



# High Altitude Research Project (HARP)

## HAB 5 Experiment Submission Guide



### **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.

It's High Altitude Research Project (HARP) is an on-going program designed to give Middle and High School students real life experience designing, carrying out and evaluating the results of scientific experiments. The payload of each High-Altitude Balloon (HAB) Science Heads launches 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 that at the surface of Mars.

The cost of launching the HABs is financed with donations given to Science Heads. Students that submit experiment proposals should be prepared to cover the cost of their own experiments (typically less than \$20).

## 2. Objective

The objective of HARP 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 HAB that will affect the design of experiments. These include

- a. Number of experimental slots in the payload: 5 - 6.
- b. Weight allocated for each experiment slot:  $\leq 1$  lb.
- d. Excluded Items: Hazardous, explosive, radioactive materials and live animals.
- e. Environmental Conditions: Experiments must be designed to

withstand typical conditions at 100,000 feet in altitude:

Atmospheric Pressure: ~ 0.162 psia

Temperature: -50 degrees F

Galactic radiation exposure: > 8.85 microsieverts (60,000 feet for 1 hour)<sup>1</sup>

UV radiation: 30 x greater than at the Earth's surface<sup>2</sup>

- f. Experiment design must take into account that recovery of the payload may take 48 – 72 hours after the launch.

### **Experiments Must:**

1. Be delivered pre-packaged, assembled and “ready to fly”. Packaging must be pre-approved by Science Heads. Acceptable packaging includes envelopes, cardboard boxes and sheets of cardboard or foamboard enclosed in plastic zip lock bags. (A pre-approved zip lock bag with a cardboard insert is available on request). Experiment packages can be either dropped off at a predetermined location or picked up by request.
2. Fit within the following dimensions: 6 in x 6 in x 1.25 in.
3. If electronic - be self-powered (e.g. include batteries, solar panel etc.). 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.

## **4. Proposal Submissions**

### **Due Dates:**

- A) Proposals for HAB5 will be accepted until 5:00 pm PT Monday, November 2nd, 2020.

B) Proposals can be either submitted electronically in Microsoft Word, PowerPoint or PDF formats via e-mail, - or sent on thumb drive or CDROM discs to the following address:

**e-submission:**

Richard@scienceheads.org (add "HAB Experiment Proposal" to the subject the line).

**Physical 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 the behalf of the student experimenters.

D) The experiment proposals should be developed with the help of an adult educator/mentor/parent.

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 educator/mentor sponsoring the experiment.
- Grade level of the student/team submitting the proposal.
- The number of students in the team.
- School name and postal address.
- Educator/parent's contact phone number.
- Educator/parent'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.

## **Telemetry Data**

Installed in the HAB payload will be an APRS transmitter and a GoPro camera. The transmitter will provide internal payload temperature, atmospheric pressure, altitude, and GPS coordinates at 1 minute intervals during the flight. The GoPro camera will capture a video looking out horizontally from the payload during the entire flight. Science Heads will make this data available post flight to all experimenter for incorporation into their data sets.

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

## **Submission Accuracy**

By submitting an experiment proposal, the educator/adult 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 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 announce and post the selected experiments on Monday, November 9<sup>th</sup>, 2020 on the [www.ScienceHeads.org](http://www.ScienceHeads.org) web site.

### **The criteria for acceptance includes:**

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

## **Day of Launch**

The HAB and its payload will be launched from a public site in Orange County, CA. The launch will take place around 11 am on Saturday November 21<sup>st</sup>, 2020 subject to weather and FAA clearance. 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 more to recover the payload and experiments.

If launching is not possible on the planned date – Science Heads will attempt to launch again on the earliest possible date.

Normally schools are encouraged to invite their students, parents and supporters to witness the launch and support their experiment teams. During the pandemic though public participation at the launch is not recommended.

## **6. 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 snared in trees etc. – it may take several days to retrieve the payload and return your experiments if at all possible.

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.

Experimenters and their families are welcome to monitor the flight APRS data and radio communications in real time. Science Heads will provide the web site, call signs, and radio frequencies used.

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

## 7. Where to Address Questions

Email questions about this event to:

Richard Stember, Executive Director, Science Heads Inc.  
Email: [richard@scienceheads.org](mailto:richard@scienceheads.org)

## 8. Glossary

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

## 9. 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

- <sup>1</sup> FAA CARI-6 software flight dose calculator  
[https://www.faa.gov/data\\_research/research/med\\_humanfacs/aeromedical/radiobiology/](https://www.faa.gov/data_research/research/med_humanfacs/aeromedical/radiobiology/)
- <sup>2</sup> World Health Organization. [www.who.int/uv/uv\\_and\\_health/en/](http://www.who.int/uv/uv_and_health/en/)