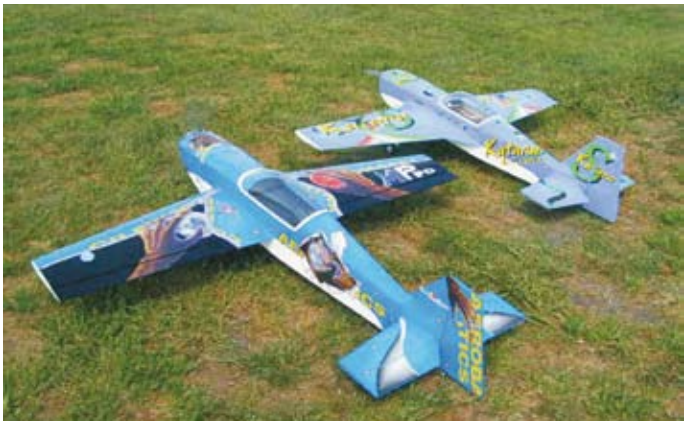
Stick and rudder



120-140 sized scale aerobatic machines. In the forground is a Giles 202 with an OS 200FS swinging and 18x8 APC prop. The Katana has an OS 160 FX with an APC 16x10.

Advance aerobatics requires the use of rudder and in order of degree of difficulty, here are a four manoeuvres that require rudder. The spin, knife edge, knife edge loop and the side slip. At any field around the country it is highly likely that a scale aerobatic model will sitting in the pits. There is a multitude of scale aerobatic product available in a range of all sizes and the 20 and in particular the 50cc sized models are one of one of the most rapidly growing market segments.

I always wanted a model with enough grunt to do a knife edge cuban eight. My CM Pro Katana has enough grunt to do fly over the top and accelerate fast enough to pull over the second half. Boy, you really have to work controls going over the top, particularly the second half .

The four-stoke powered Giles will also do it but the manoeuvre has to be much smaller as there is not as much power.

Spins

This is easy, stall the model then pull in full up elevator then apply full aileron and rudder. To make a spin in particular direction ease in a bit of rudder just before the stall to encourage the model the desired way. Inverted spins are of course using full down elevator however the rudder and aileron directions are split, ie left rudder and right aileron.

A more spectacular spin is the flat spin either upright or inverted. Establish the spin then slowly apply opposite aileron and the nose should raise and the spin rate increase. This is usually improved with power and about half works best with my Katana. Also the upright flat spin looks better as the nose will almost be level with the horizon with that model.

Standard spin recovery technique is simply centre the controls but a flat spin can take a couple of rotations to stop. Lowering the nose and applying opposite rudder will give a rapid recovery if you are running out of altitude. Unless you are in a competition how you enter a spin isn't that important but the exit is. You can just snap roll in but you can also snap roll back in on the pullout. A spin is low airspeed and high angle of attack and the biggest mistake you can make is trying to pull out straight after the spin has stopped.

Let the thing drop at least fifty feet before pulling out level.

Control Throws

These are the throws I use on the Katana. They have been measured at the widest point on the inboard edge of control surface.

	High	Low
Rudder	65	85
Aileron	20	24
Elevator up	15	20
down	18	25

The extra down elevator value is set to give the same looping radius for inside and outside loops. Assuming the model is trimmed to fly upright, to maintain level flight a symmetrical wing section must fly at a given angle of attack. The faster speed less angle required. If the model was trimmed for inverted these values would be reversed but this is why more throw is needed one way.

Props

I should save this for my Grumpy Old Man column but I can't do that until next year when I turn fifty. The Helicopter 3D trend has transcended to aeroplanes and now lots of people want to hover. Unfortunately the low pitch 3D hovering props create a hell of a lot of noise at full throttle but blatting around at altitude with full power can be a bit anti social.

The props tips wail as they break the sound barrier which just annoys the neighbours and other modellers at your flying site. If you are not convinced drive a kilometre away from the field and listen when one is in the air.

Needle valve.

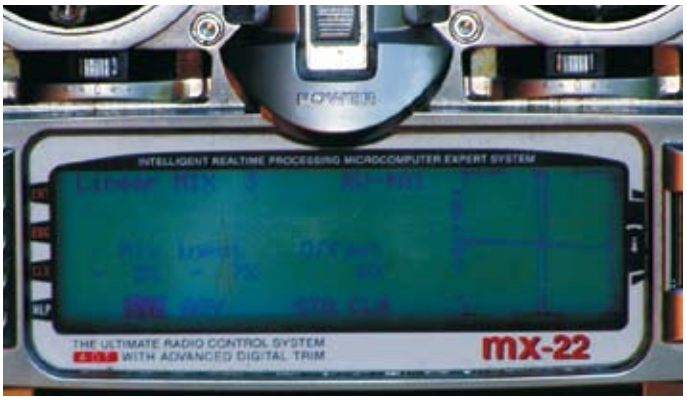
If you intend doing a whole flight practising a series of the next two manoeuvres than set a richer than normal setting otherwise the engine will overheat.. This applies to both methanol and petrol engines

I guess electric modellers may chuckle because they carry on regardless but if it were my grands worth of battery packs up there, I would fly five long knife edge passes then land to check how hot the packs. Just to be sure.

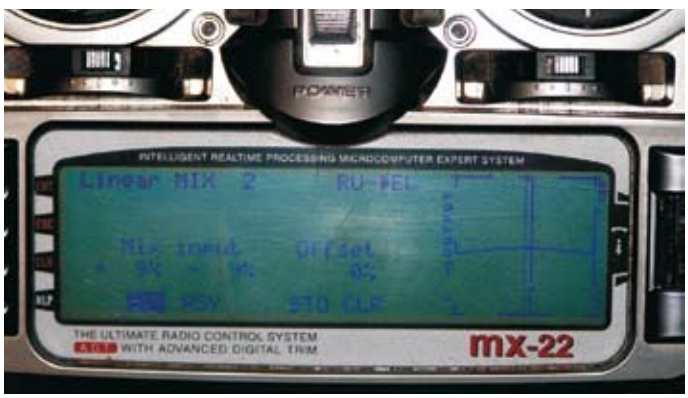
Knife Edge

This is where the lift generated by the fuselage and the prop is enough to maintain level flight. Rolling onto the side for a second or two isn't what knife edge is all about, that's a vertical bank.

Sustaining knife edge requires rudder to raise the nose. This is where most people get their first inkling about yaw coupling and although some types are better than others, the aileron and elevator will need



Rudder to aileron mix, 5% left and 7% right.



Rudder to elevator mix 9%.

Sustained knife edge requires a touch of left aileron and a touch of down elevator to keep it straight.

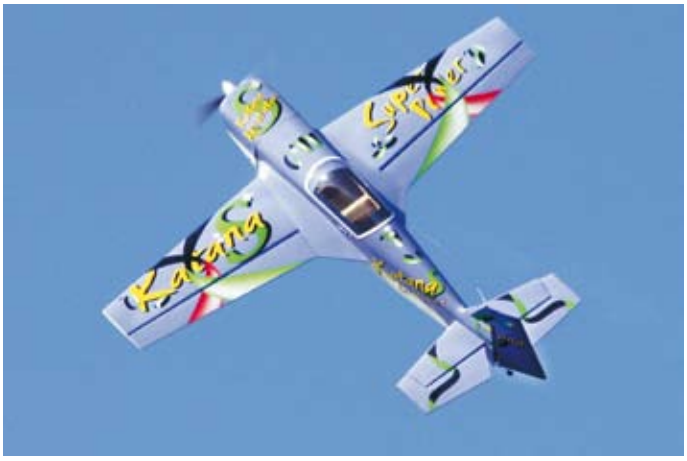
to be adjusted to keep a sustained knife edge straight. The model will probably want up elevator and opposite aileron. The next time someone tells you their model does not need any yaw-coupling mix this manoeuvre is a simple way to test that claim. Once established they should be able to take their hand off the aileron and the model will track across the horizon without rolling out.

The computer radio does make this easier to do by programming in mixing. Many new radio systems now include suggested values in the instructions. The mixing values in the photos are from a Graupner MX 22 for the Katana and these were set to give the best possible assistance for knife edge flight.

The model has an OS 160 FX driving a 16x10 APC at 9,000 rpm so it is quite fast With 9% mixing on elevator and 7% on aileron it may seem a lot but those values are at full deflection. Flying flat out, the Katana only needs around half rudder in low rate to knife edge but the settings give the desired flight path with that amount of rudder.

If I was to set the mixing to fly stop the nose pitching as rudder is applied in a vertical climb the values would be slightly different. Even when you are happy the mix set there will be subtle varions on a different day but that is what makes flying aeroplanes accurately so challenging.

Climbing up to the top of a loop. As the speed decays pushing up to the top of a knife edge loop the left aileron and up elevator have to be increased.



In a side slip keep the rudder constant and steer it in with elevator and aileron. The low wing goes into wind.

Knife edge loop.

Chunk it down into two sections. As it climbs away and the speed reduces the Katana needs more and more opposite aileron and up elevator. As it comes up toward the top the model is quite slow and I am holding a heap of elevator and aileron. If I didn't make those adjustments the model would have rolled out and pitched way off line after a just few seconds.

After you have achieved getting over the top then take a deep breath and go back under. The control inputs at the top will be reduced quite rapidly when the nose passes below the horizon and the speed increases. At the bottom is where a lot of rudder power is needed because the speed is high. If you start getting to low, rolling the wing off vertical by five degrees increases the lift markedly and most people won't even notice. Once you can do a loop try for a cuban eight. Getting a straight down line with a half roll in the middle takes a lot of practice.

Side Slip

Hopefully it will have dawned on you why I have left the next manoeuvre till last. This is because anything associated with landing requires manoeuvering at low altitude.

By now you will have aquired new skills at compensating with the other controls and gained some understanding of how much drag a rudder can create. This drag becomes very useful because high pitched props on some of these models make them a little harder to slow up.

Line up to land, with excess height and kill the power then lower the nose. Apply the rudder to yaw then bank at forty five degrees and steer it in using combination of aileron and elevator. To come in closer, slightly increase the bank or to move away decrease or you can also use elevator but I suggest mastering one axis at a time. If the model gets slow, increase the bank and lower the nose with elevator to pick up speed. You can also apply a little throttle.

Once you have all three axiis reliably under control you continue on and land. Just ease off the rudder and roll out before the flare and the key to this is speed. Not airspeed but how quickly do you let the rudder off. Because aeroplanes have different characteristic and some can be quirky, slowly is better as there is more time to assess the total picture. For example the huge inboard wing fillets tend to blank out the tailplane at slow speeds on the Katana.

If it all starts getting pear shaped, make the decision to go early an early one. Don't muck around, get full power on and fly out.

By the way if you are a beginner there is a series of article on the basics of learning to fly available for free off our website,www.rcmn.com.au. Good Flying, Stephen Green