

# Slope Soaring EPP R/C Planes for Beginners



An awestruck passer-by sees the colourful planes zooming and rolling across the slope, comes over to the fliers and gushes out questions like: “Is it a kite? What is it? Does it have a motor? How do you control it? Where do you get them?? How much does it cost? How do you get into it!??”

Well, the last thing fliers want to do on a good day is spend half an hour talking about planes instead of flying them! It takes time because although it's not complex, foamie building and flying introduces new concepts and the hardware and information

needed are in lots of places.

So, the aim of this document is to be a good introductory summary for our “new enquirer”. So we don't want a bunch of emails from experienced fliers saying “you haven't mentioned the blah blah blah”. We're trying to keep this simple, in plain language and without too many complexities.

## WHAT ARE THEY?

If you saw the planes flying at Shorncliffe and you've looked up this info to find out more, it's a sure bet that what you saw were the boomerang shaped wings with no fuselage, and just 2 ailerons which do all the controlling.

If you asked the fliers “What do you call it?” you could have got one of many answers! There's no one all-encompassing name for the things we fly. They might say ...

“It's a Bee” (or a Duck or a Bat or a Tornado or a Fatboy Brat or a Zagi or a Skua or a Scorpion or a Jazz), or

“It's a Slope Soaring Glider” or

“It's a Combat Wing!” or

“It's a Delta Wing Foamie” or

“It's an EPP Elevon Sailplane” ... and so on!



Years ago, the “Zagi” was one of the very first delta-winged foam gliders sold commercially ... so for many people they are still called “Zagi's” the same way we refer to all cling films as “Glad Wrap”! Now, there's a smorgasbord of Zagi type planes out there.

Their common features are:

- They're radio controlled
- The wing shape is made out of foam. The first “foamies” which started the foamie revolution were built from polystyrene foam (like eskies), but the white foam did crush and crack. The advent of EPP (expanded polypropylene) foam which is flexible, took foamies to a new level of “crash resistance”. In the old days of balsa planes, one crash usually meant the end of flying for the day, and many hours of repairs. EPP planes crash, crash and crash again ... and don't need much fixing. The boom in flying at places like Shorncliffe is due to EPP.
- They don't have motors (well, actually some foamies have electric motors too).
- They have only 2 control surfaces, called “elevons”.

There are other types of foamies including ones with fuselages and tails, even amazing scale replicas of warplanes like our local S&B Models. But for simplicity, I'm only describing the delta wings here.

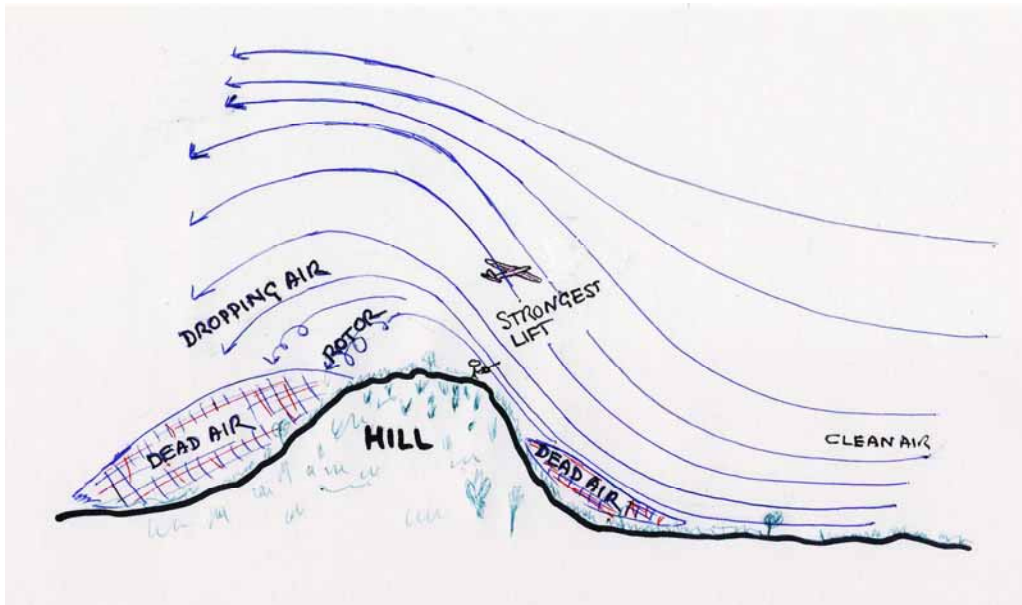
## HOW DO THEY WORK?

Hmm, where do we start ... Well, apart from a plane, the other thing a slope flyer needs is ...

### LIFT!

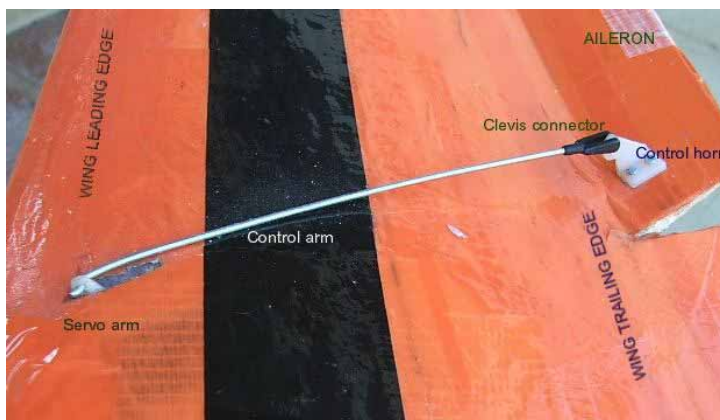
First you have to understand that all gliders descend at a certain rate. Really sleek, light, super-efficient carbon fibre sailplanes might only lose a metre of altitude for every 200 meters they fly, but our foamies are not very efficient and they probably drop a metre in every 20 or so. So no matter how high or how fast you launch them, they're going to return to earth soon! But imagine ... if the plane is flying in air that's going up faster than it's going down ... the net result is that the plane goes up!

If wind is blowing across the land and it hits a big obstruction (a hill, ridge, mountain etc) it will flow up to get over the bump. Our planes are called "slope soarers" because they stay up there by flying in air which is racing up a steep slope – just like an eagle soaring along a ridge.



But if the wind drops, so does the lift. Also, if the wind direction changes so it's hitting the ridge at an angle, the lift will drop because the oncoming air will flow across the slope to get past it, instead of going up. Some foamies are more suited to really light air and less lift (Weasel, Alula, etc) and some are only able to fly in strong wind and huge lift. But whatever the plane, you need to keep it under ...

### CONTROL!



Most foamies are controlled by "elevons" which means that they have only 2 control surfaces; one at the trailing edge of each wing. These surfaces can work opposite to each other (one goes up, the other goes down) to perform the function of ailerons – which cause the wing to bank, or roll. They can also work together (both go up at the same time ... or down) to perform the function of the elevator – to control up and down movement. Hence the combined name

"Elevons". Normal planes have a third control - the rudder – which is absent in delta wings. The combination of roll and pitch control is all you need.

### IT SOUNDS HARD!

Yes, delta wings are actually a difficult thing to learn to fly. They are fairly sensitive to control, and they don't have much "inherent stability" ... meaning that they don't "right themselves". If

you bank steeply and start to dive, the plane will keep accelerating down! On the other hand, there are many conventional sailplanes which are much more forgiving to fly ... but with their more fragile nature, they're not forgiving to crash! As long as you can get someone to teach you some foamie basics and help rescue you for the first hour or so in the air, you'll probably get enough basic skills to go it on your own.

Once you've got the basics, the coordination you'll get from the many hours you spend flying a foamie will make flying anything else much easier.

## **WHAT GEAR DO YOU NEED?**

Obviously a kit for a plane first! Or if you're very clever you can make it yourself. A kit would generally include

- The foam wings (left and right)
- Elevons
- Winglets for wingtips.

... and it may or may not include some of the other stuff you'll need, including: Control horns, control rods, control link connectors eg Clevis pins; cross-filament fiberglass tape, coloured covering tape, lead for balance, etc.

Also, you'll need various glues. It would not be unusual to use all of these in building one foamie:

- Cyanoacrylate (CA) glue (like superglue, available in various thicknesses – medium is good).
- 5- Minute Epoxy
- Polyurethane woodworking glue.
- 3-M Super-77, also called 3-M Multipurpose Spray Adhesive.
- Hot-Glue Gun.

You'll also need some sort of switch and charging socket.

Also, we reckon that a lost model alarm (LMA) should be mandatory equipment.

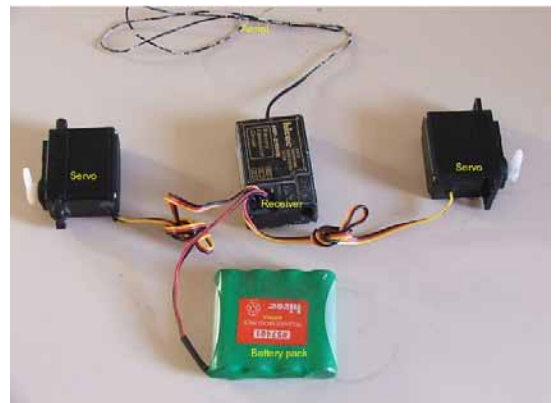
You'll also need a Radio, and it's such an important subject we'll give it a new heading:

## **YOUR FIRST RADIO!**

The cheapest radios are "AM" and the more modern ones are "FM". There's nothing wrong with using AM, but like everything electronic, if you pay a bit more you get loads more useful features. Firstly, FM gives a smoother "feel" and encounters less interference. But it doesn't stop there. You can get many advanced features with FM, which we'll explain below.

Let's say you set up your radio control gear in the simplest way, with one servo on channel one of your receiver, and the other servo connected to channel 2. The right stick of your transmitter will transmit to channel one, which will control one servo, and the left stick will control channel 2 and will move the other servo. But ... you won't be able to fly your plane like that! You need to get it set up somehow so that the left stick can control both elevons to go up and down together (the elevator), and the right stick can make them go opposite directions, to make the plane bank (the ailerons).

To do this, you need to get "mixing" of the 2 channels. There are 2 main ways to do that, and you'll have to choose!



## **BASIC RADIO WITH AN ELEVON MIXER**

You can buy a piece of electronic hardware called an "elevon mixer" from hobby suppliers. You connect it to channels 1 and 2 in your receiver, then the servos to it. The more expensive mixers allow you to vary the "rates" of control – the main use of this is that you can set it to give small amounts of up/down control, whilst retaining full aileron control. This is a big advantage because

you want lots of aileron movement, but the planes are very sensitive to up/down and too much elevator makes them hard to control. The cheap ones don't have this feature.

If you're using an elevon mixer you can use any sort of radio – AM or FM, as long as it has at least 2 channels.

A cheap AM 2 channel radio with receiver, servos, etc can be bought for as little as \$80, and the mixer for about \$25.

### **COMPUTER RADIO WITH ELEVON PROGRAMMING**

For \$300 or so, you can buy a "Computer Radio" which is an FM radio with programming capability. They have an LCD screen and buttons to scroll through and change things.

For an elevon foamie, just select elevon mixing in your computer radio and hey presto ... it will work properly! Not only that, but you can fine-tune the throw rates, the sensitivity, and many other options.

You can even program a number of planes into one radio! For example, you could use the same radio to work a foamie, or a full-house sailplane, or in some cases a helicopter. So if you have several planes you just program each of them into the radio's model memory, and when you swap planes, just press the buttons to change the radio to the new plane, and it remembers all of the programming for that plane. It would take too long in this article to describe the possibilities of a \$300 computer radio. (... the fancy ones run to thousands of \$\$, but they're not of any extra value for foamies).

At this stage, you'll be thinking "I don't even understand that stuff, so I don't need it". But the flexibility that you have with computer radios becomes incredibly useful as you learn to fly and start fiddling with your plane's setup.

There are many other useful things about computer radios. The best advice is: if you can afford one, get it. There's nuthin wrong with a basic 2 channel AM radio, but if you keep up your interest in flying, it will probably end up in the cupboard before long.

Of course, there are many options available in receivers (small, less interference, more channels etc) and servos (small, powerful, fine resolution, digital, thin, etc).



### **HOW DO YOU MAKE A FOAMIE?**

This could take up a book in itself! Most foamies come with good instructions. Also, there is heaps of info on the internet about building (eg on RCGroups.com).

The Wowings Duck (no longer available) has excellent instructions and they're still available on the net at Wowings.com. The directions apply equally well to other planes.

A quick summary for most models is:

- ◆ Glue wing halves together accurately.
- ◆ Fit and glue spars if needed.
- ◆ Keep it all flat and straight on the bench during building.
- ◆ Work out where you'll fit receiver, servos, battery, leads, aerial, and (if using them) switch, charging jack and lost model alarm. Mark and cut recesses for them. (The Bee has some of these pre-moulded).
- ◆ Test the radio gear on the bench, to check that it's all working as it should. When you push the left stick (elevator) forward, both elevons should move down. When you push the right stick (aileron) to the right, the right elevon should come up and the left one go down. The aileron movement can be large (eg 10 - 15mm either way) but if you can adjust the mixing, elevator should only have half that amount of throw.
- ◆ Fit and tape/ glue the radio gear in, flush mount foam slices over them where necessary.
- ◆ Spray the wing with 3-M Multipurpose adhesive. Let it get tacky.

- ◆ Tape one side of the wing using lengthways strips of filament tape (always use crossfilament, not linear tape). Sand the surface of each strip of tape after laying it on, to remove the non-stick coating, so the next layer grips to it fully. The sanding also presses it into the glue.
- ◆ Tape diagonal strips over the longitudinal ones. Some people use lots of tape, and some don't use much to keep the plane lighter.
- ◆ Do the same on the top surface.
- ◆ Cut ailerons to length. Bevel front edge at 45 degrees. Spray glue on trailing edge (TE) and on ailerons. (When tacky ...) use tape strips to hinge, as per Duck instructions.
- ◆ Apply covering. Strips of coloured packing tape are great. Some people use heat shrink film (eg Monokote). It looks better, adds toughness (so you can use less filament tape) but it's much more expensive, harder to work with, and not so good when you're going to be learning and crashing a lot. A few people use automotive signwriting vinyl ... a bit heavier (so get the really thin stuff!) but good to work with. Whatever you use, spray lightly with 3-M glue before putting the covering on.
- ◆ Fit control rods and horns
- ◆ Fit winglets (vertical stabilizers at wingtips).
- ◆ Check and adjust balance point. For the first flights it's best to set the CG at 3mm further forward than recommended, with the ability to remove nose weight to shift the CG back later. (warning – sometimes the recommended CG isn't right!) Mark the recommended CG underneath the wing with a pen.
- ◆ Check and adjust control throws.
- ◆ Not a bad idea to iron the wing on low heat to really flatten and stick the coverings, but keep the wing straight ... don't iron a twist into it.



Very heavily taped wing on the Drongo

## **HOW DO YOU GET IT TO FLY?**

### **GET HELP!**

No doubt the best option is to hook up with some experienced fliers when they're at a big airy slope with lots of lift, and ask if someone could check out your plane and test fly it ... and perhaps give you a few pointers. If you log into to the Windssock forum you can ask there, and most likely some other fliers will organize to meet you when the weather's good.

When someone test flies it for you, they'll initially adjust the trims (fine control of the centering of the ailerons) so it flies straight and level. They'll also test out the climb and dive behaviour of the plane for CG problems and maybe add or remove nose weight till it is trimmed well.

At first, it's great if another flier can launch your plane and get it out there, then give you the Tx to take over, and grab it back off you if you're in trouble. Even with help like that, big crashes will still occur! When the learner puts the plane into a death dive, it's hard for the teacher to get the TX back and react quickly enough to save it.

The best way to learn is with a "Buddy System" which is 2 Tx's, linked by a buddy cable. The teacher has a flip switch which he holds to give you control, so he can regain control in a split second.



## IF ON YOUR OWN

If you can't get help, don't have your first-ever flight at a big slope, or you mightn't see your plane again. Best to find a big soft-grassed paddock with a steady non-turbulent breeze, and preferably a high spot where you can toss the plane into the breeze. If there's turbulence, such as wind coming over trees or houses, you won't be able to make sense of the plane at all. You need a steady straight breeze.

If possible, get someone else to throw it for you. They need to throw it very straight, like a javelin, and keep it pointing directly into the breeze as they throw, so the wind doesn't "grab" the wing and force the nose up or down as they toss it. It's easiest to keep control if they hold the back of the wing, between the ailerons, with 2 fingers on top and thumb/ knuckles underneath. This gives reasonable grip. They can also hold the nose if they wish.

Throwing it yourself requires some nerve and coordination at first. Hold the Tx in your left hand with your left thumb on the elevator stick so you can quickly correct the up/down as it takes off.



You'll probably feel very conservative, and want to throw it gently. But the plane needs to reach its cruising speed to fly properly, so it needs to be tossed quite hard. That first throw is always scary, because it could go nose-in, or it could shoot up and stall, and then nose in. Imagine how much scarier this would be with a balsa plane!

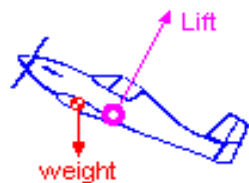
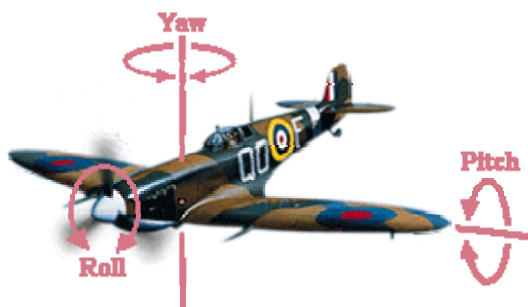
As soon as you have the basic idea, try to get yourself to a slope, preferably with other fliers. When you're just starting off it feels safe in a park, but the plane is always very close to the ground, so you crash a lot! It's a catch-22 situation. Flying on

"Big" slopes looks scary, but in many ways it's easier to learn because there's so much sky to play around in that you get time to work out what the plane's doing. If you fly up high and well out there, there's plenty of room to make mistakes and recover without hitting mother earth.

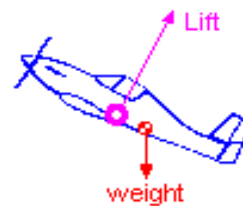
## TRIM TIPS

Trimming properly for good flying is a big subject, so we'll only put a few basic tips here ...

The CG is the point at which the weight of the plane is equally balanced in all directions, when it's held perfectly horizontal. When the plane is flying, the CG is like a ball joint and the plane rotates around it. The rotation can take place in 3 directions which are controlled by the plane's control surfaces, as shown here:



When the CG is ahead of NP the weight tends to correct the upset = Stable



When the CG is behind NP the weight worsens the upset = Unstable

When the plane is flying properly there is a central point of lift created by the wing, referred to as the centre of lift (CL) or neutral point (NP). If your plane simply won't fly at all, ie it keeps crashing, fluttering, stalling, spinning etc and never even looks like it will glide, it may be due to the CG being too far back (tail heavy). Try taping a marble-sized piece of lead (hammered flat if possible) on the tip of the nose. Moving the CG will completely change the performance of the plane.

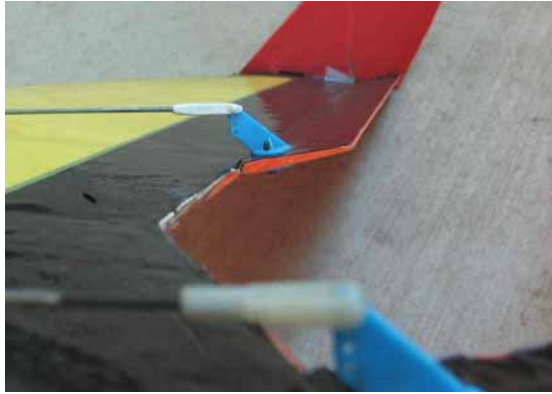
(the above diagrams courtesy of <http://adamone.rchomepage.com>)

When you throw it hard, the plane will usually shoot up steeply due to the lift from accelerating to higher than normal speed. With no control input, it may shoot straight up and stall, then fall

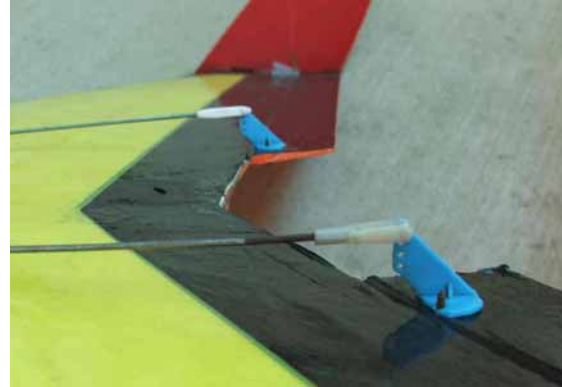
and lose height or crash. So be ready to push the left stick forward as it shoots up, to smooth the climb out.

As it levels out, watch how it flies. If it's trying to float, or stall, give it more down trim. If it's going down much too fast, give it a few clicks of up trim. Similarly if it's rolling to one side, adjust aileron trim till it's flying flat and straight.

When it's trimmed to glide well, leave the radio on, and stop and have a look at the angle of the elevons. If they're angled up a fair bit, that means that you have too much nose weight.



Too much elevator up trim



Just right.

When you get it flying properly, start removing nose weight bit by bit. It should start to fly better initially – you may have to trim the elevator down too. When you've taken too much nose weight off, the plane will pitch up or dive too easily and will be hard to control. Add a bit more weight back to get it handling well. When the plane is trimmed well, it should only need a small amount of up/down throw to give good control.

The "Dive Test" is a good way of checking for optimum CG position, but you need to be capable of flying at a big slope. Get the plane trimmed for optimum level flight – cruising well and gaining height without stalling. Put the plane into a 45° dive and when it's near max speed, let go of the elevator stick. If it pulls out of the dive strongly, it is too nose-heavy. (yes, the opposite of what you'd think!). If it pulls out slowly, that's perfect. If it doesn't pull out, and you're not an experienced flier, you should probably add a bit of nose weight.

If you get it trimmed well in a paddock, then you take it to a lifty slope, it will need a few clicks of down trim.

## **LEARNER FLYING - FIRST ESSENTIALS**

### ***Control Sensitivity***

These planes fly best with minimum control movement - the exact opposite of a computer game joystick. Watch the guys flying at the slope. Even when the plane is looping and rolling, you can hardly see their thumb movement. If you use radical control, the elevons act like air brakes and slow or stall the plane. It's very important to use very fine control movements.

When you first launch off a slope, the first thing is to fly the plane directly away from you. Teach yourself to control it flying straight and level, for the first few seconds after launch.

### ***Speed***

Don't try to make the plane float slowly. Learners usually think it's safer to keep the plane flying slow, and that speed is dangerous. The truth is that the plane needs speed to fly well. You should aim to keep the plane flying at its fast cruising speed – that way when you need to turn suddenly, or go up to avoid an obstacle, there's energy in the plane to respond. If you're going slowly you're too close to stall speed. The plane will respond sluggishly and a sudden control movement could stall the plane, sending it crashing down. Many learners fly so slowly that the plane is constantly doing "micro-stalls" and the learner can't understand why the other planes are going up and they're not! Slow speed does not provide more lift.

### ***Turn Into Wind***

Get the plane well away from the slope, so there's plenty of room. Then, turn the plane gently into the wind. That way it keeps its airspeed but isn't moving too fast in relation to you. When you're learning, don't turn downwind ... all of a sudden the plane's airspeed will drop, causing

the control response to become sloppy, and meanwhile the plane will be shooting downwind at a great rate. Stick to into-wind turns until you're confident.

### ***No "Inherent Stability"***

When you push the right stick it makes the plane bank (roll). With many "conventional" planes, if you let go of the stick, the plane will right itself and return to level flight. But elevon delta wings will just stay on whatever angle you bank them to. They don't right themselves! So when you bank to turn, you need to push the stick the other way to level the wing out again. Don't keep pushing the right stick or the plane will keep rolling onto knife-edge (and spiral dive) or go upside down etc.

### ***How to Turn***

When you turn, the plane will often start to nose-down and dive during the turn (depends on the plane). This can quickly become a spiral dive and most learners crash at this point. Counteract it with a bit of gentle up-stick during the turn, so the plane doesn't dip too much.

The first thing to get the hang of is to zig-zag back and forth across the slope in front of you, turning into wind at each end. Be in control of the plane – don't let it go wherever it wants to go! Keep it well away from the slope so you can stuff up and correct it before hitting the ground, but not so far away that you can't work out what's happening.

When you turn gently, there's a lag in response. When you initiate a turn it will bank, and then gradually begin to turn. So you need to anticipate the control inputs and start them before they're needed.

Let's say the plane is flying across the slope to your right. The routine to turn is: push the right stick gently to the left. Plane banks left and starts to turn away from you. Let the right stick centre and the plane will keep banking and turning. Pull back slightly on the left stick to avoid diving and hold that thru the middle of the turn. Try to come out of the turn at about the same level. When 2/3 thru the turn, push the right stick gently to the right until the wing levels out. Then fly across the slope again and repeat it the other way.

As you get the hang of the zig-zags, start coming closer and closer to the slope. Being close to yourself will give you a closer perspective and you'll begin to learn fine control.

Next, take the plane way out and fly it directly back towards yourself. It's confusing at first but it has to become instinctive. One way to think about control when the plane's coming towards you is: whichever wing drops, push the right stick that way. That will keep the plane flying flat, and it's very useful if you're landing towards yourself.

### ***Other Tips***

On slopes, there are often strong updraughts of lift which will pitch the nose of the plane up. Don't let the plane stall up too steeply in the lift. Push a bit of down elevator to keep the plane's speed up.

To do tight turns, banking steeply and pull up elevator when the plane's on its side.

When you're confident, try a loop. Get lots of height, fly across the slope, dive down at about 75°, get lots of speed, and then pull the left stick back. The plane will pull out of the dive. Hold the stick back till the plane goes right over the top and back again. One learner mistake is to pull full up for loops. This can slow the plane too much. Pull just enough up to do the full loop with plenty of speed over the top.

Then try a barrel roll. Get plenty of height, come back over the slope and fly the plane directly away from you, dive down at 30° or so to get lots of speed, then pull up gently out of the dive. As it comes up past level, heading slightly up, let go of the left stick and push the right stick most of the way to one side. Let the plane roll upside down then back again, and keep flying!

## **LANDING ON THE SLOPE**

The 3 clues for good landings are:

**Pick your landing spot and try to land on it!** Obviously, the softer the better! If there's deep grass you can crash into it with no worries. If it's a hard surface, hmmm.

**Lose as much speed as possible without losing control.**

The best way to land, if possible, is to come behind the slope and fly back into the wind. That way you have good control, but low groundspeed. However many slopes don't have a backside landing patch, so you have to land on the front, in the lift band, which will be making the plane fly fast if it's windy. Drop the plane down quite low below you, then come back up, keeping close to the slope, until you're at the top then turn across the slope and plonk it down.

**Land with the wings flat.** Otherwise you'll cartwheel and maybe do some damage.

Remember, you can always go around again. If you're coming in for a landing but it's not quite right, just keep going and try again. Sometimes we do a dozen approaches before landing.

When everything's right, make the plane land by nosing it down gently. Drive it onto the landing zone. It's better to hit the ground in the right place, on the right angle but with a bit of a smack ... than to float past it gracefully and hit something else.



Lotsa soft grass for a fast landing

## **RADIO ETIQUETTE**

You must realize that you may have a radio with the same frequency as someone else. Don't turn up to a flying spot and just switch your radio on!!! You might "shoot down" another guy's plane, and he won't be happy! Ask the other guys what frequencies they're on. If necessary, change crystals, or wait till the other guy stops flying.

## **WHERE TO FROM HERE? ...**

If you're anything like most of us, you may progress to exhibiting the following dysfunctional behaviours:

- ◆ Fiddling with your plane in front of the TV, annoying anyone else.
- ◆ Obsessively looking for weather reports suggesting good wind.
- ◆ Suddenly taking an interest in country drives, searching for likely looking slopes.
- ◆ Surfing the internet for websites about planes, flying, building, etc.
- ◆ Accumulating an ever increasing range of planes and spending days and days in the shed when you get a new one.

Sloping looks like such a peaceful activity, but every flier is burned up with passion about the next big thing. Learning to do those slow rolls across the lip. Finishing that new plane that's going to love flying upside down. Trying out that new slope. At the extreme end, guys are buying radar guns to clock their speed planes, and slope gliding has moved to a new level with the worldwide phenomon of Dynamic Soaring (DS).

Yes, this is a totally absorbing and addictive pursuit! **Be warned!**

## **WEBSITE LINKS ON GLIDERS AND SLOPING**

There is a ton of information on the internet about subjects related to slope soaring. Just type “beginner slope soaring” or “EPP slope” into Google and start browsing.

Our local site for South East Qld sloping is a good start, and you can get help via the forum:

<http://www.windsock.net.au/>

RCGroups (or RCG) is a must-have favourite site, as it’s the most-used site in the world for forums dedicated to all aspects of radio control. There are sections for a huge range of categories. There are many sailplanes categories, including slope soaring – even categories within sloping! If you can’t find it on RCG it probably doesn’t exist! They have regions within RCG so you can select discussions within Australia, which is useful.

<http://www.rcgroups.com/forums/index.php>

This one is very comprehensive:

<http://www.moneysmith.net/Soaring/soaring.html>

Ian Cole is an experienced Aussie flyer who has an informative site with lots of good links etc:

<http://users.ompac.net.au/~iancole/>

This one is about the experience of a couple of newbies with their first planes (Weasels).

<http://www.shallowsky.com/planes/weasel/slopetips.html>

This site is dedicated to all aspects of sloping and is very comprehensive:

<http://slopeflyer.com/>

This one has a huge list of the slope planes on the market:

<http://www.fatlion.com/sailplanes/slope.html>

Speedfreeks is an Australian-based (but worldwide interest) site dedicated to the more extreme end of sloping, ie speed and dynamic soaring. These guys are more likely to be talking about radar guns than balsawood!

<http://speedfreeks.com/about.php>

