

Ballooning Ideas for Amateur Radio Operations

Lighter-than-air Ballooning operation basically requires displacing ambient air with a lighter gas. This can be as simple as heating the air inside the balloon to a higher temperature, as in a hot air balloon. The hotter the air is, the stronger the lift for the balloon. In other words, *the difference in density of the inside air and the normal outside air develops the lift of the balloon envelope.*

Without heating the air inside the balloon, a less dense gas like hydrogen or helium works very well. Now, with which gas should one work? Hydrogen has about 5 % stronger lift than helium for the same volume. Those who like explosive events pick hydrogen; you can rename the project the Hindenburg, because hydrogen when mixed with air is very flammable! The small amount of lift loss per volume in helium is forgotten when one identifies that helium is an inert gas – no fiery events from the helium mixing with air.

How much lift does helium support? The volume of one cubic ft lifts 0.064 lb. The size of the balloon(s) directly affects the lift as has been demonstrated by the “LA lawn chair” or “balloon boy” events. The lift of a balloon three ft in diameter will be 0.9 lb. A six ft diameter balloon lifts 7.1 lbs and a 12 ft diameter balloon can lift 57lbs. That covers the basics of balloon lift.

Does anyone care about ballooning events? YES, the Federal Aviation Administration (FAA) is very interested in all activities and all objects that are in the air over the US! Their rules for balloons are covered in FAA part 101. Following are the requirements for two unmanned modes, moored and free flight.

Unmanned moored balloons could carry a payload of APRS, cross-band repeater, digital repeater, weather station, camera or amateur TV (ATV). The balloon payload is the creative and major effort of group involvement in the pre-launch activities. The major requirements of a moored balloon with a payload, prior and during the operation, are:

- If the balloon will be 150 ft or less above the earth, the nearest FCC ATC facility is not required to be called prior to activity.
- If you operate a balloon below the top of any structure, or within 250 ft of a structure, this is a special condition called a shielded operation. The balloon cannot obscure any lighting of the structure. The structure shielding the operation covers the operation requirements of the FCC.
- If the operation is unshielded and more than 150 ft above the earth, then notification must be given to the nearest FCC Air Traffic Control (ATC) facility at least 24 hours prior to the start of the operation. Additional requirements are: must be at least five miles from any airport; maximum height of 500 ft above earth surface; ground visibility more than three miles; keep 500 ft below cloud base.

Unmanned free-flight balloon payload may include items on the moored operation payload list, but additional control circuits are required as part of the payload. There must be at least two independent control circuits which, when activated remotely by an operator(s), will cut the payload and parachute away from the balloon envelope or simply deflate the balloon for descent. Also required is a radar reflector to reflect to the surface radar operating between 200 and 2700 MHz. The major effort required will be the initial development of the required payload control circuits.

Also important to free-flight ballooning are FCC notification, weather and environmental requirements. The minimum requirements include:

- Six to 24 hrs before launch, call nearest FAA ATC facility with balloon identification, estimated launch date and time, location, cruising altitude, forecast trajectory and eta to cruising altitude of up to 60,000 ft, duration of flight, a forecast of time and location for descent and landing (part 101.37).
- To maintain and continue flight: at any altitude, cloud cover less than 50 %; below 60,000 ft, visibility of better than 5 miles; for the first 1,000 ft of ascent and on impact with the surface, balloon or payload does not create hazard to persons or property not associated with operation (part 101.33).
- Operator(s) shall activate the appropriate control circuit devices required above to descend payload, when weather conditions drop below limits or operations become hazardous to other air traffic or to persons and property on the surface.

Wow, I sure have let out a lot of air covering this topic. So let us wrap up this discussion with the final item to be covered, which will be on the lighter side. Literally.

Where does commercial helium come from? Helium is a product cryogenically distilled out of natural gas production. In places that have a lot of uranium ore, natural gas tends to contain high concentrations (up to 7 %) of helium. Helium is stored for commercial use in high pressure tanks that can be rented or purchased locally.

I look forward to ideas and suggestions from persons interested in this Ballooning Project activity.

I thank Bruce N9VID for initially discussing the topic during our general meeting in 2009.

Regards, Les KC9HHB 22 Feb 2010