
Team SASS Presents
Proposal for Balloon Satellite
Chris Gladden
Zane Daughhetee
Val Hemstreet
Ashley Moore
Darlene Przytulski
Ankit Tripathi

Mission Statement

As students exploring space and engineering, team SASS (Supreme Acts of Satellite Science) seeks to design and build a balloonsat that will successfully fly to the troposphere, perform experiments, record data, and return safely to earth.

Overview

Within the confines of 1,500 cubic centimeters, science will be performed, data will be measured, and discoveries will be made. Since the balloonsat will fly at an altitude of approximately 30.48 kilometers, a great opportunity not available at the earth's surface arises. The balloonsat project requires that the satellite measure the temperature and ascent and descent ratespressure, and image the earth and balloon in flight. Measuring these things at the "edge of space" in the stratosphere will reveal differences in the atmosphere and environment in comparison with the troposphere in which we live. The satellite will be equipped with one or two cameras. In addition to these requirements, radiation will be qualitatively measured by analyzing its effect on unexposed film. Also, a solar cell will measure the solar intensity of the sun in the stratosphere. This particular experiment requires an E.M.C. (Electronic Memory Composite) to move the solar cell away from the balloonsat and out of the shadow to intercept the solar rays. Furthermore, the balloonsat will house an a.m. radio receiver. Does the high altitude cause a delay? And, what radio waves does it receive? The balloonsat will discover all this and fly at the edge of space….

Technical Overview

Design:

The balloonsat will be approximately 1,000 cubic centimeters, and will weigh less than 500 grams. It will be constructed of a foam core shell with aluminum supports and covered with mylar for insulation. The interior will consist of two aluminum panels. These panels will hold the mother board with basic stamp, HOBO data logger, a.m. radio and recorder, film, cameras, and power supply. To secure the satellite to the balloon, a tube will be inserted through the center, and the rope can go through this tube. Hopefully, an E.M.C deployment hinge, donated by CTD, will be attached to the exterior of the balloonsat to hold the solar cell and extend it to absorb the solar rays. Nine-volt batteries will provide power to run everything excluding the radio, recorder, and the cameras. To image the balloon in flight as well as the earth, two possible plans exist. First, using only one camera, fiber optics will be attached to the lens and split into receptors on the top and bottom of satellite. Therefore, each photograph taken will be a split screen with the top imaging the balloon and the bottom imaging the earth. If the fiber optics do not work, two cameras will be required. One camera lens will face the balloon and the other will face the earth. The cameras need to record the time of the picture. Using this, the ascent and descent rates can be calculated mathematically. Also, an external temperature cable will be attached on the exterior of the satellite to measure the temperature. The HOBO data logger that is provided can measure and record this temperature. The HOBO also can record the relative humidity. It has an external input that can record the data from the solar cell. The basic stamp will be programmed to operate the cameras, operate the radio and recorder, and it may possibly turn on the E.M.C.

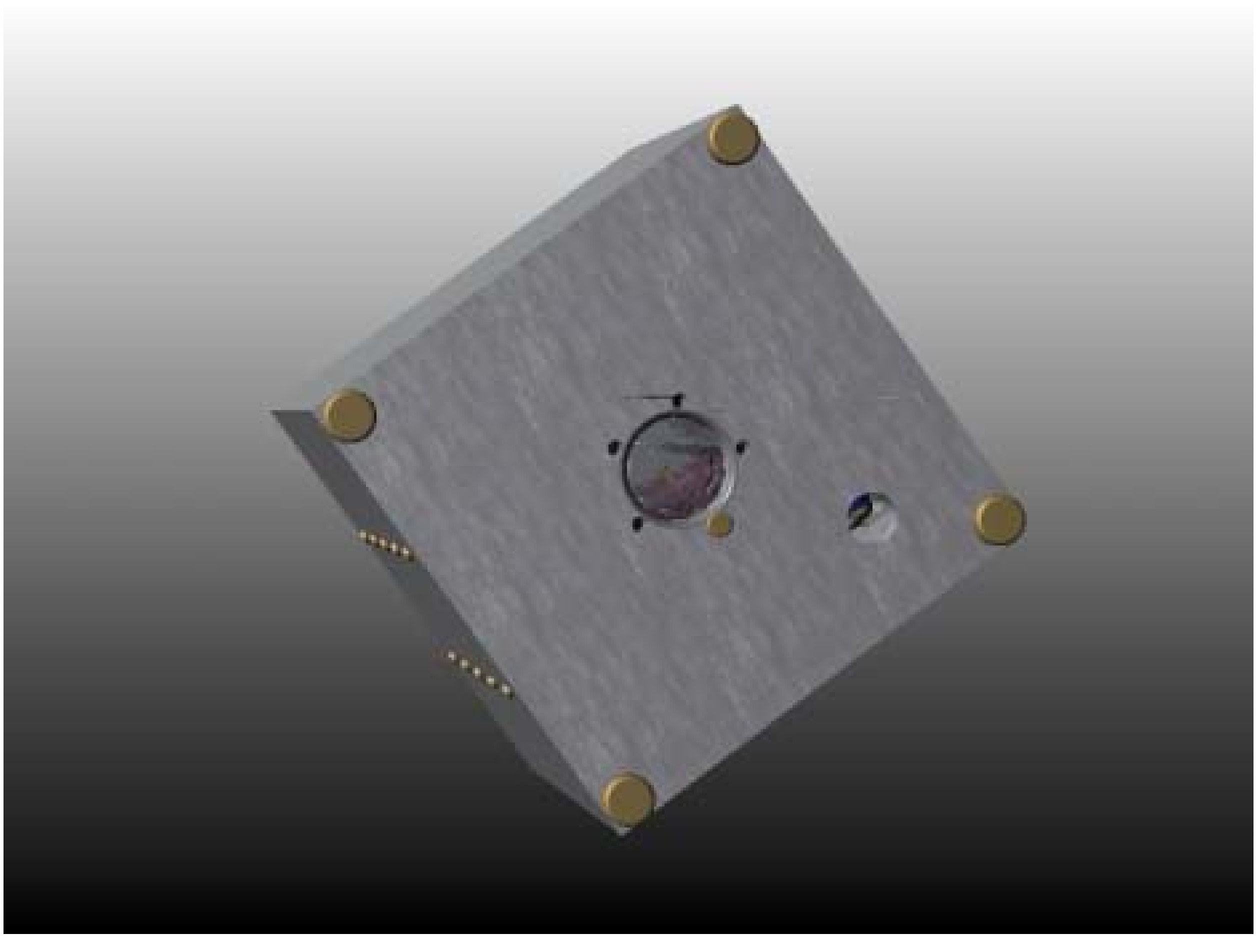
Experiments:

Solar intensity: Is the energy emitted by the sun stronger at the higher altitude? A solar cell that will measure the solar intensity will be attached to a deployment device, an E.M.C (electronic memory composite). This device is essential to the experiment because the solar cell needs to be moved away from the balloonsat. If the sensor is kept on the exterior, it may be disrupted by shadows from the balloon or other ballonsats. The E.M.C would move the solar cell out of the shadow and enable it to measure the solar intensity. A HOBO that can record the data from the solar intensity sensor is also necessary.

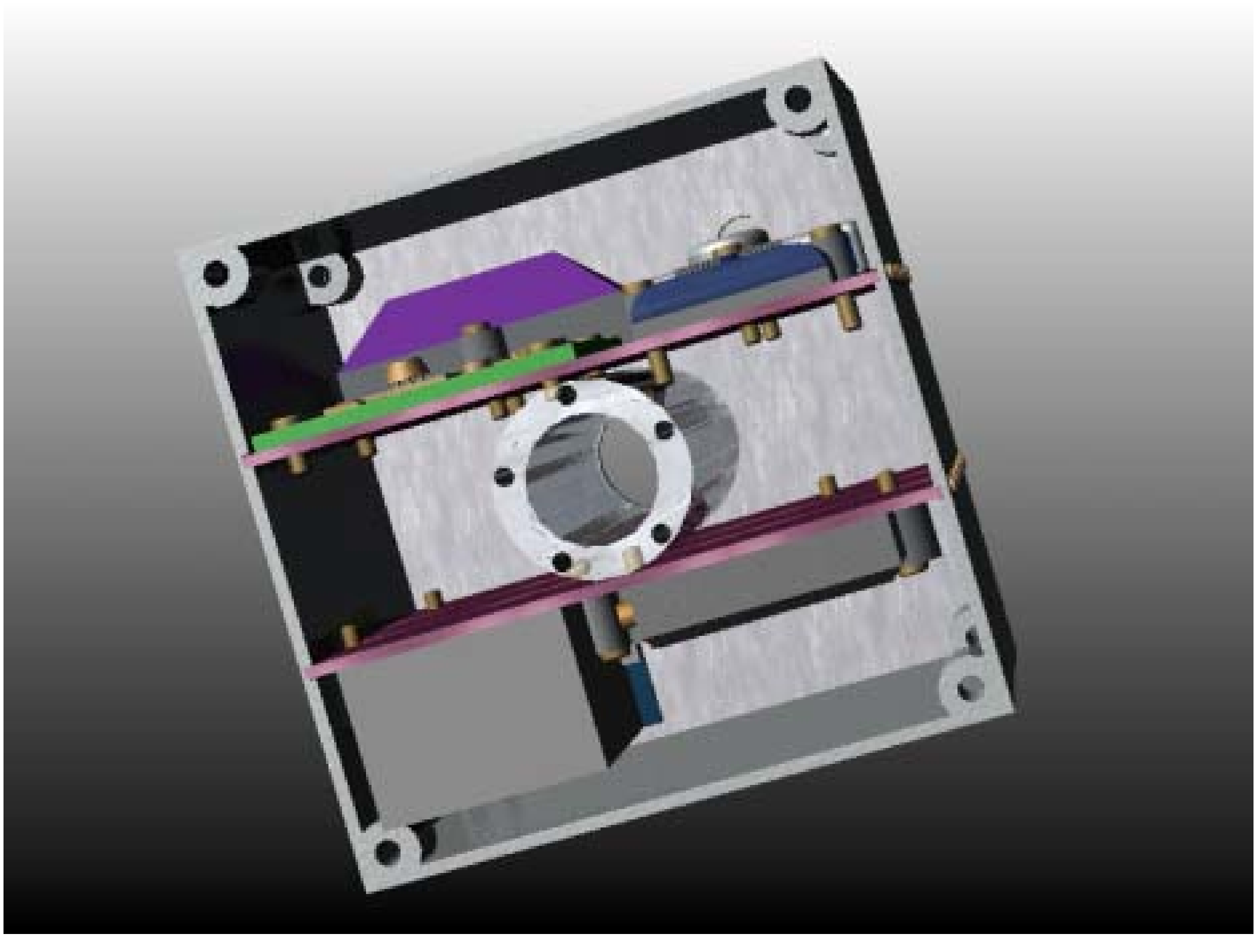
Film and Radiation: What is the effect of radiation in the upper atmostphere on unexposed film? Undeveloped Film that has not been exposed to light will be placed in the balloonsat. It will probably be housed in its plastic canister to ensure complete darkness. After recovery, the film will be developed to see if radiation caused any unusual effects.

A.M. Radio Waves: Radio waves are transmitted into space constantly. What would an A.M. radio receiver pick up at that atmosphere? Would there be any kind of delay? Using a compact a.m. radio, with a recorder, digital or cassette, the a.m. radio waves that bounce off the upper atmosphere will be recorded. To determine if delay exists, an a.m. radio receiver with recorder, set to the same frequency, will record the waves received on the ground. The two recordings can be compared to discover any differences.

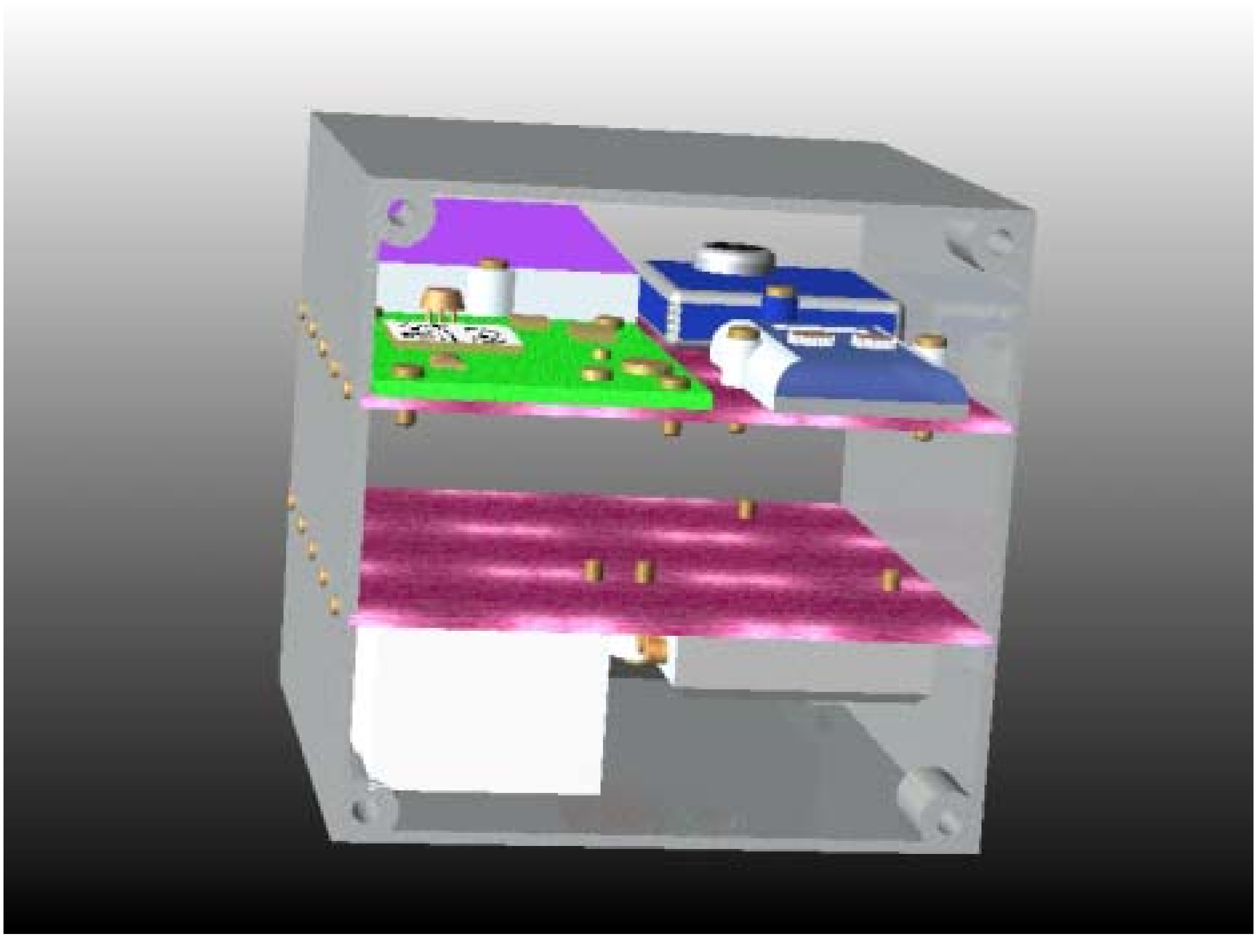
Pictures of design:



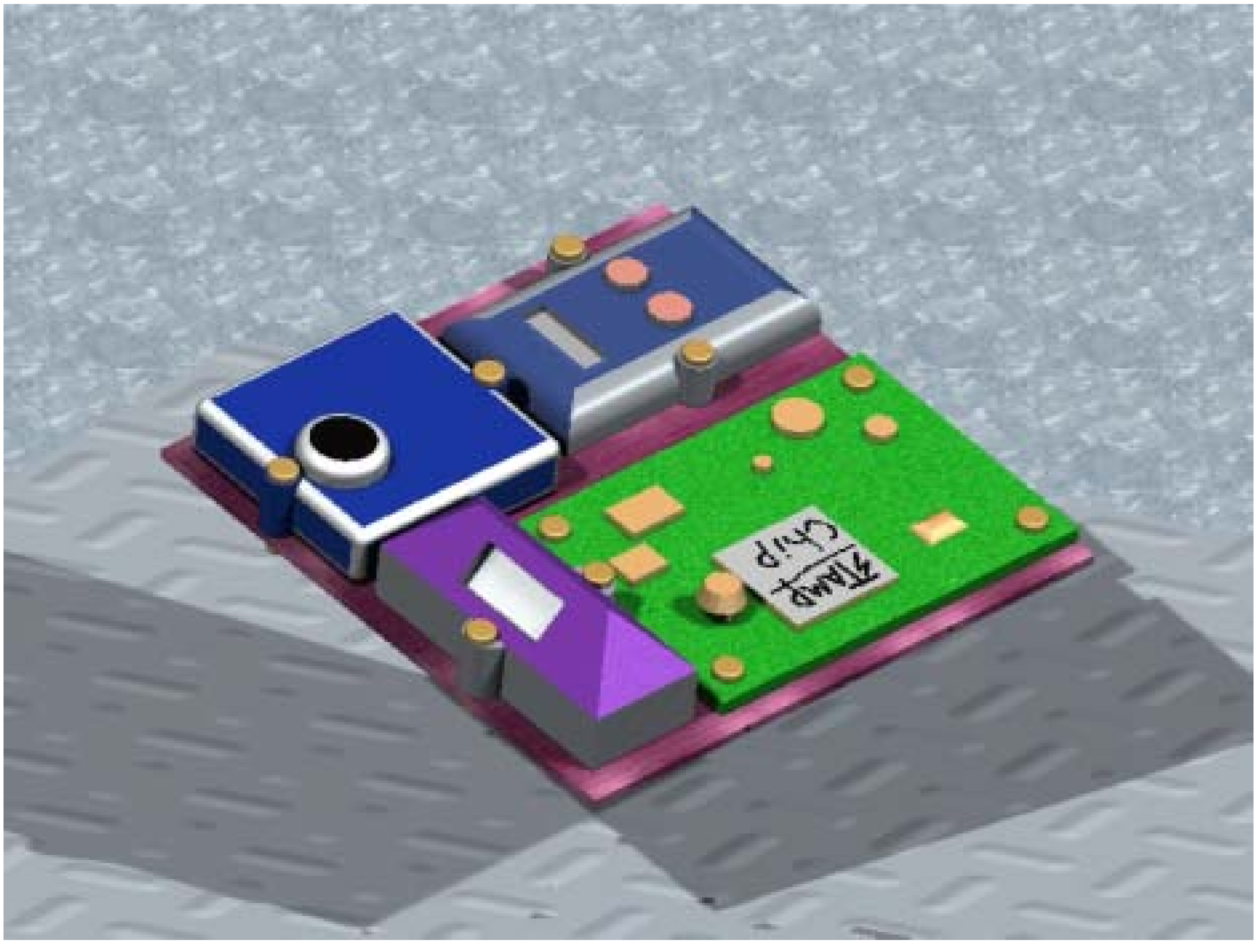
Completed Balloonsat



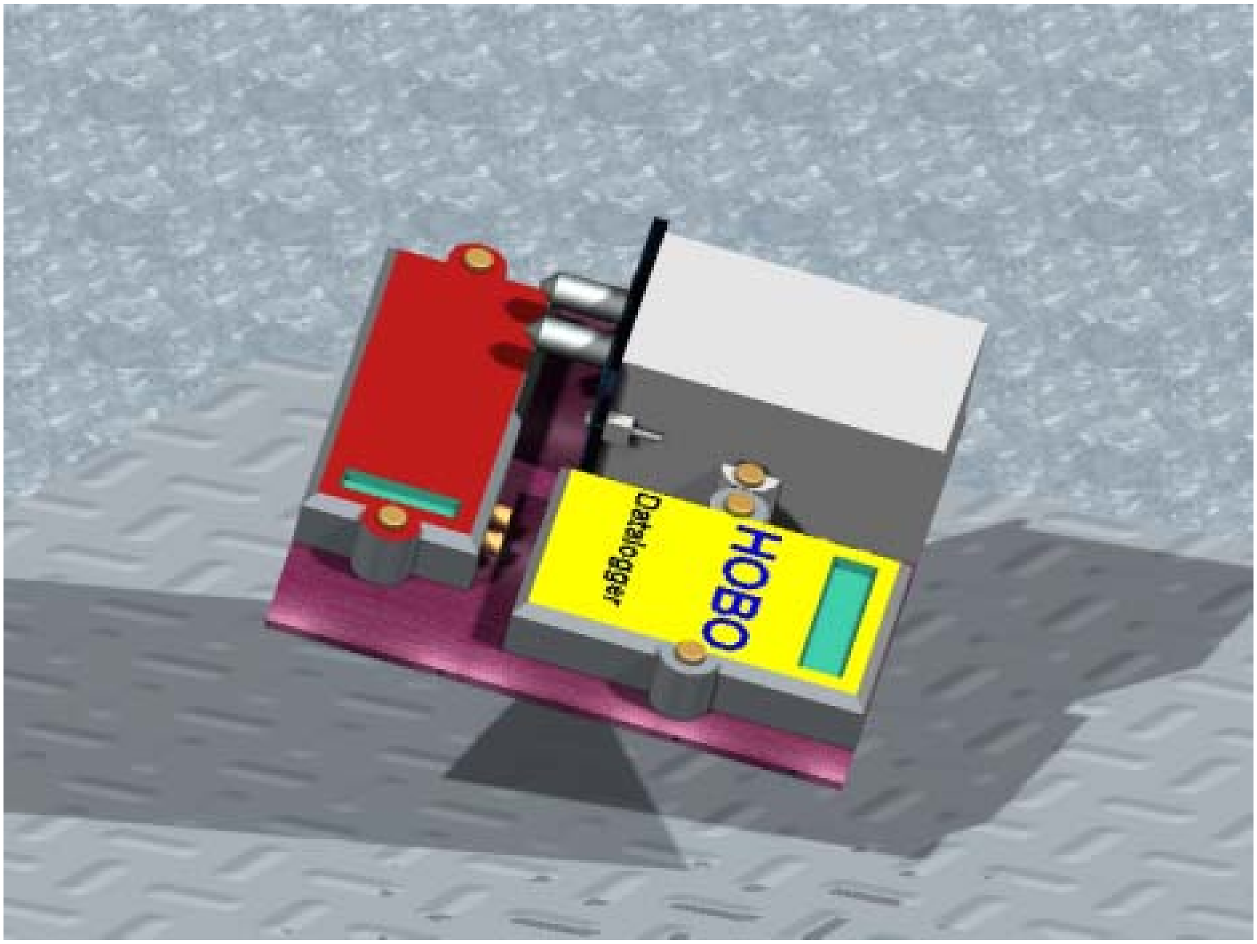
Satellite with tube for balloon attachment



Interior of satellite with panels to hold all hardware



The primary panel holding the mother board with basic stamp, camera, a.m. radio, and tape recorder.



Secondary panel holding the HOBO, power supply, and the E.M.C control

Hardware and Budget:

Digital camera (2?)	28 g	$28.00
HOBO	29 g	provided
BASIC Stamp	.4536 g	$34.00
Film	1 g	$5.00
Batteries (9volt)	35 g each	$10.00
Wires	2 g	$3.00
Aluminum sheeting	100 g	$10.00
Mylar	15 g	$5.00
Foam core	60 g	$10.00
Radio receiver	15 g	$5.00
Temperature cable	20 g	provided
U.S. Flag sticker	0	----
Solar cell	5 g	$5.00
E.M.C	10 g	free

Tubing for balloon attachment	30 g	$.15/ft.
Sealant (tile caulk)	10 g	$4.00
Pressure Valve	15 g	$1.00
Screws	10 g	$1.00
Cassette recorder	70 g	$30.00
Total:	455 g	$151.00

Optional hardware: fibers optics and adaptor, aluminum rods.

Budget:

The max budget available is $250.00. As the estimated budget stands, nearly $100 is still available. Since the project is under budget, it should not be difficult to maintain the $250.00 limit.

Building:

The team will all work together to build the satellite. Each team member has different skills that will be applied accordingly. After class each Tuesday, the team will meet to work on the construction. Also, the help of Tim May from the ITLL will be enlisted to assist with electronics.

Testing:

To insure proper functioning of all aspects of the ballonsat, several tests will be performed. The balloonsat will be placed in a freezer to simulate the temperature at the stratosphere. This test will determine if and how much condensation forms and how this condensation will effect the electronics and experiments. The whip test assesses the structural integrity and whether or not the satellite will remain attached to the balloon if it gets whipped around. Also, the circuitry needs to be tested. Does the camera turn on? Does the radio work and does the recorder actually record? Test all mechanical devices, particularly the E.M.C. hinge, to ensure expected performance.

Launch program:

On Saturday, April 19, 2003, the balloonsat will be launched from Windsor, CO. To prepare for launch, all team members will awake to buzzing alarms to arrive in Windsor, CO by 7:00 A.M. All will be dressed warmly and ready for the launch. On the day of launch, the balloonsat must be completely finished. Only adjustments that must be made prior to launch are permissible. For launch, the balloonsat will be attached, along with all other balloonsats, to the balloon. One team member will hold the satellite as the balloon lifts off the ground. The balloon will be launched early in the morning to ensure best weather conditions. After launch, one team member will join the recovery effort. The balloonsats will be tracked and recovered a few hours later in eastern Colorado.

Safety:

When building the balloonsat, all necessary safety precautions will be taken. At the launch, the team member who holds the satellite must be sure not to get caught in the rope. Also, careful driving to and from the launch site is necessary.

<u>Management and Cost Overview</u>

Schedule:

Complete Design:	February 6, 2003
Get hardware:	February 18, 2003
Prototyping design:	March 4, 2003
Tests:	Begin by March 13, 2003; Finish by

April 17, 2003

Design Review: Mid March, 2003

Team Member info:

Zane Daughhetee
CU- Engineering and Applied Science
Major: Aerospace

Chris Gladden
CU- Engineering and Applied Science
Major: Mechanical

Val Hemstreet
CU-Arts and Sciences
Major: Astronomy

Ashley Moore
CU- Engineering and Applied Science
Major: Aerospace/ Applied Math

Darlene Przytulski
CU- Engineering and Applied Science
Major: Aerospace

Ankit Tripathi
CU- Engineering and Applied Science
Major: Aerospace