

- **Speed-to-fly:** the optimum airspeed for cross-country soaring.  
Flying at the "correct" speed-to-fly can mean *either flying farthest from a given altitude or flying between thermals such that the average speed is maximized.*
- Why do we need speed-to-fly?
- Speed polar: valid at one particular gross weight (wing loading). If the wing loading changes, we can determine new sink rates and speed by applying a scaling factor.

	Gross wt.	Wing loading	Scaling Factor wrt 5.64 lb/ft <sup>2</sup>
Solo empty weight:	485 lb		
Pilot weight	160 lb	645 lb	0.98
	180 lb	665 lb	1.00
	240 lb	725 lb	1.04
	1060 lb	9.00 lb/ft <sup>2</sup>	1.26

- Gliding for maximum distance.
  - Fly **slower** in the case of strong **tailwinds** and **faster** for strong **headwinds** than the best speed to fly in still air.

Wind	Speed-to-fly: calm air	Speed-to-fly: 3 kts
-20 kts	53 kts	72 kts
-15	51	69
-10	49	66
-5	48	64
0	47	62
5	46	60
10	45	58
15	44	57
20	44	56

- Glide for maximum cruise speed.  
Cloud bases are about 4000 ft above the ground, the average lift is about 3 kts, thermals are 4 nm apart, and the air in between is calm.  
Pilot A flies at 47 (max L/D).  
Pilot B flies at 62 (speed-to-fly).  
Pilot C flies at 80 (balls-to-the-wall).

Pilot	time cruising	time climbing	total time	average speed	altitude lost
A	5.11 min	2.64 min	7.75 min	31.0 kts	792 ft
B	3.87 min	3.17 min	7.04 min	34.1 kts	952 ft
C	3.00 min	4.67 min	7.67 min	31.3 kts	1400 ft

On a 100 mile task (85 nm) flying the proper speed save you at least 15 min!

- **Fly fast when the thermals are strong, slow when they are weak.**
- **Fly fast in sink, slow in lift.**
- Do not circle in lift weaker than MacCready unless necessary.
- *In the Solo, with the average thermal strength of 3 kts, cruise about 62 kts, slower in lift and faster in sink.*
- Speed ring.  
In order to fly at the correct speed-to-fly, it is simplest to display the appropriate speed-to-fly values on a moveable ring fixed about the variometer. This will show the desired airspeed opposite the vertical speed shown on the instrument.
- Dolphin flight.
  - If we choose to run along areas of lift (cloud streets) it is possible to fly long distances without circling or losing altitude. Higher average speeds, than predicted by MacCready theory, are possible.