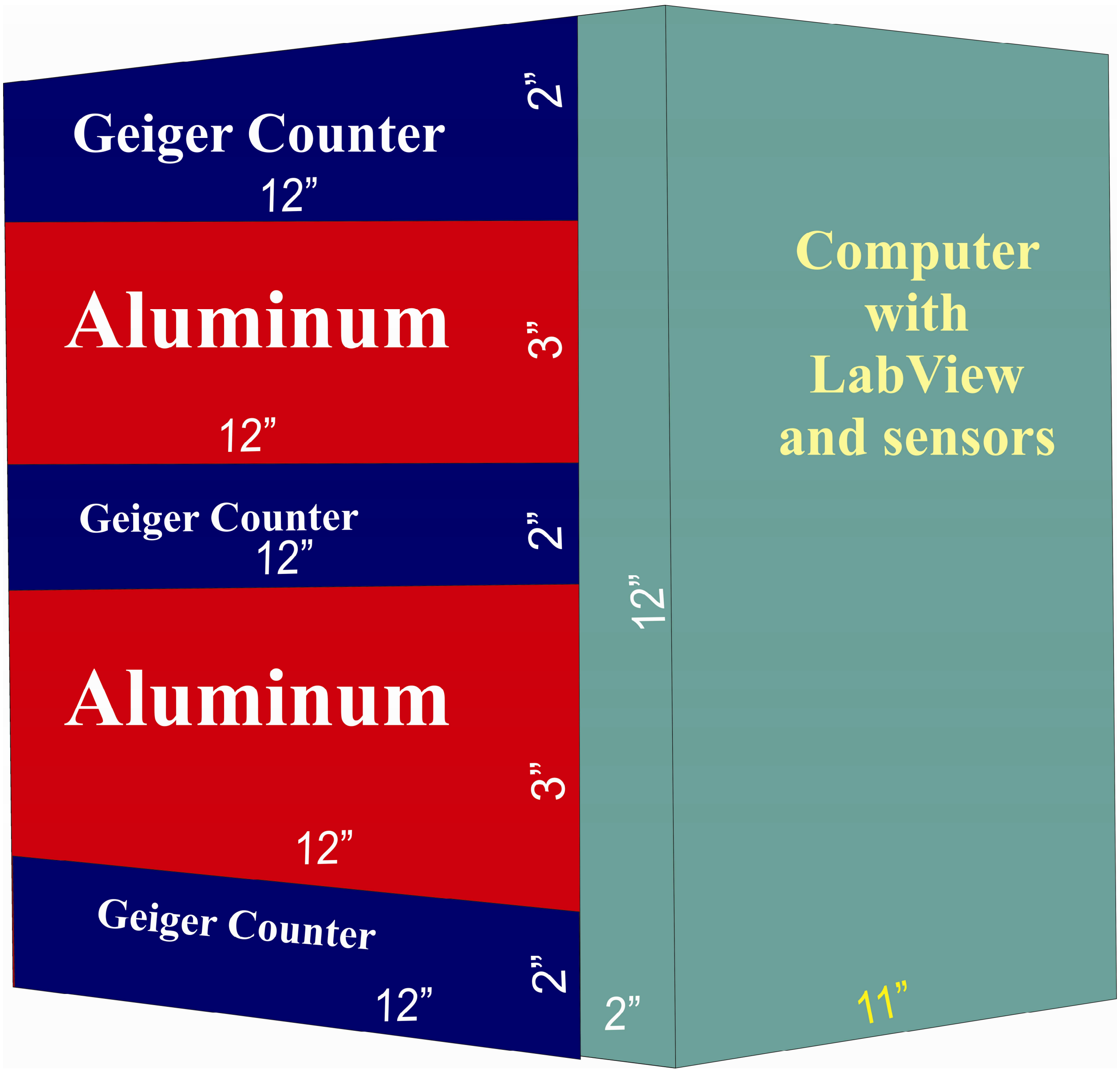

Figure 2

This is a large picture of our platform. It will be bolted to the HASP mounting plate through the bottom of the CajunSat platform.