Getting to the core of clouds

John Coutts, *from Sailplane & Gliding*

THE ART OF THERMALLING begins well before you even start circling. It can be divided into two phases. First, you must locate the general area within which you think the core could be. Second, you must find – and keep the sailplane in – the strongest part of the thermal column. Many pilots can recognize a good area, but can't locate the strong core quickly enough.

Techniques for searching and centring vary from pilot to pilot. However, the fundamentals of successful thermal centring are the same so, rather than recommending any one method, I have simply detailed some rules that seem to work for me.

When you watch the pundits, you'll clearly see that they have an uncanny knack of locating a good core instantly, requiring minimal amounts of centering. This is not purely luck: they have been carefully studying the indicators which help pinpoint the core. If it is a reasonable day for soaring, there will be cumulus marking the next search area. As you glide towards it, you should be carefully studying all the clues, such as the development of the cumulus ahead or, on blue days, searching for signs of a thermal leaving the ground.

Reading clouds is a skill, taking years to gain a modest understanding. Probably no one has truly mastered it. If you are serious about competition or cross-country flying, try to learn when you are on the ground. From your window study the sky. Watch clouds developing for a few minutes, then tell yourself how each will change. Five minutes later, see if you were right.

Understanding clouds is perhaps the most important skill in soaring, since the majority of our flying is in conditions where thermals are marked by cumulus. As a general rule, the larger the size and depth of the cu the more studying and searching is required to find a good climb. Two examples: on a day with small cumulus marking the top of the thermals, the area in which the lift should be is relatively small so the lift is found quickly. On the other hand, a cu nim may have an excellent core or even cores – however, there is an extensive cloud shelf to search under.

Techniques for searching under cumulus therefore differ according to the size of the cloud. Consider the four cloud situations below, along with some basic rules that I employ while searching for the best lift.

Shallow cumulus

These conditions are ideal as the cloud distribution is low (probably less than a quarter) and ground heating is not impeded by cloud shadow. Unfortunately, the thermals can cycle quickly, meaning that often the best climbs are found by flying towards developing wisps. Conversely, promising looking clouds can produce little.

- If cloud centres fail to work well look for edges that show the most rotation or movement.
- Only search areas of cloud that are clearly growing.
- If a cloud shows signs of decay, look to the sides for signs of new wisps forming, especially upwind or downwind in breezes stronger than 10 knots.
- When low, finding heavy sink can be a good sign: look carefully at the cloud for a building edge and the corresponding lift.
- Allow for wind drift – that is, when low, look slightly upwind.
- Prepare to leave before cloudbase due to small latent heat generation (heat energy released by vapour condensing to cloud forming water droplets).

Moderate cumulus

When the clouds grow higher they tend to occupy a larger proportion of the sky, perhaps a half. If the airmass is moist enough with a strong inversion, there is a risk of spreadout. The cloud shadows cover more of the ground; indeed, the clouds now grow big enough to block ground heating and can starve themselves. If this happens, the cloud dissolves and once again the sun can heat the ground to produce another thermal. This is known as cycling. Generally, if you're getting down to below half the height of cloudbase, you need to look for cores under edges of good clouds where the ground is still in sunlight. If there is no sun, you could be in trouble!

- Stay high to use latent heat effects.
- Look for the darkest, most defined base with a concave shape.
- Look for tendrils of cloud and centre directly underneath them.
- When there is a recognized step in cloudbase, always search under the higher side.
- Be very wary when there is no sun on the ground underneath a promising cloud, especially if you are low: watch out for cycling.

Large cumulus

These clouds normally indicate that the airmass is unstable and by late afternoon areas of over-development can be expected. More than half the sky can be covered by cloud. Now you really need to consider the effects of cloud shadow. However, cloud shadow alone is unlikely to starve the thermal, because large cumulus may begin sucking the air upward: that is, the instability within the cloud promotes and prolongs convective motion. This, combined with plenty of sun on the ground, can give phenomenal climbs that improve near cloudbase. It's crucial to study large clouds carefully before you arrive underneath because, as well as finding the lift, you also need to avoid the sink. Exploding cloud tops should

indicate the general search area, and you should home in on tendrils once underneath. Use the same techniques as for moderate cumulus, plus the following:

- Look for climbs against the downwind edges of rain showers usually marked by a small line of tendrils.
- Fly under cloud domes that seem to be rising fastest (look the freshest).

Blue conditions

Unless you see gliders or birds circling, or a haze dome, you must rely on ground features to indicate where a thermal might be. Following high terrain is also necessary, especially if there are narrow valleys. In the blue, with no obvious signs of lift, all you can do is fly on track, taking in any town or field that looks like it attracts more heat. Once you find rising air, it can be hit-and-miss whether you locate the core. In winds of more than 10 knots you can consider looking upwind or downwind for blue thermal streets. If the thermal is on its own then you should turn into wind, unless there is a clear indication the thermal is downwind. In droughts and dry environments like Australia, dust devils offer the best clue to the thermal's location. Sometimes the best ones are in the middle of two or more dust devils.These develop as individual cores that feed into the main core. Smoke, dust or the waves on a lake can also indicate possible ground winds feeding a thermal core. It's usually quite hard to locate the core on the ground surface alone unless an obvious trigger point can be seen: a high or moving object, or the downwind edge of a likely thermal reservoir.

If you have read the situation correctly to this point in your flight, you should be flying in the most probable area for a respectable thermal. The next task is to centre in it and keep the glider there. Visualize the thermal's distribution, then move the glider's circle, by whichever method you prefer, over the core. There are many techniques for centering in thermals, some of which can seem rather technical, so here I shall suggest what I find works for me.

The strength of thermal decides the action required. Generally, anything less than 3 knots is going to be of limited size and therefore small corrections should be made. Try to fly the glider accurately, using only moderate bank angles (up to 30°) – moving the circle centre by widening out the turn seems to work best.

If the lift is greater than 3 knots, employ more aggressive techniques, especially if the core is really strong. Usually, steeper bank angles are required (45–60°) and even tightening up the turn more in the best bits works well. Occasionally (especially in blue conditions) you will hit an extra surge: by turning really tightly you can stay with the bubble for a few hundred feet. It is common to climb right through a gaggle in such a bubble.

It is very rare that you come across the perfect thermal that is round and is going up all at the same rate. Often the thermal is a little broken, elongated and irregular in shape. When thermals are like this (that is, most of the time) remember it is physically impossible to get the glider completely within the thermal climbing smoothly. The key is to centre on roughly the middle of the thermal and use only minor adjustments to feel the best of the air, slowly working your circle into the best parts and keeping it there all the way up. You may even elongate your circling to mirror the shape of the thermal.

- In strong conditions your priority is to get the glider in the core as quickly as possible!
- The reverse turn centering technique is one of my favourite tools in larger thermals.
- Don't be afraid to crank it over: many pilots don't turn tightly enough when a reasonable core is found.
- If you lose the core, widen out the turn to extend your search area.
- At the beginning of a thermal cycle, the thermal may be wide and smooth but not very strong. However, hang in there if the strength slowly increases with each turn.
- At the end of the thermal cycle, you may get half a turn in good lift but the rest in rubbish. If the next turn is worse you have probably arrived too late.

While circling in a balanced turn (with the yaw string straight), you may notice that you need to hold a slight amount of opposite aileron, that is, out of the turn. This is because the inboard tip is travelling slightly slower than the outboard tip. While circling in this manner a portion of your wing section is not in an efficient form for circling flight. To centralize the ailerons during circling flight use a small amount of top rudder. This will result in the glider slipping around the turn. This increases the angle of attack of the inboard wing and so produces more lift. The amount of slip depends on the angle of dihedral: more dihedral requires less slip.

Don't compromise on instruments. I prefer my mechanical variometer for visual and the electric variometer for audio and average climb. However, variometers tend to respond to horizontal air motion as well as vertical, hence those times when the instruments indicate good lift for momentary periods when the seat of the pants tells you otherwise. Your instincts are a valuable tool that should not be underestimated.

Climbing has to become second nature. You need to be sufficiently current to instinctively centre and re-centre the glider without thinking about it. Time circling should be spent concentrating on your next plan of attack, observing the conditions ahead and looking at secondary options. Last but not least, don't forget your lookout. ❖

New Zealander John Coutts began gliding in 1991 at Auckland GC, aged 15. He won the Standard class in the New Zealand Nationals twice. He arrived in the UK in 1999, and flies LS-8 "KM" from the Booker and Cambridge gliding clubs. The youngest pilot in last year's Worlds, he came second in the Standard class.