The Colorado Space Grant Consortium, 
The University of Colorado at Boulder Department of 
Aerospace Engineering Sciences, and the 
Edge of Space Sciences 
present 

BalloonSat Missions to the Edge of Space 

Request For Proposal 
#RFP 1400S15 

Spring 2015 Announcement 

Proposal Due No Later Than: 

| DATE:       | February 9, 2015 |
| TIME:       | 8:00 AM         |
A. Introduction:
The Colorado Space Grant Consortium, the CU Aerospace Engineering Sciences Department, and the Edge of Space Sciences are accepting proposals for the BalloonSat Missions to the Edge of Space for launch on April 11th, 2015 at ~6:50 AM. This request (RFP 1400S15) will allow teams to submit proposals for up to $225. In addition, each team will be provided with (and expected to fly) one Canon digital camera and 2GB memory card, two Arduino Unos and microSD card shields, one internal and external temperature sensors, one pressure sensor, one 3 axis accelerometer, one humidity sensor, one I2C compass module, one heater kits, switches, three half sheets of black 3/8 inch foam core, batteries (flight only = 5 alkaline 9V), aluminum tape, hot glue, Velcro, insulation, and other miscellaneous items that are available or required. This hardware is valued at over $450 and shall be returned at the end of course. Test batteries and dry ice are expenses that must be covered by individual teams (should not exceed $120 per team or ~$15 per team member). The organizations listed above expect to award approximately $1,800 under this solicitation and reserves the right to partially fund proposals. Hardware and supplies purchased with the $225 remain the property of the University of Colorado at Boulder and shall be returned to the professor at the end of the course.

B. Pertinent Dates: (Additional items listed in Section H)

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C. Eligibility Requirements:
Proposals shall only be accepted from the teams associated with the Gateway to Space course (ASEN 1400). Only one proposal per team.

D. Background:
This program is now in its 18th iteration, which started in the fall of 2000. Approximately 1,449 students have launched over 209 BalloonSats through this course. During this period, only three BalloonSats have been lost during the flight and recovery. Numerous scientific data has been returned and
reported. Most teams have done very well during this experience however some have not. It is very important that this project and team mission be taken seriously.

E. Proposal Instructions:
Proposals must be typed, 12 point, Times font, 1 inch margins, page number and team name in footer, single spaced, and project name in header. Proposal must be no less than 7 pages and not exceed 10 pages, including cover sheet and budget. Proposal must include drawings of idea (include dimensions), organization chart with those responsible for each task, functional block diagram, schedule of design, build, and test dates, itemized budget with total, mission statement detailing what you expect to discover. Examples of these items are included in the back of this announcement.

Proposal must be written in Microsoft Word (.docx) and shall not exceed 20 MB. Please send proposal via email to your instructor by 8:00 AM on February 9, 2015. All pictures, budgets and schedules must be included in the single, electronic file. Proposals turned in after deadline will be penalized by 15% to 99% depending on the lateness. There shall be zero unknowns in your proposal (i.e. To Be Determined or Will Figure Out Later). This is not your final design and it can and will change but your mission, at its core, should not. Your weight and cost estimates should be as detailed as possible. Cover the HOW and WHY of your mission in great detail. Most students lose all their points here. Avoid weasel words. Do a VERY professional job on the formatting as well. Proposals shall be written in the third person.

F. Proposal Format and Structure:
The following is the outline that you should follow exactly when creating your proposal. Be sure to cover every item of each section in your proposal. Order of the sections shall be followed but order of items in each section can be arranged in the order your team feels best supports your effort.

I. Overview and Mission Statement: (WHY and WHAT?)
- State your mission concept concisely (Mission Statement)
- Explain WHY you want to do what your team is proposing
- Propose WHAT you plan to discover
- This section shall be at least one page of your proposal
- The WHAT and/or WHY should be referenced with at least three sources (i.e. do research on the WHAT and WHY of your mission and cite those research references).

II. Technical Overview: (HOW?)
- Explain completely HOW you will achieve your WHAT and WHY above with proposed design (Small changes expected as your design becomes more refined)
- Illustrate your design (Drawings with dimensions with design components shall be labeled)
- Discuss the hardware you will need and where you plan to acquire it
- Discuss HOW your team will turn your design into an actual satellite (“we will order hardware XYZ and then test with hardware ABC and then we will integrate it into the structure and then we will test the XYZ and then we will use these results to make further changes.)
- Discuss HOW your team will test your design to ensure it meets all your science and mission objectives. This means have a detailed test plan.
- Discuss HOW you will keep people from getting hurt
- Include the special features of your design and HOW they will enhance and/or help you achieve your mission
- Include a preliminary summary of HOW you will do data retrieval during testing and after launch and recovery
- Include a Functional Block Diagram showing HOW all your systems of your design work together (HINT - Chris really likes these diagrams)
- Include a plan on HOW your team intends to track, meet, and verify all the requirements (coming up in Section G) of this RFP.
- All these requirements shall also be discussed in your proposal.

III. Management and Cost Overview: (WHO, WHEN, and COST)
- Create a detailed schedule of WHEN these events will occur. You may discover others to include while creating this schedule.
  (Design complete, acquire all hardware, prototyping design complete, testing final design complete, cold test complete, design reviews, other activities described on class syllabus (demos, mission sims, inspections, weigh-in), team meetings, etc)
- Include an organizational chart of WHO is on your team and their title
- Provide a plan of WHO is going to do what on the team with specific tasks listed (i.e. manage budget, software modification, camera programmer, etc.)
- You should include a brief description of WHO each team member.
- Document phone numbers, school, addresses, special skills, etc.
- Create a detailed and itemized budget for project COSTs with total including where hardware will be ordered.
- Include a plan on HOW your team will keep its budget & WHO will manage it.

G. General Mission Requirements
The following requirements apply to all teams and must be met. A portion of your team grade will be dependent compliance with these requirements.

1. Design shall have one additional experiment(s) that collects science data and teams must analyze this data.
2. Design shall have one additional sensor that collects engineering data about the flight.
3. After flight, BalloonSat shall be turned in working and ready to fly again.
4. Flight string interface tube shall be a non-metal tube (provided) through the center of the BalloonSat and shall be secured to the box so it will not pull through the BalloonSat or interfere with the flight string. (See flight string attachment diagram in Appendix A.)
5. Internal temperature of the BalloonSat shall remain above -10°C during the flight.
6. Total weight shall not exceed 1,000 grams.
7. Each team shall acquire ascent and descent rates of the flight string.
8. Design shall allow for a Arduino UNO plus microSD card shield (provided)
9. Design shall allow for external temperature sensor (provided) which shall extend at least 1 inch beyond the exterior of the box.
10. Design shall fly a Canon A3400 IS Digital Camera (provided) 22x55x95mm (does not account for extended lens) and 145 grams (including battery and SD card)
11. Design shall allow for an active heater system weighing ~100 grams with batteries and is 10x50x50mm (provided). Dimensions do not include 2 x 9 volt batteries.
12. BalloonSat shall be made of foam core (Three half sheets provided).
13. Parts list and budget shall include spare parts.
14. All BalloonSats shall have contact information written on the outside along with a US Flag (provided).
15. Proposal, design, and other documentation units shall be in metric.
16. Launch is in April 11, 2015. Time and location: 6:50 AM in Windsor, CO. Launch schedule will be given later. Everyone is expected to show up for launch. No transportation is provided as part of the class. Only one team member is required to participate on the recovery. Launch and recovery should be completed by 3:00 PM.
17. No one shall get hurt.
18. All hardware is the property of the Gateway to Space program and must be returned in working order end of the semester.
19. All parts shall be ordered and paid by Chris Koehler’s CU Visa by appointment to minimize reimbursement paperwork. All teams shall keep detailed budgets on every purchase and receipts shall be turned in within 48 hours of purchase with team name written on the receipt along with a copy of the Gateway order form (HW 06).
20. All purchases made by team individuals shall be approved PRIOR to purchase. Purchases not approved prior to purchase will not be reimbursed. All receipts must be submitted within 60 days of purchase or reimbursement will be subject to income taxes. Only one person shall make purchases for their team and therefore only one person per team shall be reimbursed by the University of Colorado at Boulder. This method of making purchases is highly discouraged.
21. Have fun, be creative and no complaining about the amount of work.
22. Absolutely nothing alive will be permitted as payloads, with the exception of yellow jackets, mosquitoes, fire ants, earwigs, roaches, or anything you would squish if you found it in your bed. That being said, if you embark upon a mission with living creatures you are required to clearly explain the justification in doing as well as provide thoroughly complete details on how you will collect your data from your living creatures post flight.
23. Completion of final report (extra credit if team video is included)
24. All BalloonSats shall have visual indicators on the outside of the flight structure to confirm at launch that the payload is active and running as well as excellent internal wire management as this is the leading cause of failure. (examples in Appendix C)
25. All switches shall be covered/protected with foam core cover.
H. Reporting and Presentation Guidelines

Each team shall complete five presentations (Conceptual Design Review (CoDR), Preliminary Design Review (PDR), Launch Readiness Review (LRR), Quick Look Post Launch, and Final) and three revisions of their Design Document (Rev A/B, C, and D). The guidelines for each presentation are on the website under Teams/Templates/Presentations. The guidelines for all revisions of the Design Document can be found on the website under Teams/Templates/Design Document. The revisions of the Design Document allow teams to be writing their final report throughout the semester. All presentations are due at 7:00 AM on the day of class presentations unless otherwise noted on the syllabus or discussed in class. For example, the Final Presentations are held in the evening and presentations are due at 4:00 PM. All Design Document revisions are due on at 7:00 AM of due date. Times and dates listed on the class syllabus and/or discussed in class by the instructor override those included here.

CoDR Slides Due 02-03-15  
Design Document Rev A/B Due 03-03-15  
PDR Slides Due 03-03-15  
LRR Slides Due 04-07-15  
Design Document Rev C 04-09-15  
Quick Look Slides Due 04-16-15  
1st Draft Design Document Rev D Due 04-25-15  
Design Expo 04-25-15  
Extra Credit video Due (less than 4 minutes) 04-25-15  
Final Presentations Due 04-28-15  
BalloonSat Hardware Turn In 04-30-15  
Final Draft of Design Document Rev D Due 05-05-15
Appendix A: BalloonSat Attachment to Flight String

1200 gm latex balloon

1.8 m diam parachute

EOSS Cutdown / CW Beacon

8 x CU BalloonSats spaced 12"

EOSS GPS & telemetry

2.4mm braided Dacron line

Preferred

8 mm Figure-8 knots, top & bottom.

Alternate

Anti-abrasion bushings, 3.6~5.5 mm ID, top and bottom.

Eyebolts >5mm ID

BalloonSat, <10 cm, <500 gm
Appendix B: Example Functional Diagram

- Lithium-Ion Battery
- Switch
- Digital Camera
- LED Indicator
- 2GB SD Card
- 4x9V Alkaline Batteries
- LED Indicator
- O₂ Sensor
- O₂ Sensor
- Switch
- Switch
- Arduino
- O₂ Sensor
- UV-B Photodiode
- Temperature Sensor
- Arduino
- 2GB Memory Card
- 2GB Memory Card
- Humidity Sensor
- 3-axis Accelerometer
- Pressure Sensor
- 3x9V Alkaline Batteries
- Switch
- Heater System
- LED Indicator
Appendix C: Example External LED Indicators
Appendix D: Example External LED Indicators
Appendix E: Mission Statement Examples:

Mission Statement:
BalloonSat Morpheus will measure the concentration of ozone and the intensity of 285 nm ultraviolet-B radiation in the atmosphere to determine any correlation between the two as a function of altitude. In addition, Morpheus will measure the relative humidity at different elevations in the atmosphere, from ground to the maximum height of 30km. This data will be used to determine how this affects the concentration of ozone at the different elevations. Morpheus shall be in condition to launch again within a 1 week period subsequent of recovery.

Mission Statement:
The mission of Team Orion is to develop a BalloonSat with a payload that will collect data on ultraviolet radiation to serve a dual purpose: to allow us to compare our relevant data with past records of the sun's activity, as well as find a correlation between altitude and strength of UV rays.

1.1 Mission Statement
   Our Mission is to disprove the viability of 3D imaging of large, distant objects and to prove that 3D imaging is possible for objects close to the cameras in space. Our mission is to show 3D images are possible in close fields of view, like rocks near the rover, but not possible in space for creating 3D images of large landscapes, planets, or stars, thus saving companies millions of dollars in future investments and validating NASA’s expenditures on 3D imaging on the Mars rovers.

More examples can be found in the Final reports from previous semesters located on the Class Website.

Heater Circuit