

Flying the Mountains

A Training Manual for Flying Single-Engine Aircraft

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1

Altitude

Mountain flying is tremendously affected by altitude.

Effects of altitude

Some traces of the earth's atmosphere may be detected at altitudes as high as 350 mi. By convention, though, space is said to begin at 100-mi elevation, the realm above which all flight is ballistic rather than aerodynamic. The lights of the Aurora Borealis result from the interaction of solar radiation and the atmosphere at elevations from 70 to 100 mi high. The very highest of cirrus clouds are at altitudes of only around 7 mi, which we can now convert to a more useful 35,000 ft.

Yes, some of the atmosphere reaches up very far away—but not very much of it. The atmosphere in which conventional aerodynamically controlled aircraft can fly is very thin indeed. Few airliners can reach 40,000 ft—less than 8 mi above sea level. Yet this is a very deceptive number indeed, because *in terms of pressure, one-half of the earth's atmosphere is below 18,000 ft. Most of the earth's weather is also below 18,000 ft.* One-half the atmosphere, one-half the weather, nearly all the clouds you can see other than large thunderstorms—all that is less than 4 mi higher than sea level.

At elevations over 14,000 ft, the Rocky Mountains rise almost 3 mi above sea level. You reach halfway through the atmosphere only 1 mi higher. The atmosphere is a very thin shell around the earth, and high mountains poke almost halfway through it.

Any thought of flying in the mountains must be put in the context of altitude. This book has as its basic frame of reference the Rocky Mountains of Colorado, where no less than 52 mountains exceed



Cascade Mountains and the Pacific Coast range. Because of the nearby ocean, these are the rainiest and snowiest mountains in America.

14,000 ft in elevation. But elevation is a factor to varying degrees in all mountains. The Saint Elias Mountains in southeast Alaska rise to even higher elevations right out of the ocean. The less than 5000-ft elevations above sea level of all but a couple of the Appalachian Mountains in the eastern United States might seem trivial compared to the climb from over 5000 ft up to over 15,000 ft needed to clear the Front Range only 20 mi west of some Denver airports. Yet that mild rise in elevation compared to the substantially lower Mississippi valley to the west and Atlantic coastal plain to the east can and frequently does produce severe weather which exceeds the capability of small aircraft. Gently rounded Mount Washington in New Hampshire, scarcely 5200 ft high above a 3000-ft-high base, sees surface winds over 100 mi/h. Your aircraft may have far better performance flying the low Appalachians than the high Rockies, but you are still faced with at least as much mountain-induced weather, if not more. I direct the reader's attention to Ernest Gann's *Fate Is the Hunter* (see "Further reading" in Chapter 8) for descriptions of low visibility approaches and icing over the Appalachians.

A few peaks in the Sierras are quite high, but an altitude of 12,000 ft will see you over virtually all the rest—unless of course the very nearby Pacific Ocean has added moisture to the air. Then snowfall in places such as Donner Pass can be so rapid and so intense that people are stranded for months and forced to eat their dead. Just east of the Sierras in the Sierra wave, glider altitude world records are set on good days, and very large airliners are tested to the point of airframe damage on bad ones.

Within the mountains proper in Colorado, the lowest airports are still close to if not above 6000-ft elevation, with Telluride at 9078 ft, Leadville at 9927 ft, and a large group clustered just below 8000 ft. This last figure is determined by climate—8000 ft is the lowest elevation in Colorado where you find dependable snow cover all winter long, and therefore it is the base elevation for most ski areas. Sitting on the ground on the ramp at the airport in Telluride, Colorado, you are feeling and breathing air at less than 70 percent sea-level pressure. The altitudes required to safely cross the 52 peaks of the Rocky Mountains with altitudes over 14,000 ft in marginal weather will have you flying in air at less than 50 percent sea-level pressure. Your airplane and its engine depend on air. Here, with one-half the air, they will do only one-half as well.



The northern Appalachian Mountains. Mt. Washington in northern New Hampshire has recorded a record 265 mi/h wind.



The Sierras: The Owens valley east of Fresno and Mt. Whitney. See mountain wave reaching over 50,000 ft msl. Travelers at Donner Pass north of Lake Tahoe were trapped by heavy snow and ate their dead.



The central Rocky Mountains. Some 54 mountains in Colorado are over 14,000 ft high.

Altitude, in the context of flying and breathing, is not so much a factor of how many feet above sea level as it is a factor of air pressure. On a hot day or a humid day, the air is much thinner, so the effective altitude can be substantially higher. More on this later...

Both your body and your aircraft require air, and there is nowhere near as much of it available as you want in the mountains.

Some aircraft performance charts

Service ceiling is the altitude above which an aircraft cannot maintain a climb rate of 100 ft/min. For all practical purposes, this is about as high as you can fly. *Absolute ceiling* is a little higher but, from a practical standpoint, very difficult to actually maintain. Let us take a look at the service ceiling of some typical low-performance small aircraft:



This might be the perfect mountain small aircraft. It is no bigger than a Beech Bonanza, but with 1600 hp, the Spitfire has a climb rate well in excess of 2000 ft/min and can in fact pull up into a vertical climb from horizontal flight and gain better than 1000 ft before having to level off again. Endurance is only about an hour, luggage capacity is limited to the wing storage bays where the machine gun ammunition used to go, and this one is for sale for close to \$2 million—but you want one, don't you? TR Youngstron photo.