Flying Between Thermals.

Climb in the core of the best part of the best thermal, and then fly at the most efficient speed along the best energy path to.—The core of the best part of the next thermal……

Inter Thermal.

Once the glider has climbed it is necessary to get to the next thermal in the most efficient manner. This can be split into two functions, the speed flown and the path that extracts the most energy.

MacCready

The MacCready theory established the best speed to fly to the NEXT thermal. It can be deducted from a polar curve. Figure 1 shows the polar curve for a specific standard class glider. It indicates that if the next thermal is 3 knots then theoretically the most efficient speed to fly is 82 knots, which will give an average cross country speed of 87 kph and this gives a glide angle of 40:1.

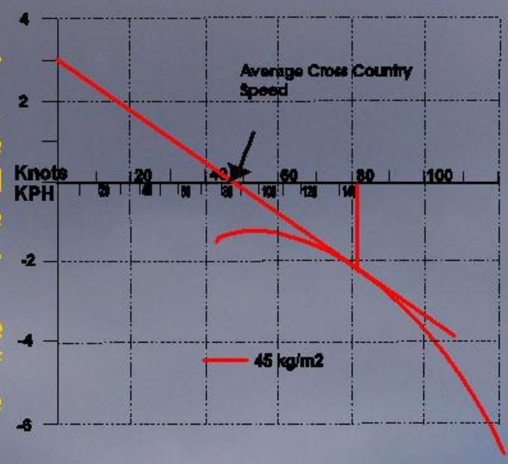

Fig 1

Fast or Slow?

Figure 2 shows what happens when three gliders cruise at different speeds to their next thermal. The green glider flies fast and reaches the thermal first but low and consequently needs to spend more time climbing to the top. The blue glider flies slowly and reaches the thermal higher but much later. The red glider flies at the optimum speed and is clearly ahead after the climb.

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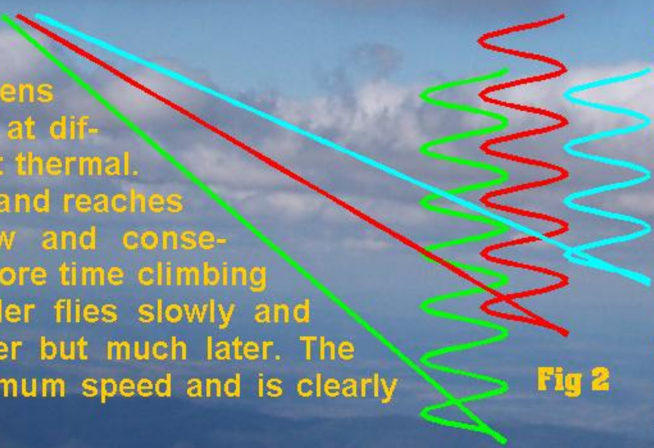

Fig 2

Effect of speed selection on overall cross-country speed

MacCready is OK in theory but if the glider flies a little slower it will have a shallower glide giving it a greater area to search for thermals. But how much slower should it fly. Figure 3 shows the relationship between inter thermal speed and cross country speed for various thermal strengths. It can be seen that if the glider flies a little slower or faster, the cross country speed is hardly affected. However, the achieved cross-country speed suffers considerably if the cruising speed moves further away from the optimum

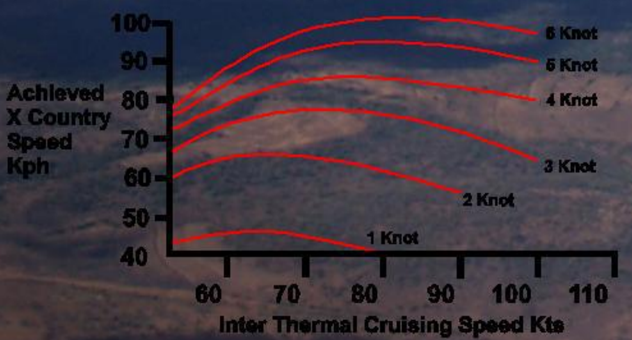

Fig 3

Reliability of Weather and Pilot.

Other important things to consider are the overall tactics and the conditions ahead. Although our cruising speed should be based on the next thermal strength. We should slowing down when we want to stretch the glide. This could be the crossing of less reliable terrain, flying later in the day when thermals become further apart or operating on tricky blue days with narrow and broken lift. If we are trying to stay in a narrow height band we may also fly a little slower. Perhaps most important is the pilot's skill in being able to find the next thermal.

Block Speeds.

The MacCready theory dictates different cruising speeds depending on the amount of lift or sink encountered. However, the theoretically necessary speed adjustments can result in major aerodynamic losses. Experience has shown that block speeds with only minor speed variations in sink or lift give better results. (Fly a little faster in the sink and a little slower in the rising air.) This decreases the pilot's work load, frees up time for making tactical decisions, allows for a good look out and enables us to concentrate on feeling the air.

The table indicates the speeds to fly for glider with the polar curves shown previously.

Speed to fly	Weak	Medium	Strong
Dry	65 Knots	75 Knots	85 Knots
Wet		85 Knots	100 Knots

The rule of thumb is fly a constant speed and only slow down if you intend to stop.

Extracting Energy in Cruise

Ideally our flight path should lead us through the path of maximum atmospheric energy and the maximum number of potential thermals. In other words, we should attempt to divert through as many paths of rising air as possible without increasing the flight distance excessively. Gaining energy in cruise will increase our cross country speed dramatically. This is highlighted in Figure 4. The glider will increase its cross country speed by 8% from 87 to 95 kph if the pilot manages to fly through air which is only half a knot better.

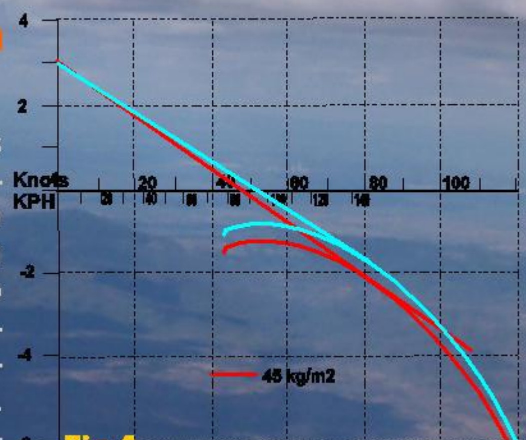

Fig 4

However, diversions increase our flying distance and therefore we must find stronger thermals to compensate. The table shows the extra distance for a given diversion. We can see that diversions of 20° have a very small impact on the distance flown while diversions of greater than 30° require a 15% improvement in thermal strength. However any diversion is better than landing out!

Degrees Diversion	Extra Distance
0	0%
10	2%
20	6%
30	15%
40	31%
50	56%
60	100%
70	192%
80	476%
90	∞

Stepping stones.

While an experienced pilot can pick thermal sources, they can never be guaranteed. The more potential thermal sources passed the greater the possibility of finding the good one. On leaving a thermal, a pre-planned path should be flown to intercept further potential energy sources on track.

As a guide there are two suggested tracks, the yellow one to the right following ground sources, the red one to the left follows the cloud streets.

Conclusion.

Inter thermal flying needs a balance of the right speed with the correct amount of deviation, picking up the most efficient energy.

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