Operating Standards for the High Altitude Ballooning Community

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This paper provides an overview of work to define a set of standards for adoption by the academic high altitude balloon community. These standards go above-and-beyond the requirements imposed by §101 of the Federal Aviation Regulations, incorporating best practices and suggesting how §101 requirements should be interpreted and applied in several situations.

One area where FAR§101 is extremely vague is with regards to the operations of balloons with small payloads. These payloads are exempt from most requirements; however, they are required to not create a "hazard". Problematically, what exactly qualifies as a "hazard" is not defined in FAR§101 or elsewhere (with direct applicability). The definition of "hazard" within the scope of aviation law is explored. Prospective standards for these light-weight payloads to comply with the requirement to not create a hazard are presented and discussed.

The paper also considers the value of enacting standards and how they might be adopted. Value, primarily, stems from three areas. First, by enacting the standards, community members (particularly those new to high altitude ballooning) have a clear expectation of how to conduct safe and effective operations. Second, in the event of an incident, adherence to broadly accepted guidelines may have the impact of demonstrating prudent decision making and non-negligent behavior. Third, in the event of an accident, pre-existing voluntary self-regulation may be looked upon favorably by the FAA preventing a reactionary prohibition of high altitude ballooning in the United States or onerous regulations created in response to the incident.

I. Introduction

THIS paper presents proposed standards for high altitude balloon (HAB) operations which exceed those mandated by the FAA. These standards fill a gap in Federal Aviation Regulations related to small payloads and extends beyond the regulatory authority of the FAA to cover payload retrieval and other considerations. Section II provides an overview of the proposed standards. Section III discusses their implementation and Section IV discusses the prospective benefits of implementing standards such as those proposed. The paper concludes (in Section V) with a discussion of next steps and future work.

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II. Proposed Operating Standards

A set of operating standards for HABs were presented in [1]. An overview of these standards will now be presented in an abbreviated form. These standards cover preparation and training, assembly and testing of a payload train, required train components, preparation for launch, acceptable launch locations, acceptable launch conditions, required launch notifications, chase operations, payload recovery and topics not explicitly covered. These standards seek to avoid the creation of a 'hazard' as stated (but not defined) in Section 101.7 of the Federal Aviation Regulations.

Payloads shall be enclosed in a durable shell which can withstand an impact of at least 10 pounds of force without puncturing or releasing its contents. The payload shall be sealed to prevent the release of parts during flight. The payload shall not be constructed to drop an item, unless operated over a controlled area. No item shall be designed to break or sever from the payload under normal flight conditions. Ballast can be released as long as this doesn't endanger humans, property or the environment. Payloads shall be compliant with mass guidelines stated in Section 101.4. Payloads which are constructed of a material which can absorb moisture shall be weighed (and meet requirements) in both non-saturated and saturated conditions.

The payload train line must be able to be severed via the application of 50 pounds of force or less. This shall be tested via applying a mass of 50 pounds with a flat object to a length of suspended string no less than one inch across and by hanging a mass of 50 pounds from the string. In both cases, the line must sever with no movement applied beyond the gentle placement of the mass. The train must have (at minimum) a balloon, parachute and radar reflector (with minimum dimensions in all directions of no less than 14 centimeters). A FAA-approved APRS transmitter shall be able to be substituted for the transmitter, if desired. Payloads launched or expected to be in the air (inclusive of a margin for error) before or after daylight shall include a strobe light that can be seen from at least 1,000 feet away. The payload train for any non-burstable balloon shall include at least two cut-down mechanisms and at least one must not rely on ground communication to work.

Each launch shall be preceded by a briefing and review. This shall ensure that participants have received suitable training, the payload and train comply with requirements and flight activities (launch location, flight path, etc.) do not pose a hazard. The leader of the mission shall verify compliance and that all required notifications have occurred and/or are planned as required.

HABs shall not be launched within 10 miles from controlled airspace without the controller's permission or within 500 feet of a major roadway or major pedestrian / bicycle path. They shall not be launched from private property without owner permission or in proximity to a building (where impact is possible under prevailing wind conditions) without the building owner's permission. If the length of a tether line for a tethered balloon is more than 333 feet, then the distance from a major roadway or major pedestrian / bicycle path shall be at least 150% the length of the tether.

HABs shall be launched when the following conditions are met:

- Cloud cover: at least 40% of the sky directly above must be clear (based a 20-degree upward facing cone from the launch location), unless launching in controlled airspace with approval.
- Wind: less than 25 miles per hour unless a condition appropriate launch plan has been developed.
- Lighting: for night/near-night launches, a strobe light visible from at least 1,000 feet must be included on the train.
- Air traffic: HABs shall not be launched when air traffic is over or in close proximity to the launch site or in congested areas without controller coordination.

A Notice to Airmen (NOTAM) shall be filed in all cases; a waiver shall be obtained if required as per Section 101.4 (or other applicable regulation). Participants shall obey all national, state and local regulations (e.g., traffic codes) while performing chase operations. Vehicles shall be configured to allow tracking system operation without impairing the driver's ability to operate the vehicle safely. All tracking systems (other than navigation systems specifically designed for driver use in a motor vehicle) shall be operated by passengers.

HAB payloads shall be retrieved:

- From public property: in a way that minimizes the impact of the HAB on the public property and returns the property to as close a state as possible to prior to the HAB landing. Restricted public property shall only be accessed after permission is obtained from an appropriate authority.
- From private property: owner permission shall be obtained unless the payload appears to pose imminent harm to the property or its inhabitants and this can be mitigated by its retrieval.
- In a way that does not endanger participants. Sources of prospective danger include (but are not limited to): climbing trees or structures without suitable skill and appropriate safety equipment, entering a body of water without suitable skill and flotation gear, entering a public roadway, entering an active hunting

area and/or entering an area where environmental factors (vegetation, quicksand, etc.) may pose danger.

- In groups. A member of each group shall always remain in a safe area with an operable communications mechanism (monitored radio, mobile phone, etc.) to seek help if required.

These proposed rules (and the more detailed version presented in [1]) cannot cover every possible scenario. Three key principles should drive decision making. First, HAB operators shall take actions to protect humans (first) and property (second) from danger. They shall not engage in activities that appear to pose danger to themselves or others or which are likely to damage property (without owner permission). Second, HAB operators shall remember that operations carry a level of risk which cannot be completely mitigated. All participants and those for whom impact can be reasonably foreseen shall be advised of this risk. Third, HAB operators shall remember that they represent a larger group of educators, enthusiasts, researchers and others when operating and that continued operations may be jeopardized by their inappropriate actions. They shall act in a way commensurate with this responsibility.

Finally, it is suggested (but not required) that HAB operators procure insurance to protect themselves and the public when engaging in HAB activities. Further, it is understood that some facilities that an operator may launch at or in conjunction with (e.g., the NASA Columbia Ballooning Facility or NOAA) may have their own regulations and that following these instead, when operating in a covered location, is also considered acceptable compliance with this code.

III. Implementation

Implementation of the proposed code will consist of three phases. These are now discussed.

First, the proposed code should be reviewed by all interested external stakeholders and the HAB community. Changes should be suggested and discussed. Discussions with the FAA should occur and FAA feedback incorporated as applicable.

Second, the proposed code (as revised) should be adopted by a national high altitude ballooning organization and suggested for adoption by all institutional members (or the institutions of personal members). This could initially start as a suggestion and, over time, advance to a requirement for institutional membership.

Third, each institution should formally adopt the code via whatever process is appropriate to the institution. Each institution, when adopting it, should add other areas of institutional concern to create a codified single-source document for HAB operations under the auspices of the institution. Once adopted, appropriate training should be provided to those that will be responsible for and participating in HAB operations at the institution.

IV. Benefits

Having an agreed code of conduct for HAB operations presents several possible benefits. First, it provides an easy starting point for new entrants to the HAB community and existing participants who do not yet have a formal code of conduct. They can modify or add to the code, as desired, and adopt it. This makes the process easier and increases the likelihood of a formal code being used at a given institution.

Second, having a code of best practices can be valuable to prospective participants who are having trouble gaining internal permission to perform what may be perceived as a high-risk activity. Showing that they are following an established set of rules may increase decision-maker comfort.

Third, if an accident occurs the operator will want to demonstrate that they were not acting negligently. Following an established set of rules demonstrates prudence of conduct.

Forth, if an accident which involves significant impact occurs, the ability to operate HABs could be restricted or eliminated by the FAA. Having a codified set of rules may cause the FAA to allow community self-regulation following an accident (particularly by an entity not following the set of rules) instead of the FAA introducing government-administered regulations or curtailing the activity.

Finally, and most importantly, a codified document reminds (or informs, in the case of new participants) operators about key considerations that may be lost in the moment when dealing with last minute preparation pressures. Following these rules may help operators avoid injury to team members and others and damage to property.

V. Conclusion

This paper has presented a brief overview of the proposed operating standards discussed in greater detail in [1]. It aims to be a starting point for a discussion of these proposed standards, their revision and eventual implementation. A proposed three-phase process has been presented for this. Future work will, thus, involve the

revision of these standards, their adoption by an applicable organization and their eventual adoption by member (and non-member operators).

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References

[1] Straub, J., Nordlie, J. and Anderson, E., "A Need for Operating Standards in the Academic and Research High Altitude Balloon Community," Issues in Aviation Law and Policy, Vol. 12. No. 3, 2013.