GEOCam-Reflight

Space Engineering Institute
Texas A&M University

Payload Specification and Integration Plan

Introduction

This document is will define basic specifications for our payload, GEOCam-Reflight (GEOCam-R, Payload ID: 3). Since our project is still in the design stage, some of these numbers are best guess estimates. If any of these numbers cross over our current estimates and exceed specified limits, we will immediately consult with HASP management.

Mechanical/Structural

GEOCam-R is an extension of last year's project, GEOCam. That being said, most of the mechanical and structural aspects of the project are identical to GEOCam. A change to this year's project is for our camera to have one degree of freedom compared to last year's fixed camera (We had planned to do this last year, but under the assumption that the balloon was going to spin decided to fix the camera at an angle instead). In addition to simple scanning of the ground, we hope to turn the camera a full 90 degrees to catch a few pictures of the horizon.

A design has not yet been finalized on how we are going to achieve the additional rotation, but a small servo and some mounting has been accounted for in the weight estimates below. To help describe our project structurally you can find several pictures and descriptions attached to this document and to verify that our project can withstand the required 5 and 10 G shocks we have attached a stress analysis report as well.

Weight Estimates

Part(s)	**Weight (grams)**
Outer shell of containing box	314
Top of box and attached power board	235
Camera frame, servos, and various mounting	510
Foam insulation	66
Camera	412
Total	**1537**

Power

GEOCam-R will be consuming power from HASP. The 28 volts given will be converted to 12 and 5 volts using voltage converters. The 5 volts will be used to provide power to our servos and microcontroller while the 12 volts will be further reduced to 7.4 volts using a voltage regulator and used to power our camera. Last year, additional current was drawn to power 5 kapton heaters which caused us to exceed the current limit for our project. We did not realize this until we were doing some last minute testing at Ft. Sumner and the necessary equipment to reduce the current flow was not available. This year we plan to take extra precautions to stay under this limit. Attached to the end of this document are schematics of the power conversions and servo controller. We are also considering painting part of the box black in order to retain warmth during the flight.

Communications

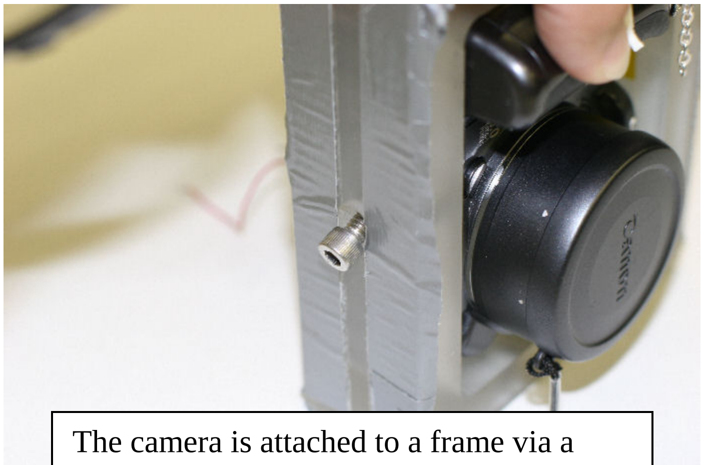
There are no current plans to have any uplink or downlink communications.

Integration and Logistics

We would like to have our integration as late as possible during integration week (hopefully in the range of July 26-28) with Friday, July 27th, being our first choice. We can be flexible with the exact date since we will probably be driving up the day of integration and then driving back (Palestine is only a 2 hour drive away). The afternoon would probably be the best time for us to integrate, starting around 1:00 pm and ending around 2:00 or 2:30 pm, but again, we can be flexible in this area. At this point, the integration team leader (John Yezak, jyezak@tamu.edu) will probably be the only person to attend the integration. If additional participants are coming we will notify the HASP management in advance.

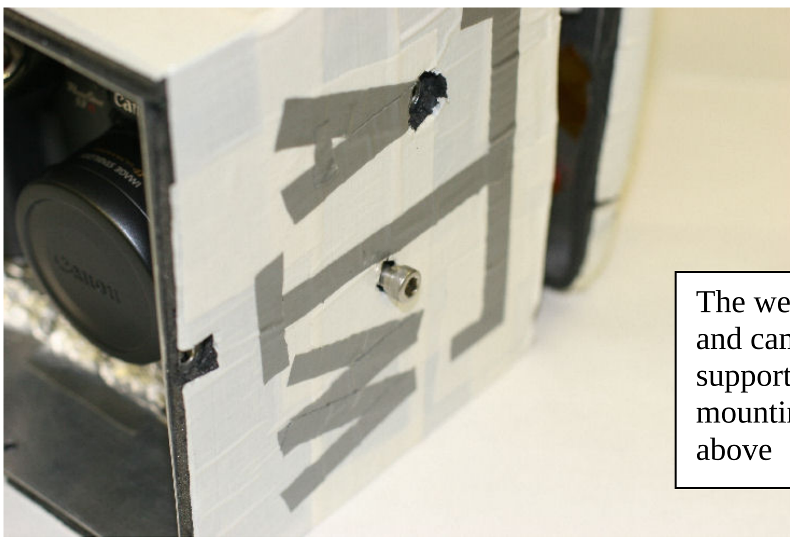
On the day of integration, we plan to bring in our project fully assembled and ready to be attached to HASP based on past experience. Once attached to the HASP structure we would like to have power turned on to our project by HASP management and shortly after we will switch our manual toggle switch to the 'on' position. Once the project is fully powered we will observe the camera's actions and movements to ensure that it is operating correctly. After the camera completes a couple of cycles taking pictures, we will then request to have the power cycled a couple of times by HASP management to confirm that our project will sustain a short-term power loss and still continue to zoom in and take pictures. Once this is complete all power to the project will be turned off and GEOCam-R will be disassembled to show the HASP management the internal workings of our project, check that pictures were actually taken, and erase the pictures that are there. Once approved, the project will be reassembled, tested once more to ensure it was properly assembled, and then handed over to HASP management to be shipped to Ft. Sumner, New Mexico. Note: an integration checklist has been attached to the end of this document.

Structural Pictures and Descriptions

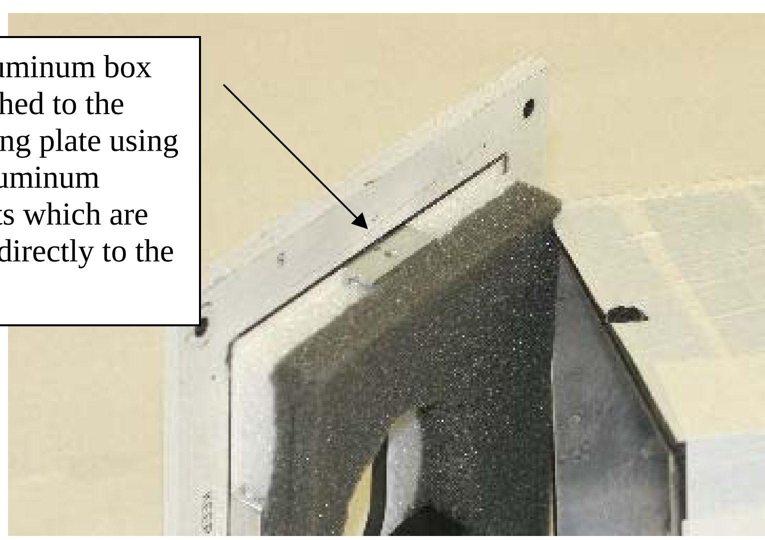


The camera is attached to a frame via a stainless bolt and the camera's threaded mounting hole.

Custom bolts created to mount the camera frame to our aluminum box. These bolts cannot pass completely through the side of the box.



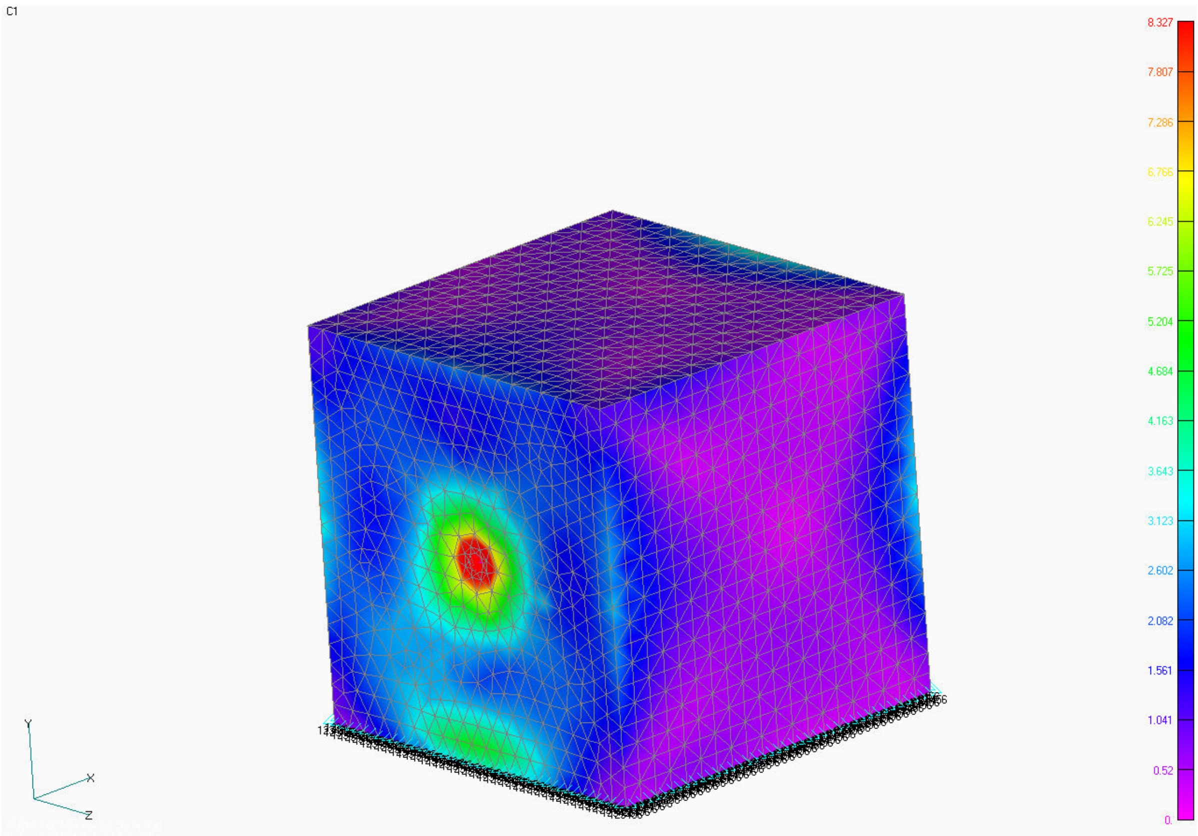
The weight of the camera and camera frame are supported by the two mounting bolts shown above



The aluminum box is attached to the mounting plate using four aluminum brackets which are bolted directly to the plate.

Stress Analysis

Using MSC Nastran, we were able to do a stress analysis on our project. Shown below are the results from a 10 G vertical force (y-direction) and two 5 G horizontal forces (x- and z-directions) on our enclosure.



The box shown here is made from aluminum 6061 and is supporting a 750g mass from the two holes drilled in either side. The bottom has been constrained since it will be mounted directly to the HASP structure. Using a safety factor of 1.5, this box has a maximum stress of 8.327 MPa and a margin of safety of: 23.84.

Analysis done by:
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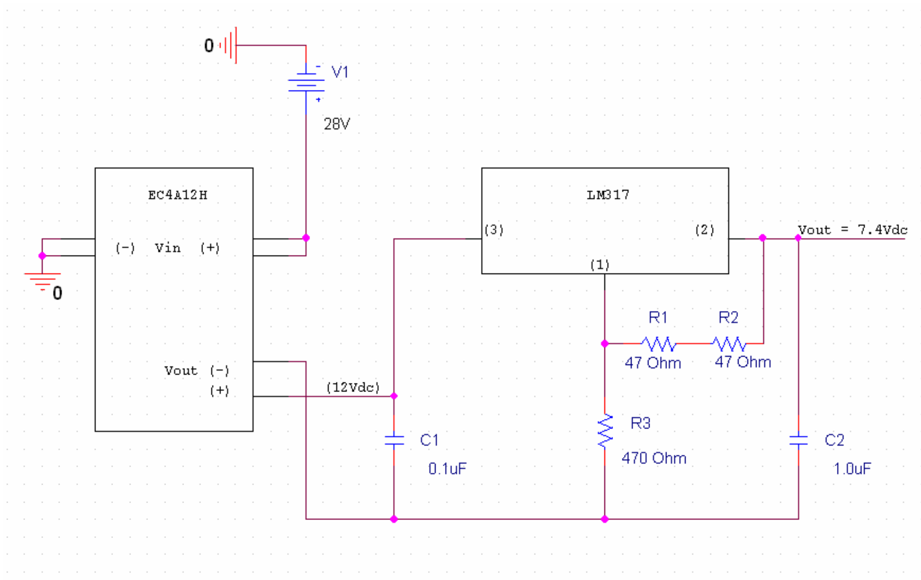
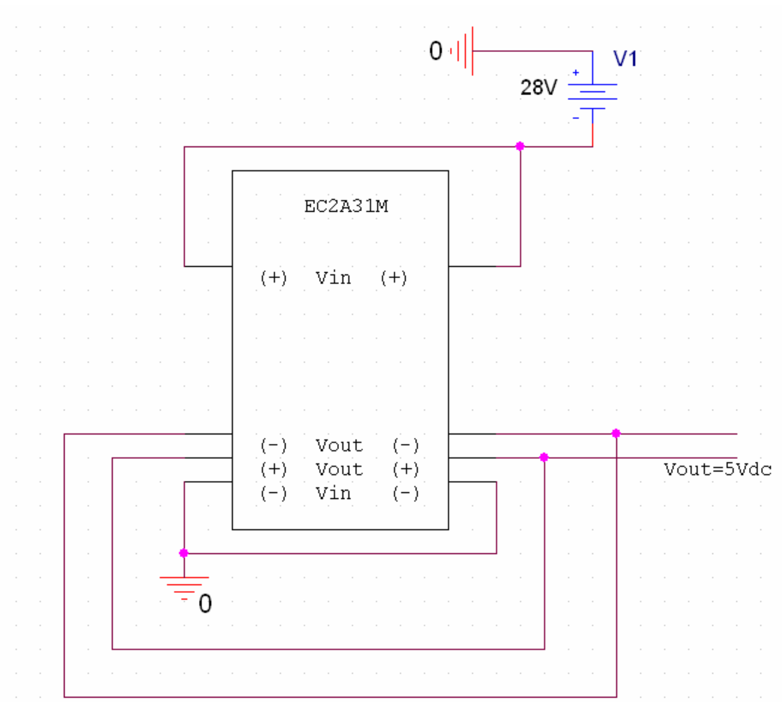
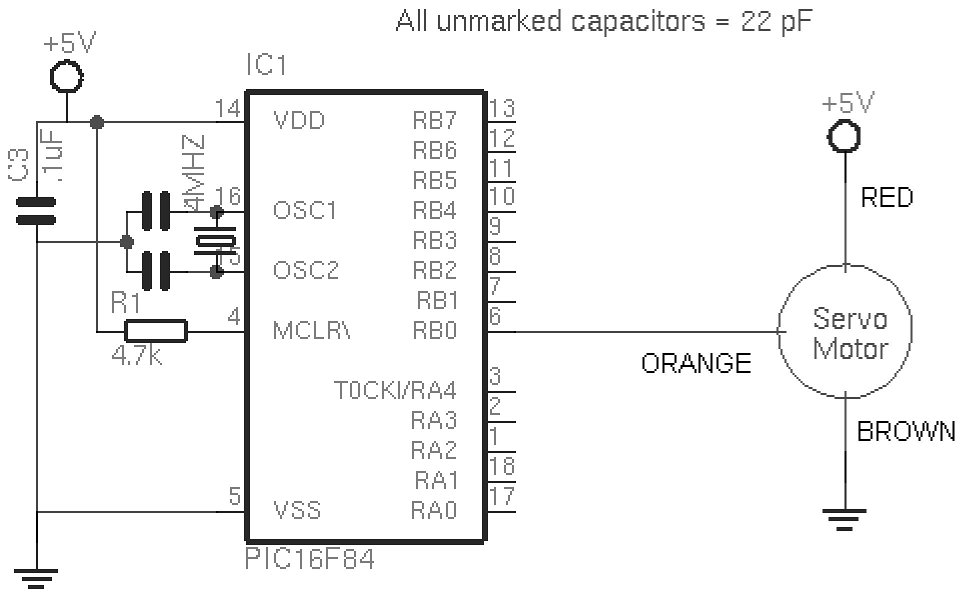
Schematics



Schematic 1: 28V-7.4V Design Layout



Schematic 2: 28V-5V Design Layout



Schematic 3: Microcontroller for Camera Trigger

Integration Checklist

Camera Operation

- The camera successfully powers on.
- Once powered on, the camera autonomously zooms out to prepare taking pictures.
- The camera autonomously pans and takes pictures at the desired interval.
- The camera successfully rotates the full 90 degrees to take pictures of the horizon.
- When power is cycled by HASP management, the camera resumes normal operations.

Camera Disassembly/Reassembly

- Pictures are taken and stored on the SD card.
- All pictures are erased before reassembly.
- Camera still operates correctly after reassembly.

Project Limits

Official weight: __________________

Peak Current Usage: __________________