



High Altitude Balloon Launch (HAB 9)

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 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 being financed with donations given to Science Heads. Schools and organizations that submit experiment proposals should be prepared to cover the cost of their own experiments (typically less than \$50).

Science Heads Inc. takes appropriate measures to ensure the safety of the public and aircraft in the area. All of the rules published by the FAA regarding unmanned balloons are strictly followed (reference [14 CFR Part 101](#)). Additionally, before the day of the launch, Science Heads Inc. files a “Notice to Airmen” (NOTAM) with the Federal Aviation Administration (FAA). And just prior to launch local air traffic controllers are contacted to receive final clearance.

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 proposing and carrying out an experiment of their own design or participating in an on-going experiment. Experiments involving all scientific fields of study will be considered as long as they are appropriate for the limitations listed in this document.

3. Experiment Design

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

- a. Number of experimental slots in the payload: 5 - 6.
- b. Weight allocated for each experiment slot: ≤ 1 lb.
- c. Excluded Items: hazardous, explosive, radioactive materials, and live animals.
- d. 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 microsieverts (60,000 feet for 1 hour)¹

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

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

Experiments Must:

1. Be delivered pre-packaged, assembled, and “ready to fly”. Packaging must be approved by Science Heads Inc. Acceptable packaging includes envelopes, cardboard boxes, cardboard, and foamboard. (A pre-approved zip lock bag with a cardboard insert can be provided upon request for your use).
2. Fit within the following dimensions: 6 in x 6 in x 1.25 in.
3. Be self-powered (batteries or solar panel) if needed for the experiment. Please note that some 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. Contain all liquids used in leak proof and explosion proof containers so as to not contaminate other experiments.
5. Include sensors, power sources, and other parts which are intended to be mounted on the exterior of the payload. Pre-approval by Science Heads Inc. is required for all exterior mounted components. Exterior space is generally limited to 1 or 2 experiments.
6. Include “Day of launch” instructions prior to launch. For example: “1. Turn on power switch. 2. Red LED will indicate power that is applied. 3. Activate and attach hand-warmer to battery pack with provided rubber band.”

4. Proposal Submissions

Due Date: April 3rd, 2023

- A) Proposals will be accepted until 5:00 pm PT.
- B) Proposals can be either submitted electronically as Microsoft Word, PowerPoint or PDF files via e-mail, - or sent on a thumb drive or CDROM to the following mailing address:

e-submissions: Richard@scienceheads.org (Use “HAB Experiment Proposal” in the subject the line)

Mailing address:

HAB 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 on behalf of the student experimenters.
- D) The experiment proposals should be developed with the help and supervision of an adult educator/mentor.
- E) Collaboration between students is encouraged.
- F) Proposals should be limited to no more than 6 pages.

Format

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

- Title of proposal.
- Name of educator/mentor sponsoring the experiment.
- Grade level of the student/group submitting the proposal.
- The number of students in the group.
- School/organization name and postal address.
- Educator’s contact phone number.

- Educator's contact 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.

Provided Telemetry & Video

An APRS transmitter and one or more GoPro camera(s) will be installed in the payload boxes. The APRS transmitter will transmit internal payload temperature, pressure, altitude, and GPS coordinates at 1 minute intervals during the flight. The GoPro camera(s) will capture a video looking out horizontally and or vertically from the payload during the entire flight. Science Heads will collect and make this data available after the recovery to all experiment groups for incorporation into their data sets.

Any additional measurements needed for the submitted experiments must be incorporated into the design of the experiment (e.g. UV exposure, external temperature, etc.)

Submission Accuracy

By submitting an experiment proposal, the adult sponsor is certifying that all proposal design 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 Inc.

5. Proposal Selection

It is expected that 5 or 6 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 notify the winning submitters at least 2 weeks before the planned launch.

The criteria for experiment acceptance:

- a) Design and objective of the experiment is clearly described.
- b) A scientific methodology is employed.
- c) The design meets the HAB requirements & limitations.
- d) The completeness of the proposal.
- e) Likelihood that the experiment will generate the intended data.

6. Launch Day – Saturday, April 22nd, 2023

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 by 10 am. The HAB is expected to reach an altitude of ~ 100,000 feet and the flight is expected to last 2 - 3 hours. It may take 48 hours or longer to recover the payload and experiments.

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

Schools and organizations are encouraged to invite their students, parents and supporters to witness the launch and support their experiment teams. The student teams are also encouraged to make posters and bring display materials describing their experiments. Table space will be provided.

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 tens of miles from the launch site -

possibly on private property, the roof of buildings, or get snared in trees etc. – it may take several days to retrieve the payload and return your experiments.

On the day of the launch several 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 to the command center and this information will be relayed to the chase teams as well as displayed on the web site www.aprs.fi.

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

Published materials about the launch and HAB project should include a credit to "Science Heads Inc., a 501(c)(3) non-profit based in Lake Forest California".

8. Where to Address Questions

Email questions about this program to:

Richard Stember, Executive Director, Science Heads Inc.

Email: richard@scienceheads.org

9. Glossary

APRS	Automatic Packet Reporting System - an amateur radio based system for location tracking and 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.
Telemetry	The process of collecting and transmitting data from a sensor.

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/