



High Altitude Balloon / STEM Program

Experiment Submission Guidelines



Science Heads Inc.

A 501(c)(3) non-profit organization
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1. Introduction

Science Heads Inc. is a Lake Forest California based non-profit whose mission is to support STEM education and raise science literacy in our local communities.

The High Altitude Balloon (HAB) / STEM program is an on-going program designed to give middle and high school students a unique, real life experience designing, carrying out, and evaluating the results of scientific experiments. The payload of each HAB carries student designed experiments to the edge of space where the atmosphere is extremely thin, temperatures very cold and the level of solar radiation is similar to the surface of Mars.

The cost of launching the HAB is financed with donations given to Science Heads Inc. Schools that submit experiment proposals should be prepared to cover the cost of their own experiments (typically less than \$50).

2. Objective

The objective of the HAB / STEM program is to give students the opportunity to apply what they have learned about scientific methodology by documenting and carrying out an experiment of their own design. Experiments from all scientific fields of study will be considered as long as they are appropriate for the environmental conditions expected at the upper atmosphere and meet the requirements listed in this document.

3. Experiment Design

There are a number of limitations of the launch that will affect the design of experiments including:

- a. Number of experimental slots in the payload: typically < 8.
- b. Weight allocated for each experiment slot: ≤ 1 lb.
- d. Excluded Items: Hazardous, explosive, radioactive materials and live animals.
- e. Environmental Conditions: Experiments should be designed to

withstand typical conditions at 100,000 feet in altitude which include:

Atmospheric Pressure: ~ 0.162 psia

Temperature: -50 degrees F

Galactic radiation exposure: > 8.85 micro sieverts (60,000 feet for 1 hour)¹

UV radiation: 30 x greater than at the Earth's surface²

- f. Take into account that recovery/retrieval of the experiments from the landing site may take 48 – 72 hours.

Experiments Must:

1. Be pre-packaged, assembled, and “ready to fly” three days before the launch. Packaging must be approved by Science Heads. Acceptable packaging includes envelopes, cardboard boxes and sheets of cardboard or foamboard enclosed in plastic. A pre-approved zip lock bag with a cardboard insert will be provided for your optional use.
2. Fit within the following dimensions: 6 in x 6 in x 1.25 in.
3. Be self-powered (e.g. include batteries, solar panel etc.) if needed for the experiment. Please note that most batteries do not function well at very low temperatures and may need an external heat source (e.g., hand warmer) to operate as intended.
4. Liquids must be contained in leak proof containers so as to not contaminate other experiments.
5. Sensors, power sources or other parts which are intended to be mounted on the exterior of the payload must be pre-approved by Science Heads. Exterior space is limited to 4 experiments.

4. Proposal Submissions

Due Date: March 13th, 2020

A) Proposals will be accepted until 5:00 pm PT Friday, March 13th, 2020.

B) Proposals can be either submitted electronically as Microsoft Word, PowerPoint or PDF files via e-mail, - or sent on thumb drive or CDROM to the following mailing addresses:

e-submissions:

Richard@scienceheads.org (Use “HAB5 Experiment Proposal” in the

subject the line)

Mailing address:

HAB5 Experiment Proposal, c/o Science Heads, 22365 El Toro Rd #185,
Lake Forest CA 92630

- C) All proposals must be submitted and sponsored by an adult.
- D) The experiment proposals should be developed with the help of an adult educator/mentor.
- E) Collaboration between students is encouraged.
- F) Proposals should be limited to no more than 6 pages in length

Format

The following information is required on the first page of the experiment proposal:

- Title of proposal.
- Name of the adult sponsoring the experiment.
- Grade level of the students submitting the proposal.
- The number of students in the group.
- School name and address.
- Sponsor's contact phone number and email address.

The following details must be provided on subsequent pages of the proposal:

- 1) Subject of the experimental investigation.
- 2) Hypothesis of the expected outcome.
- 3) List of all materials to be used in the experiment (pre-flight, during flight and post flight).
- 4) Weight of each material/item to be included in the payload for the experiment.
- 5) List of the dependent and independent variables.
- 6) References supporting hypothesis and design.

Telemetry

Installed in the HAB payload will be an APRS transmitter and a GoPro camera. The transmitter will provide internal payload temperature, pressure, altitude, and GPS coordinates at 1 minute intervals during the flight. This data will be available on the Internet at www.aprs.fi (search for call sign KM6HCB-11).

The GoPro camera will capture a video looking out horizontally from the payload during the entire flight. Science Heads will collect and make this data available post flight to all experiment groups for incorporation into their data sets.

Any additional video and/or measurements needed for the experiments must be provided for in the design of the experiment (e.g. UV exposure, external temperature etc.)

Submission Accuracy

By submitting an experiment proposal, the sponsor is certifying that all proposal data submitted is accurate. Experiments that are selected but later found to vary significantly from the submitted proposal may be excluded from the flight payload at the discretion of Science Heads.

5. Proposal Selection

It is expected that 5 or more experiments will be selected from the submission pool. If space and weight allow - additional experiments may be included.

A committee of professional scientists, engineers and educators will evaluate the submitted experiment proposals. The committee will announce and post the winning proposals on Monday, March 23rd on the www.ScienceHeads.org web site.

The criteria for acceptance includes:

- a) Design and objective of the experiment.
- b) Application of scientific methodology.
- c) Compatibility with HAB requirements/limitations.
- d) Completeness of the proposal.
- e) Likelihood that the experiment will produce useful data.

6. Day of Launch

The HAB and its payload will be launched from a site open to the public in Orange County. The launch is planned to take place around 11 am on Saturday April 18th, 2020. The HAB is expected to reach an altitude of 100,000 feet and the flight is expected to last 2 - 3 hours.

The launch date, time and location are subject to change based upon weather, FAA approval and other factors.

Schools are encouraged to invite their students, parents and supporters to witness the launch and support their teams. The students are also encouraged to make table top posters and bring display materials describing their experiments. Tables for these displays will be made available for the teams use.

Witnessing the launch and monitoring the recovery process is fun for people of all ages. Science Heads will be advertising the event to the public as a free family-oriented STEM education event.

7. Payload/Experiment Retrieval

Science Heads volunteers will do their best to retrieve the HAB payload. Considering that the payload may land many tens of miles from the launch site - possibly on private property, the roof of buildings, or get caught in trees etc. - it may take several days to retrieve the payload and return the experiments.

On the day of the launch volunteers will fan out in chase vehicles in directions consistent with the projected flight and landing profile. HAM operators will use amateur radios in these vehicles to communicate with the HAB Operations Center at the launch site. The APRS transmitter aboard the payload will transmit the HAB's GPS coordinates and telemetry to the command center. This information will be relayed to the chase teams and made available on the Internet at www.aprs.fi (search for call sign KM6HCB-11).

There is a very real possibility that the payload will not be retrieved intact. Experimenters should understand that it is possible that their experiment may be lost or damaged. Science Heads is not responsible for any lost or damaged experiments.

8. Where to Address Questions

Email questions about this event to:

Richard Stember, Executive Director, Science Heads Inc.

Email: richard@scienceheads.org

Or call Richard Stember at (949) 616-9481

9. Glossary

APRS	Automatic Packet Reporting System - an amateur radio based system for real time data acquisition.
GPS	Global Positioning System - provides accurate location data.
HAB	High Altitude Balloon (aka Weather Balloon)
Payload	Scientific experiments, telemetry equipment and video cameras housed in an insulated box carried by the HAB.

10. Resources

Experiment Ideas:

- <https://www.sciencebuddies.org>
- <https://www.education.com>
- <https://www.sciencenewsforstudents.org/blog/eureka-lab/teachers-launch-weather-balloons-and-passion-science>
- <http://www.juliantrubin.com/fairprojects/earthsciences/meteorology.html>

11. References

- ¹ FAA CARI-6 software flight dose calculator
https://www.faa.gov/data_research/research/med_humanfacs/aeromedical/radiobiology/
- ² World Health Organization. www.who.int/uv/uv_and_health/en/