Gateway To Space

AS EN / ASTR 2500

Class # 05

Colorado Space Grant Consortium
- Well it is just a lot to do considering I know nothing about most of what we need to design & build
- When are we expected to begin construction and purchases?
- Four revisions of the RFP?
- I thought you said each team had to contribute $50
- Do we pay for the equipment you provide from our budget?
- Do we have to buy everything from Qkits.com?
- How much hands-on in class or will it be lecture?
- Any time in class to work with team?
- All different documents that are required became confusing.
- Are we selecting our experiments from a list or coming up with our own?
One Minute Paper:

- How can we get 9 pages of information?
- Basic Stamp 1 or 2?
- Should we have the full schematic of sat for Proposal?
- Own vehicles to the recovery site?
- Other parameters that dictate the 2^{nd} experiment?
- Why are two cameras required?
- Does any downlink need to be operated by a HAM?
Announcements:

- Movie Night, Thanks for coming

- Next Time: Soldering 101 “Be Early”

- HW 03 DUE Today

- HW 04 DUE September 19, 2006

- Proposals and Presentations due September 21, 2006

- 60 Days To Launch

- Today: HOBO, BOX, LEGO Activity
Is it 9:40 AM?
HOBO Demo:

- Set-up and test the HOBO (15 mins)
Step 1: Take out HOBO bag and set parts out
Hands-on: Temperature & Solar Experiments

Step 2: Install S/W if you have a laptop
Hands-on: Temperature & Solar Experiments

Step 3: Install serial cable to laptop
Hands-on: Temperature & Solar Experiments

Step 4: Connect Temperature cable (TMC1-HA) to channel 4 on HOBO Computer
Step 5: Connect Voltage cable (Cable-2.5 Stereo) to channel 3 on HOBO Computer
Hands-on: Temperature & Solar Experiments

Step 6: Solar Panel to Voltage Cable
Make sure black wire from solar cell goes to the black wire on the voltage cable.
Step 7: Connect PC cable to HOBO Computer
Hands-on: Temperature & Solar Experiments

Step 7: Start HOBO Box Car 3.7 software
Hands-on: Temperature & Solar Experiments

Step 7: Start HOBO Box Car 3.7 software
Hands-on: Temperature & Solar Experiments

Step 8: Launch HOBO computer
Hands-on: Temperature & Solar Experiments

Step 9: Check Battery & select “Enable/Disable Channels”
Hands-on: Temperature & Solar Experiments

Step 10: Select Channel 4
Hands-on: Temperature & Solar Experiments

Step 11: Select correct temperature cable
Hands-on: Temperature & Solar Experiments

Step 12: Select Channel 3
Hands-on: Temperature & Solar Experiments

Step 13: Select correct voltage cable
Hands-on: Temperature & Solar Experiments

Step 14: Select Data sampling or interval
Hands-on: Temperature & Solar Experiments

Step 15: Confirm Settings and select Start
Hands-on: Temperature & Solar Experiments

Step 16: Unplug PC cable from HOBO
Hands-on: Temperature & Solar Experiments

Take and Retrieve Data
Hands-on: Temperature & Solar Experiments

Step 17: Give your HOBO sensor some data
Hands-on: Temperature & Solar Experiments

Step 18: Connect PC Cable to HOBO

Step 19: Select Readout
Hands-on: Temperature & Solar Experiments

Step 20: Verify data download
Hands-on: Temperature & Solar Experiments

Step 21: Disconnect PC cable from HOBO
Hands-on: Temperature & Solar Experiments

Step 22: Name Data
Hands-on: Temperature & Solar Experiments

Step 23: View Data
Hands-on: Temperature & Solar Experiments

Step 24: Change data channel
Hands-on: Temperature & Solar Experiments

Step 25: View Data from Channel 4
Hands-on: Temperature & Solar Experiments

Delay Start Feature
Hands-on: Temperature & Solar Experiments

To save time tomorrow and launch day…

- IMPORTANT:
  Make sure laptop time and date is correct for Colorado Mountain Daylight Time
Hands-on: Temperature & Solar Experiments

- Repeat Steps 1 through 13

- Step 26: Set sampling rate to 15 Sec

- This will give you over 8 hours of data
Hands-on: Temperature & Solar Experiments

- Step 27: Select Delay Start
- Step 28: Set the date and time to 07-15-06 at 7:00 AM
- Step 29: Select Start
Hands-on: Temperature & Solar Experiments

Step 30: Unplug PC cable from HOBO
Hands-on: Temperature & Solar Experiments

Step 31: Store HOBO and cables in box

This concludes the set and initialization for the Temperature and Solar Experiments
Is it 9:50 AM?
BalloonSats are commonly made of foam core.

Foam core is a simple, low cost composite panel.

You will use hot glue and Xacto knives to create your box.

There is a OK way of building with foam core.

Cut individual pieces and glue them together.

This way works but is not the best and requires more “belts and suspenders”
BalloonSat Construction:

- There is a BETTER way of building with foam core
- Requires algebra and geometry

- See paper on the class website

![Diagram of steps to making a miter bend viewed in cross-section]

The width $W$ of the V-groove at the inner surface is determined by the depth of the groove, $D$, and the inside bend angle $\Theta$. For this purpose, $D$ should be the foamcore thickness $T$ minus the thickness of the outer sheet of paper $P$.

For a right-angle bend, $W = 2D = 2(T-P)$. Smaller bend angles require smaller groove widths, and vice-versa. For you precision freaks, the groove width $W$ may be calculated for any material:

$$W = 2(T-P) \tan(\Theta / 2)$$
BalloonSat Construction:

- When cutting foam core, remember you are cutting through three layers

- Best to cut each layer individually

- Go slow, use metal edge ruler

- Be mindful
BalloonSat Construction:

- Step 1: Layout box design on foam core sheet
BalloonSat Construction:

- Step 2: Cut it out
Hands-on: Construction and Integration

- Draw center lines between inner and outer lines

- All edge cuts are at 45 degree angles to the centerline

- Cut inside edges first and only through top paper and foam not bottom paper (hinge)

- Cut outside edges last but all the way through

- Go Slow

Video here
**Hands-on: Construction and Integration**

- Cut holes for solar cell, switches, and temp probe

- Cut hole through center for balloon attachment tube

- Tube hole should not be on open side
BalloonSat Construction:

- Step 3: Practice integration and make modifications.

Hold box together and figure out how much insulation you want to use. Will affect how your components sit in box.
BalloonSat Construction:

- Step 4: Glue it together and strengthen corners

- Your template was designed using the “Better Method”

- After gluing, cover your seams with aluminum tape

- Please don’t go overboard, weight is still an issue
BalloonSat Construction:

- Step 4: Glue it together and strengthen corners
BalloonSat Construction:

Things to remember:

- Camera aperture and sensors

Light metering window
Must be uncovered

AF light emitter

AF Light receiver

Minimum necessary aperture
37 x 41 mm

Red eye reduction lamp
BalloonSat Construction:

- Camera aperture and sensors
BalloonSat Construction:

Things to remember:

- Switches
Hands-on: Construction and Integration

- Install switches to box and glue switches in place from back side before making electrical connections
- Keep switches on both sides and label ON/OFF positions
- Make sure to re-connect to heater and 12 V
**BalloonSat Construction:**

**Things to remember:**

- Flight tube integration
- Launch day access
- Testing
- Balloon attachment tube hole should run through center of box on non-opening side

- Make hole diameter as close to tube diameter as possible

- Secure with paper clip

- Make sure paper clip does not interfere with inner diameter
Hands-on: Construction and Integration

- Install Solar Cell, must disconnect from HOBO
Hands-on: Construction and Integration
Hands-on: Construction and Integration

- Integrate camera system and verify camera settings

- Integrate Flight String attachment tube and test clearance with sample string

- Integrate HOBO system

- Install temp probe (channel 4), metal tip must extend beyond wall of structure

- American Flag
Hands-on: Construction and Integration

- Install voltage cable (channel 3)
- Install Heater
- Test switches (will use one picture)
- Tape in off position
- Team label and reward label on outside of box
Is it 10:00 AM?
- Team Design Competition

- Requires, quick thinking, quick design and fun

- Each team must bring a working 60 watt light bulb
You and your team are in a 15 meter orbit around Pluto. A group of astronauts are on the surface conducting life sciences research. Included in this group is George Lucas.

An engineering defect in the habitat has been discovered. All life support systems are wired in series with a passage way light bulb, similar to a string of Christmas lights. Unless they receive a new, working light bulb in the next 30 minutes, they will all die a horrible death (and Star Wars, Episode VII will never be completed).

Your mission is clear. You and your team must get the astronauts that light bulb. At your disposal, as many legos as you could need and one light bulb wrapped in aluminum foil. However, due to risk of the impact damaging the habitat, you asked to use as few legos as possible.
Craft that weighs the least and successfully lands a working light bulb is the winner.

Bulb will be wrapped in a 1’ x 1’ piece of aluminum foil by your instructor and should not be altered.

ABSOLUTELY NO PUTTING LEGO$s IN YOUR MOUTH.

Light bulb must not break and must work after landing.

Please have your craft ready in 30 minutes for registration and weigh in.

First team to turn in will receive a 10 gram reduction

Second team to turn in will receive a 5 gram reduction

Team not completed after time is called will not be permitted to drop

Return to class after all drops, bulb tested there

Everyone must help clean up.
Things to Think About:

- Work effectively as a team

- Remember center of gravity during drop while designing

- Plan your design, even sketch it, before you begin building

- Don’t be still building when there is only 2 minutes left

- Prizes for first and second place
Questions?
Cheering
Things to Think About:

- Results

- Prizes

- How does this apply to my future…
Apollo 13