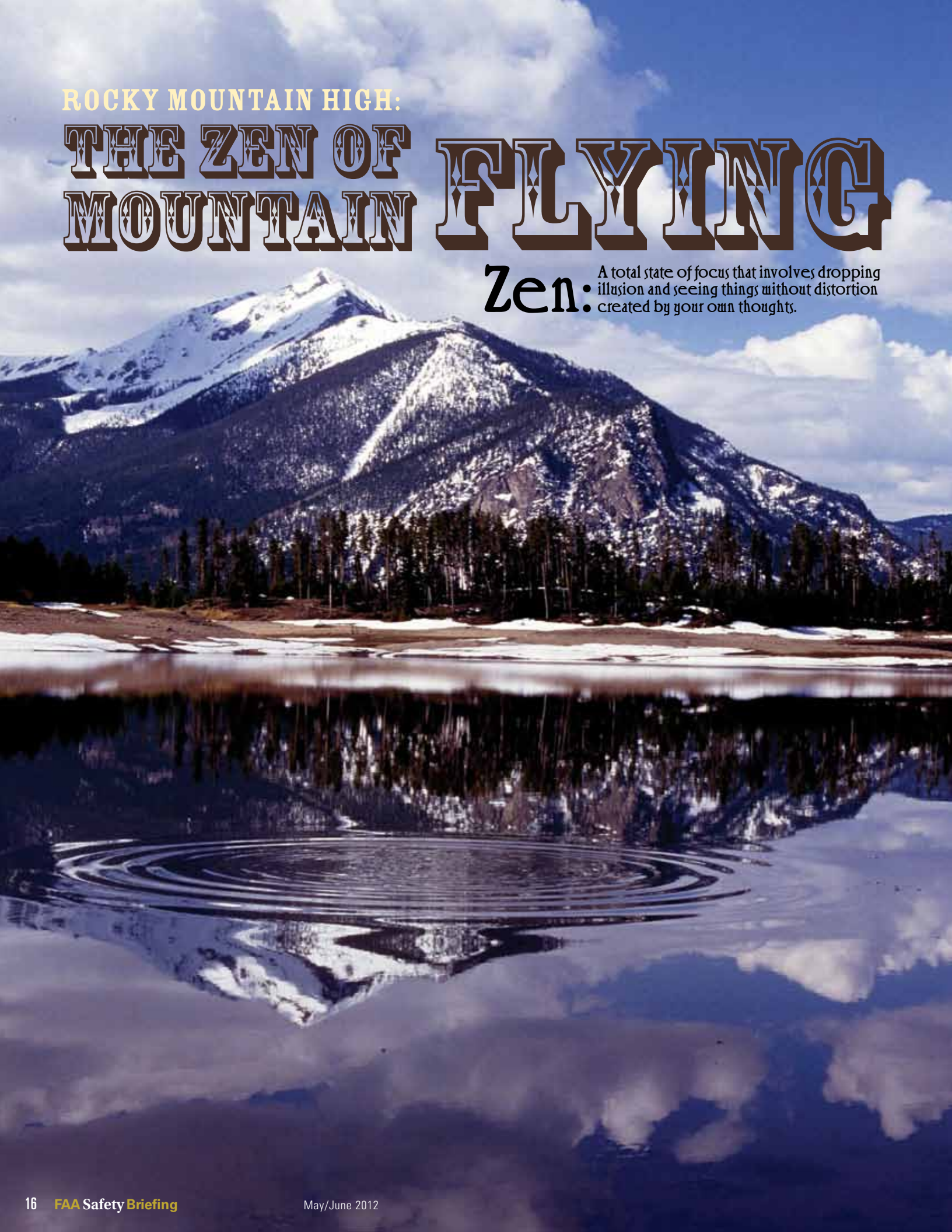

ROCKY MOUNTAIN HIGH:

THE ZEN OF MOUNTAIN FLYING

Zen: A total state of focus that involves dropping illusion and seeing things without distortion created by your own thoughts.

If perchance you have a yen to visit mountains in their own lofty neighborhood without the footwear and perspiration required to get there under your own steam, a GA airplane is a wonderful way to travel. I will never forget the thrill of flying over Arizona's famous Four Peaks mountain in my friends' Cessna T-206 *Stationair* a few springs ago. Being a regular on the DCA-PHX run, I had certainly seen it from the lofty heights of an airliner. But nothing compared to the closer view we got courtesy of general aviation.

There were no particularly difficult conditions on the day we flew in, but believe me, all three of us made a careful analysis of the weather before departing Santa Fe (KSAF) for Mesa (KFFZ). We weren't crossing the Rockies; still, we recognized that for pilots unaccustomed to operating at higher elevations, the flight environment can be very unforgiving of poor planning.

Knowing the Neighborhood

Let's start with a quick survey of hazards common to the mountain flying environment. Please note that "quick survey" carries a caveat: If you're serious about mountain flying, you need a lot more in-depth knowledge and understanding than we can provide in a short article.

Density altitude: As Jim Reynolds explains on p. 19, density altitude is the pressure altitude corrected for temperature. Since increasing temperature makes the air less dense, an airplane will perform as if it is at a higher altitude. The combination of high elevation and high temperature creates high density altitude, which has an adverse impact on aircraft performance.

Winds: Mountains create a wide-ranging menu of wind conditions. Mountain wave turbulence occurs when the wind speed is above about 25 knots and flowing perpendicular to the ridge lines. The air flow can form waves that are much like water flowing over rocks in a stream. The waves forming downwind from the ridge line are composed of strong up and down drafts, and there can also be dangerous rotor action under the crests of the waves. Mountain waves can be visible when enough moisture is present to create those beautiful and (very!) deceptively serene-looking lenticular clouds.

Another hazard is wind flowing through mountain passes. Remember the ground school discussion of carburetors? Just as the flow through a carburetor speeds up in the restriction of the throat, air moving through the narrow restriction of a mountain pass will accelerate and likely create turbulence and up- or down-drafts.

A third element of wind awareness for mountain flying is "orographic lifting," which is the term for what happens when the wind blows moist air upslope. If the temperatures are lower, the moist air will cool and form visible precipitation in the form of clouds. A cap cloud close to the mountain communicates stable air. However, with summer's unstable air, orographic lifting can easily launch the formation of thunderstorms.

Still another wind awareness item is the microburst. If you aren't familiar with mountain flying, you may not be familiar with the dry microburst, which occurs with little or no warning in the clear air beneath virga. Dry microbursts are common in and near the Rockies and other mountainous areas of the western United States during the summer. Dry microbursts are most likely to form around thunderstorms with bases above about 3,000 to 5,000 feet AGL and a temperature/dew point spread greater than 40 degrees. They can be indicated by blowing dust underneath a high-base thunderstorm … but of course you should stay well clear of thunderstorms in all circumstances.

Visibility: Temperature inversions often create fog in mountain valleys during the night. Valley fog can be very thick and, since it may require several hours to dissipate, it's definitely an item to factor into mountain area arrival and departure planning.

Acquiring the Zen

Presented in terms of the PAVE (pilot, aircraft, enVironment, external pressures) risk mitigation checklist, here are a few tips to start acquiring the distortion-free zen you need for safe mountain flying.

Pilot: Mountain flying will challenge your abilities to fly the airplane proficiently, navigate, and deal with weather. Take a clear-eyed look at your experience and background. Unless you learned to fly in such an area or have extensive mountain flying experience, safety demands that you consider taking a recognized mountain flying course to give

you the knowledge and skills you will need in this environment. The Internet provides information on the many courses available.

Aircraft: The mountain flying environment will also challenge your aircraft and, in circumstances like high density altitude combined with high elevation, conditions may demand greater performance than a GA aircraft can offer. Some experts recommend that 160 horsepower should be considered the absolute minimum for the airplane, especially when the pilot lacks significant mountain flying experience.

enVironment: Here's where the homework is critical. In addition to knowing what the pilot/aircraft team is capable of doing, you need to acquire a thorough understanding of not only the weather hazards described above, but also practical mitigation strategies. A few basic tips:

Altitudes: Plan to cross mountain passes at an altitude at least 1,000 feet above the pass elevation. This altitude could result in flying at or above 10,000 MSL, which means that you need to be sure you can meet VFR cloud clearance requirements if you are not on an IFR flight plan. Since the dearth of mountain weather reporting stations might complicate the task of fathering accurate information, be sure you have a viable escape route at all times. It's a good idea to call some of the airports along your route, and pilot reports can be as valuable as gold. Also, plan to cross ridges at a 45-degree angle. This technique allows you to turn away from the ridge more quickly if you encounter a severe downdraft or turbulence. After crossing a ridge, turn directly away from it at a 90-degree angle to depart the most likely area of turbulence.

Unless you learned to fly in the mountains or possess extensive mountain flying experience, safety demands that you consider taking a recognized mountain flying course to give you the knowledge and skills you need in this environment.

Visibility: Many experienced mountain pilots recommend having at least 15 miles of visibility before attempting mountain flights. Since your navigating will be primarily by pilotage and dead reckoning, good visibility will help keep you oriented in a sometimes confusing array of geographical cues. By the way, experienced mountain pilots generally caution against IFR and night flying in the mountains for novices. Instrument approaches and departure procedures often require a higher level of pilot skill and aircraft performance, and night obscures important visual navigation cues needed for terrain clearance.

Winds: Don't attempt to operate in mountainous terrain if the winds aloft forecast at mountain top levels is higher than 25 knots. During preflight, experts recommend that you pay close attention to forecasts at and above the mountain ridges. When flying in the west, that means checking the 9,000 and 12,000 foot forecasts. Also, the position of high and low pressure areas can offer clues to wind speed potential.

Routes: Flying in the mountains demands a lot more care than just drawing a straight line or following the magenta line on your GPS moving map navigator. The safer path in mountain areas is to follow features such as highways, river drainages, and valleys. In addition to being at a lower elevation, these routes offer better emergency landing options. Also, consider using pilot groups or Internet forums to find local pilots who have knowledge and experience to offer. And this point bears repeating: Always have a fly-able alternative!

Survival: The mountain flying environment can be very harsh, and survival equipment is a must. Do the research needed to assemble a good survival kit. At a minimum, you should have a three-day supply of food and water for each occupant, winter clothing, a medical kit, and signaling devices.

External factors: This one is easy to say, but very hard to do. As John Allen notes in his article on p. 1, elements of the pilot personality can sometimes cause us to attempt things we know we should not do. Take the time to ferret out the factors that might be pushing you into a poor position, whether in the go/no-go decision or deciding whether diversion is necessary once you are underway.

Done properly, mountain flying can significantly add to your repertoire of aviation skills and memorable adventures. Acquire the zen, and enjoy the view.

Susan Parson is a Special Assistant in the FAA's Flight Standards Service and editor of FAA Safety Briefing. She is an active general aviation pilot and flight instructor.