Private Pilot Glider Ground School

Cross Country, Thermal, Wave, Ridge Soaring

Version: February 4, 2018

All figures are from FAA Handbooks unless otherwise stated.

In Aviation, we Start out without any Experience, and a lot of Luck. We Hope we Gain Experience before we run out of luck

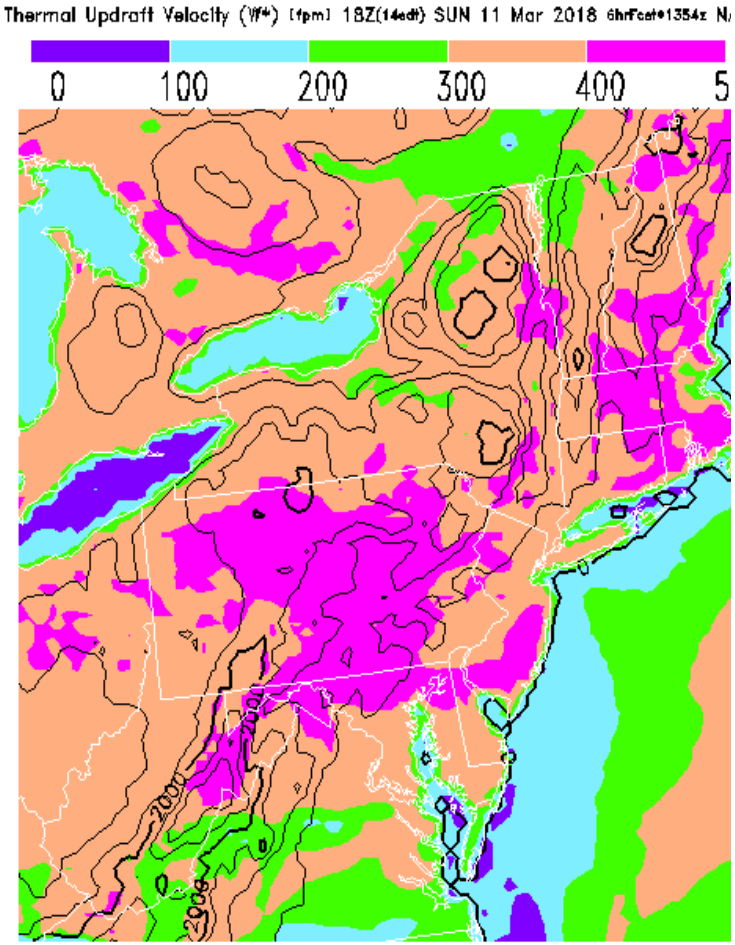
Cross Country Planning
Some Key Points

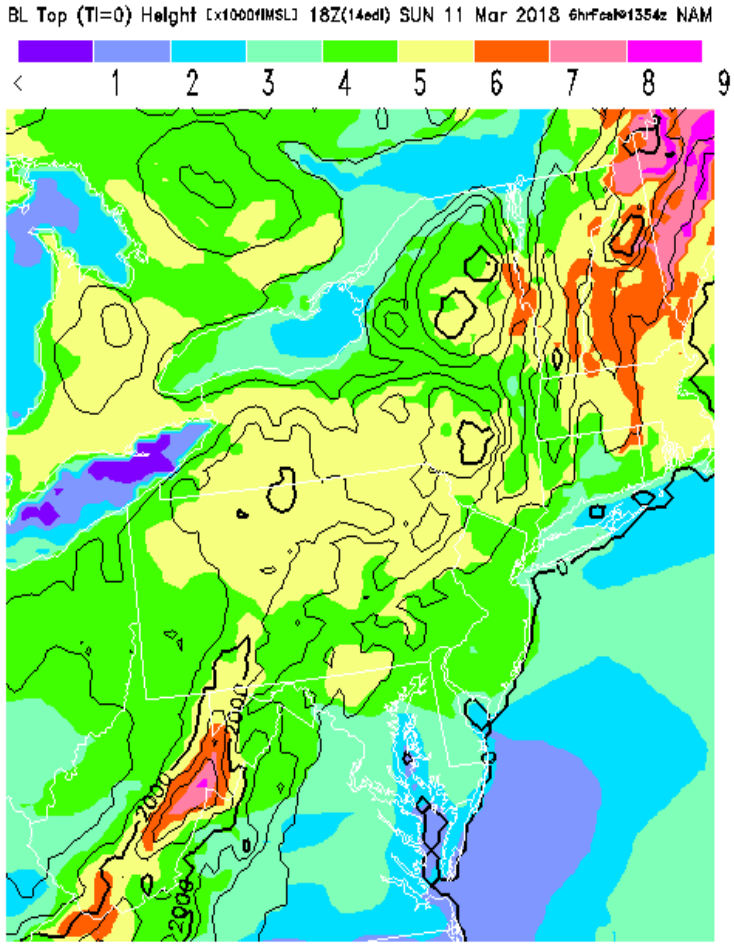
- Adequate Supply of Drinking Water
- Food
- Relief System
- Kit to Secure Glider
- Hat, sunblock
- Recent Flight Experience
- Number for the SFO of the Day. Cell Phone Numbers for all Available Tow pilots
- Trailer for the Glider you are Flying is in Good working Order
- Retrieve Vehicle, Keys in it and is it gassed up
- Who will you call in the Event of a off Field Landing??
- If you land out, Don't worry, someone will come for you always

Preflight: Weather and route planning

- Blipmaps: Blips maps are free, just have to register, other sites like XC Skys and Sky Sight, https://skysight.io the last 2 are paid subsciptions
- Determine predicted thermal strength, height of critical updraft strength, cloud base, winds, wind shear, potential for over development, thunderstorm
- Select optimum route for predicted weather, plus topography, cloud streets, emergency landing areas/airports.
- Weather briefings: Weather Channel, ADDS, soundings, FAA FSS, Blipmaps, 1-800-WXbrief
- Are there any NOTAMS For your intended route
- The bigger the flight, the better the weather to be over a larger area

Preflight: Weather and route planning





Local flight and XC Training

- Try to Always have a Objective or Goal when you go up
- Weather you are practicing maneuvers for a upcoming test, or thermalling, leaving that thermal and finding another one
- Get to know the performance characteristic of your sailplane
- Practice precision patterns and landings on every flight
- Perform patterns without reference to altimeter
- Complete flare for minimum touch down speed
- Evaluate fields both when flying and driving

Local flight and XC Training

Plan your flight path as far as you can see

Field landing should be practiced, at Sterling use the cross wind strip, try it from both directions

After your done flying Critique you flight

What would you have done differently?

Lastly, get high, stay high and don't get low. Quote from Roy B

XC flight technique What path to follow

- Identify signs of thermal streets, [clouds]
- Establish relationship of optimum lift to clouds, sunny side, upwind?

  Stay upwind of course line
- Follow cloud streets even if 30^{o} off track [<15% longer distance]
- On blue days use gentle zig-zag on course to find blue thermals
- If long region of sink, turn 90^{o} to avoid sink street. Do not make 180
- Look at the cloud shadows on the ground, is there sun coming thru to the ground, day becoming over developed? Lining up with the streets in the sky?
- Resist the temptation to turn back

XC flight technique What path to follow

- Watch conditions while circling and plan ahead. Use cloud shadows to estimate distance to clouds.
- Glide ratio roughly 5nm/1000'
- Identify prime areas of lift, baked bare ground, high ground, sun orientation, ridges
- Avoid areas likely to have sink, e.g. downwind of lakes or irrigated areas.
- Watch for soaring birds, sailplanes, fires.
- Keep track of wind from thermal drift, smoke
- Constantly monitor and stay within range of landable terrain

Tips on Thermaling

- Always turn towards rising wing
- When encountering a thermal low, do not hesitate to turn immediately
- Immediately bank steeply to minimum 35^{o} when entering thermal
- If wrong direction straighten out momentarily after 270^{o}
- Do not change direction of turn
- Do not over-control, always use minimal smooth control movements
- When lift increasing reduce bank to move circle in that direction
- Tighten the turn on a surge and vice versa
- Concentrate and never be satisfied
- When low then steeper turns are needed and are safer
- If low stay with what you have. Safe speed. Turn off the radio

Cross-Country Techniques

The number one rule of safe cross-country soaring is always stay within glide range of a suitable landing area . The alternate landing area may be airport, or a farmer's field. If thermaling is required just to make it to a suitable landing area, safe cross country procedures are not being practiced. . Sailplane pilots should always plan for high sink rates between thermals as there are always areas of sink around a lifting thermal to fill in the void vacated by the lifting air.

Determining Effective L/D

Glider specifications

Glide ratio (L/D) = 30:1
Speed (GRA) = 50 knots

$$\left(\frac{\text{GRA} \pm \text{Wind}}{\text{GRA}}\right) \times \text{L/D} = \text{Effective L/D}$$

Tailwind component	Headwind component
Wind = +10 knots 50 + 10 = 60 60/50 = 1.2 1.2 x 30 = 36	Wind = −10 knots 50 − 10 = 40 40/50 = 0.8 0.8 x 30 = 24
Effective glide ratio (L/D) is 36:1	Effective glide ratio (L/D) is 24:1

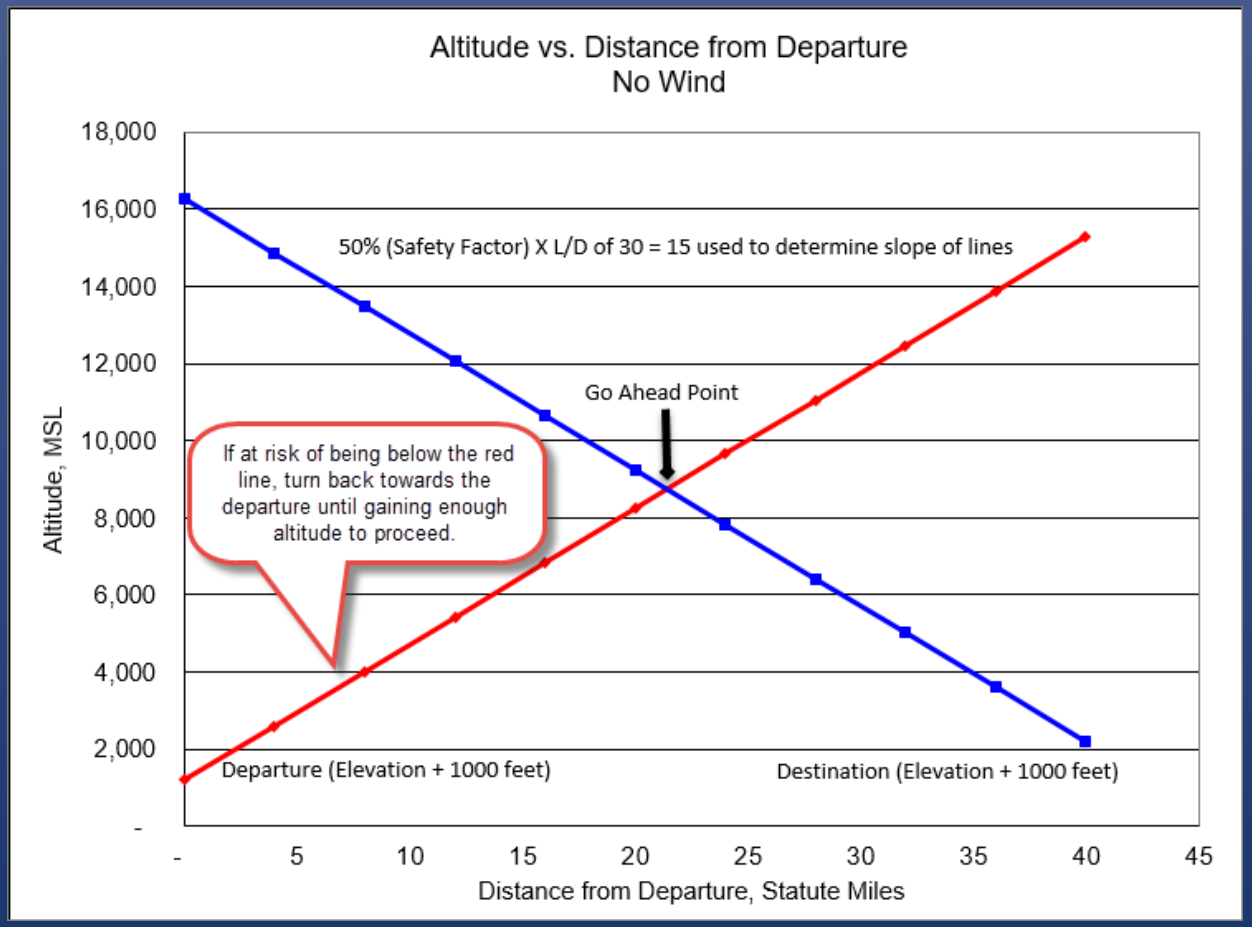
Glide Ratio to Use for Cross Country

- As I said earlier, if you use 5NM per 1000 ft of altitude this should be good for all the club ships except for the 1-26- and the 2-33.
- Depending on the day, how windy it may be, you may adjust it , say when you have a tail wind you will get 6 miles per 1000 ft with a head wind it may 4 miles per 1000ft

Beginner (use a 50% safety factor)

- Take Glider's Glide Ratio with Respect to the Air and divide by 2.
- Add 1,000 feet for pattern altitude
- Add field elevation to convert to MSL

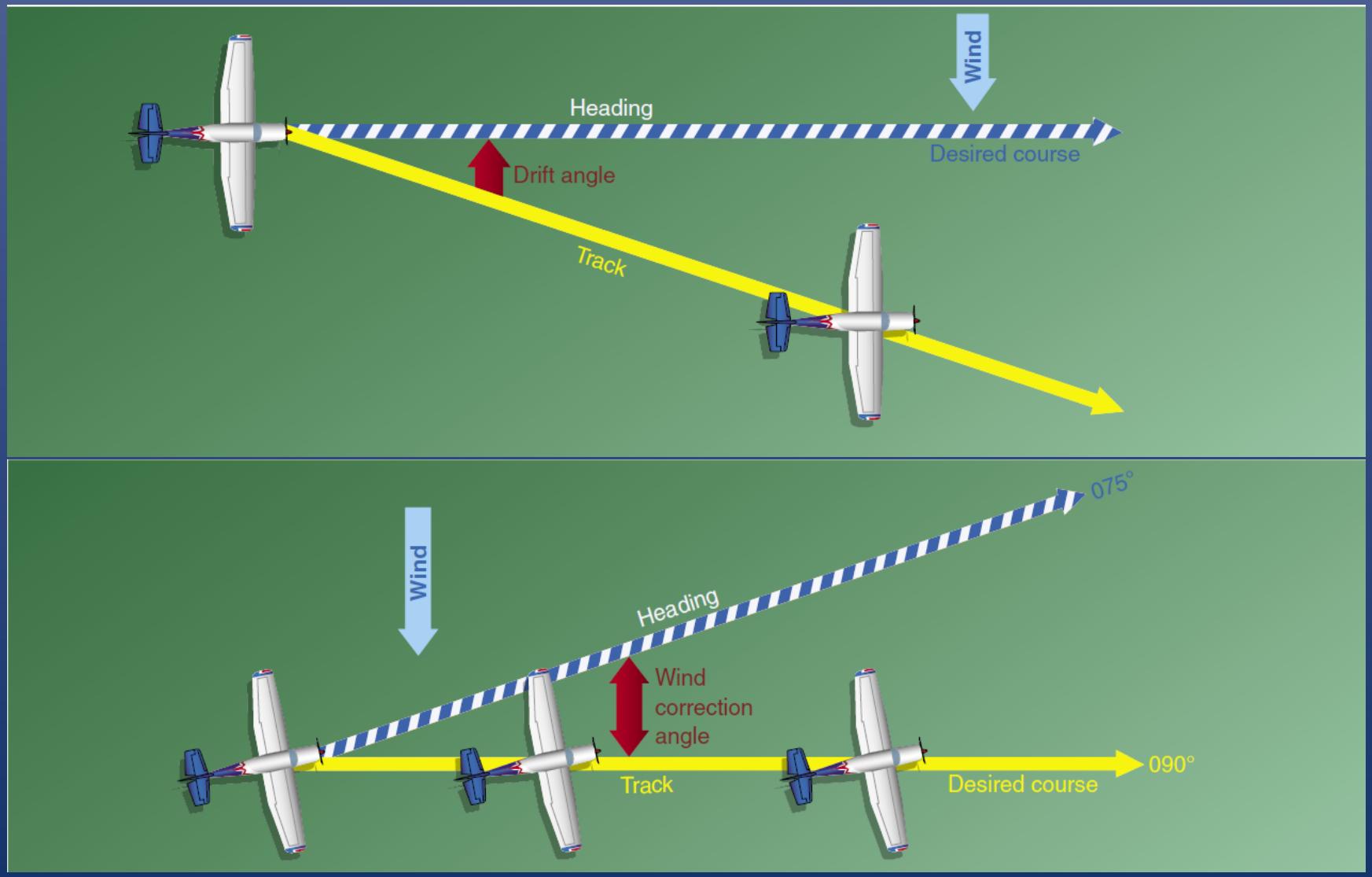
Cross Country Flight Profile Example



Correcting for Wind for Enroute Flight

- In order to fly along a pre-determined course line, the strength and direction of the wind must be considered.
    - Forecast Winds Aloft information is utilized (along with the Glider's TAS) to determine how the Wind affects Ground Speed and the Wind Correction Angle required to maintain a straight ground track.

Effect of Wind Drift on Track



Soaring Techniques

- Techniques for Flying in Thermal, Ridges, and Wave
  - Only briefly discussed here. There are many variations of approaches. Need to determine which ones work best for you.
  - Refer to the many excellent reference sources on this topic along with advice from the CFIGs.

Cumulus clouds
If the air is moist enough and thermals
Rise high enough, cumulus clouds or Cu's
Form. Glider pilots seek Cu's in the developing
Stage, while the cloud is still being built by the
Thermal underneath it. The base of the Cu should
be sharp and well defined. Clouds that are fuzzy
in appearance are likely to be well past there prime

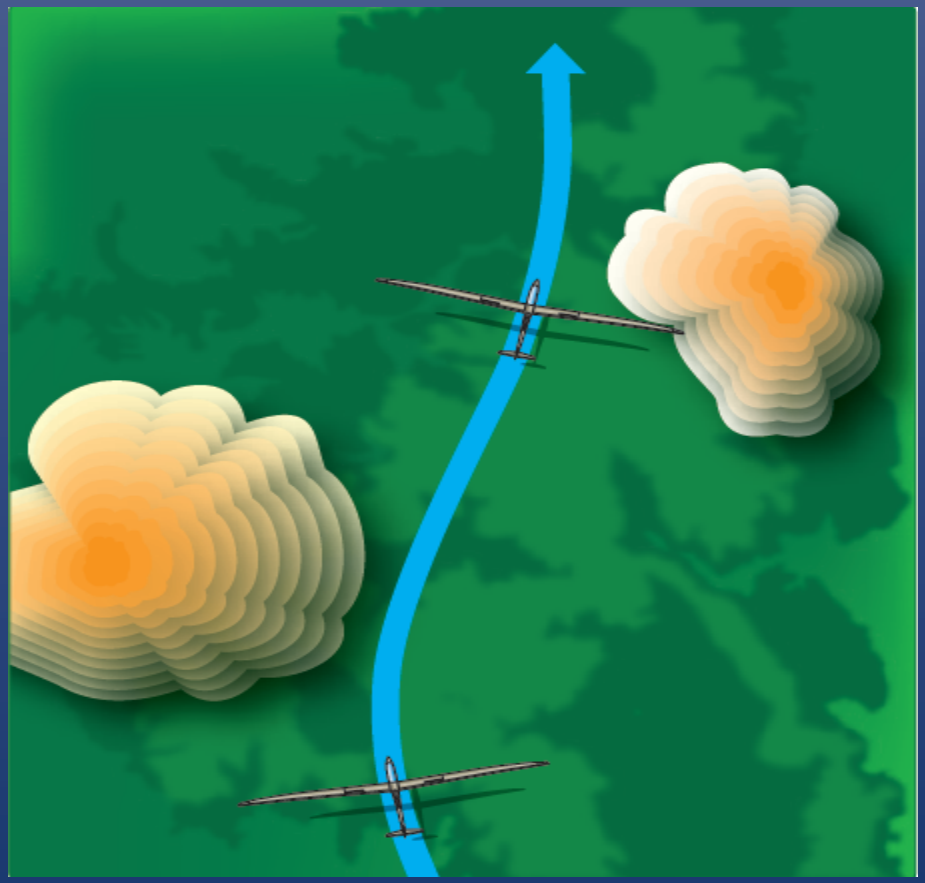
Once a thermal has been located, enter it so you do not lose it right away. The first indicator of a thermal is often is the sink will be increasing,

next a positive G force is felt, which may subtle or obvious, depending on the thermal strength. The seat-of-the-pants indication of lift is the quickest, and far faster than any variometer which usually lags behind from what you can feel.

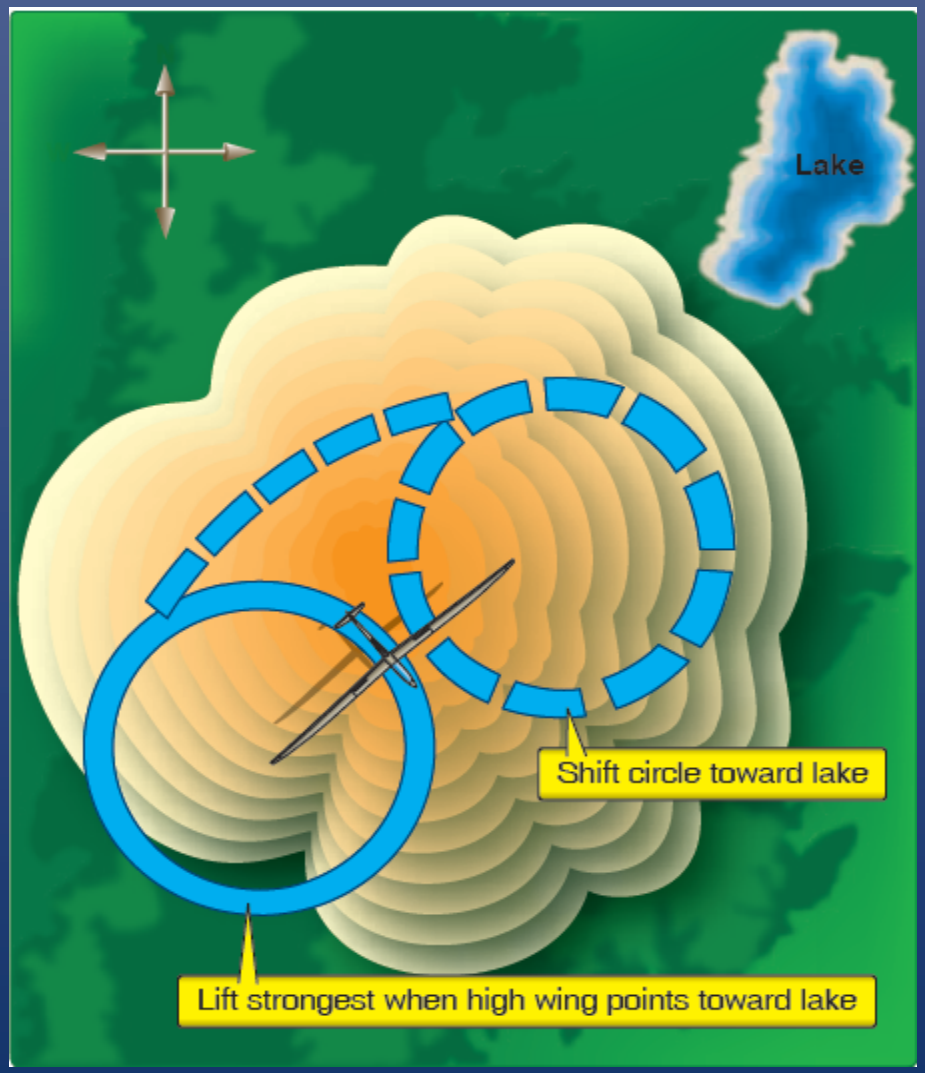
Speed should have been increased in the sink adjacent to the thermal, as The positive G forces increase, reduce speed to between L/D and minimum Sink.

At the right time in the anticipated lift, begin the turn, if everything has gone perfectly, the glider you will be climbing in the lift

Effect of Glider Banking on its Own



Shifting the Circle towards the Stronger Lift



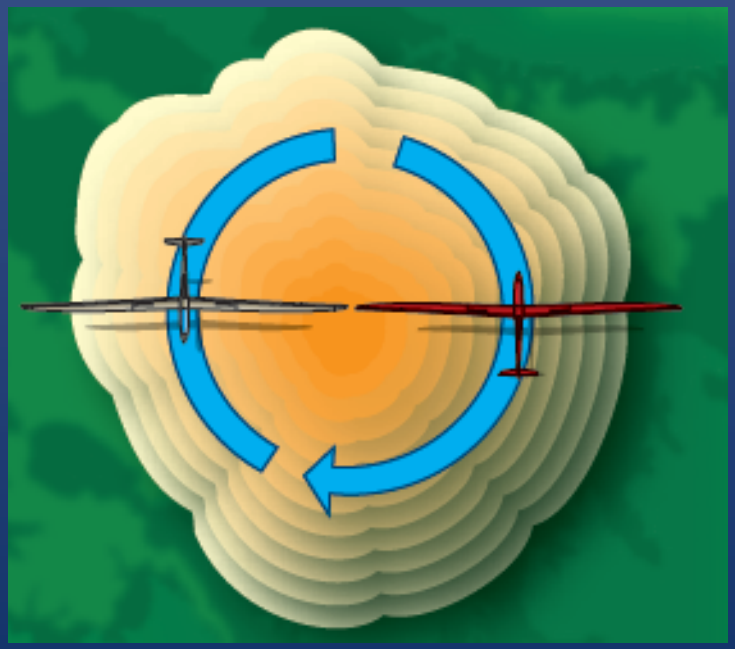
Flying with Other Gliders in a Thermal

- First Glider to Enter a Thermal establishes the direction of Turns in a Thermal.

- Best to Enter at 180° opposite another Glider.

Keep track of the other gliders in the thermal.

When your in a gliders blind spot always make sure you let them know with a radio call



Ridge Soaring

Ridge Flying Rules

- Speed – Extra airspeed for turbulence
- Turns – Always away from ridge , Again Always make turns away from the ridge
- Overtaking – On outside
- Safety – Always have a field picked
- Always have a escape route planned
- Use figure eights when working a thermal when low on a ridge
- When ridge flying, you are always a minute or less from landing

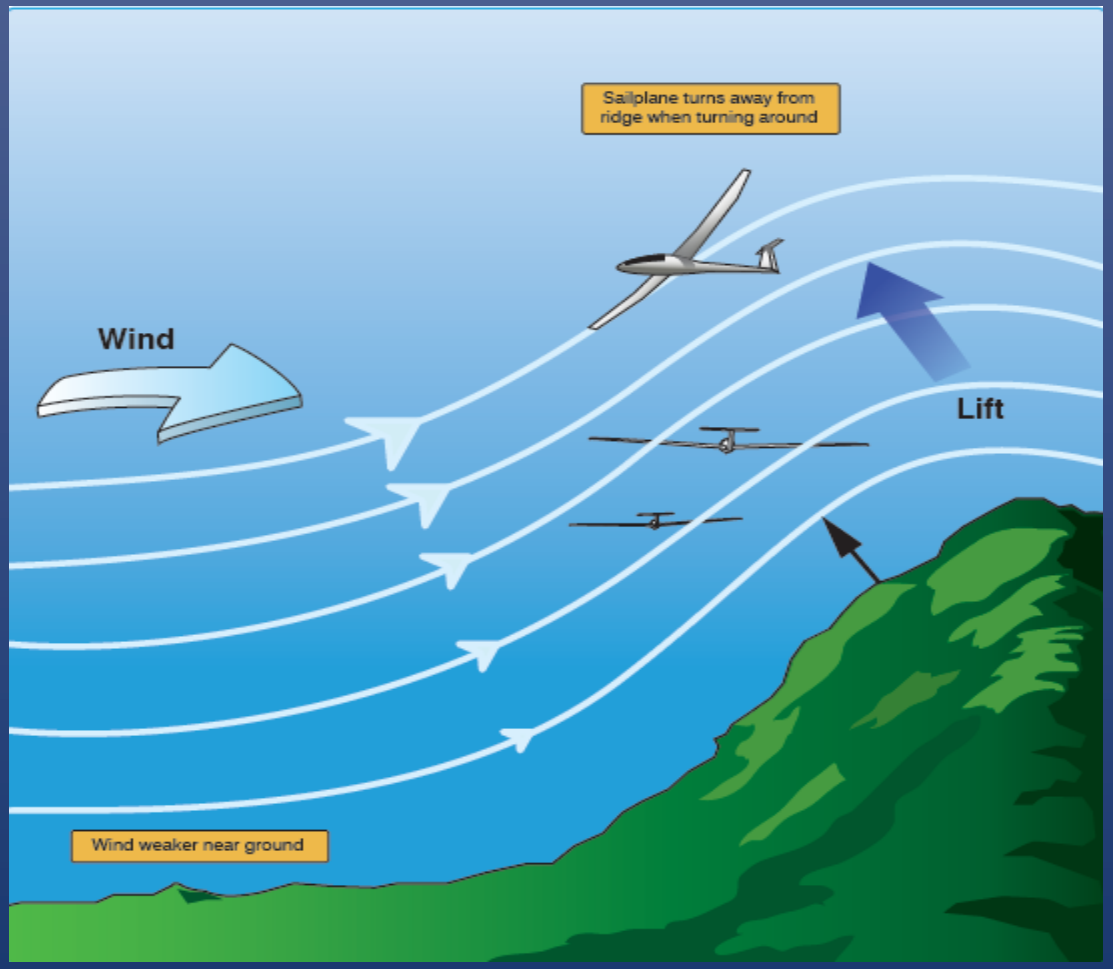
  Don’t work ridge much below top

  Get training

Slope (aka Ridge) Lift

Slope lift can extend to a maximum of two or three times the ridge height. However, the pilot may be able to climb only to ridge height. As a general rule, the higher the ridge above the adjacent valley, the higher the glider pilot can climb. Ridges only 100 or 200 feet high can produce slope lift. The problem with very low ridges is maintaining safe maneuvering altitude, as well as sufficient altitude to land safely in the adjacent valley. Practically speaking, 500 to 1,000 feet above the adjacent valley is a minimum ridge height.

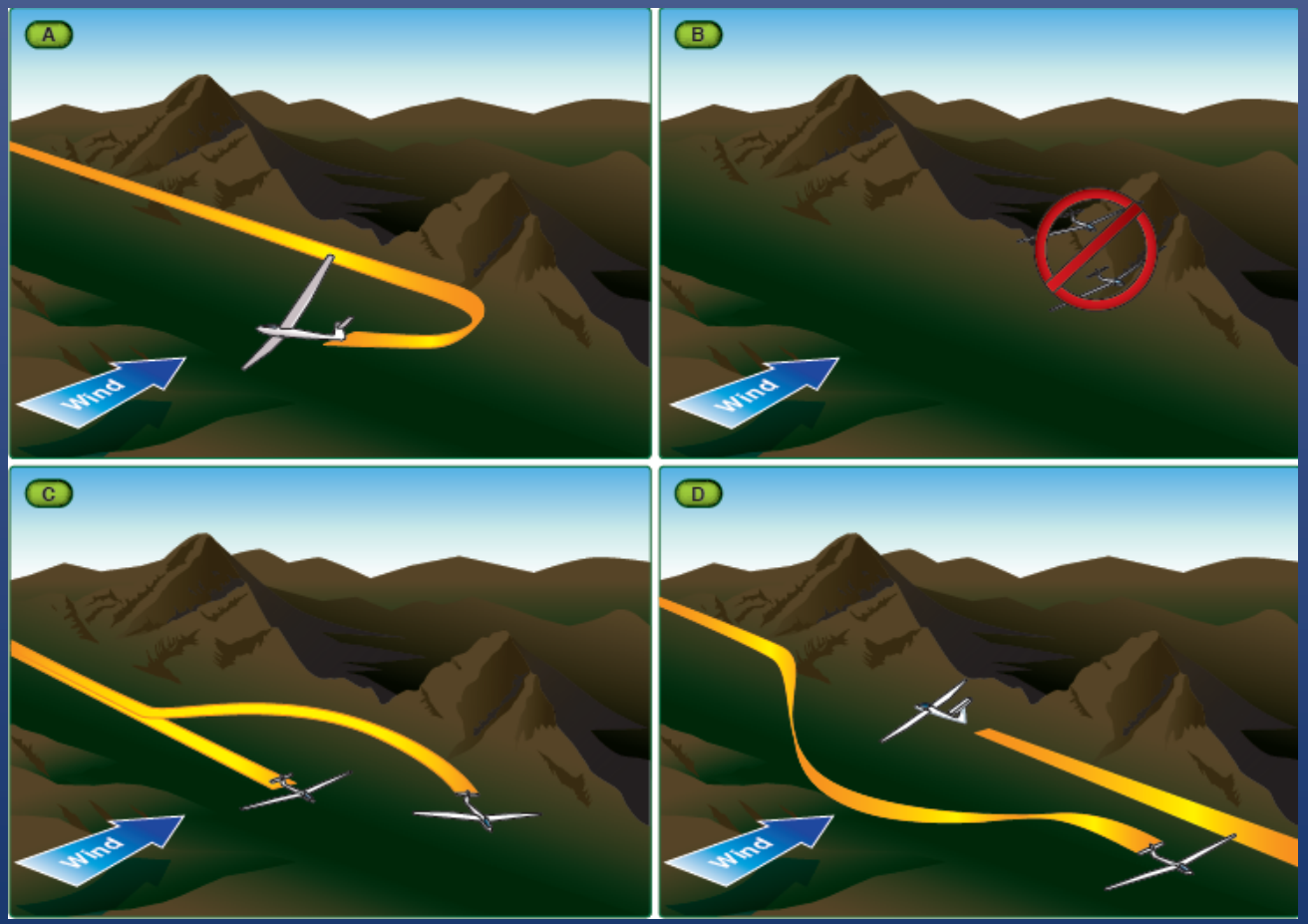
Ridge Soaring



Ridge Flying Collision Avoidance

The glider with its right side to the ridge has the right of way. *[Figure 10-22D]* Title 14 of the Code of Federal Regulations (14 CFR) requires both aircraft approaching head-on to give way to the right. A glider with the ridge to the right may not have room to move in that direction. The glider with its left side to the ridge should give way. Additionally, when overtaking a slower glider along the ridge, always pass on the ridge side. If the overtaking glider encounters sink, turbulence, etc., it must maneuver away from the ridge. This is acceptable. When piloting the glider with its right side to the ridge, ensure the approaching glider sees you and is yielding in plenty of time. In general, gliders approaching head-on are difficult to see; therefore, extra vigilance is needed to avoid collisions while slope soaring. The use of a radio during ridge soaring is recommended. Pilots must be familiar with 14 CFR part 91, section 91.113, Right-of-way rules: Except water operations, and section 91.111, Operating near other aircraft.

Ridge Rules



Mountain Wave

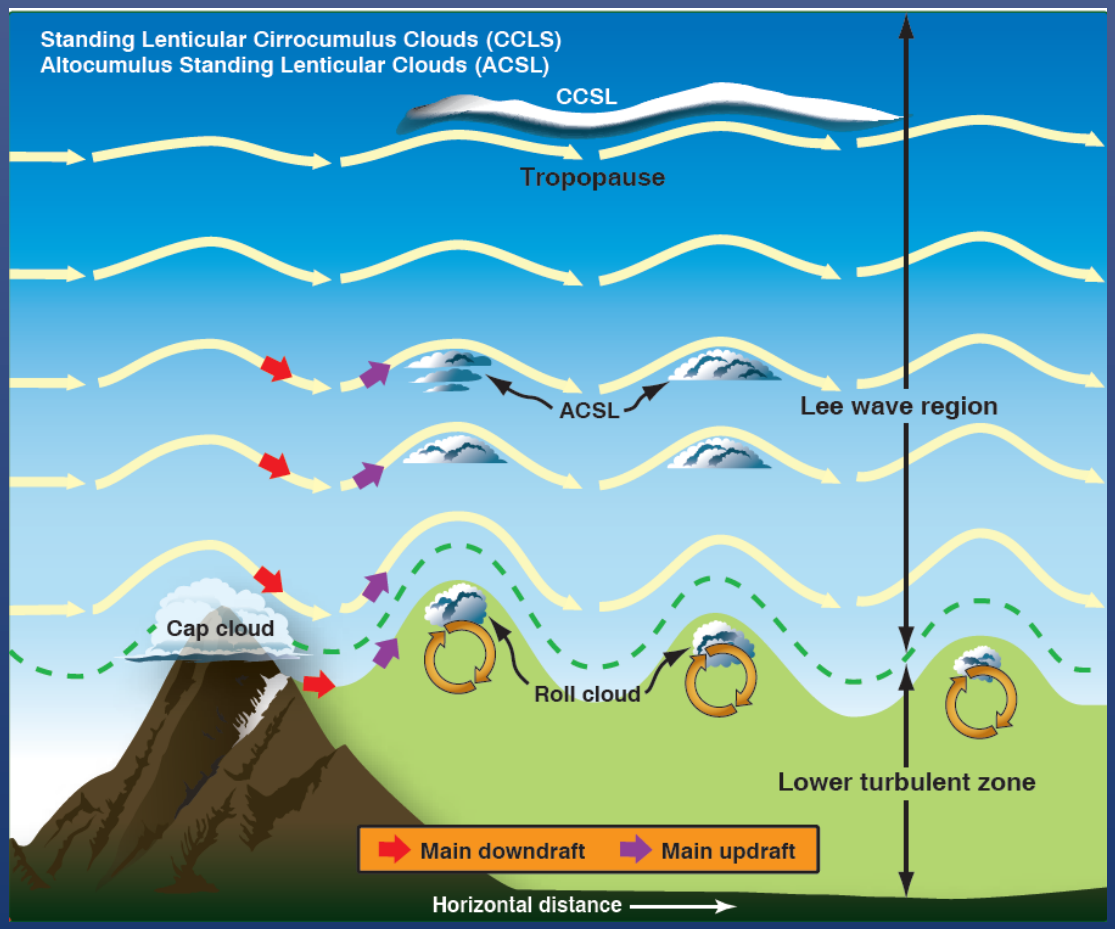
Mountain wave lift is fundamentally different from slope lift. Slope soaring occurs on the upwind side of a ridge or mountain, while mountain wave soaring occurs on the downwind side. There fore, at times near the top of the wave, the glider pilot may be almost directly over the mountain or ridge that produced the wave. The entire mountain wave system is also more complex than the comparatively simple slope soaring scenario.

Flying Mountain Wave

- Expect rough flying below the wave
- Landings need great care on strong days
- Treat rotors like thermals
- Gaps close if moist air arrives – have a plan
- Watch for freezing level
- Oxygen above 12500’
- Don’t final glide into rotor

Flying Mountain Wave

Mountain Lee Wave System



Wave Flying

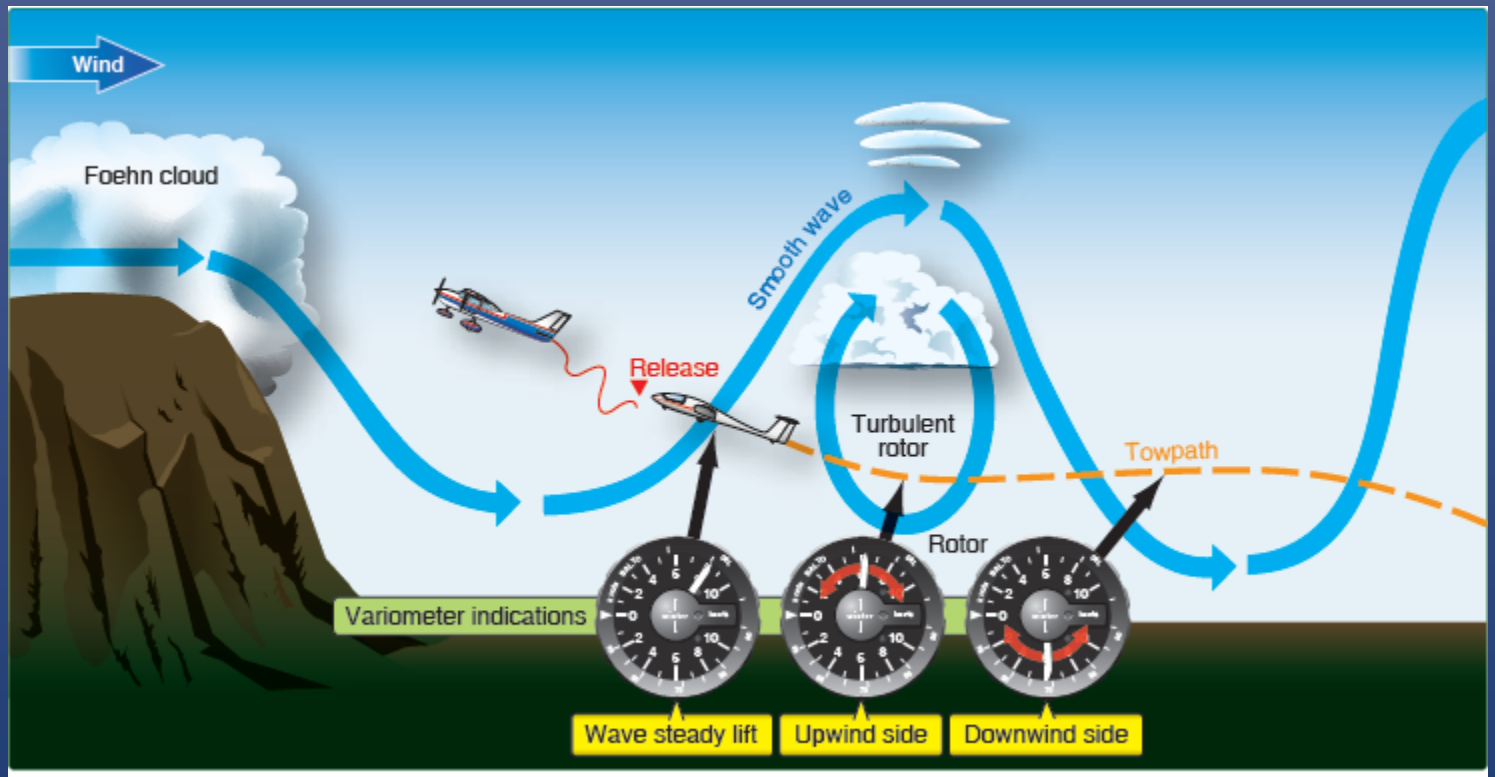


Figure 10-34. *Variometer indications during the penetration into the wave.*