Building a Re-usable, Low Cost High Altitude Balloon Payload

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What is Our Project?

- Multi-Use Launch Equipment, or M.U.L.E. is a re-usable high-altitude ballooning platform which aims to provide students and researchers with an easy to set up and low-cost opportunity to send their projects to the stratosphere.
- Our approach was to design a system that includes all the necessities of a high-altitude balloon mission so that future users need only worry about designing the instrument they want to send up. Including…
  - Central computer
  - GPS module for tracking
  - LED strobe light for nighttime flights
  - Emergency wire cut down system
  - Parachute
  - and optional horizon oriented camera
- To help aid future users of the system we will include…
  - a user manual to detail maintenance and operating instructions
  - an assembly manual to explain how to create copies of the device
  - and a pre-flight checklist to check for common problems before a typical launch
- The goal of the project is to reduce the barrier of entry for high altitude ballooning so more small instruments may be put into the stratosphere.

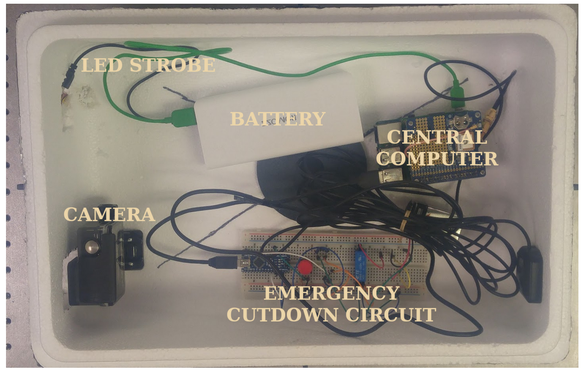
Parts of a High Altitude Balloon Mission

Electronics Packaging in a Styrofoam Box

The general goals of the box is that it be

- light
- waterproof
- relatively easy to make and remake
- well insulated

The box sports a couple custom 3d printed parts including latches to keep the top on, a fixture for the antenna, parachute fixture and 4 legs. It also has two acrylic windows for the camera and strobe lights to see out of. All of these parts are adhered to the inside with waterproof construction caulk.



Communicating GPS Data with UHF Yagi Antennas

The communication system for the high altitude balloon is what aids in the recovery of the box once it has come back down to Earth. The system consists of two parts:

- Ground 433.92 MHz
- Payload 144.39 MHz

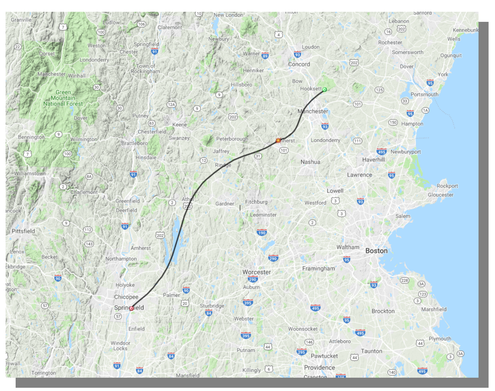
These are in the UHF and VHF range, which are available for use by HAM Technicians. This is the lowest level of certification, making this device as accessible as possible.

Flight Planning and Mission Design

Before we fly, we use the Cambridge University Space Flight landing predictor (CUSF) to estimate our flight path.

Since we are close to the ocean, we experience a fast eastward wind current that will try to pull our craft into the ocean. To combat this, we are moving further inland to launch.

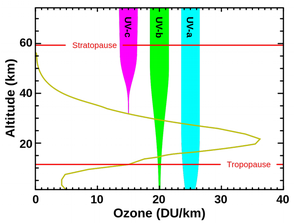
The simulation will be rerun for many different days and time during a week long flight window to find when the conditions are optimal.

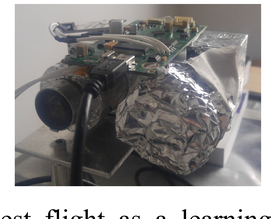


Future Direction

After this initial test flight, our goal is that M.U.L.E. will be used for other university research projects and capstones.

We are currently talking to a graduate students who works at the Lowell Center for Space Science and Technology, who is interested in testing his hyperspectral densometer in an environment above enough of the ozone layer to make ultraviolet observations.





We will also use the first test flight as a learning experience to see if there is any part of the device or the flight process that can be improved for the future.