
Strategic Decisions to Improve Your X/C Speed

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Graphics from Helmut Reichmann's Streckensegelflug

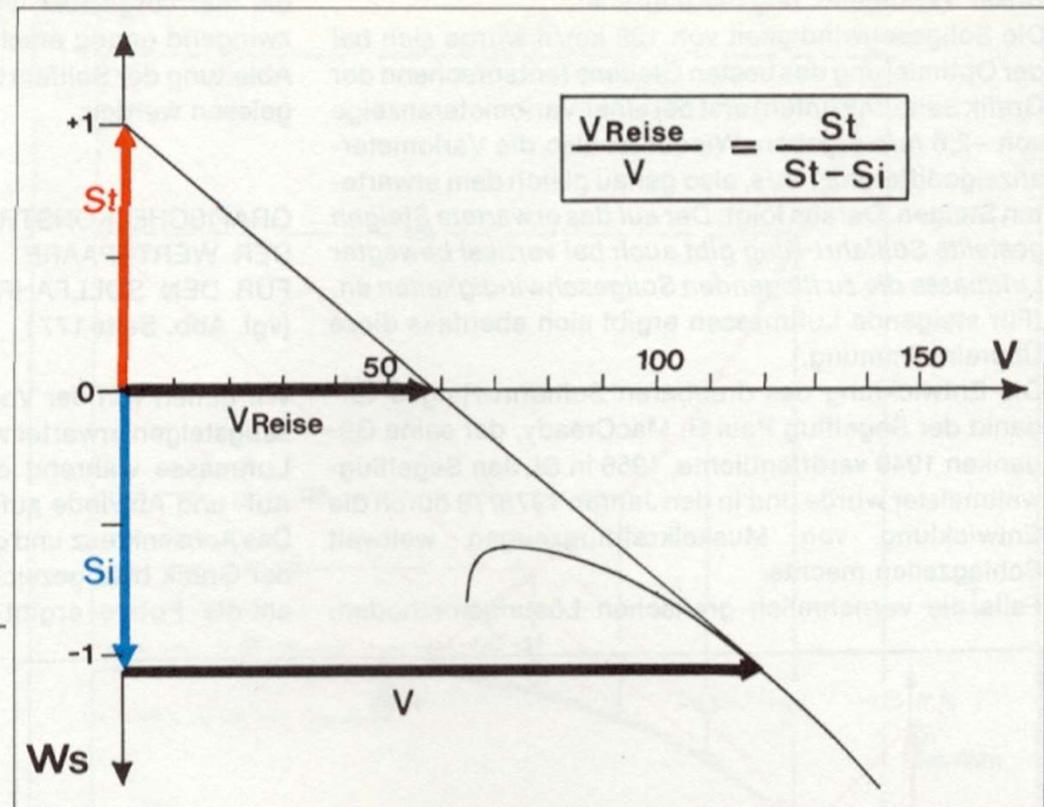


Why Speed?

- Speed is a factor for any distance greater than 400 km
 - Every contest is a race
 - Speed is the measure how effectively we are utilizing the available energy in the atmosphere
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What Speed to Expect?

- Depends on your climb rate and glider performance
- Important for task planning
- Based on MacCready - try to beat it



Decisions Affecting Your Speed

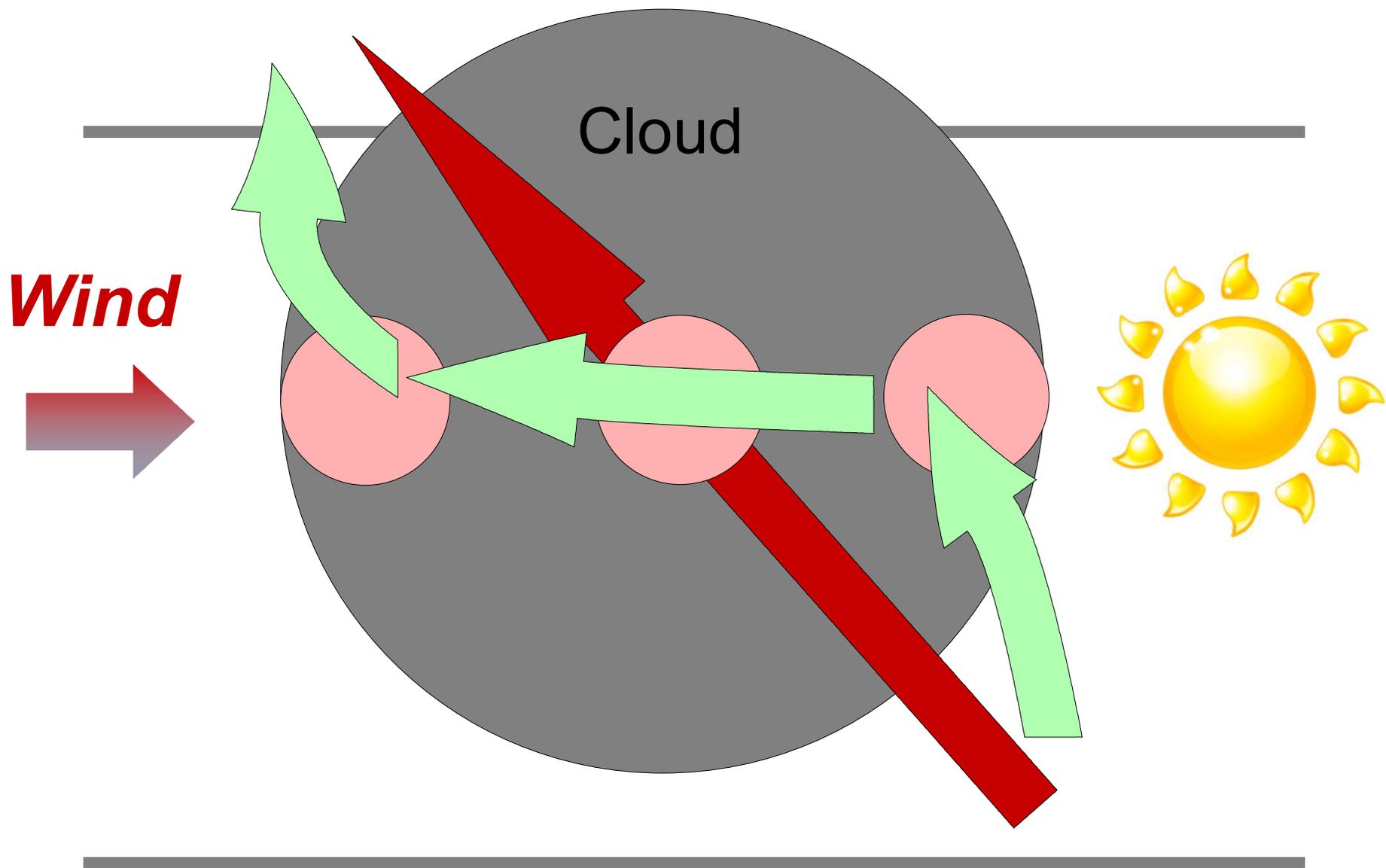
- Realized Climb Rate
 - Route - Deviations
 - Inter-Thermal Speed - MacCready
 - Knowing when to shift gears
 - Ballast
 - Final Glide
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What is the Best Route?

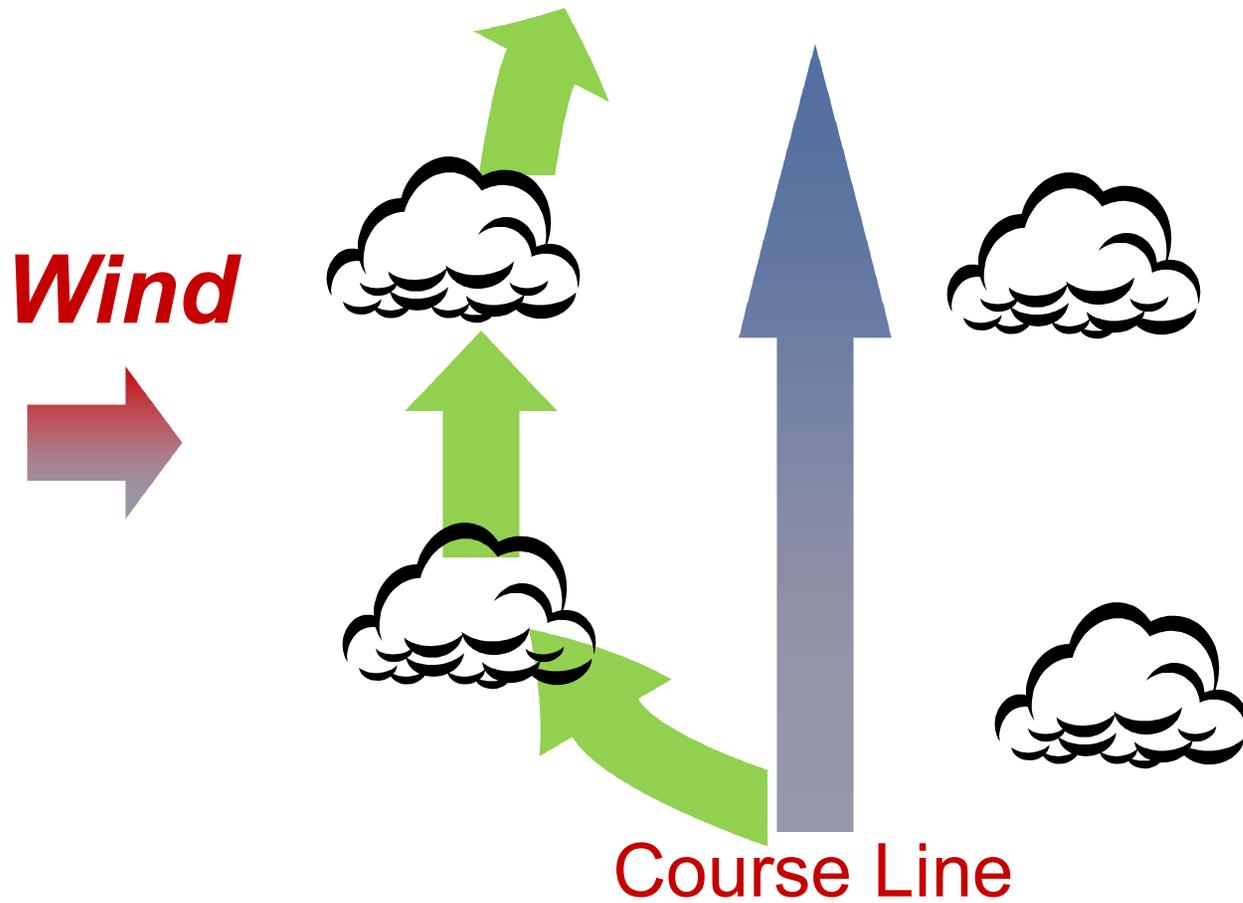
- Fly the lift - maximize straight climbs
 - Follow terrain features
 - High Ground (high = dry)
 - Ridges
 - Cloud Streets
 - Convergence Lines
- If you have to stop
 - Take the upwind thermal
 - Find the strongest lift

Circling is
for the birds!

The race is as much in the climb as in the run



Deviations



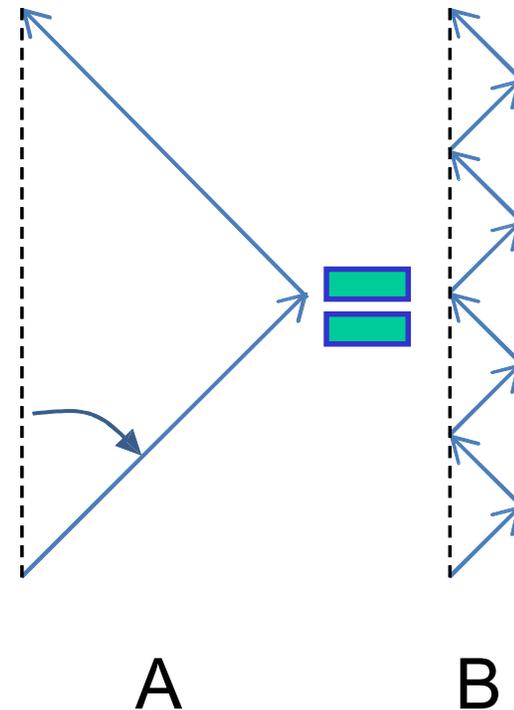
Deviations

How far should we deviate?

John Cochrane: The **angle** matters, distance off course does not.

Distance A = distance B

Deviation (Deg)	Efficiency (%)
0	100
10	98.5
20	94
30	86.6
45	70.7
60	50



Source: John Cochrane, Deviations I

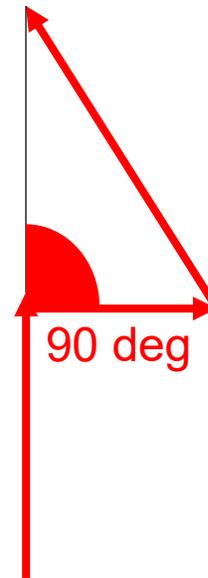
Deviations

Plan early and plan ahead

- Plan your route ahead and start deviations early
- Avoid course deviations of more than 30 deg
- Whenever possible deviate into wind

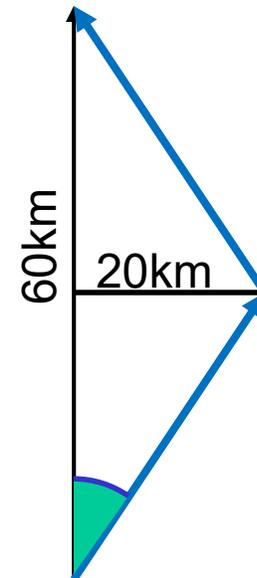
81.6 km

73%



63.2 km

95% efficient



18.4 degrees

Deviations

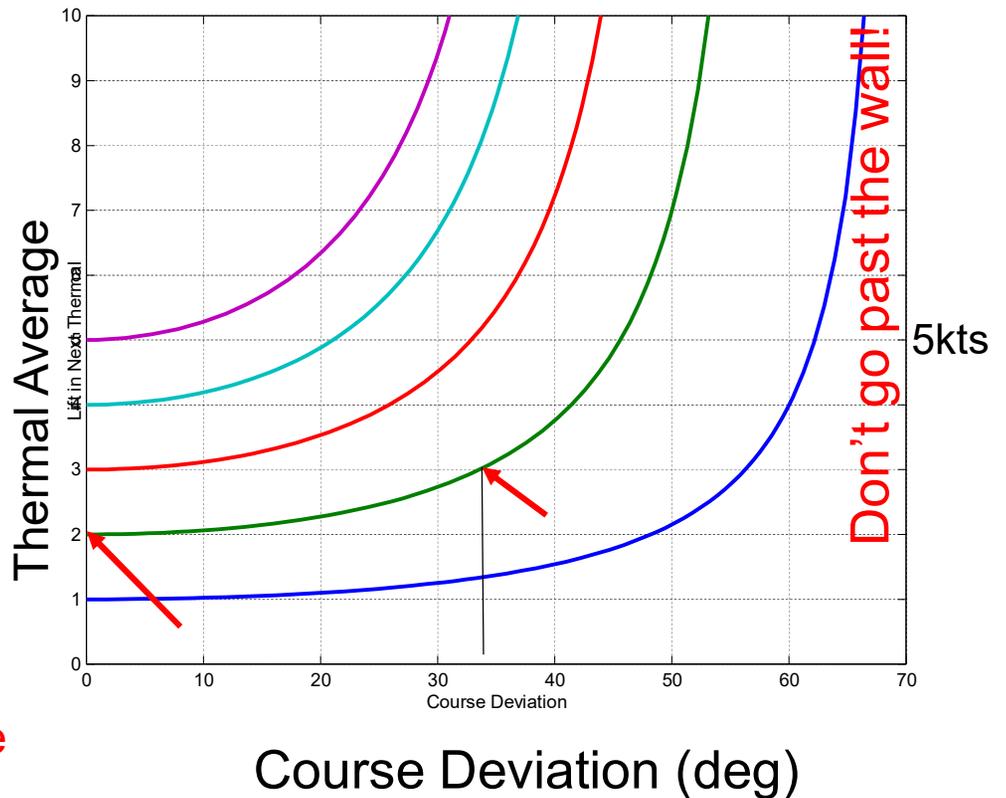
Going for the better Thermal

Assuming you are working a 2kt thermal but you expect with a deviation you can get to a 3kt thermal. Follow the green line. To where it intersects 3kts. A deviation up to 34 degrees is advantageous.

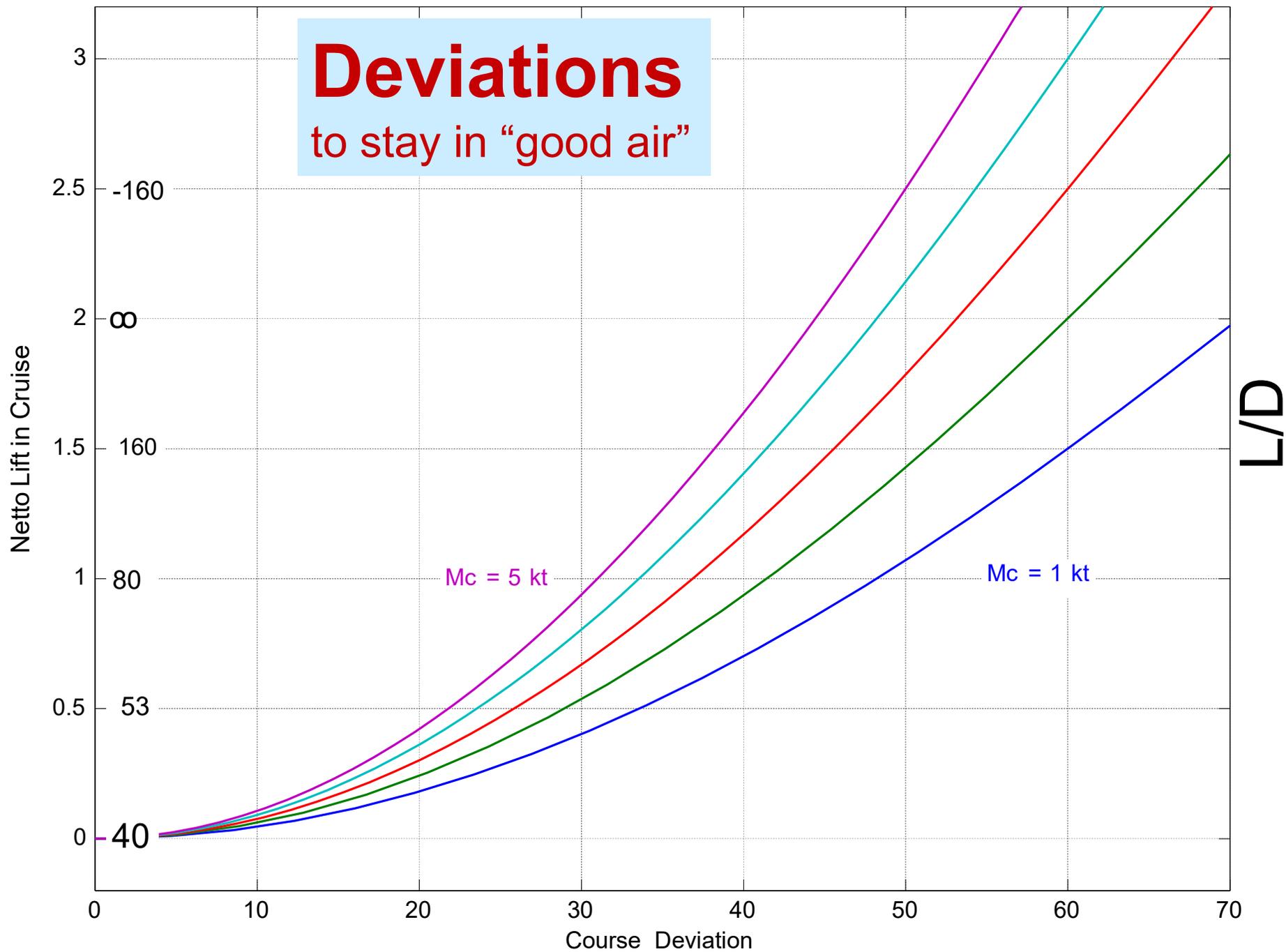
In weak conditions relatively large deviations are justified. In strong conditions it is better to go direct.

Eastern Pilots deviate for better lift
Western Pilots go straight on course

Deviation to find a better Thermal



Deviations to stay in "good air"



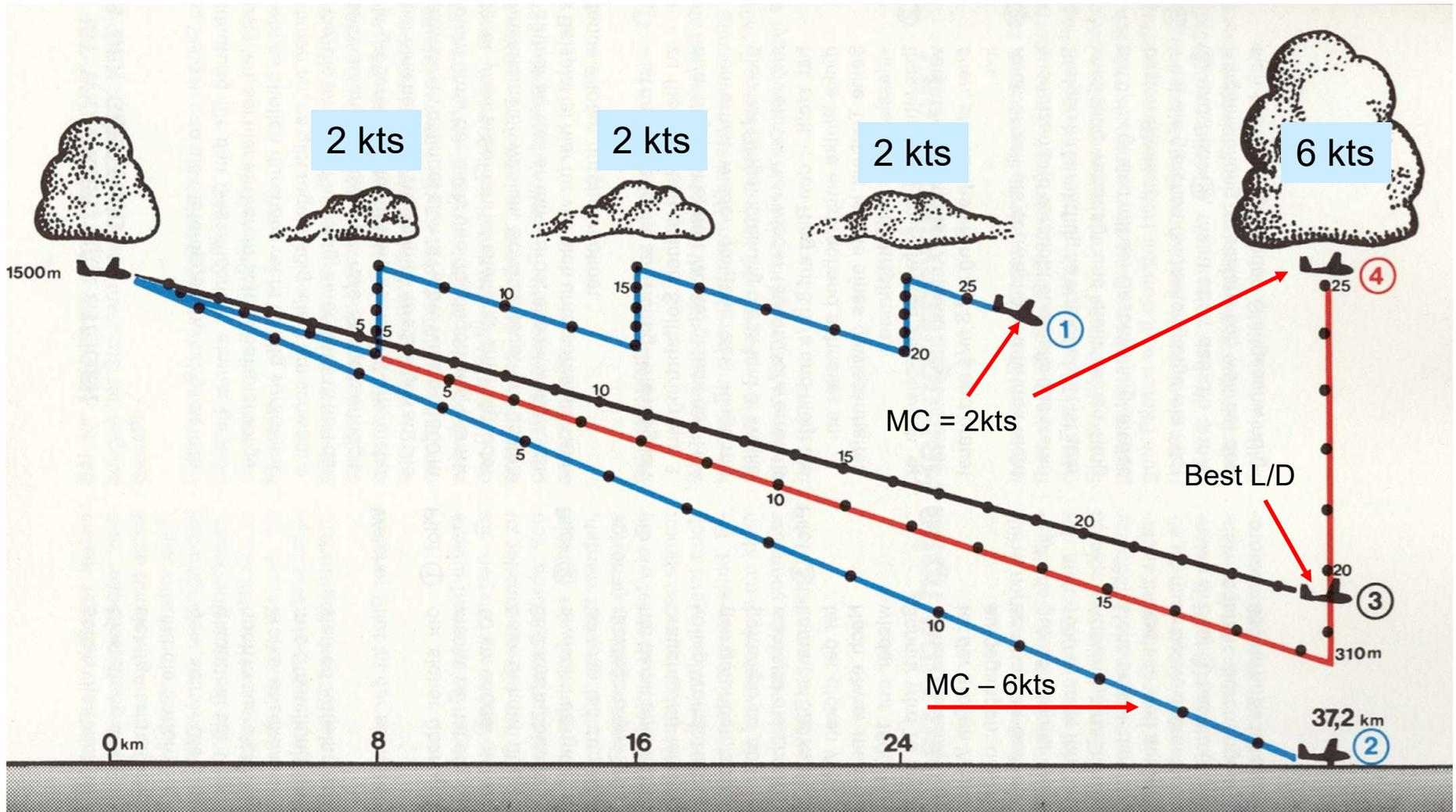
What MC-Setting?

- The classic speed to fly model (MacCready)
 - MC-setting according to the expected Thermal Average in the next thermal
- Limitations
 - Assumes unlimited height - the next thermal with the expected lift will be reached
- Real life is a bit different!



What is my Climb Rate?

- Vario indication
- Circle average (20s)
- Thermal average
 - From the moment you commit to climbing, to the moment you leave the thermal
 - The time to center is lost overhead time



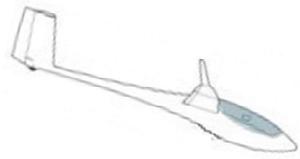
The Luck Factor

Managing the Statistical Odds

- Your chance to find strong lift improves with range
 - Assuming your chance to hit a 4kt thermal within 1 km is 5%:
 - 10 km  52%
 - 20 km  77%
 - Sometimes it makes sense to trade speed for range
 - Be conservative when low  low range
 - John Cochrane: MacCready Theory with Uncertain Lift and Limited Altitude
 - Higher performance gliders tolerate higher MC settings
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Speed vs. Range

MC setting zero = Best L/D but slow
MC setting higher = Trading range for speed



ASG 29-18:

MC Setting	Range	Speed
1kt	-5.8%	+17.5%
2kts	-15.4%	+31.5%
6kts	-46%	+80%
6kts	-42%	+96.4%

Think of the MC setting as your gas pedal!

Loss of height

Loss of Range

Incorrect Setting - what is the Loss?

The 2-3-4 Rule

Loss of Range
(ASW 19)

MacCready Setting (kts)

5		22%	7%	1%		2%	35%
4			4%	0%	1.5%	4%	26%
3		7%	2%	0.5%	3%	8%	20%
2		3%	0%	2.5%	8%		11%
0			10%	20%	30%		
	0	1	2	4	6	8	

Actual Lift found (kts)
Thermal average

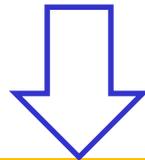
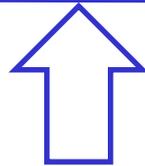
The Advantage of Deep Climbs

- Assume: Circle average 5kts = 500 fpm, time to center: 2 min
 - 1000 ft Climb:
 - Time to climb: 2 min cl + 2 min center = 4 min
 - Thermal Average: $1000\text{ft} / 4\text{min} = 250\text{ fpm} = 2.5\text{ kts}$
 - 2000 ft Climb:
 - Time to climb: 4 min cl + 2 min center = 6 min
 - Thermal Average: $2000\text{ft} / 6\text{min} = 3.3\text{ kts}$
 - Minimize the Overhead!
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Working Band

Top of the Band: Cloudbase or when Circle Average declines

Working Band



Top half: Aggressive MC setting
Only take the strongest lift.

Bottom half: Dial back MC a bit
Take reasonable lift, climb, try to
find better lift

Bottom: Half distance between Cloudbase and ground or 2500 ft AGL,
whichever is higher – make sure to be able to reach landable areas

1500 ft AGL – Survival Mode

MC best L/D, take any lift – forget about speed - stay airborne

Summary

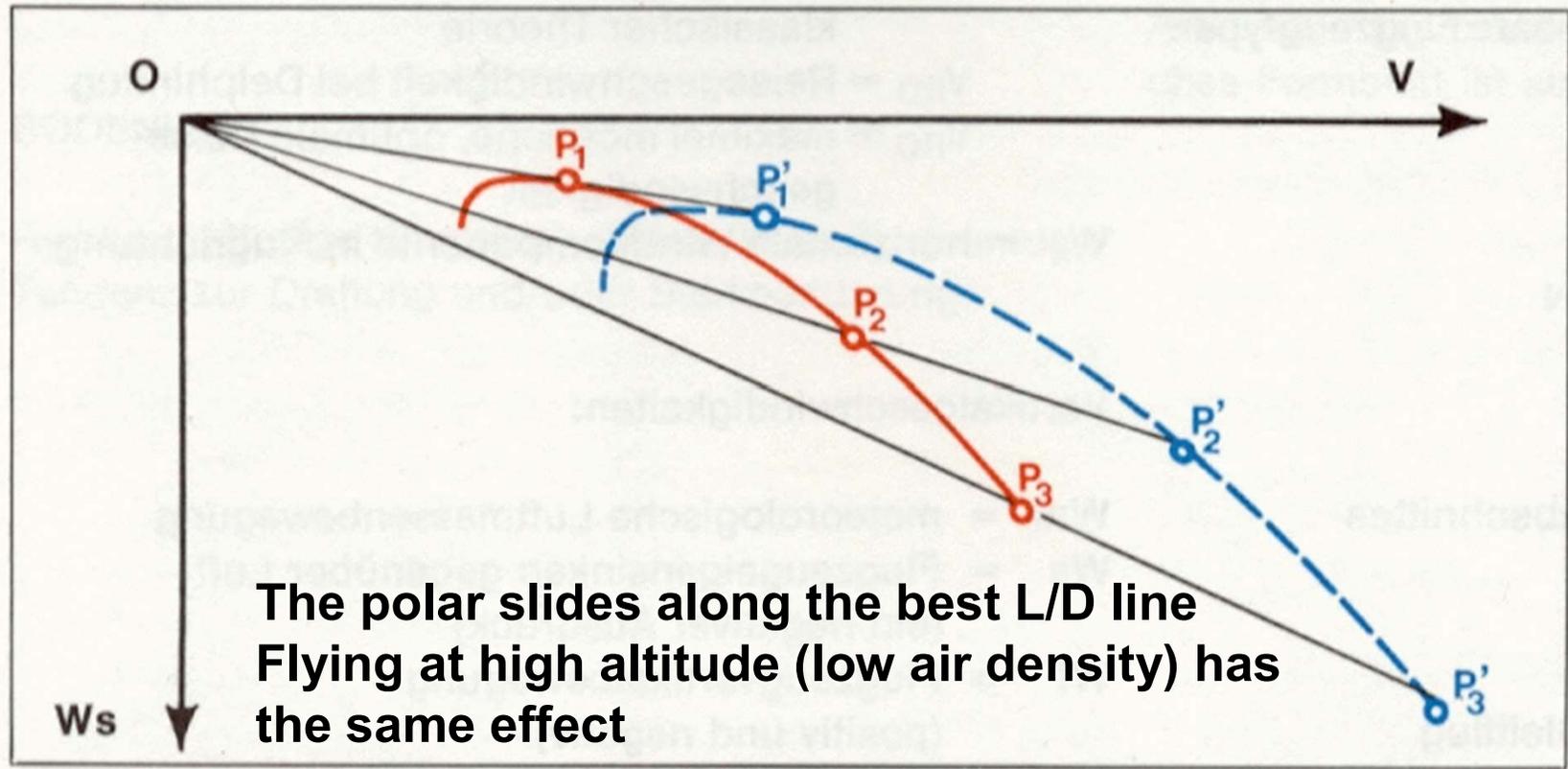
- Know the limitations of the model you apply
 - The precise MC-setting is not important
 - Conservative MC-settings increase your chances of finding better lift (or lift at all)
 - Reduce the MC-setting as you get lower
 - Avoid setting MC to zero (losses too high!) – unless you are in survival mode.
 - Do not thermal in lift below your current MC-setting when in your Working Band.
 - Thermal Average and how to improve it
 - However: There are no “hard and fast rules” everything depends on the circumstances
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Water or no Water?

Effects of Ballast

- Increases speed in the glide
 - Better L/D at high speeds
 - Increases minimum sink → reduced climb rate
 - Increases turn radius → more difficult to core
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Effects of Ballast



When does Water Make Sense?

- In strong conditions
 - Thermal average more than 4 kts
 - Smooth lift → wide cores
- Linear lift → no need to circle
 - Ridge
 - Wave [caution: freezing!]
 - Streets
 - Convergence Lines (Sea Breeze)



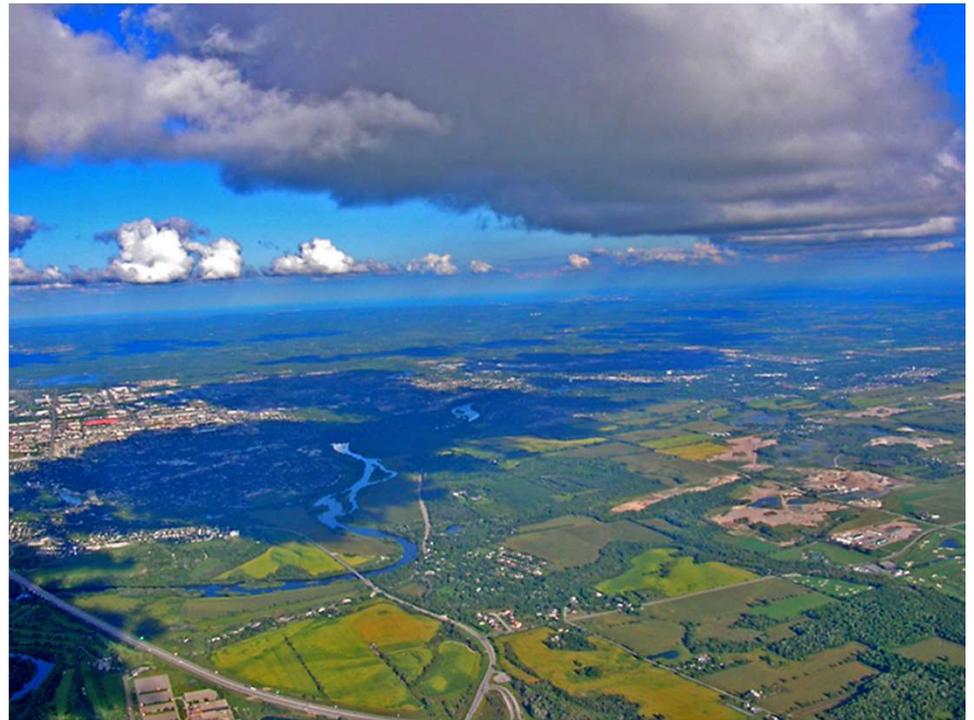
Common Mistakes

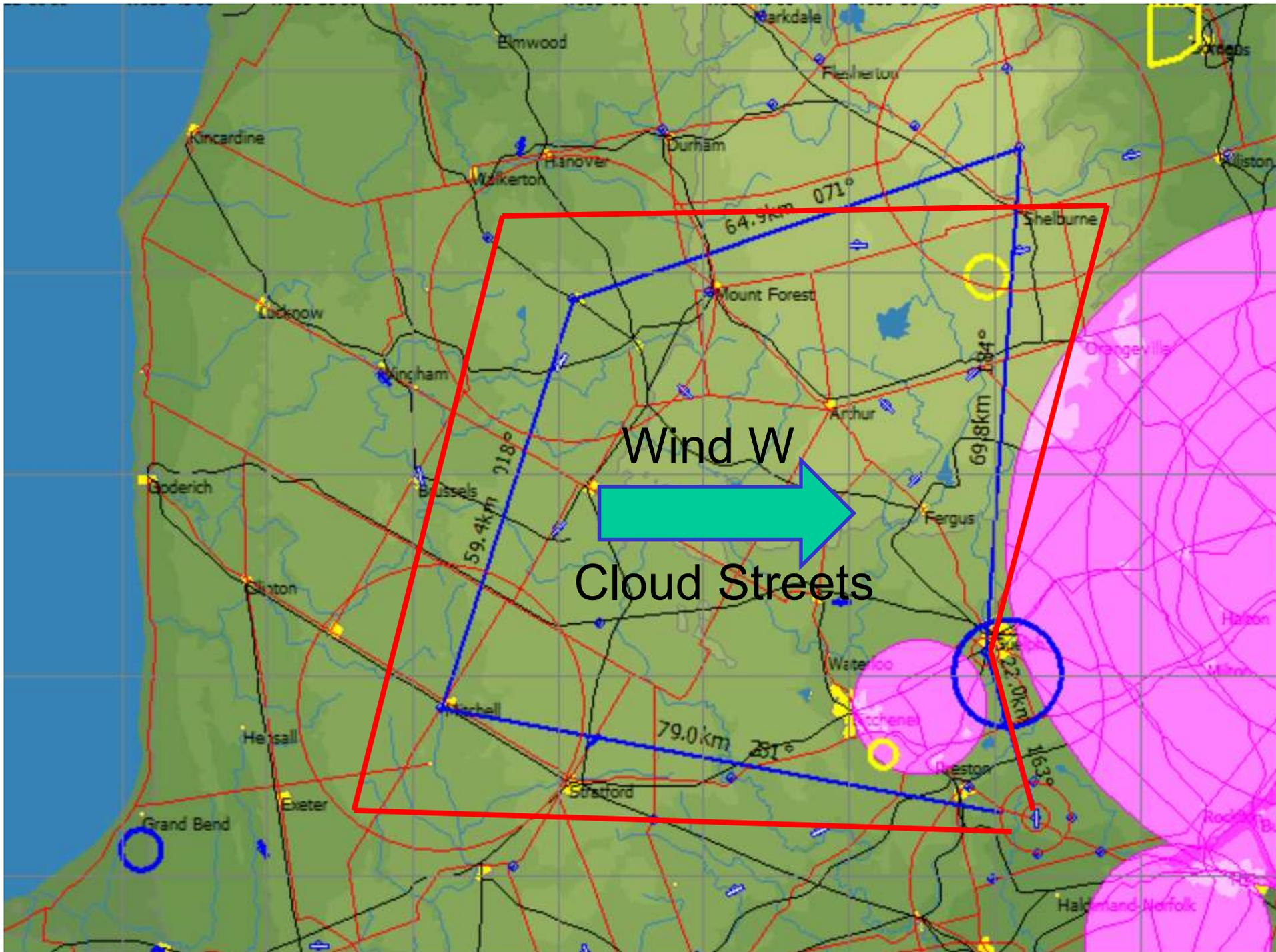
- Water kept too long
 - The speed advantage is obvious, the climb penalty is not
 - Dropping is irreversible
 - Lot of work to load
 - Drop as soon as you have difficulties climbing

- Water only used in contests
 - Water changes the handling characteristics of your glider
 - If you want to use water in a contest you have to practice with it

Wind

- Breaks up thermals
- Drift
 - A 15kt headwind can reduce your effective climb rate by as much as 35% - 50%
 - Climb as much as possible on downwind legs
- Turnpoint Strategy
 - Final glide on upwind TPs with sufficient height to connect and climb on your way out
- Cloud Streets
 - Opportunities for AAT



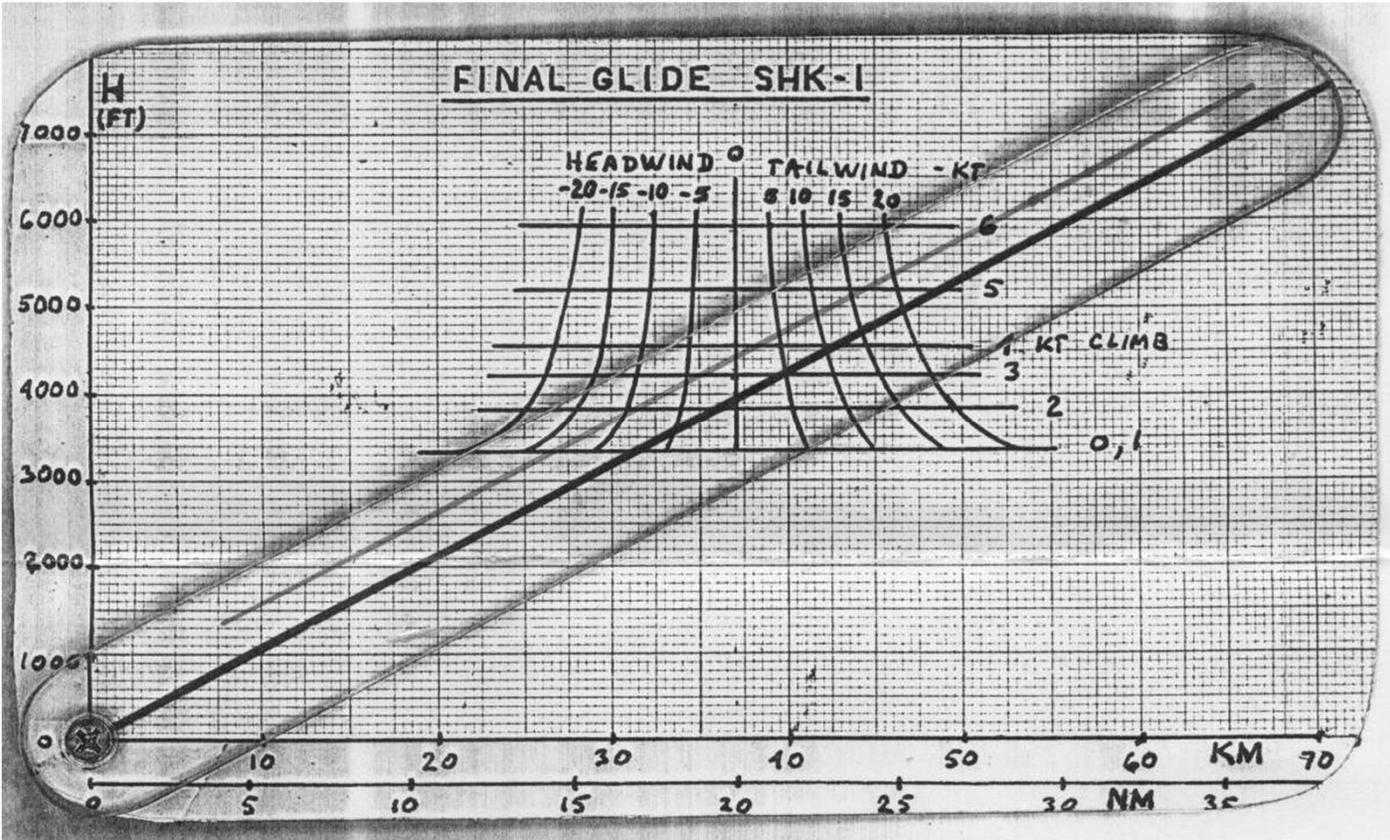


Final Glide

Well executed, it will significantly improve your Task Speed!

- The classic Model is MacCready inverted
 - You fly the MC-setting of your last thermal
 - The higher the setting, the better your safety margin.
 - Inputs are:
 - Distance
 - Head/Tail-wind component
 - MC Setting
 - Rule of Thumb: 1000 ft per 10k (L/D: 30)
 - Safety Margins
 - Arrival at 1000 ft AGL + 500ft safety
 - Avoid MC = 0
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A Simple Final Glide Calculator



Reality is Different

Two Scenarios - what is the Difference?

1. At 4:30 p.m. on a day with lift ranging from 3 to 6 kts you are 60km out, 6000 ft AGL, climbing in 5 kts. Your final glide computer says you need another 1000 ft to be on final glide with a MC-setting of 5 kts. Do you stay or go?
2. On a weak day you are 7 km out, scratching at 600 ft AGL in 1 kt, you are high enough to make it home with best L/D (zero MC-setting); for a setting of 2 kts you would need another 100 ft. How high do you climb?

The Difference is in the Chance to find Lift

Scenario 1: 60 k out, 6000 ft AGL

- Over a distance of 60 km there is a good chance of
 - making up the missing 1000 ft by pulling up in thermals along the way
 - finding a 6 knotter
 - If it hasn't happened at the 3000 ft AGL level there is still plenty of opportunity to slow down and/or climb.
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The Difference is in the Chance to find Lift

Scenario 2: 7 k out, 600 ft AGL

- Within 7 km and below 600 ft there is very little (no!) chance to find usable lift
- Once you start the final glide you are committed. That's why it's called the **COFFIN CORNER!** There are no more options if it doesn't work out. You will likely break something.