Balloon Federation of America to Study Minimum Safe Altitudes

by Ruth Lind

When it comes to an in-flight emergency, lower altitudes enable a balloon pilot to land quickly and safely and with the greatest possible control of the aircraft, thus minimizing risk to those on the ground and in the air. Flexible altitude restrictions provide safer operations with respect to flying balloons. For that reason, and that reason alone, the Balloon Federation of America (BFA) petitioned the FAA to sanction a study to gather data with an eye toward clearing the way for a rule change to Title 14 Code of Federal Regulations (14 CFR) §91.119 (b) and (c) for lighter-than-air flight. The one-year study began March 1, 2004, when the exemption was approved.

Flight characteristics for balloons differ significantly from those of airplanes in that balloons have no means of propulsion through the air, only the ability to change altitude. That means for the balloon to change horizontal direction it must change altitude to take advantage of different air currents. At no time is this maneuverability more critical than during the landing phase of the flight. In order to maneuver the aircraft into a suitable landing site, the pilot must use wind speeds and direction at lower altitudes with skill and finesse, particularly in other than flat areas of the country, while of course exercising utmost caution to provide for the safety of persons and property on the ground.

The Grant of Exemption permits a limited number of BFA pilots to fly at 500 feet agl over congested areas and 200 feet Agl over non-congested areas. In addition, the pilots may, over congested areas, demonstrate approaches to suitable landing areas with a break-off altitude of 200 feet agl with no intent to land.

Far from being a free pass for low flying, the study requires participating pilots to meet a number of standards. First of all, each pilot must hold a commercial rating for balloons or enough hours to qualify for a commercial rating, and the pilot must be current, including flying within 30 days of flight testing. No paying passengers may be carried on study flights nor may instruction be given. During the flight, an observer must collect and record wind speed and direction data on a form approved by the BFA and the FAA. In addition, local FAA aviation safety inspectors will be invited to fly and observe each test flight. After the flight, the pilot will immediately file the completed test profile forms with the BFA Office, which will forward them to General Aviation and Commercial Division's AFS-820, monthly.

It is interesting to note that a significant number of balloon events operate throughout the country each year under waivers providing relief from the requirements of 14 CFR § 91.119(b) and (c). Many of these waivers call for flight operations identical, or nearly so, to the restrictions in the Grant of Exemption. At no time has any deterioration of safety been observed or recorded under these waivers. For the purpose of gathering data, however, the BFA and FAA wish to consider flights under normal operating conditions outside the realm of structured events.

While the study guidelines lower the minimum safe altitude requirements, they do not change the important provision of 14 CFR § 91.119(a), created to prohibit pilots from causing a "…hazard to persons or property on the surface." In other words, even while participating in the study, BFA pilots will not consider this a license to fly low in areas where such operations would be inappropriate, such as over certain livestock. The BFA heartily endorses this paragraph of 14 CFR § 91.119 for all pilots.

A critical component to the BFA study is the BFA Flight Profile Form, submitted after each flight made under the provisions of the exemption. On this form, pilots will record the details of the preflight weather briefing and the measured conditions actually present during the flight. An observer, using a GPS, will record wind speed and direction at 100-foot altitude increments below 1,000 feet. The pilot will note changes in actual conditions from those forecast, as well as changes occurring during flight. The pilot will also record the speeds and directions necessary for a suitable approach and landing, and at what altitudes these were found.

Let’s take a look at how this form will contribute to a better understanding of balloon operational conditions.

Carol has planned a morning flight for Saturday and has briefed her crew and prepared her equipment on Friday evening. Since the winds are most stable within two or three hours of sunrise and sunset, and sunrise the following day will be at 5:30 a.m., she’s in bed early. Carol sets her alarm for 4:15 to call the Flight Service Station (FSS) in preparation for a launch at 5:45.

The briefer tells Carol that surface winds at the airport nearest her launch field (remember, balloons rarely use airports for launching and landing) are currently out of the southwest at less than five knots. The forecast calls for winds 200° at six knots through 8:00 a.m., and 210° at 10 knots through 11:00. The reporting airport is about 30 miles away, so Carol will want to send up a helium pilot balloon (pibal) before she takes off. Winds aloft at the nearest reporting station, over 100 miles to the west, are 220° at 12 knots at 3,000 feet, 240° at 17 knots at 6,000 feet, and 250° at 25 knots at 9,000 feet. The ceiling and visibility are unlimited, temperature and dew point more than 10° apart (fog won’t be a problem) and nothing shows up on radar within 200 miles.

Carol expects a beautiful flight. She knows the reporting airport sits atop a large, flat hill, so the five knots reported there is probably the strongest surface wind she’ll encounter. She plans to be on the ground before 7:30 a.m., so the wind speed for her flight should be well within her safety window, even hours after her planned landing.

As she climbs, the winds will veer or shift to the right with altitude. Veering winds indicate stable weather. The opposite will also be true. As Carol descends, especially when she’s on landing approach, the direction will shift to the left. As the sun heats the night-cooled boundary layer near the earth, the atmosphere and winds begin to mix. Later in the morning, the direction and speed of the reported or actual winds aloft will eventually reach the surface. Therefore, as the morning progresses, Carol will lose her left turn during descent. It may happen before her landing, or not until hours later, depending on her local conditions.

Arriving at the launch site, Carol releases a pibal. As it climbs, she watches its speed and direction and notes that the winds at the surface are from 180° rather than the reported 200°. They’re also much slower, more like two or three knots. The pilot knows this is partly due to the terrain. Remember the airport reporting station is up on a hill, and Carol’s launch site is a large grassy field in a river valley.

The river flows from north to south down a valley about 800 feet below the tops of the ridges on either side.

After launch, Carol floats at 300 feet agl up the valley for about 20 minutes. Her general direction is to the north, at an average three knots. Then she climbs out over the ridge, and turns toward the east with altitude. She finds that at 2,000 feet, she's heading pretty well east, at 15 knots. Her pre-flight FSS briefing would have had her flying 50 degrees more toward the north at a somewhat slower speed. Oh well, the winds aloft reporting station is more than 100 miles away, after all. And she has seen this shift in her pibal.

The difference in direction, however, means that there is no way Carol will be able to land in her uncle's fallow pasture, as the forecast and first flight plan would have indicated. She'll be well south of that by the time she reaches it. She selects an alternate landing site, based on the flow of the stream in the next valley (wind speed and directions change over water), the changing wind direction as the sun rises higher in the sky, and the direction of the smaller ridgeline she will cross.

About two miles away from her landing site, the pilot descends slowly to 700 feet, making a gradual shift in direction toward the north as she does so. From careful observation and past experience, Carol knows there are some crops, but no livestock between her present location and her landing spot, a freshly mown field.

At a half mile out, she comes down to 300 feet, again shifting her direction by 5°. Now on her final approach, she notices the morning mist from a farmer's pond is drifting due north, so she waits until she's nearly due south of her chosen field to drop to the surface and glide in for a stand-up landing next to the road.

Carol's observer, meanwhile, has recorded every change of altitude and direction throughout the flight. After they've packed up the balloon and thanked the landowner for his hospitality, the pilot and observer complete the BFA Flight Profile Form. On paper, the collected numbers, as compared to the FSS briefing numbers recorded before launch, show differences in speed and direction that have made a six-mile difference in Carol's landing site. The pilot, of course, expected this before take-off to some degree, but the ability to use the valley flows and indicators in the form of morning mist have enabled her to maneuver her aircraft with skill and finesse. A precise, gentle landing has resulted. Had she been required to use only the winds above 1,000 feet, her landing might well have been harder and much less precise.

Carol's form, with hundreds of others, will show these minute changes and their effects on flying balloons safely, in virtually all parts of the country. While Carol works with valley drift in the Appalachians, Tom accommodates a low-level jet in Iowa. Diane navigates the mountain currents in Colorado, while Ray plays the canyon drainage winds in Albuquerque. Joe plans a magnificent sea-breeze flight on a spring afternoon in Maine. In all these areas, terrain and local weather trends provide the only horizontal control a balloon pilot can use, the direction of the breeze. Just a few degrees of directional shift, or a knot or two of speed, makes a significant difference in the direction of the flight. And these changes are found at altitudes within a few hundred feet of the surface. The ability to use these lower altitude currents gives the balloon pilot a most valuable tool in the operation of his aircraft.

If you are skilled with a GPS, you might contact a local BFA pilot participating in this study to request an observer spot. You'll learn a lot as you record the minute changes in speed and direction and see firsthand what those changes mean for the pilot in terms of control. And for the first time, data collected in this study will provide a scientific look at how balloons really fly. With this data, the BFA study hopes to show that lower operating limits for balloons can enhance safety for persons or property on the ground and those in the basket.

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