University of Maine High Altitude Balloon Team - Eclipse Day Experiences

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Abstract

The University of Maine High Altitude Ballooning (UMHAB) team launched two balloons during the August 21, 2017 total solar eclipse, producing a consistent online video stream of the eclipse to an altitude of 110,000 feet. This poster discusses the key factors that lead to a successful launch and recovery, such as thorough testing procedures, redesign of components, choice of launch site, and sometimes luck. In preparation for the event, the team tested the equipment and code over eleven balloon launches. Airplane based testing and land testing were also conducted for the tracking and video stream components. The payloads and nozzle were redesigned to improve efficiency and ease of use. Moreover, the launch site was scouted ahead of time, establishing a good relationship with the host and garnering excellent support for the event. Along with the successful video stream and experiments, the posterr will cover the various points of failure and lessons learned from the event.

Practice and Testing

Testing connection from an airplane

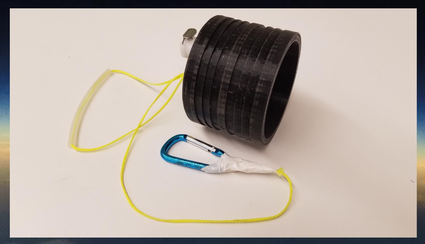
Beginning the previous year and then throughout the spring and summer, the team conducted eleven practice launches. One practice involved two balloons to mimic eclipse day conditions.

Various components of the system were tested to confirm functionality under normal operating conditions. One of the more significant component is the video stream payload, which would provide a live stream of the eclipse from the balloon. For a consistent and high quality stream, the ground station must accurately track the payload and establish a solid connection. The team conducted a test in which they flew the payloads in an airplane and monitored the tracking system on the ground station, thus identifying some tracking improvements.

The team also confirmed the range of the video stream by bringing the payload up to the peak of a mountain and pointing it down to the ground station.

Two students dedicated the summer to testing and improving the equipment and software, as well as becoming intimately familiar with the equipment and its operation.

Redesign



The Nozzle

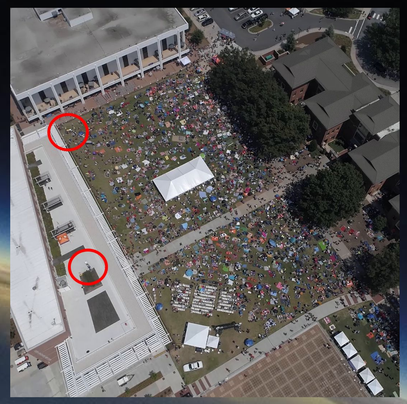
The nozzle was re-designed to make filling and launching the balloons an easier task. Once inserted into the balloon the nozzle is not removed. It stays in the balloon for the launch and payloads are simply attached to the balloon by the nozzle. The desired neck lift is achieved more accurately with the quick disconnect mechanism. Furthermore, the gas flow is controlled at the nozzle instead of at the tank. The nozzle ensures that the balloon is securely handled while filling as someone can hold the nozzle by a convenient strap, minimizing the possibility of a premature balloon release.

RFD payload that was redesigned to be more compact and waterproof.

The payloads were redesigned to make launching the balloons and recovery easier. Reducing the weight allows us to stay below the 12 lb weight limit that the balloons are allowed to carry. Water-proofing the payloads protects the payloads in case of a water landing, which was a concern considering all the swamps and lakes in the vicinity of Clemson. Maine is also heavily covered in lakes in streams, so landing in water was also a concern for practice launches. Changing the payloads to a bright orange color allows them to be easily spotted in a dense forest or lake.

Launch Site Preparations

Ahead of time a planning trip was done to scout out the launch location. Possible launch sites were established and connections were also made with our host, Clemson University. They provided us with plenty of support from landlines to our ground stations, to food on the launch day, ensuring that the launch was a success. They also assisted in setting up our gas delivery and setup and testing in the days before the launch.



Ground stations at Clemson University

Lessons learned

Despite our preparations, several failures occurred during the launch. The 360 degree camera was turned on but somehow was not set to record before flight. During the launch the IR camera shut down so it recorded no video, likely due to the extreme heat at the launch site. One of the GoPros recording during the launch shut down mid-accent due to a battery malfunction and did not record footage of the eclipse. One ground station failed due to a servo motor breaking while tracking the balloon. This caused only one successful stream to be produced form our launch.

Conclusion

Overall, the UMHAB team experience during the Aug. 21 2017 Eclipse was a positive one. Many students were able to help with the project that had been going on since 2015 and were finally able to achieve the goal of a successful live stream of the total solar eclipse. 20 students were able to make the trek from Maine to Clemson to help ensure that UMAHB launches 76 and 77 were a success.