Planning and Flying Tips
for
High Density Altitude, Mountain Flying

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Planning: I try to plan conservatively to help me avoid getting into a situation, in flight, were I am trying to get the airplane to do something that is not within its capability. The problem is that performance data, often times, is not provided for the expected altitudes. Sometimes, only some basic sea level performance numbers are provided.

1. Service Ceiling minus 5,000 ft. = MSL altitude for planning

2. Density Altitude:

   Temperature difference from standard is the primary factor. When estimating, I don't usually account for non standard pressure. I just use MSL altitude.

   Numbers I find useful to remember:

MSL/P. A.	Std. Temp.
5,000	41 F / 5 C
7,500	32 F / 0 C
10,000	23 F / -5 C

   Add 60 ft. for every degree F above Std. Temp.
   Add 110 ft. for every degree C above Std. Temp.

   I find it useful to estimate Density Altitude for Takeoff, Landing and Enroute.

3. Takeoff and Climb Performance:

   If I have manufacturer or flight test data I use it. If not, I estimate:

   For every 5,000 ft. increase in density altitude above sea level:
   Takeoff distance doubles and Climb rate is cut in half.

4. Adjust for Decreased Weight:

   10% less than maximum gross weight results in:
   20% shorter takeoff
   20% greater climb rate

   20% less than maximum gross weight results in:
   35% shorter takeoff
   35% greater climb rate

5. Route Planning:

   Plan a route where terrain does not exceed Service Ceiling minus 5,000 ft.
   Plan more direct/higher routes that can be used based on actual inflight performance.
   Plan to use runways that are at least twice as long as estimated takeoff distance.
   Plan to use airports where climb is expected to be at least 200 fpm after take off.
   Plan fuel and route so diversion to a desirable airport is always possible with reserve.

Flying: I try to always have an "out", from takeoff to landing. After takeoff, I start monitoring actual performance vs. the performance I planned on. Then I adjust my plan as justified or required by actual performance and conditions.

1. Climbing:

   After takeoff I transition to cruise climb speed of Vy to Vy + 30% IAS.

   Vy decreases with altitude, Vx increases with altitude, they meet at the maximum altitude the airplane is going to climb to. (All these speeds decrease with decreased weight, but not very much). I let IAS decrease gradually with altitude to maintain a climb (constant TAS climb works well in many airplanes). When the IAS is between Vx and Vy and the climb stops the airplane is as high as it is going to go without help in the form of up drafts.

2. Enroute:

   I start out on the primary planned route.

   If I find that I can climb above S. C. - 5,000 ft. I consider more direct/higher routes as altitude and weather allow. I always want to have a plan (route and fuel) to return to the primary route without having to climb. Airports planned for possible diversion or a fuel stop may need to change when the route is changed.

   If I cannot climb to S. C. - 5,000 ft. it is probably a good idea to go back and make a different plan, wait for more favorable conditions or use a different airplane.

3. Fly where updrafts are more likely to be found than down drafts:

   I try to maintain awareness of the wind direction (winds aloft fcst., drift, GS vs. TAS, clouds) and then fly on the up wind side of ridges and mountains. If the wind is calm, fly on the sunny side of ridges and mountains.

   I try not to get locked into programmed GPS course lines. They don't take into account where up and down drafts might be.

   The FAA's Glider Flying Handbook, chapters 9 and 10, gives great insight into how to find updrafts.

4. Avoid flying into terrain constrained situations:

   I always want to have a plan to get to lower terrain in the event that a down draft shows up and forces the airplane to loose altitude rapidly.

   I prefer down hill takeoffs toward lower terrain to up hill takeoffs into higher terrain.

   I avoid flying below canyon walls going up hill unless I am planning to land. If I am planning to land at an airport in a canyon I want to consider go around options, or the lack of them.

5. Descent:

   I always expect turbulence when descending on the down wind side of ridges and mountains.

   I want to know Va and stay well below it unless I know there is no turbulence.

Sonex
Performance Expectations
80 hp

Data from Sonex Aircraft:
Max. Weight 1100 lbs., S. L. takeoff run 400 ft., S. L. climb 800 fpm, Service Ceiling 16,000 ft.

Density Altitude ft.	Takeoff ft.	Climb fpm
1100 lb. gross weight:		
S. L.	400	800
5,000	800	400
10,000	1,600	200
15,000	3,200	100
990 lb. gross weight:		
S. L.	320	960
5,000	640	480
10,000	1,280	240
15,000	2,560	120
880 lb. gross weight:		
S. L.	260	1080
5,000	520	540
10,000	1040	270
15,000	2080	135