Mountain Flying Qualification Course

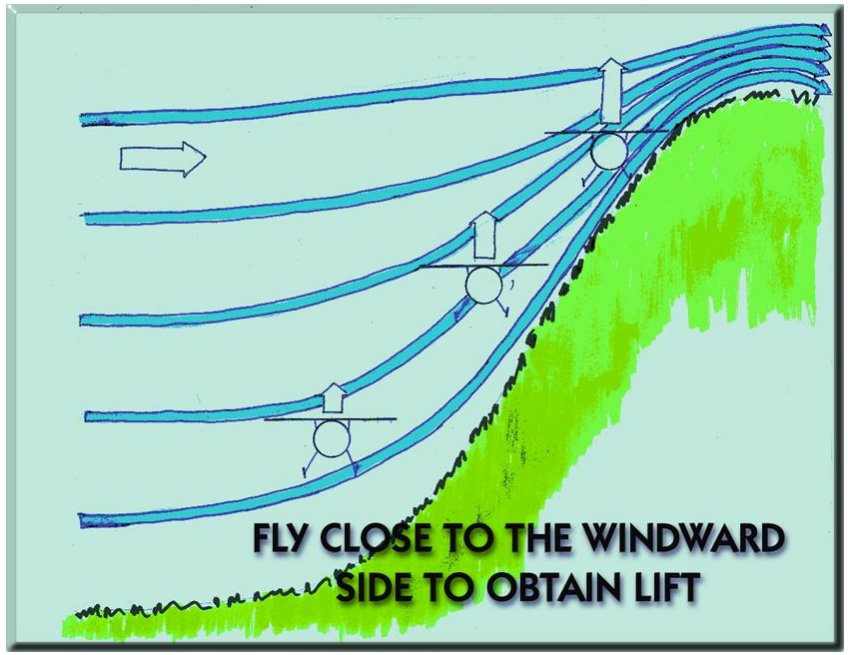
Civil Air Patrol

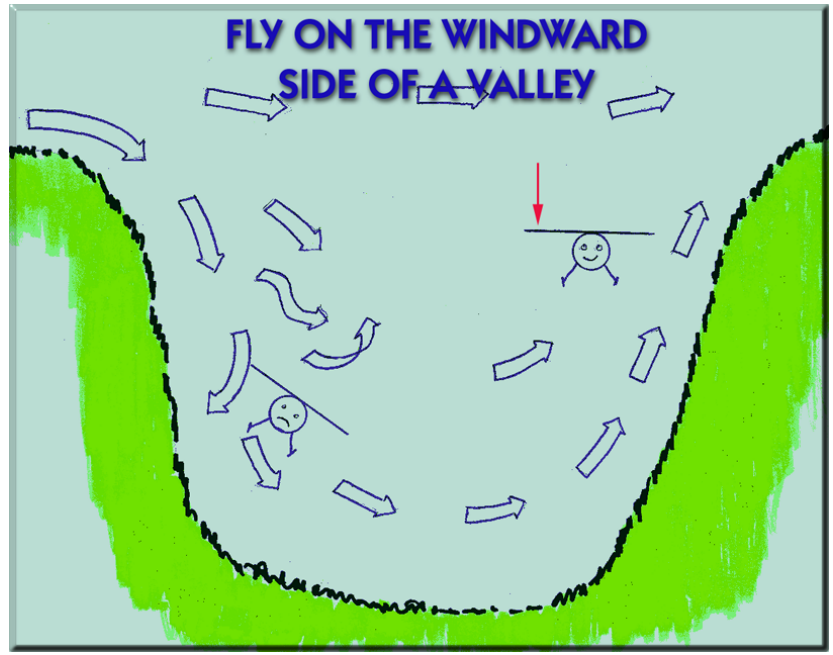
Auxiliary of the United States Air Force

Mountain Flying

Flying in Mountain Winds

- Determine direction and velocity of steady winds by observing dust, smoke, tree leaves, or aircraft drift.
- Smoother and easier flying along windward slopes
- Use caution along leeward slopes until tested. Watch for downdrafts and turbulence, especially below passes.
- Always be in a position to turn toward lower terrain.
- Constantly monitor airspeed and vertical velocity.
- Slow to aircraft's maneuvering speed in turbulence.





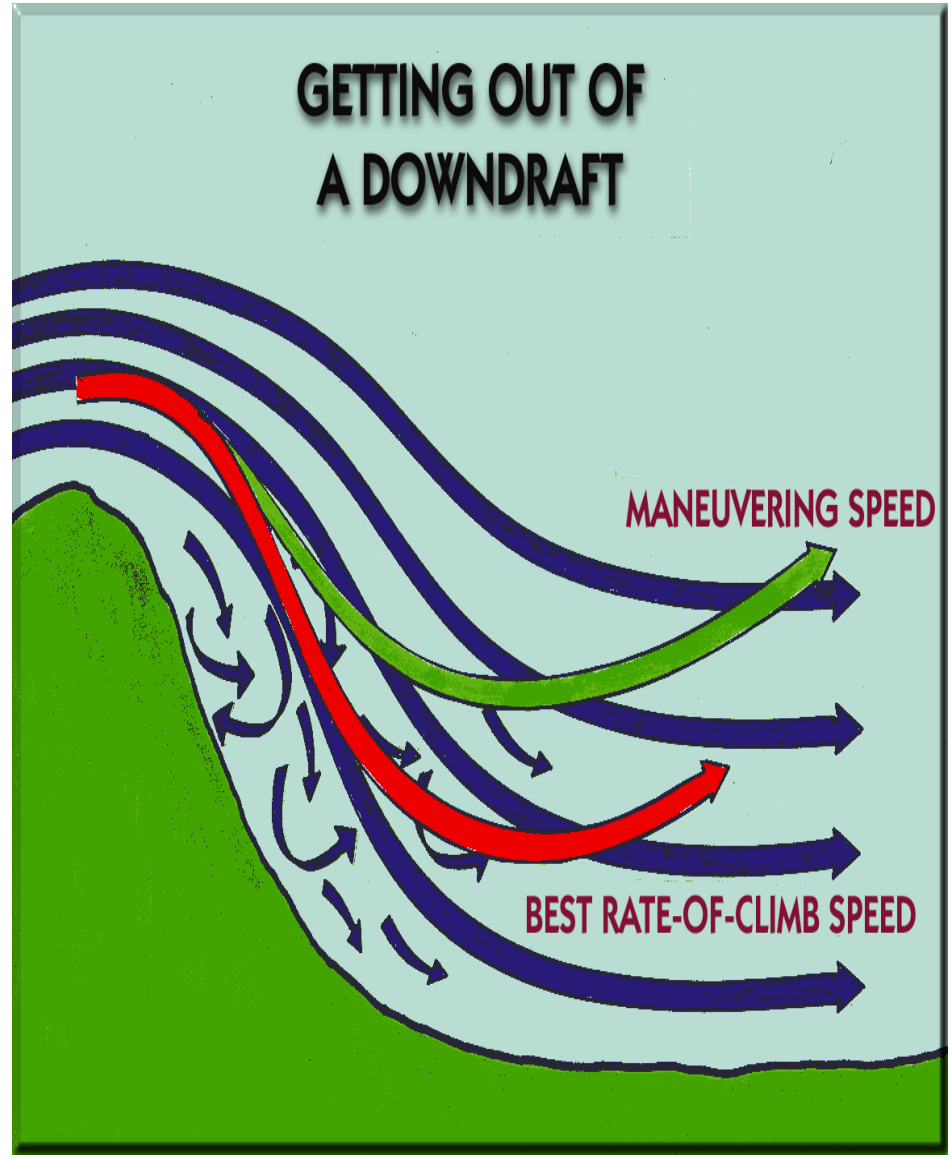
Exiting Downdrafts

In a strong or sustained downdraft:

- Turn towards lower terrain
- Apply maximum power (throttle + propeller pitch)
- Attain and maintain Best Rate–of-Climb Speed
- Fly out of downdraft area (downwind usually best)

If descending faster then your calculated rate of climb:

- Increase airspeed to rapidly fly out of downdraft area
- Use cruise speed or, if in turbulence, use Maneuvering Speed
- Accept temporary increase in rate of descent



Crossing Ridges

When approaching ridge from windward side:

- Fly directly toward ridge
- If caught in downdraft while crossing ridge, this course will be most direct path away from ridgeline

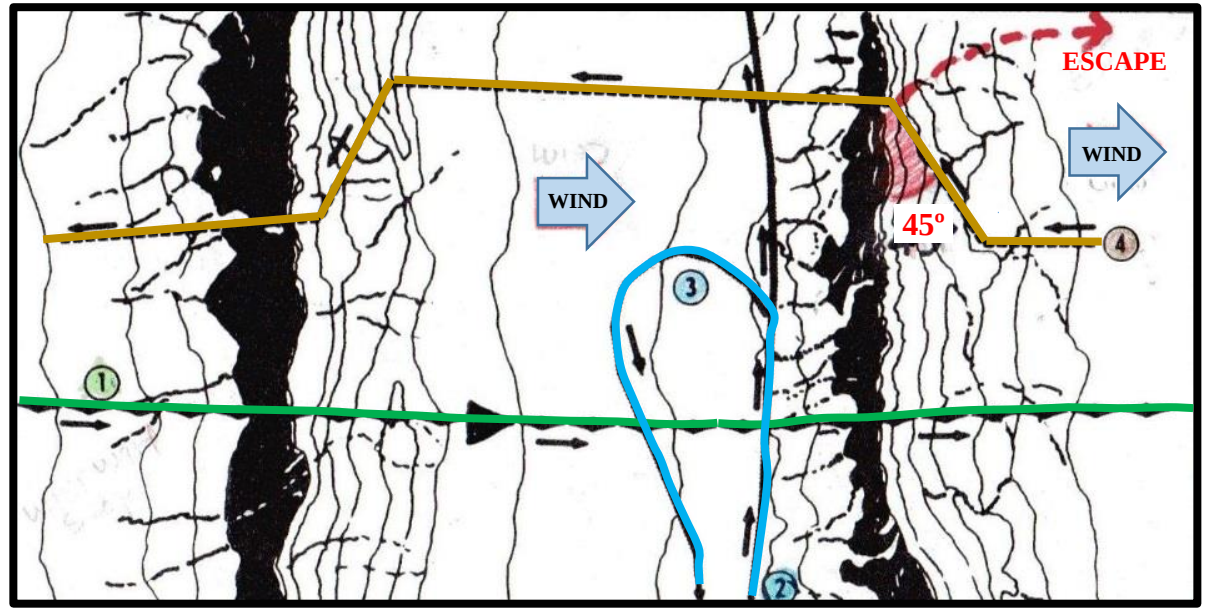
When approaching ridge from leeward side

- Achieve desired altitude well before reaching ridge
- Approach at 45° angle to allow shortest turn away if caught in downdraft

Determining relative height

- If you see more terrain on other side of ridge as you approach, your altitude is greater than that of ridgeline

Crossing Ridges



1. Fly downwind direction. There is a buoyant on the windward side which carries the aircraft up and over the ridge. On the leeward side, in the downdraft area, the route is away from the ridge towards lowering terrain.

2. When flying up or down a valley, stay on the windward side with updraft and less turbulent air. The other side of the valley (lee side of the ridge) is a downdraft area with possible turbulence.

3. If weather or turbulence necessitates a 180° turn, a short, upwind, climbing turn is best.

4. Do not fly directly toward the leeward side of a ridge. The aircraft will encounter a downdraft and, without sufficient altitude, may be forced into the mountain. Approach the ridgeline at a 45° angle. If turbulence or downdrafts become dangerous, a 90° turn exits the ridgeline towards lowering terrain. A head-on approach requires a 180° turn, and there may not be enough time to execute the turn.

Canyon Flying

- Never fly up a canyon if there is insufficient lateral width to comfortably turn around
- Never fly beyond the “point of no return”
- Always remain in a position to allow a turn toward lowering terrain
- Fly along one side of the canyon (usually the upwind side) to provide the full canyon width to turn around
- Always know your location; side canyons can look like your desired route but can lead to disaster

Course Reversal Maneuver

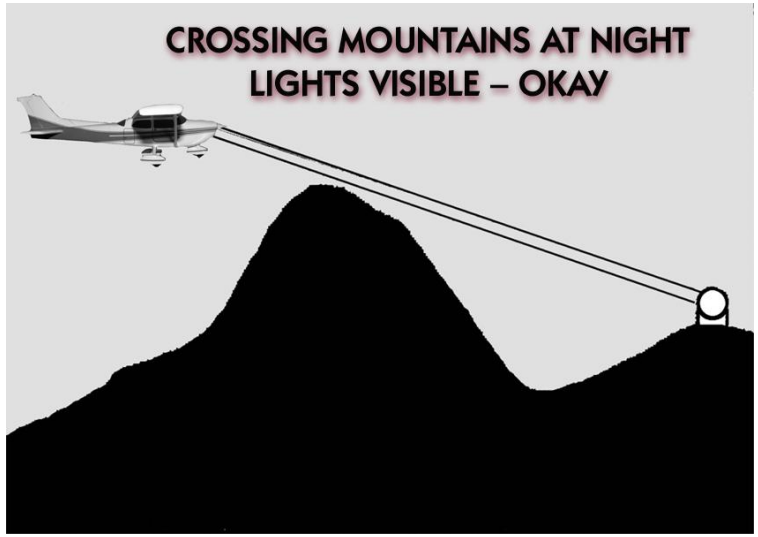
- May be required in rapidly-rising terrain or rapidly-narrowing canyon
- Pull up to gain altitude and achieve best cornering velocity
- Deploy 10-20° flaps to increase lift
- Rapidly achieve 60° bank and pull to achieve tightest turn radius while maintaining adequate stall margin
- If vertical terrain clearance permits, accept altitude loss during turn to maintain “g” loading and safe airspeed

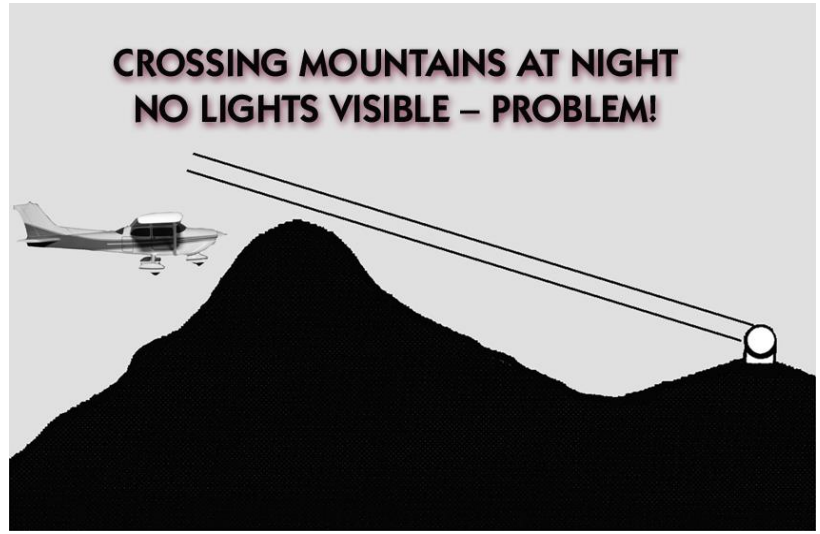
Sensory Illusions

- False Horizon
  - Perhaps the greatest cause of mountain mishaps
  - Experienced when flying toward gradually-rising terrain
  - Actual horizon is well below perceived horizon
  - Airspeed decays during unperceived slow climb
- High Terrain Hidden in Shadow
  - Lighting from behind distant high terrain hides closer hill
- Indicated Versus True Airspeed
  - Perceived airspeed margin due to high groundspeed

Night Flying

- ❑ High terrain can “sneak up” on you at night
- ❑ Maintain positional awareness at all times
- ❑ Terrain clearance must be constantly monitored
  - o Optical information is often insufficient
  - o Utilize charts, radar services, local knowledge
- ❑ Decreasing lights ahead indicates higher ridgeline
- ❑ Isolated lights can produce vertigo
- ❑ Follow lighted roads
  - o Usually runs through lowest terrain (beware of tunnels!)
  - o Useful in the event of power loss





Night Flying

Follow a road or lighted area when flying over rugged terrain during the night

Mountain Airport Operations

- Often confined spaces and sloped runways
- Plan your pattern to accommodate local conditions
- Traffic patterns usually on side away from terrain
- Thoroughly research local procedures
- Runway surface may be questionable
- Expect unpredictable air currents at low altitudes
- Beware of downdrafts immediately after liftoff
- Conduct circling climb above airport before heading directly toward high terrain

- Airport on top of a hill
- Land upslope to the north
- A portion of the runway fell down the cliff resulting in a displaced threshold

- Airport built on the side of a mountain
- Shear drop offs at both ends
- Avoid strips like this on windy days

Mountain Airport Operations

- When departing a mountain airport with high density altitude, use an anticipated minimum climb rate of 300 fpm as a Go/No Go decision.
- To reduce take-off distance and increase rate of climb, the recommended method is to off-load fuel, baggage or passengers.
- When landing at a mountain airport you should assess the terrain conditions, widen your pattern to compensate for higher true airspeed, and plan for a go-around.
- Before take-off, the mixture should be leaned according to the manufacture’s recommendation based on the airport’s reported density altitude.
- A 10% increase in takeoff gross weight causes a 5% increase in the speed necessary for takeoff, at least a 9% decrease in acceleration, and at least a 21% increase in takeoff distance.
- Landing speed (ground speed) will be higher at airports with higher elevations and/or high density altitude.
- Braking action can be improved by raising the flaps after touchdown.
- A soft runway surface during high density altitude operations may require up to 10% more runway for takeoff.
- When landing and taking off from a high altitude airport, the aircraft should be flown at the same indicated airspeed as used at sea level.

Mountain Airport Operations

Uphill versus Downhill Takeoff

- Use this formula when deciding whether to takeoff downhill with a tailwind or uphill with a headwind.
- Uphill Takeoff: Actual headwind component is greater than the calculated "Breakeven Headwind."
- Downhill Takeoff: Actual headwind component is less than the calculated "Breakeven Headwind."

$$\text{Breakeven Headwind} = \frac{\text{Runway Slope} \times \text{No-Wind Take Off Distance}}{5 \times \text{Liftoff Speed in KTAS}}$$

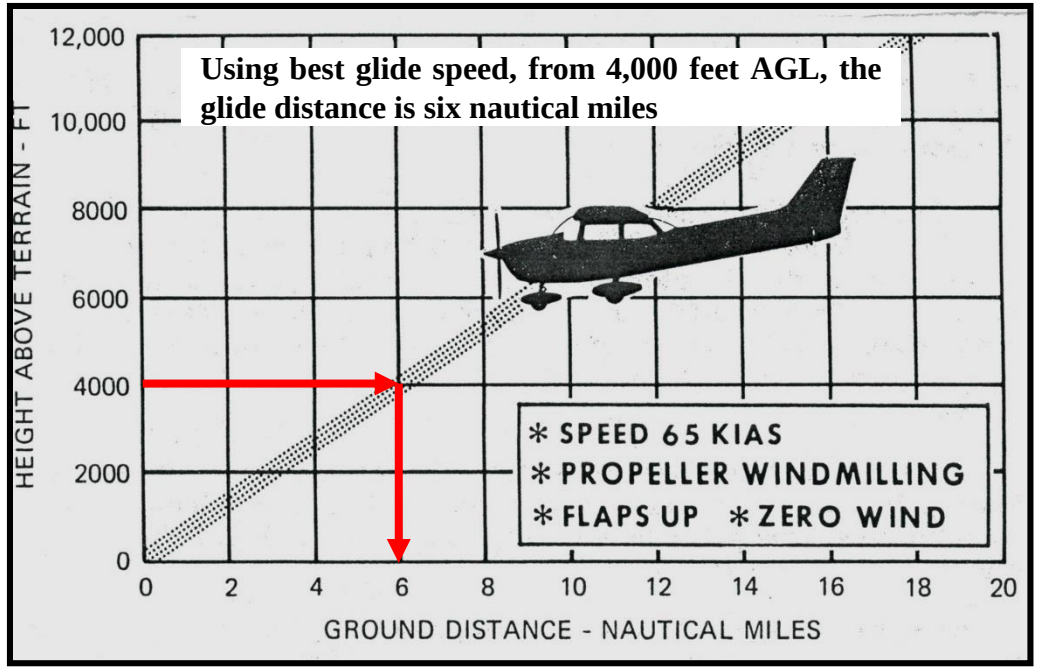
Runway Slope = 4º
No-Wind Take Off Distance = 1,500 feet
Liftoff Speed = 70 knots TAS
Actual headwind component = 18 knots

$$\text{Breakeven Headwind} = \frac{4 \times 1{,}500}{5 \times 70} = 17 \text{ knots}$$

Actual headwind component > Breakeven Headwind
Select an uphill takeoff

Mountain Flying Safety

- Always exercise good judgement and caution.
- Always maintain positional awareness.
- Know your aircraft performance capabilities including engine out glide distance.
- Do not exceed your aircraft performance capabilities.
- Watch for power lines and their support structures.
- Determine the best emergency notification frequency.
  - May not be 121.5
  - Consider remote antenna locations, ARTCC frequencies.
- Always have a downward path toward lower terrain.
- And <u>always</u> WATCH YOUR AIRSPEED!



Mountain Flying Safety

- The best route that can be chosen when flying cross country in the mountains will follow roads, rivers and valleys.
- When choosing an aeronautical chart to use when flying in the mountains, your best choice would be Sectional Chart.
- A common mistake for pilots new to flying in the mountains is using the mountain top as the horizon reference.
- Recommended types of navigation in mountainous terrain: Pilotage & Dead Reckoning.
- The recommended enroute altitude is at least 1000 feet above the highest elevation and within a three mile radius of the line of flight.
- For best visibility in mountain flying under cloudy conditions, divide the distance from the surface to the cloud base into thirds and fly in the lower third.
- Be alert to temperature and dewpoint spread. If the trend is closure, fog can occur. Be prepared to land when the difference is less than five degrees Fahrenheit.


UNITED STATES AIR FORCE AUXILIARY
CIVIL AIR PATROL
END