DYNAMIC SOARING – the challenge.

By Klaus Weiss.

In the past year or two, there has been a substantial increase in the numbers of pilots wanting to learn more about silent flight. The thermal duration competitions, particularly the two metre class, has become very popular with R.C. pilots.

Likewise, slope soaring is also benefiting from an increased participation. Many pilots, who have only ever flown power models previously, have been seen lurking around my local slopes and having a go at this "other" form of flying.

There are a number of, highly damage resistant, slope soaring kits available on the market these days, so the fear of crashing is no longer a concern for newcomers to this form of flying.

EPP and EPS foam construction, enable pilots to fly their models in new and exciting ways, without the fear of a major rebuild, should there be a miscalculation or hard arrival.

One of the most recent challenges for slope pilots, is the need for speed, using high performance gliders, or low cost EPP and foam models.

In the U.S.A. and Europe, the speed freaks and adventurous, are exploring the potential of a style of energy flying, called Dynamic Soaring.

This form of soaring has been perfected in nature, by a variety of sea birds, particularly the Albatross, who use the principals of D.S. to fly vast distances, with a minimum of energy being expended. For those of you with computers, and the curiosity to know, the a good reference as to the explanation of Albatross flight can be found on the internet, at http://www.wfu.edu/albatross/atwork/dynamic_soaring.htm,
An explanation of how the albatross and some other birds use dynamic soaring to achieve seemingly endless flight over the ocean without flapping their wings, is well outlined in that article.

Briefly, when wind blows over water, the lower layers of air are slowed down, due to friction with the waves. As a result, a gradient of differing wind speeds is produced, with wind speed at a maximum, around 30 metres or so above the surface. Sea birds will climb upwards, to around the 30 metre mark and then enter a dive, gaining air speed, and at the same time, covering substantial distance. When their glide reaches almost sea level, they turn into the wind using their momentum, to once again climb into the stronger wind gradient higher up. They will lose speed during this climb, but this is compensated for by the distance covered, in the downwind glide. This cycle is repeated over and over, enabling these birds to cover vast distances, without the loss of much energy.

What does that have to do with our slope soaring models? Well, R.C. Glider pilots can also use this phenomenon, to reach unbelievable speeds, whilst flying banked circles in the area behind suitably shaped slopes.

Experienced glider pilots generally develop a skill for reading the air, and can usually take full advantage of whatever lift is available.

On the slopes, a pilot can fly a model on the face for hours on end, without having to land. Air is constantly moving, exactly like water does in a river.
If you take the time to sit and watch water flowing in a shallow stream, then you have an exact equivalent of what the air is doing. Only difference is that you cannot easily see the air currents.

When water flow hits an obstruction, like a boulder, it "boils" over the top. The water directly behind the boulder is relatively calm, and so it is with wind that blows over a ridge top. When the wind meets a ridge, it is compressed as it passes over the crest. Where this layer of fast moving air meets the turbulent air on the lee of the ridge, there is a definite separation layer, called the boundary layer.
On the correctly shaped slope, this is the air you want to dive into, to commence the circles for dynamic soaring.

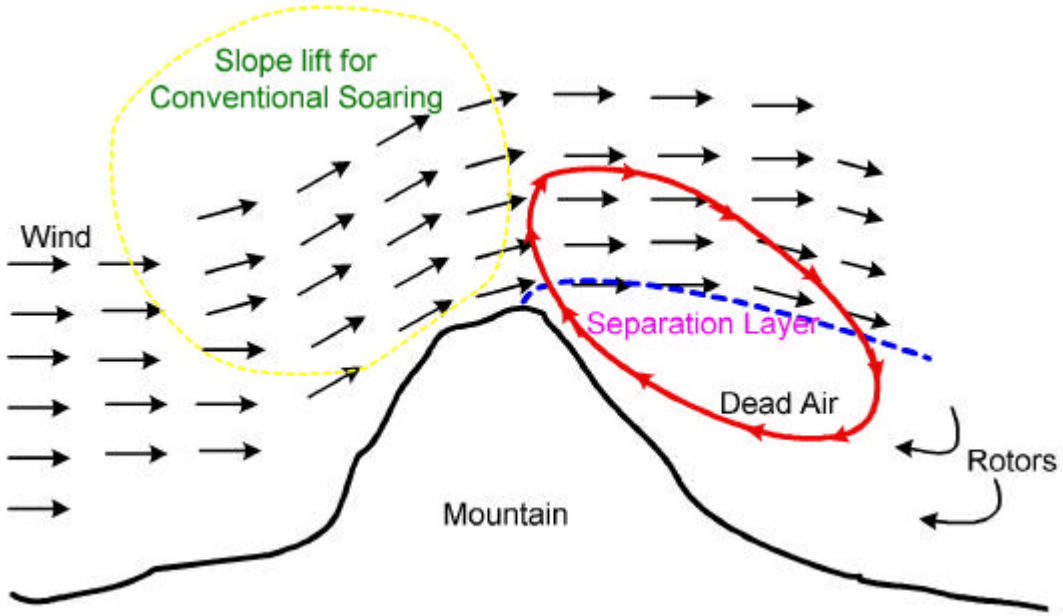

Diagram 1.

R. C gliders fly along a tilted circular path on the back of the slope, crossing this boundary layer into the lift for a portion of this path, and just as the seabirds do, extract energy to keep flying as long as they wish.

The circular manoeuvre performed at high speed by these gliders, is awesome to watch, and even more awesome to be heard. With each circle flown, the ground speed of the model increases proportionally to the wind speed coming over the hill. The air screams, as the glider is dynamic soaring.

It is my opinion, that glider technology and performance, is at the forefront of R.C. development. The advances made in design, efficiency, lightness, strength, airfoil design and construction, allows pilots to explore this potential of Dynamic Soaring.

How fast can a plane go whilst Dynamic Soaring? Well, it is dependant on the strength of the wind, blowing onto the slope. In the U.S.A. speeds in excess of 320kph have been reported. Difficult to believe? Not when you have seen it.!

Model aircraft can be, and often are, destroyed, whilst engaging in dynamic soaring. This is due to a variety of causes; Pilot error, and integrity of the airframe, being the most likely causes. High-speed flutter of either the wing or the tail surfaces, coupled with very strong forces as the plane encounters turbulence at the boundary, are also major contributors.

A pilot can often be a fraction of a second behind in controlling the plane, and as the flight takes place very close to the ground, things can happen very fast. A fraction of a second lack of concentration, can lead to a spectacular and mostly permanent destruction of a model. I guess this is one of the factors which makes it so challenging, and so much fun.

Generally, the faster and less draggy a plane is, the better it will be at dynamic soaring. EPP flying wings, such as the Vector, Jazz Extreme, Zagi, etc, will work well, although they have a lower top speed than composite or moulded models, with stiffer wings. These EPP flying wings are excellent planes to learn Dynamic Soaring with, as they tend to survive crashes much better. If you want to learn DS with a more fragile plane, then be prepared to see it destroyed.

If you have a suitable hill, and want to have a go at Dynamic Soaring, then begin by launching the glider on the "correct" side of the hill, and build up altitude. Now, come over the back of the hill with a dive downwind. Pull into a banked turn, coming back up the hill. You will be in the "dead air" zone at this stage, and climbing towards the boundary layer. As it hits the layer, it receives a boost, so continue on until you judge it is time to turn again and repeat the process. If you master the technique, the model will gain tremendous ground speed, with each successive circle.

Photo by Stanley Chan.

I have seen 3 metre span gliders punch through the boundary layer, and after only three circles, climb almost out of sight, at high speed, with accompanying and awesome sound.

Dynamic Soaring can be extremely dangerous to spectators and pilots alike, so if you venture there, then fly safely, and in controlled areas.

There are various videos available, which show dynamic soaring, so if you get a chance, have a look. There is always something to excite everyone in this great sport of ours.