REQUEST FOR PROPOSAL

REQUEST FOR PROPOSAL (RFP) NUMBER: 2519F09
FOR THE DESIGN CONCEPT
OF THE

Balloon Satellite
(BALLOONSAT)

Date:

October 22, 2001

Project Cloud 9

Team Members:

Jon Nikkel
Matt Calvin
Brede Wegener
Eric Ridenour
Liban Buni
Shaun Davies
Ben Hamilton

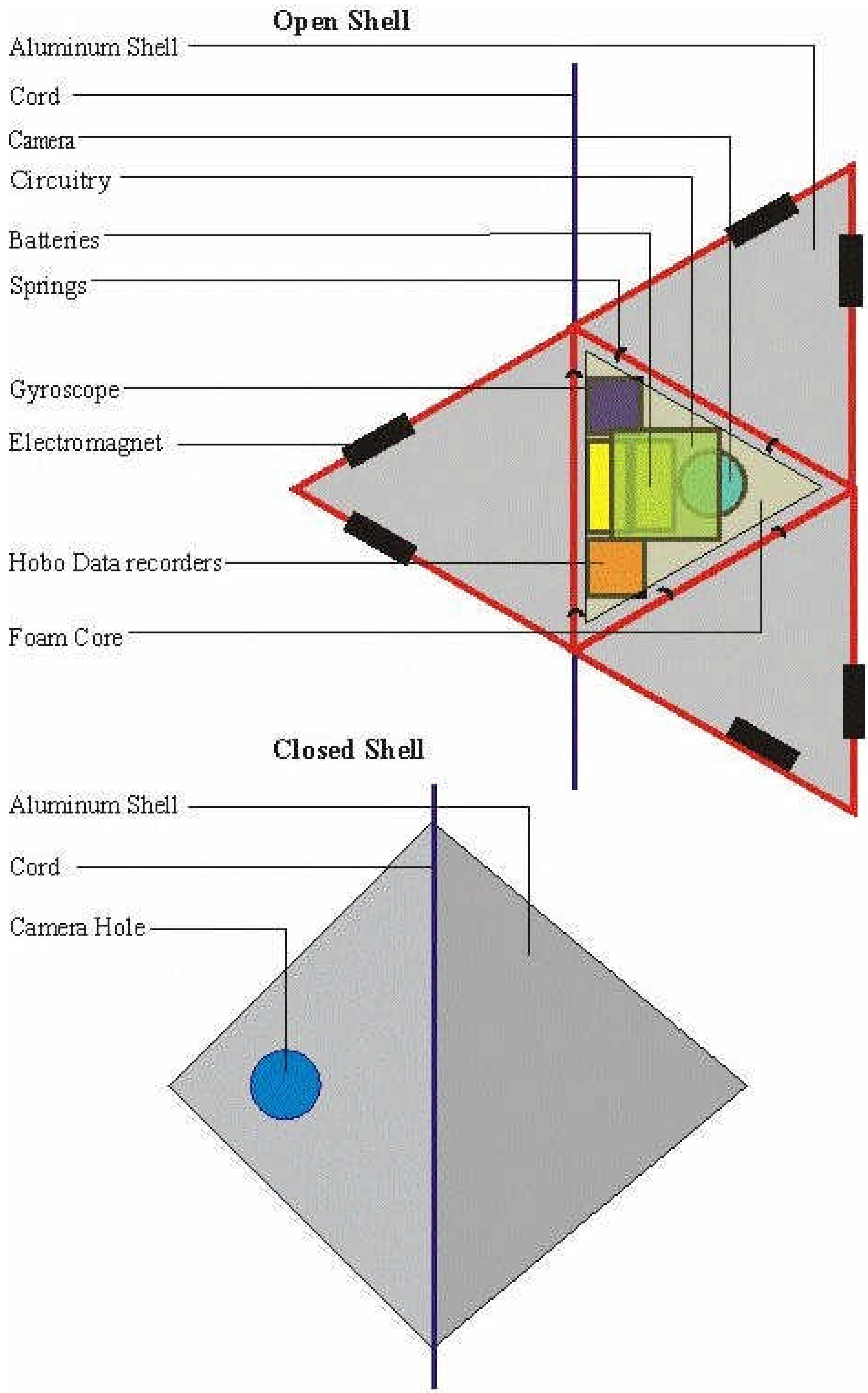
-Proposal Overview

We were assigned the task to design a CubeSat that would go 100,000 feet in altitude and would perform a variety of tasks and/or experiments. The tasks that we have decided to implement into our design include temperature readings (both inside and outside our satellite), a working gyroscope to take 360° range of pictures, a digital camera to take images outside of the satellite during it's voyage, and a remote controlled landing device to ensure that the satellite lands upright. In order for the landing device to work correctly we designed a pyramid structure for our CubeSat. The structure will be a three-sided equilateral triangle pyramid. The remote controlled landing device will use spring hinges and electromagnets to ensure it lands upward. We will obtain our temperature readings with the use of a HOBO collection device, which will be battery powered. The gyroscope will be powered solely by a solar cell placed on one of the three sides of the CubeSat. The camera, which will be run by a BASIC program, will be battery powered as well. The computer used in our satellite will be a BASIC stamp.

Our hope for our CubeSat is that our structure will stay intact, that the BASIC program will run without error, that we will obtain quality images and temperature data, and that our satellite will land upright.

-Technical Overview

1. The basic structure of our satellite is a pyramidal shape with a triangle base. We have designed it to deploy the three sides of the satellite in a spring action upon command to correct the satellite to its upright position. The sides of the satellite will be held in place during flight with electromagnets, which will lose current and release the spring-held sides upon command. The rest of the equipment will be encased in an inner shell made of foam. There will be a camera located in the base of the satellite to collect images from the surroundings. There will be a gyroscope located in the center of the satellite and will cause it to rotate around the anchor line. The gyroscope will be powered by three solar panels located on each side of the pyramid. This rotation will allow it to collect pictures from multiple angles. There will also be a HOBO chip located in the satellite to collect both internal and external temperatures. The picture images and the temperature data will be stored and collected using a Basic Stamp chip. Both the HOBO chip and the camera will be powered by small sealed lead cell batteries.



3.

Hardware List:

Aluminum Metal
Foam Core Sheeting
HOBO datalogger (Temperature)
CCD Camera and accessories
Gyroscope Mechanism
Electromagnetic Deployment System
BASIC Stamp II Computer
Sealed-Lead Batteries
Solar Panels for Powering Gyroscope

RC Deployment Unit
Replacement Parts, Wiring, Small Accessories, etc.

The two main materials that we will be using for the structure are aluminum and foam core sheeting. This will compose the bulk of the satellite. All other materials will be placed on the inside of the foam casing. The Solar Panels will be attached to the outide of the aluminum shell. The Gyroscope mechanism will be constructed of a small motor fixed to the center of the satellite. The motion created by the rotation of the motor will cause the entire satellite to slowly begin to rotate as well. All other hardware will be used in the satellite just as it is purchased, without any modifications.

4. All primary construction on our satellite will be performed in the Aerospace Machine shop located in the basement of the University of Colorado Engineering Center. We will use the machines located in the shop for the construction of both the outer shell and the inner casing. The solar panels will need to be cut to fit the triangular sides of the satellite. Once the two shells are completed and the solar panels have been cut, the satellite will be constructed in the machine shop with all of our other materials. Our personnel are divided into three main groups for construction. Some team members are involved with more than one group. Brede Wegener, Liban Buni, Jon Nikkel, and Ben Hamilton will be involved in the functioning of the HOBO and Basic Stamp systems. Matt Calvin and Jon Nikkel will be working with the imaging system and camera placement. Shaun Davies and Eric Ridenour will be working on the construction of the main structure.

5. We will perform six different tests to evaluate the performance of our satellite. The first test will be a structural integrity test, in which we will drop the satellite down a flight of stairs. The second test will be a heat test, in which we will freeze the satellite to very low temperatures using dry ice. The third test will be a test of the functioning of the gyroscope, in which we will suspend the satellite from a cord similar to the one used in flight to see if it rotates correctly around its tether. The fourth test will be a deployment and correction test in which we test the ability of the satellite to right itself upon landing incorrectly. We will do this by placing the satellite on an incorrect side and using the radio control to attempt to correct the incorrect positioning. The fifth test we will perform will be a test of the imaging system in the satellite. We will do this by taking pictures with the camera and retrieving them, as we will do after its launch. The sixth and final test will be performed to test the functioning of the HOBO and Basic Stamp components of the satellite to make sure that they are properly collecting and storing the desired data.

6. The EOSS team members will conduct most of the launch operations. The specific operations of the satellite will be carried out in a timed sequence embedded in the BASIC Stamp computer. Temperature readings will be conducted during short time intervals, and a number of images (yet

to be determined) will be taken in sequence. Upon landing, the Pyramid Deployment system will activate and deploy three sides of the pyramid, pushing the satellite right side up during the process.

7. We plan to keep everyone safe during the construction of the satellite by having all members of the team participate in the machine shop training course. This course is required to gain access to the machine shop, and it teaches correct safety practices to be used in the shop. The only safety concerns involved in this project involve the actual construction of the satellite, and all construction will be done in the machine shop, which has authorized personnel overseeing the work.

8. The main feature of our satellite is its unique structure. The three sided pyramidal shape is vital to the system we have designed to assure the satellite being placed on the correct side upon landing. Another special feature of our satellite is the gyroscope located inside of the satellite in order to make the satellite spin around the tether. The purpose of this function is to allow the camera to take pictures from multiple angles.

9. Include Launch Site Summary of Events/ Pictures of the Operation – to be included after launch and recovery operations are completed.

-Management and Cost Overview

Schedule of Events

Completion of design: Oct. 26
Finalized inventory and order of all necessary hardware: Nov. 1
Prototype design build: Nov. 16
Prototype testing and debugging: Nov. 20
Final design build and test: Nov. 25

In order to meet this schedule on time, our team will keep good communication. This ensures that if the team is late in meeting any of these dates, we can get together and work hard to stay on schedule. This schedule is practical, and we will be able to meet the dates, but it does not allow much leniency. Therefore, our team must do our best to stay on schedule in order to be ready for the launch date on Dec. 1st.

Team Members:

-Brede Wegener – Graphical Modeling, System Interface
Phone Number: 786-4264; Address: Cockerell Hall, 26; Special Skills: Graphics design, basic electronics skills; Email Address: Brede.Wegener@colorado.edu

-Liban Buni – Power Systems, HOBO Data Logger System
Special Skills:
Machine-shop certified; Email Address: Liban.Buni@colorado.edu
-Jon Nikkel - Imaging Systems, Gyroscope Motion System
Special Skills: Web
Design, electronics, machine shop certified, HTML; Email Address: Jonathan.Nikkel@colorado.edu
-Matt Calvin – Imaging Systems, Electromagnetic Coupling
Special Skills:
Movie editing skills, Mathlab experience; Email Address: Matthew.Calvin@colorado.edu
-Shaun Davies – Structural Design, Landing Deployment System
Special Skills:
Mathematica experience, and some C++; Email Address: Shaun.Davies@colorado.edu
-Eric Ridenour – Structural Design, Landing Deployment System
Special Skills: Solid-
works; Email Address: Eric.Ridenour@colorado.edu
-Ben Hamilton – Electromagnetic Coupling, HOBO Data System
Special Skills:
Computing Skills; Email Address: Benjamin.Hamilton@colorado.edu

Budget:
Our team will be maintaining its budget by keeping track of all purchases with receipts, and by calculating amounts of money to be spent on each item before they are purchased. In this way, we will attempt to stay within a budget of $400.

Budget Items:	Cost:
-Aluminum metal/sheeting	-minimal
-Foam Core sheeting	~$10
-2 Function HOBO datalogger (Temperature)	~$100
-1/4" CCD Camera and accessories	~$170
-Gyroscope Mechanism	-minimal
-Electromagnetic Deployment system	-minimal
-BASIC Stamp II Computer	-$60
-Power supply (Sealed-Lead Batteries, 6?)	-$5/unit x 6 = $30
-Solar Panels for powering Gyroscope	~$10-30
-RC Circuit for control of Deployment System	~minimal - $30
-Replacement parts, small accessories, etc.	~$30

Total Cost: ~$400-460