Team Boom Box

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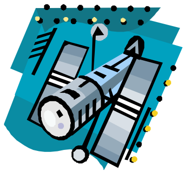
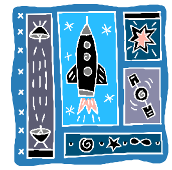




Mission Overview

Team Boom Box' aim is to build a satellite capable of high altitude measurement of sound waves. The mission will have two thrusts, firstly to measure the audio composition of the atmosphere at different levels, and secondly, to take measurements of temperature, density and humidity. We will try to make assumptions about the way sound propagation differs with height.

'Acoustic thermometry capitalizes on sound channels in the deep sea capable of trapping and transmitting sound over very long distances. The channels are created by the variation of pressure and temperature with depth. Located about 3,000 feet below the surface, these deep sea super-highways act almost like a lens in focusing the sound and guiding it over thousands of miles.'

Could such phenomena exist in the atmosphere? What can be heard at 90,000ft? How can these sounds be explained? If you tried to play your stereo at 20,000ft and then again at 80,000ft what would the sound differences be?

The greatest task in this mission will involve interpreting the data we will gather. As is such we must learn the wave patterns of sound that we hypothesize will occur in the upper atmosphere so that we may be knowledgeable enough to interpret our results. Noise that will be heard by hearing range and low frequency detection might include airplanes, ground explosions, aurora, falling meteors, and wind.

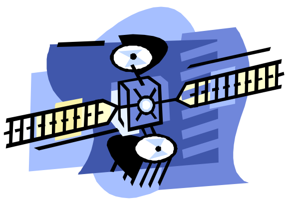
Mission Roles

Design: This task will include detailed drawings of the design as well as detailed instructions on how to assemble the parts correctly. The Designers will work closely with the structural role and be on hand when the design is being applied. They will also be responsible for gathering the stocks needed to realize their created design.

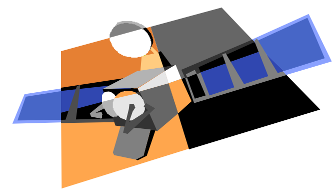
Structural: The main task of this role is to use the design constructed by the Designers to assemble the different CUBESat parts and integrate them.

They are responsible for the integrity and accuracy of the CUBESat so that it may fly safely.

Testing: This task will involve a number of tests done on the CUBESat, including testing of parts separately and integrated. They are responsible for ensuring the function and accuracy of the measurement equipment so that we are certain the CUBESat is working before it is "launched." There are three testing periods as detailed in the schedule.



The Team



'The Six Amigos'

Team Member (Link to phone and address)	Function	Major	Email
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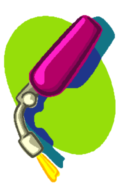
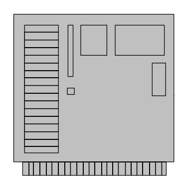




Hardware and Measurement Equipment

We have decided on a conventional design so as to use the most tried and tested methods for making atmospheric measurements. The centerpiece of the hardware will be a HOBO data logger which will have the capacity to take in measurements from four separate devices. Temperature, density, and the humidity of the surrounding air will be calculated throughout the accent. At the same time corresponding sound wave measurements will be taken. Although rough calculations can be made concerning air conditions at different altitudes, we felt it was necessary to collect our own real-time data to have confidence in conclusions we would hope to draw later.

The measurement of atmospheric conditions should be fairly standard. However, measurement of sound waves will involve highly specialized equipment including a microbarograph. (An instrument used to sense tiny changes in pressure caused by very low frequency waves) The challenge here will be to collect accurate and meaningful data across as wide a range as possible, whilst still embracing the K.I.S.S principle and meeting weight requirements.

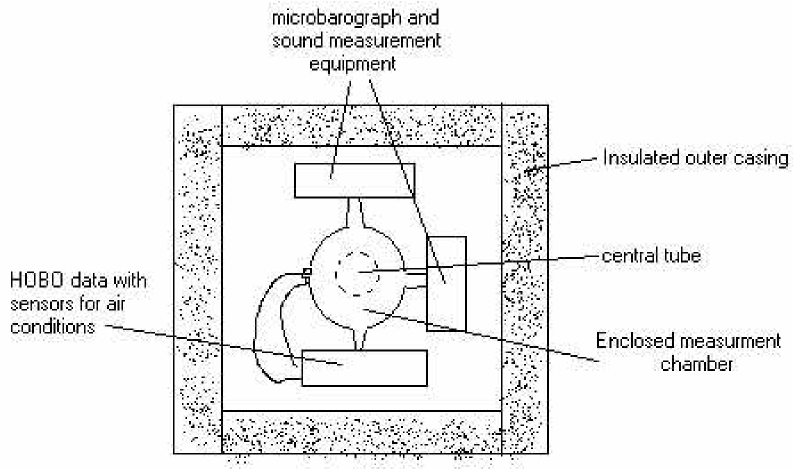
Outer Casing

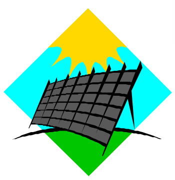
This will be critical in preserving the hardware elements against dramatic changes in temperature and humidity in the atmosphere and the impact of touch down.

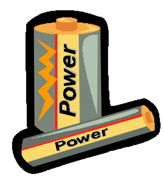
During the design process many different shapes were considered including a torpedo, a pyramid and even an egg shape. One of our favorites was a spherical clear Plexiglas design. However, due to time constraints and our lack of experience we opted for a cube shaped satellite. This should be cheap and fast to manufacture whilst offering us a robust and simple solution.

Materials we considered were plastics, foams, fiberglass, and aluminum. In the end we decided on combination of different foams with a rigid aluminum chassis. A composite design will compliment the cushioning and insulating properties of the foam with the strength and durability of the aluminum.

In order to provide stability in flight a tube will pass through the center of the box through which the flightline will be threaded. Additionally, holes will be drilled in this tube to house the external sound monitoring equipment in an attempt to minimize the affects of high winds to the sensitive recording equipment. However, this is an experimental design which may require some further work.







Power

Two main options present themselves, solar power or battery power. Solar power would be good for a long mission where power consumption was small. However, the length of the flight time (100mins), and the number of instruments which will need to be powered, points to a battery operated solution. Given more time, we could perhaps use a combination of a rechargeable battery and solar panels to further extend the life of the power source.

Heating

Temperature within the capsule could be a critical factor especially since the HOBO will need to be kept above –5C. Although insulation should do the job adequately a chemical heating device (hand warmers etc…) may be needed later on after testing.

Shopping List

Components	**Quantity**	**Cost**	**Weight**
HOBO data log	One	$80	80g
Microphone	One	$2	5g
Microbarograph	One	$100	30g
Aluminum	600 cm^2	$20	150g
Foam	600 cm^3	$10	15g
Batteries	Two 9v	$10	40g
Wire / connectors	~10+	$5	20g
Heating element	One	$15	20g
Total	N/A	$242	360g

Schedule

Task	**Date To Be Completed**
Presentation of Proposal	October 22 2001
Buy Materials	October 24 – 28 2001
Gather Extra Parts (aluminum…etc)	October 26
Design Outer Housing	November 3
Team Presentations	November 5
Design Inner Structure	November 6
Construct Outer Housing	November 10
Test Inner Structure and Outer Housing	November 12
Integrate Inner Structure with Outer Housing	November 14
2nd Test of Integrated CUBESat	November 16
Deposit Insulation	November 17
3rd Test of Complete CUBESat	November 18
Team Readiness Review	November 28
Launch	December 1
Final Report	December 10

Budget Discussion

The budget is very tentative for now. We may include or exclude various items when we start to get into the practical details of a design and assembly. We have not yet followed any options of receiving donations from companies. We thought that it would be interesting to ask Radio Shack if they can sponsor parts of our project in return for the application of a Radio Shack decal on our CUBESat. We are not aware of any restrictions of greater funding or “donations” and will proceed in that way.

Launch Program Discussion

As outlined in the schedule presented, our design will incorporate a step by step process. We will design and assemble the outer and inner components separately. After both outer and inner components have been thoroughly tested we will integrate the two and test again. This is a robust launch program because it will make sure that any difficulties found can be removed before parts are integrated so as to prevent any major repairs from occurring on the finalized CUBESat. It is similar to computer programming, in that testing code, as one progresses to a final product, will prevent any major and hard to find problems from surfacing in the end.