17C - CROSS-COUNTRY TECHNIQUES

SPL Syllabus: Exercise 17c Cross-country Techniques	
(i)	**Lookout procedures**
(ii)	**Maximising potential cross-country performance**
(iii)	**Risk reduction and threat reaction**

INTRODUCTION

Flying cross country is an aspiration of many early pilots, but they often need help to develop the confidence to go and do it themselves.

Proper and thorough briefing and training is an important step towards increasing their confidence, together with some gentle encouragement.

As always, they need to be properly prepared.

Lookout Procedures

If the trainee pilot is having to navigate as well as soar, their workload has increased substantially compared to just soaring locally. Consequently, they may neglect their lookout. Hopefully, lookout will have been re-enforced so often in their basic training, that it is second nature but sadly this is often not the case.

Flying cross-country often involves thermalling with other gliders, which is a higher risk situation, particularly when joining or leaving a thermal. Avoid flying in other gliders blind spots.

The risk increases when close to cloud base.

Flying along a "street" is another point of potential conflict with traffic in the opposing direction. Because the glider in a head on situation remains in a constant position in the canopy, it is harder to see. This, combined with a high closing speed, is a very high-risk situation that all pilots should be aware of. Again, it is worse close to cloud-base.

Flarm is a valuable aid to look out, but not a substitute. The pilot must be familiar with using it.

Remind trainees to:

- carry out a thorough lookout before and after any head in cockpit time (for example, looking at or making changes to the nav system or map).
- incorporate any traffic display into their scan to add to their situational awareness of other traffic.

Maximising potential cross-country performance

Whole books are written on the topic of maximising potential cross-country performance, so the question is what you can sensibly teach a new cross-country pilot for their early cross-country flights.

Usual advice for first cross-country flights is to 'get high and stay high' For those looking to start increasing their performance, a discussion around the following topics might be useful:

- Sensible choice of operating band – typically between close to cloud-base and about halfway between that and the ground. Any lower than that and they risk becoming disconnected from the clouds.
- Sensible thermal selection – not always stopping to climb when high, not pushing on when low.
- Discussion about when to leave a thermal. E.g. setting a minimum rate of climb to accept provided the sky ahead still looks reliable.
- How to estimate range and height-loss to the next climb.
- Routing – selection of best energy line – how far off track to go and in which direction. Most early x-country pilots simply look for the next cloud rather than a line of energy. Looking further ahead for the best line of energy will be new to them. Up to 20 degrees of track, adds very little to the overall distance to travel down a leg. But this is an exponential curve – so by the time you are 60 degrees off track you would double the length off the track if you stayed 'permanently' on that line. Remind them, that is 20 degrees either side of the track – not twenty degrees either side of where the glider is pointing at the time.
- On a crosswind leg, if there is a choice of routes, take the upwind route – whilst you are upwind of the track, every time you stop to thermal you will be drifting back towards the original track line rather than drifting further downwind.
- Looking at clouds – signs of new clouds rather than decaying clouds.
- Search patterns under clouds and tips for where they might find the best lifts – up wind/ sunny edge, steps in the cloud base etc.
- When near to cloud base, the route ahead can be difficult to see, but looking at the cloud shadows on the ground will give you a good indication.
- What to do in blue conditions. Good potential thermal sources. Task up / down wind direction. If flying up or down wind and finding only sink, consider deviating crosswind to escape the possibility of a 'sink street.' Look for haze caps at inversion level.
- Speeds to fly for given conditions and glider performance. The speeds to fly are based on Macready theory, as are final glide calculations. Following the 'speed-to-fly' command is usually counter-productive, due to the lag in the vario, the pilot's reaction to the vario and the time it takes for the glider to accelerate.

Block speeds often work better e.g. in a medium performance glider 60 kts between thermal in weaker conditions, 70 kts in good conditions and 80 on a good day – adding another 10 kts when carrying water.

- Final glides. Must include a discussion of the risks and safety margins. For more competitive performance, discuss the use of final glide calculations/calculators and adding the appropriate arrival heights/safety margin.

An explanation of MacCready theory can be found at the end of this chapter for completeness.

Outlandings

Outlanding considerations are covered in Chapter 16, but it is worth thinking about reasons why people might increase the chances of landing out:

- Poor thermalling
- Impatience
- Flying into poor conditions instead of having a plan B such as 'parking up' or deviating from route
- Poor task setting
- Weather forecast incorrect
- Fatigue/lack of concentration
- Instrument problems – leaks in vario's etc
- Out of practice.

Practising

Flying with a cross-country coach in a two -seater is ideal but not always available. Ultimately, getting better requires practice and some key cross-country skills can and should be practised locally even when the weather is not suitable for tasking e.g.

- Thermal centring
- Entering thermals and getting straight into the core.
- Good thermal discipline when flying with other gliders.
- Gaining familiarity with the navigation instruments and logger.
- Starts and final glides
- Staying airborne in weaker conditions – nearly every long-distance flight has a difficult patch, so encourage them not to only fly on weaker days and work at staying airborne locally.

Proper preparation will increase their confidence and thus willingness to go cross-country. This includes

- Improving interpretations of weather forecasts and understanding tephigrams.
- Familiarity with checking Notams
- Field landing practice in a motor glider
- Trailer preparation – a job to do in the winter.

Risk reduction and threat reaction

Flying cross country carries a statistically great risk than local soaring – only partly due to the risks associated with field landings.

Consider factors such as:

- Poor preparation
- Fatigue or dehydration
- Inexperience
- Lack of currency
- Difficult terrain/poor field selection
- Technical issues

There are several things a pilot can do to reduce risk:

- Preparation starts well before the day. Having kit fully prepared and ready for use/potential tasks planned in advance/research circuit/landing procedures for potential airfields en-route etc
- Allow plenty of time to prepare for the flight. Some pilots find checklists help with personal and glider preparation.
- Conscientious lookout
- Manage the flight so that there are always landable options available – see the chapter on field landings. That means a change in approach as the glider gets lower, with the exact details dependent on the number and quality of the available fields. In extremis, in otherwise unlandable areas, that means always staying within safe gliding range of a known good option.

MACCREADY THEORY

MacCready theory is a gliding strategy that tells a pilot the optimal speed to fly between sources of lift (e.g. thermals) to maximize average cross-country speed. The theory balances the trade-off between flying faster and losing altitude more quickly versus flying slower to conserve altitude.

The key takeaway is that the pilot's speed **depends on the strength of the *next* thermal they expect to encounter,** not on the thermal they just left. Therefore, this depends on how good the pilot is at judging conditions ahead. However, during a final glide you are not expecting to have to climb again so in this case, the calculation **does** depend on the climb rate of the last climb.

Adjusting your flight based on conditions

The MacCready setting—the expected climb rate—determines the strategy. Put simply:

- **Strong thermals (high MacCready setting):** If a pilot anticipates strong lift, they should fly faster between thermals. Higher speed is more costly in attitude altitude quickly, but is compensated for by reaching the next climb more quickly so the time is made up by the faster climb rate.
- **Weak thermals (low MacCready setting):** If thermals are weak or fading, the pilot should fly more conservatively, at a slower speed. This minimizes the rate of descent and conserves precious altitude, since regaining it will take more time in weak lift.

However, the obvious risk is that you do not reach the next climb and therefore land out – i.e. game over, or more

subtly, the climbs are weaker lower down and you have fewer choices of climbs, so you end up having to take a weaker climb instead.

While fundamentally sound, MacCready theory has some practical limitations.

- **Idealized flight path.** The basic theory assumes an ideal "sawtooth" flight path of straight glides and circling climbs. The pattern of rise and sink does not follow such as fixed formula.
- **Wind effects.** The basic theory ignores wind effects, though adjustments can be made. For example, a pilot should fly faster into a headwind and slower with a tailwind during a final glide to a destination.

How it works

The principles of MacCready theory are used in modern flight computers, which automate the speed-to-fly calculations based on the pilot's input of the expected thermal strength.

The usual practice is to set the MacCready at half the expected rate of climb in the next thermal (this is **the average over the whole climb** from including the time to centre the thermal and the last turn when you wish you had left a turn earlier!)

If setting the MacCready to the achieved rate of climb in the last thermal, turn it back again for the final glide until you are sure you are gaining on glide and 'comfortably in.'

Older gliders may still have a **MacCready Ring**, a rotating scale fitted around a glider's variometer (an instrument that shows the vertical speed).

The pilot estimates the average rate of climb they expect in the next thermal. They rotate the ring to align this estimated climb rate with an index mark. The variometer's needle will then point to the optimal cruising speed to fly in the current airmass.