Balloon Satellite Proposal

Astrogliders

10/22/01

Satellite: Blazing Saddle

1.0 Overview

1.1 Mission Statement & Objectives

Our goal is to build a small, lightweight and inexpensive satellite capable of performing internal temperature, external temperature, and relative humidity measurements as a function of time at a range of altitudes up to 100,000 ft. Team Astrogliders will also include a digital camera onboard capable of photographing the different layers of the atmosphere. The satellite must be durable enough to withstand the extreme temperature drop at the Tropopause, a descent rate of up to Mach 1, and an expected impact speed of 2000 ft. per minute. Our Balloonsat will, upon recovery, provide valuable data concerning the makeup of the upper atmosphere.

1.2 Purpose

The study of the atmosphere, its components, and its properties is an important goal in its own right, extending our knowledge of our planet and enhancing our ability to predict the weather. But it is also a necessary step in the long-term goals of aerospace engineers to understand the atmosphere in order to design spacecraft that can operate properly at any altitude. Using materials and technology available to any consumer, the Astrogliders plan to launch a satellite capable of independent operation and data sampling.

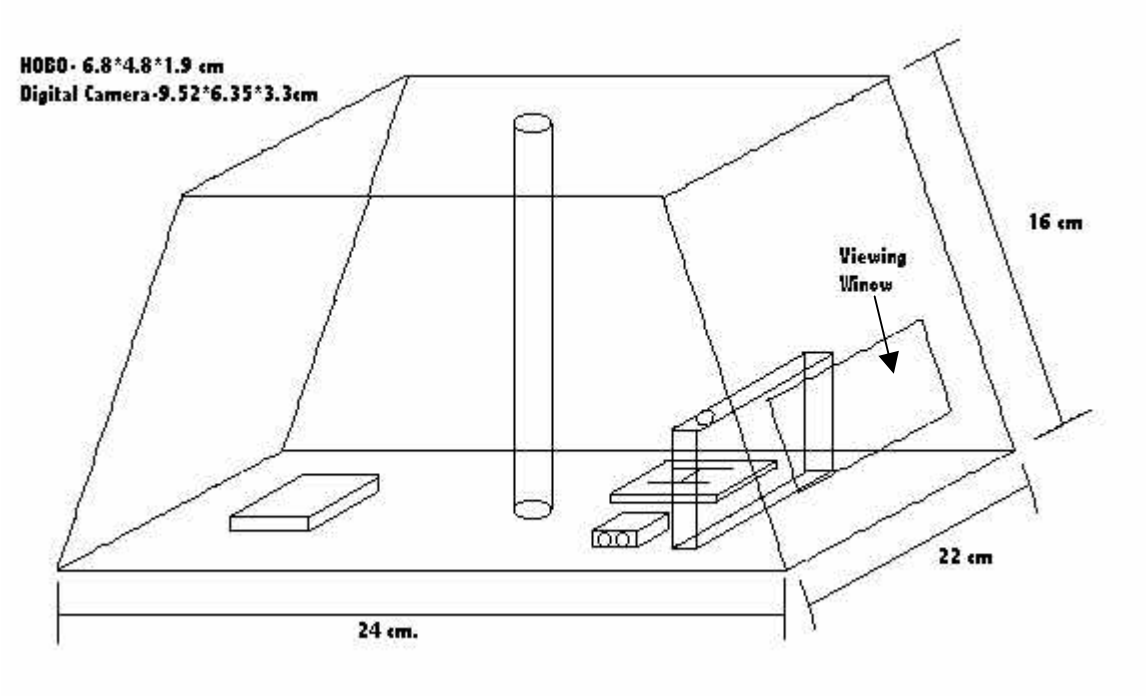
2.0 Technical Overview

2.1 Design & Special Features

The Balloonsat will consist of a trapezoidal body with all instruments inside and near the base. By arranging the payload correctly we will create a satellite with a heavy base, allowing it to land upright. To ensure that the instruments will continue to function in the wide temperature ranges the hardware, as well as the interior of the satellite, will be insulated. We will be using insulation board, hot glue and Parafilm to both strengthen and seal the structure. Placement of the hole for the 2.4 mm braided Dacron line in the center of the satellite will provide correct orientation of the satellite during flight, decent and landing. The satellite will be divided into compartments, one containing the camera and the other containing the HOBO Data Logger. This will not only provide extra structural integrity, it will also help ensure mission success in case of a structural breach. Lastly, it is imperative that we mention that the outside of the satellite will be black. We feel this will allow the Balloonsat to absorb more heat and

keep the hardware at a more moderate temperature range as it travels throughout the atmosphere. A brief sketch is shown below.

2.2 Illustration



2.3 Hardware

In order to ensure that the correct data will be taken, team Astrogliders will be using a HOBO H8 RH/Temp 2X (External) Data Logger. An external temperature lead will be connected to the HOBO to record the outside temperature. Upon recovery of the satellite, we will use the BoxCar 3.7 software to record and covert the data into readable tables and charts. The lightweight digital camera will provide our visual imagery. We will be using a 555 timer and wiring to gauge and automate the shutter operation. By doing this the camera will take photographs at the appropriate altitudes, using a 9-volt battery as power source. The structure itself will be made out of lightweight foam core as described below.

2.4 Building

Team member Nathan Powers will lead the Astrogliders in the construction of Blazing Saddle. Once the hardware has been acquired, the team will determine final dimensions of the trapezoidal framework. We plan to construct the satellite with the fewest number of joints possible using foam core for the framework. We plan to draw out the dimensions and then score, fold, and glue the foam core

to the desired shape, using hot glue to seal and bond the sides. We have researched that hot glue is a more than adequate adhesive and sealant to obtain our mission objectives. To make the "eye hole" for the camera we plan to carve out a portion of the inner part of the foam board and place a small piece of plexi-glass in between. We will then seal it with the hot glue on the interior and exterior of the box. In construction we will try to keep the satellite as "clean" as possible, acting under the assumption that dust in or on the seams of the exterior of our satellite may attract moisture into our key components. Final sealing of the design will be accomplished with Parafilm.

2.5 Testing

We will use three satellite bodies for the purpose of testing. For the purposes of testing how our craft will perform in cold temperatures, we will place our first body in a dry ice bath, and place an insulated probe inside the body to measure the temperature. This will give us an idea of how well our model and instruments will endure the extreme temperatures. Multiple tests will be performed to determine amount of insulation needed as well as placement of the instruments within the satellite. In order to test the structural integrity of our craft, we will make two additional models and subject them to stresses associated with a 2000 ft/minute impact, as well as dragging after impact. Using equally sensitive materials inside the satellite will provide insight into how well the design will protect its contents.

2.6 Launch Program

On the launch date, the entire Astrogliders team will be present at the launch site. Launch time is set for 9:00 am on Saturday, December 1, and the team will be arriving via carpool approximately 2 hours prior to launch time in order to make final preparations. After arrival at the launch site, team members Andrew Shulman and Nate Powers will perform a final evaluation of the satellite's structural integrity and data sampling hardware, at which time final authority to launch will be given. Using an on-site laptop computer, team members Jess Murphy and Jaclyn Francese will perform system start-up procedures, programming the HOBO data logger to begin sampling data after a specified delay. This delay will allow time for attachment to the helium-filled latex EOSS balloon. Successful and timely launch will result in the data sampling coinciding with launch. Team members Michael Cragg and Dan Bellinghausen have been assigned organizational roles at the launch site. After launch, they will be continuing with the tracking and recovery team in order to retrieve the satellite and the data recorded by its instrumentation.

2.7 Safety Precautions

To maintain total group safety we will follow all precautions that are given and or implied while working before, during, and following the launch of our satellite.

3.0 Management and Cost Overview

3.1 Timeline

In order to meet the launch date, team Astrogliders has compiled the following timeline for design and construction:

- October 22, 2001 - Proposals due for approval and ATP from industry
- October 29, 2001 - Complete prototype for thermal testing
- November 1, 2001 - Obtain all hardware
- November 5, 2001 - Team presentation for industry. By this date the prototype design should be completed for testing of structural integrity and feasibility of design concept. Preliminary systems integration testing should be underway
- November 21, 2001 - Final design completed and ready for systems integration testing and durability requirements are met
- Week of 11/21 - 11/28 Final refit and last minute details
- November 28, 2001 - Team Readiness Review by industry. Satellite will be fully functional and ready for launch.
- December 1, 2001 - Launch date

3.2 Itemized Budget:

The total amount of available funds for this project is $400. The construction of the Astrogliders satellite will require the following items:

- HOBO H8 Logger - $95
- 1 ft temperature sensor - $23
- BoxCar 3.7 software - $14
- Digital Camera - $75
- 555 timer & circuitry- $ 5
- 9 V battery - $3
- Foam core - $20
- Testing supplies - $10
- Misc. Building supplies - $30

Total - $ 180

3.3 Team Members' Roles

- Jess Murphy – General Manager and Chief of Production
- Jaclyn Francese – President of Research and Development (R/D)
- Dan Bellinghausen – Director of Testing and System Analysis
- Nate Powers – Director of Construction
- Michael Cragg – Chief of System Integration
- Andrew Shulman- Director of Computing Graphics and Analysis

3.4 Team Members

Team Astrogliders consists of the following members:

- Jess Murphy – University of Colorado, college of Engineering; Jess.Murphy@Colorado.edu
- Jaclyn Francese – University of Colorado, college of Engineering; Jaclyn.Francese@Colorado.edu
- Dan Bellinghausen – University of Colorado, college of Engineering; Dan.Bellinghausen@Colorado.edu
- Nate Powers – University of Colorado, college of Engineering; craggyfingers@aol.com
- Michael Cragg – University of Colorado, college of Engineering; Michael.Cragg@Colorado.edu
- Andrew Shulman- University of Colorado, college of Engineering; Andrew.Shulman@Colorado.edu