With plenty of height, our decisions turn to routeing: Go round or jump across the blue (sink)? (Tony Cronshaw)

THE THERMALLING DAY
PART 2: THE PLOT THICKENS

Tony Cronshaw continues his discussion with leading coach Kevin Atkinson to discover how nature's diurnal forces influence the unfolding day

THINGS are looking good. At the end of part 1 [1] we had launched into a sky populated with cu developing nicely and cloudbase going up. With sufficient height, it would soon be time to set off on task.

So far so good, but we strain to look around at the sky in all directions. The UK weather can be fickle and forecasts can turn out wrong. Is that a front approaching or just a shower? Is that cirrus – or a build-up of contrails – over there?

Tony continues his discussion with Kevin to understand how nature's diurnal cycle is about to literally "turn the heat on" and shape soaring conditions in the middle of the day and the afternoon.

TONY: ***Once launched and climbing in the first thermal of the day, what issues should we think about?***

KEVIN: Our first priority is to climb! It's likely to be a bubble thermal [2] because it's too early in the day for column thermals to form and, if it's a winch launch, we are low anyway. Whilst working patiently to stay in the bubble, sometimes we might drop out of the bottom, in which case we should search for the next bubble – if there is one from the same source – which would be located directly upwind.

Cloud shadows can help to identify cloud positions and gaps (Tony Cronshaw)

The next question is if the weather is developing as predicted, or do we already see a divergence from the forecast? We also want to assess the height of cloudbase and get high enough to set off – whilst having in mind a suitable operating band in the mid-airspace instability band, rather than dropping down to lower thermals.

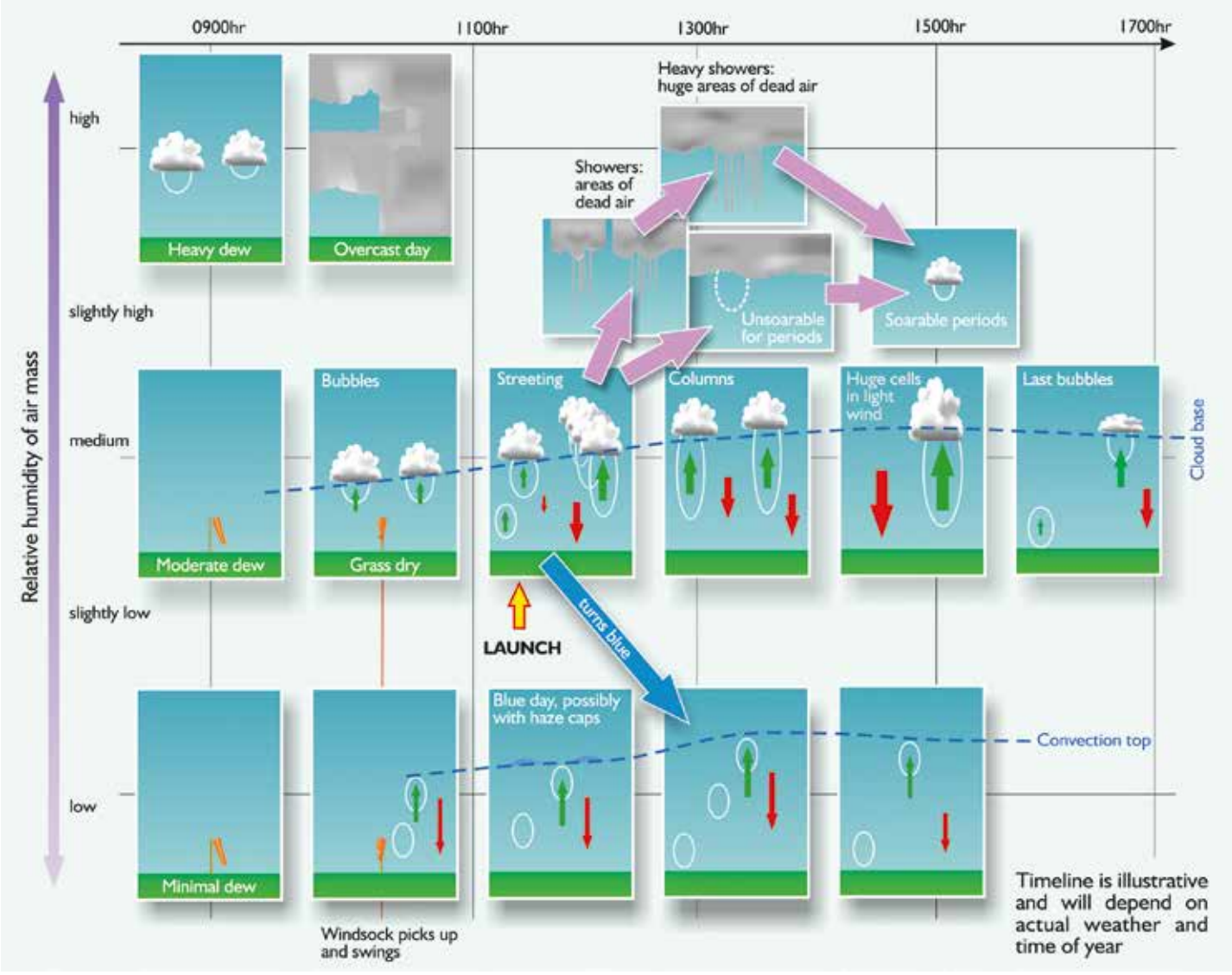
It often pays to start slowly using street systems if they are on track, staying high because the operating band is currently shallow, making steady easy progress down track. Then, as cloudbase slowly goes up, we adjust to fly a little more quickly, less cautiously and hence start to increase task speed.

This is not about being brave or taking risks, but making timely, informed decisions comparing the conditions that we have just flown in and how conditions ahead relate to this.

TONY: ***When do we know that column thermals are forming?***

KEVIN: Column thermals are associated with bigger cu forming with, ideally, plenty of vertical development. As the lower layers warm up, instability throughout the vertical mass of air increases and the cloud grows higher and the thermal column below grows downward. This transformation happens as the sun's heat intensifies in the middle of the day, supported by the massive evaporation on the cloud surface and creation of a 'tube' of sink around the original thermal, which then reinforces the column thermal [3].

TONY: ***How quickly will streets form?***



Thermalling conditions depend on the air mass's relative humidity and the diurnal clock (Steve Longland)

KEVIN: Strengthening heat from the sun will feed and sustain the circulating air patterns in a street ([4] – *how to use streets*), but for well defined streeting we also need a reasonable breeze and an inversion interfering somewhere below cloud tops.

TONY: ***With clouds developing in different ways, how can we visualise the sequence as the day evolves?***

KEVIN: A simplified sequence of cloud development and evolution is shown in the middle row of pictograms in the figure (above). Days with low RH (relative humidity) are shown at the bottom of the figure, and days with higher RH at the top. Of course, many days don't fit neatly into these three categories, perhaps turning out to be borderline humid or borderline dry, and the RH can change significantly during the day.

TONY: ***I notice there's a lower row of pictograms for a blue day.***

KEVIN: If RH is very low, rising air may cool, but not sufficiently to reach the dew point temperature before it reaches the inversion where the air starts to become warmer above. It is therefore too dry for cloud to form at the top of thermals, so we have a partly blue day – perhaps with haze caps – or totally blue. Dry grass, ie no dew in the early morning, is a clue to this possibility. Unlike a cumulus day, the inversion and therefore thermal tops, are always lowering quite some distance away from the coast. Sea breezes will tend to extend further inland.

However, if we are stuck with stable air, thermals will not rise very far. Think of those hot blue stable days when, despite the strength of the sun in mid-summer, we hang around sweltering hoping for the

FOR WELL DEFINED STREETING WE ALSO NEED A REASONABLE BREEZE AND AN INVERSION INTERFERING SOMEWHERE BELOW CLOUD TOPS

■ Kevin's book *Gliding in Lift and G-SINK* is available at *www.bgashop.co.uk* or direct from *kratkinson@yahoo.com*

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■ In the next *Ask the Coach* Tony talks to Kevin about the Aim Higher coaching initiative, and how this is planned to develop in the future

inversion to break and it doesn't. So a good sunny day doesn't necessarily mean we're going to have great thermals.

TONY: ***Now that we're on task, what clues should we look for?***
KEVIN: As mentioned, we hope to see cloudbase rising, thermals becoming stronger and clouds building vertically with multiple domes: These are signs of stronger lift – and stronger sink – and clouds becoming self-sustaining, structured and organised and developing column thermals beneath.

Statistically, as cloudbase goes up, thermal strength goes up and we climb for shorter periods compared to the cruise despite a higher cruise speed. For example, if we climb at 2kts, we might cruise at 2kts down, but if we climb at 6kts we might then cruise at 4kts down. We detour for better climbs in slightly weak conditions (leave 1kt to find 2kts). In strong conditions we accept any reasonably strong thermal on track – accept 4kts despite the fact that you think there might be 5kts. These guidelines will give you broadly suitable block speeds, but see [5] - [8] on optimising speed-to-fly.

TONY: ***Can visual clues on the ground also help?***
KEVIN: Observations of cloud shadows can be very useful. It can be difficult to see clouds ahead when we are already near to cloudbase, whereas the cloud shadows can help to identify cloud positions and gaps. We route efficiently to sample the maximum number of promising clouds, not just the strongest looking ones. The biggest might be spent and dying, whilst the smallest might be an embryonic monster thermal.

Cloud shadows also have a big effect because they cause uneven heating of the ground: The colder air in the cloud shadow can act as a mini cold front to undercut and trigger thermal bubbles heated in the sunny area ahead. Recognising this can be very helpful if we are forced to search for lift lower down.

TONY: ***What tactics do you recommend when flying into a breeze?***
KEVIN: It is crucial to climb in the strongest thermals when tracking into the wind and fly an appropriately faster speed, concentrating hard to make it each time to the next strong thermal. Plan your tasks to have into-wind legs, or crosswind legs, during the strongest part of the day or through areas forecast to be strongest. Plan to track with a tailwind where conditions are forecast to be weakest.

TONY: ***We've talked so far about textbook thermal soaring conditions, but the UK weather is often a mixed bag. On some days it doesn't take much for the sky, and the soaring conditions, to change dramatically.***
KEVIN: The arrows in the figure (page 13) show how conditions can diverge from ideal conditions to less favourable conditions, perhaps because the RH is slightly higher, or slightly lower than optimum.

High RH may be indicated by scattered showers in the late morning: This suggests that heavy showers or thunderstorms may follow. It may be possible to route around the showers if they are scattered widely enough. Similarly, if we see spreadout developing (also caused by slightly high RH and/or an inversion above) we should try to route around it or consider if we have the range to glide through it. Spreadout tends to cycle, but it can take a long time to clear, before finally giving way to good conditions from mid-afternoon onward.

TONY: ***As the day moves on into the mid-afternoon, we sometimes find the sky polarising into areas of cu and areas of blue. What tactics are best then?***
KEVIN: We may face longer glides across the blue, perhaps increasingly big holes to cross when the preferred option to route around is not practical, but often strong thermals when the other side is reached. We may bump into decent thermals in the blue, but these are always weaker than the strong thermals generated over areas where cumulus is being generated.

Ask yourself, is this blue hole thermic? Or is the sky ahead dead or weak due to a change of air mass, poor thermal generating

ground (forests, wet lands, marshes) or wave influence? Remain acutely aware that if the air is smooth, then max glide or a detour will be necessary.

TONY: ***I've noticed that thermals sometimes strengthen as the afternoon progresses: It feels like 2kts at 2 o'clock, 3kts at 3, and 4kts at 4. But then things collapse.***
KEVIN: There can be conditions, especially in light winds in the afternoon, when clouds build into large cells with enormously high tops, almost to the point of breaking into heavy showers. The sink around these cells is heavy and extends for miles around. Long glides are needed through the sink, but can be rewarded with strong lift when a core is found.

The collapse happens when the driving force for new thermals drops off as the sun wanes in the late afternoon. We are left with clouds evaporating and generating extensive areas of sink. So be aware that the strong climb you found might be the day's last hurrah.

TONY: ***On other days, the clouds just seem to thin out and lose vertical development.***
KEVIN: In the late afternoon, these are classic signs of the imminent end of the soaring day. It might also be a sign of a changing air mass. Middle air space instability might still generate and support thermal vortices, so stay high and cruise cautiously.

If we are getting lower, we will have to rely on radiator hot spots – residual heat from stored ground sources – such as villages, towns and, if really late, woods. Or we might be lucky if a tractor working in a field sets off a late afternoon thermal.

TONY: ***What's the situation still later in the afternoon?***
KEVIN: You mean when everyone else is back home having a cup of tea, and wondering where you've got to? Perhaps you're surviving on a series of little bubbles rising from a ground source, each time trying to climb to get onto a new glide, or onto final glide, all this time managing the options for a landout.

TONY: ***I find the stress is lower if this happens near a known landout field, but drifting whilst scraping can add stress if I have uncertainties about the field.***
KEVIN: I agree it's well worth building up knowledge of landout fields and alternative airfields. I have a simple philosophy that there is no such thing as a marginal glide. You either set up for a safe final glide to land back home, or a safe field landing.

Regarding scraping and drifting, I suggest you stay truly local to the chosen landout field. Make the decision to break off circling in good time to avoid drifting too far. Follow your field landing training and checklist, and at circuit height fly a basic circuit that correctly positions your glider for the right approach "picture".

If you succeed in climbing by patiently working a bubble, your final glide may benefit from the air being less turbulent, perhaps completely dead. Your glider's glide performance, apparently poor in earlier turbulent air, will be more efficient when gliding home through the placid air.

Late afternoon sky from the cockpit (Steve Lynn)

Tony Cronshaw is an Ass Cat instructor at Cambridge Gliding Centre with over 1,000 hours gliding. His enthusiasm for helping the next generation of pilots includes running courses for visitors and members, and supporting CGC's recruitment and retention sub-committee

[1] part 1 *S&G* article, June/July 2016, pp14-17
[2] *The structure of thermals, S&G* Aug/Sept 2015, pp10-11
[3] *How a column thermal forms, S&G* Oct/Nov 2015, pp10-11
[4] *Learn basics to exploit streets, S&G* Dec 2015/Jan 2016, pp8-10
[5] *Learning how to go faster – part 1, S&G* Aug/Sept 2014, pp10-13
[6] *Learning how to go faster – part 2, S&G* Oct/Nov 2014, pp10-13
[7] *Learning how to go faster – part 3, S&G* Dec 2014/Jan 2015, pp12-15
[8] *Learning how to go faster - Q&A, S&G* Jun/July 2015, pp10-13

BE AWARE THAT THE STRONG CLIMB YOU FOUND MIGHT BE THE DAY'S LAST HURRAH