In The Air

Spring is finally here. And so is Fall.

Terence C. Gannon

"le pilote s'appelait Gaston et c'est grâce à lui que nous avons découvert le modelisme il y a 20 ans...Il nous a aidé à régler nos premiers modeles...une bien belle aventure, les premiers pas sont toujours plein de doute" — words and image by Régis Geledan, Gez-ez-Angles, Hautes-Pyrénées, France.

For those of us in the northern part of the Northern Hemisphere — the part where it gets cold and snowy mid-November and stays that way until the end of March — there's nothing quite like feeling the first warming rays of the sun in Spring and watching the last sad remnants of dirty snow drip away. The world is once again full of possibility and we think of summer days to come and the new chapter in our flying journal we're going to write.

Having grown up in a time when you simply accepted what the science teacher said at face value, I understood the globe had a distinct up — the Northern Hemisphere — and a distinct down which was the Southern, of course. What else could possibly explain the phrase *Down Under* which I have a decided feeling **wasn't** coined by anyone in Australia or New Zealand.

But I also grew up in a time when we marvelled at the *Earthrise* photo taken by the crew of Apollo 8 in December of 1968. Anybody looking at that photo suddenly realized that you could turn it 'upside down' and it looked exactly the same. For the big blue marble hanging in the blackness of space, there is no up or down.

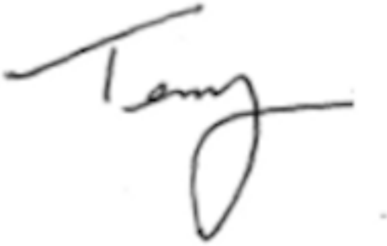
What I'm trying to say, of course, is that while here in The Great White North we revel in the new green-ness of Spring which has just arrived, for many others this is the all-too-soon end of the flying season. The key image this month — once again provided by our friend Régis Geledan — captures the ambiguity of the shoulder seasons perfectly. Is this the first time out after a long winter of hibernation? Or the last flight before retreating to the shed for the winter building season. You be the judge.

I've never had to add so many new timezones to my Clock app on my phone! RCSD readers and contributors represent an international community, which I'm proud to now call friends which circles our big blue marble across both timezones and hemispheres. It is truly one of the pleasant surprises of having taken on this role and I'm looking forward to meeting you all in person some day.

For March, I've tried to line up an array of stories so that there's a bit of something for everybody. Leading off is the **first part of a four part series** by James 'Doc' Hammond entitled *Designing for Slope Aerobatics*. It's the master class in sailplane design for which you've been waiting. We have a comprehensive product review from Pierre Rondel on *MicroMAX, the Pocket F3F!* Ryan Woebkenberg takes us along with him on *My Southwest Classic F5J 2021 Experience* which will make you want to attend the next one for sure. Rene Wallage turns the re-kitting of his Schwing Corsa into a *Pre-Flight Check* from which we can all benefit. Peter Scott walks us through the intricate details of the *ToolkitRC ST8 Servo Tester* and Tom Broeski (of *Tom's Tips* fame) helps us build a *Clevis Tool.* And you may even find a few little extra surprises thrown in to the bargain.

OK, it's time for me to get out of the way and I hope you enjoy the March issue.

Fair winds and blue skies!



The gorgeous cover photo for this issue is provided by Alexandre Mittaz, and was taken on March 18th 2021 at La Gruyère, Switzerland. Alexandre goes on to say: "It was an afterwork late afternoon flight, maiden flight of the Vantage F3F, with a moderate NE wind (we call it 'bise' here). The mountains in the back are the Swiss Prealpes in Canton de Fribourg, Gruyère Region." Now, without further ado, please turn to the ***next*** *article in this issue or go to the* *table of contents**. Downloadable PDFS: article issue.*

Designing for Slope Aerobatics

And other aerial gyrations.

James Hammond

Greg Lewis heaves off the big Aresti 108" for its maiden flight at Ivinghoe beacon UK — it was even better than we expected. (image: Mike Shellim)

Slope aerobatics, like all model aircraft disciplines is a highly opinionated subject and this is a good thing — it leads to constant development. What I have tried to do here is simply explain my own approach. Many may not agree with what I have written here, but nevertheless it's the way I do it. If you can get some good stuff out of these meanderings then I am happy, if not then maybe you can tell me the error *of my ways. — JH*

So, what's it all about? Back in the day…

I guess that slope aerobatics has been around as long as slope flying itself. Even in those days of yore (that I remember 🙂) when kit instructions came in Latin, planes were made of balsa, tissue and dope, and the only form of control was bang-bang rudder only; enthusiastic pilots have always tried to push the envelope as far as possible with whatever they could get their hands on — something we will always do, I hope.

Basically, the models of old have changed quite a bit in the last three decades or so but the raw, exciting, enthusiasm and sheer unmatched craziness of slopeheads remains exactly the same — and that is another good thing!

Me? As well as quite a few slope soarers in other discipline types, I have designed and put into limited or full-scale production, a series of seven 'Big Air' aerobatic slope soarers, namely: *Vector 2* (1984), *Vector 3* (1986), *Dorado* (was going to be called *Vector IV*, 1990), *Mini Vector* (*Minivec,* 2005), *Aresti 80* (2008), *Aresti 108* (2010). It should be noted that every one of these models was designed using all the good bit from the previous design, and omitting the bad bits, while adding new ideas. This is a true development and in fact I'm happy to say that every model was in some ways better than its predecessor.

Photo 1: *James stands behind his designs (!) at the Camp and Fly event — Sunset Beach California in 2018.*

So, let's get into it: Lets design an aerobatic slope soarer — it's not as hard as it may seem. Things to consider...are all aerobatic airframes the same? Well, yes and no. I guess that today the slope aerobatic airframes might be largely, though not completely divided into two types, namely:

VTPR (Voltige Très Près du Relief)

Photo 2: Justin Gafford's 'Disturbance' VTPR design. 'Slopecorn' has developed a reputation as one of the premier bespoke VTPR builders and practitioners of this type of flying. (image: Justin Gafford)

These are broadly the 'in your face', close to the slope, milliseconds from disaster, tumbling type of plane ranging through the original *Sonic* and now encompassing such designs as *Le Fish, Coquillaj, Ahi*, and many more like those. Mostly, though not always, these types of plane tend to be around, or less than two meters (80″) span.

As the definition of the acronym might suggest, this type of flying was formalized in France — though it has to be said that VTPR has been going on for a long time elsewhere too

— sometimes by accident!

Precision Maneuver 'Big Air' Aerobats.

From my stable, planes such as my own *Vector III* and *Minivec*, plus the later *Aresti 80* and its big brother the *Aresti 108* are Big Air type, with of course many others such *Phase 6*, *Voltij, Wasabi, Sagitta*, and indeed more like them that fit this sector. These planes are more suited to the 'formal' Big Air scheduled maneuvers such as you might find in slope aerobatic competitions, and less suitable for the low level, VTPR "edge of the slope" freestyle flipping type of cycles.

Note that it has to be emphasized that there are many grey areas of cross performance and maneuvers that can be well performed by both types.

> *Takeaway: You need to decide at the onset which type you are going for.*

What are the basic ingredients of a well performing slope aerobatic plane?

Size — does it really matter? — well, not

that much:

***Photo 3**: Gremlin — a quirky 60″ aerobatic sloper designed in 2007.*

As hinted above, the Big Air aerobatic planes tend to be larger for performing large open maneuvers, while the VTPR planes tend to be smaller, more agile, as they fly much closer to the slope — and some might say DISASTER. Again, it's true to say that both types can fill some of the roles of the other, but maybe not quite as well as a dedicated airframe. If you want to see huge, ballistic aerobatics, take a look at a good aerobatic pilot flying my *Aresti 108*. There are lots of videos out there on the public video channels — just type in "Aresti 108".

> *Takeaway: Make the size fit the*

application.

Weight:

VTPR Here there does tend to be a difference. The VTPR type planes are made as light as possible — a requirement of the high-speed rapidly changing attitudes and directions needed for this type of flight. Lightness however does not always mean only flyable in light conditions, as with their larger, Big Air brothers, most can have weight added in the form of ballast.

Key point is that for violently direction changing stunts, the airframe will not perform well if it is too heavy and has a high inertia. Also, the smaller VTPR types tend to be affected by very strong winds more than the Big Air type, so look for, or at least consider some sort of ballast ability.

Big Air Though lightness is also important on the Big Air type models, it is not as critical. Some Big Air type models — especially mine — though constructed very light, can be made extremely heavy so as to fly in hurricane conditions if needed, but without the added weight, will fly very well in light lift.

> *Takeaway: Think about ballast placement and build it light but as*

strong as you can!

***Photo 4**: Aresti 80 on a low pass — note the wing shape to give good lift distribution.*

Wing area and aspect ratio:

Typically, both VTPR and Big Air type planes will have a lower aspect ratio than their thermal, racing, or scale cousins. Simply put, the higher the aspect ratio, the slower the roll rate because you have to move more bits about that are further away from the roll axis. In an ideal situation the maximum chord thickness point will remain in the same position along the length of the wings so as to give a symmetrical MAC and nice roll/pitch response. Wing area follows but in the opposite way; within reason we need as much wing area as we can carry, but there's not much point in putting too much out at the tips where it's not needed. This is why I choose an elliptical shaped planform for lift, but with the maximum wing thickness point at 90 degrees to the fuselage in my designs. I cut off the tips, as with our models an elliptical "Spitfire" tip can cause a lot of unwanted effects at the most unwelcome times.

> *Takeaway: We need lower aspect ratio wings for fast roll response, and as much wing area as we can get — within reason, but put it in the right places.*

Horizontal stabilizer and elevator area:

Oddly, stability is a requirement of aerobatic models. The model needs to go where its pointed, immediately and without any protest and then stay put. This means that the wing and tail area need to be well matched. There is no point in having a horizontal stabilizer that is too small in order to, say, reduce drag because it won't work and the model will always require constant control inputs. In contrast, having a stabilizer that is too large can be a drag — literally — and will cause its own trouble in flight by forcing constant control inputs to counteract its damping effects in a similar way to an undersized Stab.

20 to 25% of the wing area is a good place to have a model aerobatic glider tailplane with the elevator area at 25% of the of the total Stabilizer area.

> *Takeaway: Balance the wing and tailplane areas.*

Fuselage shape and side area:

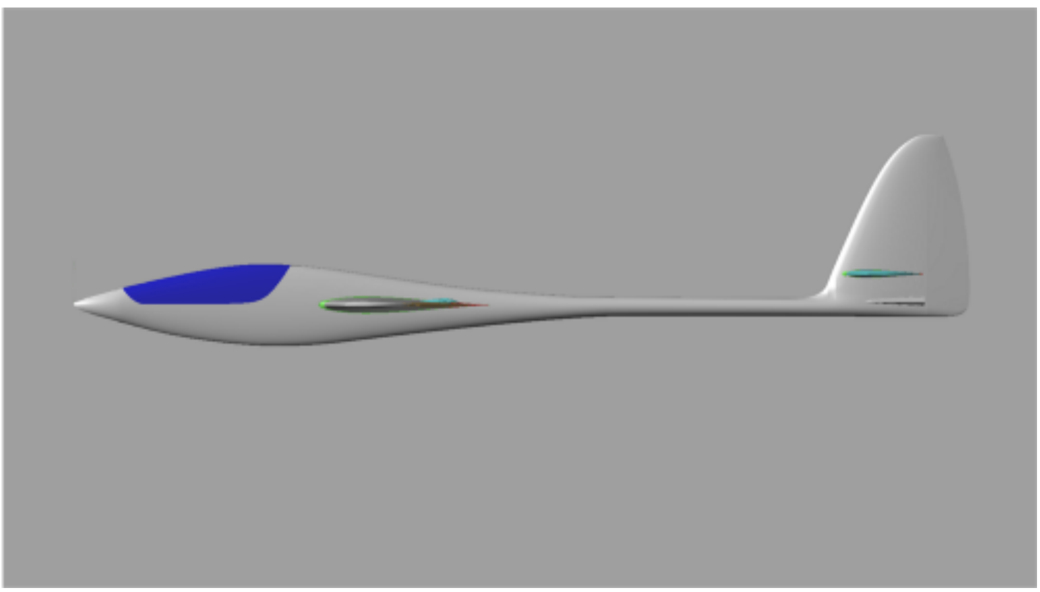


Photo 5*: Original Vector III CAD design — subsequent designs were refinements on this basic shape.*

Now here is an interesting topic for discussion.

The fuselage, what does it do? It's a stick to contain all the radio bits and to hold the wing and back end, apart right? Well, maybe a bit more than that, at least on an aerobatic model. As usual with any sailplane, we want to make it do its job well as the primary consideration, then after that make it look good as good as we can within the design performance envelope. This means that we do need to consider side area, sometimes simply from the point of balance of the plane around the three-dimensional CG.

Much is made of side area for our aerobatic airframes of whatever type, Big Air or VTPR because for reasons totally beyond me, ‘knife edge’ flight — a regime that is totally alien to any aircraft, let alone un-powered ones — is a consideration for most, if not the majority of slope aerobatic flyers.

So…as a commercial model plane designer I have to concede that our aerobatic planes need to have a larger than strictly needed side area. However as usual there is a caveat: In fact, flying with a side wind — which effectively the model is doing when making a pass along the slope — also needs a nicely balanced side area to prevent unwanted yaw attitude changes. Needless to say, a large side area is not of much use if the fin and rudder are too small.

> *Takeaway: What we need is a fish shaped fuselage. Basically, a deep body where it matters — forward of the CG, that is balanced by a large*

enough fin and rudder control surface to be able (in theory) to achieve some semblance of knife-edge flight.

Choice of aerofoil section type:

Here again, a very sticky wicket. For me, a modeler who always tries to get the very last drop of potential performance out of any airframe I design — whatever the discipline — there is only one choice for slope aerobatics and that is the fully symmetrical section — period.

I have heard cries of "symmetrical sections have no light wind soaring performance!" or protests like "I don't want to compromise my light wind soaring performance with a symmetrical section!" for example.

Point is that the object of the exercise when designing an aerobatic airframe is **performance** so I design for pilots who are way better than I will ever be.

If the flying speed of a good symmetrical section is maintained, then while a slope aerobat will never outsoar say an F3F plane — it will still have a more than reasonable performance, even in light air.

Takeaway: If you are serious, use a

fully symmetrical section. If you want a REALLY good one, use mine(!)

Which fully symmetrical section?

OK here we can make a few rules, but not many. The best fully symmetrical aerofoil sections for slope aerobatics typically will be those that have a low drag when compared to their chord thickness. I had used the good old SD8020 for many years and many models, mostly because it had the lowest drag for its 10% thickness that I could find, until I was contracted to design some new ones that were not for model use.

Nowadays there are lots of people working on low drag symmetrical section for various applications and not only for slope aerobatics.

A consideration which we now have the luxury of studying is the relationship between the control surface when deflected and the front of the section when flying. This is a big consideration for F3F Horizontal Stabs for example where great fast handling is needed without the section letting go in a stall. Also, a big consideration for almost any slope soaring application is the alpha α performance of the section (i.e. when the section is not actually flying parallel to the airflow across it, but at a positive or negative angle)

If your chosen section will tolerate a nice bunch of sudden attitude changes without suddenly giving up on you, then you are clearly in a good situation.

What thickness?

Thickness plays a large part in our choice for aerobatic planes too — basically we need some, and for many years, in fact for the last series of five designs I opted for 10% as it seemed to be a good compromise between carrying energy and converting that energy to speed, however my latest design uses a 9% section — of my own devising as usual — I feel the need for a little more speed.

For better drag performance and also improved control response and tolerance, I have found, and evidence shows that the double cusped sections offer possibly the best of both worlds.

> *Takeaway: Try to find sections which offer low drag and have been tested at thicknesses of at least 10%.*

A personal word on model aircraft aerofoil sections:

Even though I am in theory a professional model aircraft designer, I am not a believer in ‘secret’ or ‘special’ model aircraft aerofoil sections, so all of mine are public domain — use them as you wish — all I ask is to be given the credit for designing them. The aerofoil police are already on my trail, so a few more flying won’t make too much difference.

> *Takeaway: We need to use a symmetrical section with the lowest drag for its thickness, a good alpha tolerance and as good a control response spectrum as we can get.*

Note that any of my own designed sections are available from me. As mentioned all I ask is to be given the design credit.

Control volumes:

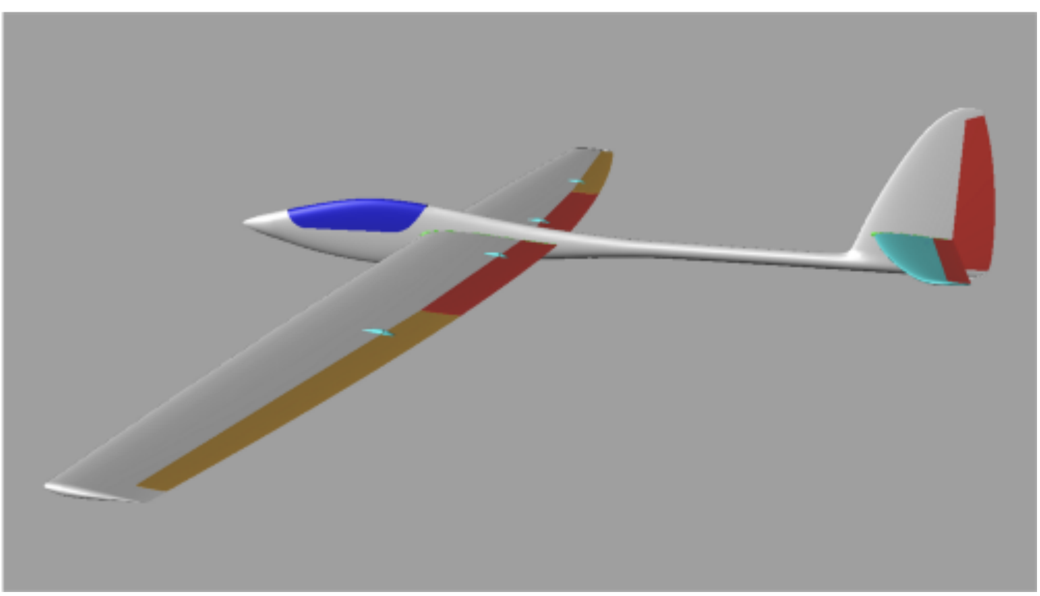


Photo 6: General arrangement of the control surfaces — Note the wing control volumes all at 25% of the chord.

Typically, the control volumes, i.e. Control surface area versus the actual size/aspect ratio of the wings, tailplanes, and fin, will be larger than on our not-so-aerobatic slope cousins. It is also probably true to say that for VTPR you would typically design-in even larger control areas and crazy volumes than you would for a Big Air slope aerobat, due to the extreme nature of the maneuvers anticipated.

Big Air models would typically — though I stress again, not always! — have a greater turn of speed in order to perform their work than a slower, and yes maybe more maneuverable VTPR type model. It's good to remember that it's easier to get a good response at a given speed from a larger control surface that moves the minimum amount, than it is from a smaller surface with larger travel.

> *Takeaway: Make the control surfaces as large as you can without being ridiculous and also consider retaining the strength that is normally robbed by over-large control surfaces.*

Getting it right — but also making it look

cool:

Yeah…come on…we can all put together a few planks, a bagged wing, and some bits that we have had laying around from previous re-kitting events and get something that will fly, and probably tolerably well. But for those who do not live in the Ugly Tree, we'd like to have a little bit of a cool factor — right? What I tend to do is to use a kind of step by step evolution for any plane I design — aerobatic or otherwise. It goes like this:

***Photo 7**: An Aresti 108 just out of the moulds.*

Preliminary questions:

1. What work will the envisaged plane have to do?
2. What will be its flight limitations?
3. What are the practical construction limitations?
4. What will be the approximate size?
5. What will it have to carry and where? — not only radio

considerations which now are small because of the advances made in the last few years, but also ballast carriage etc.

6. How strong will it have to be? What materials will be best?
7. Is it an experimental one-off development type, or with the knowledge available could it go to a production model with small changes?

> *Takeaway: Get all the sizes and parameters roughly figured out and write them down.*

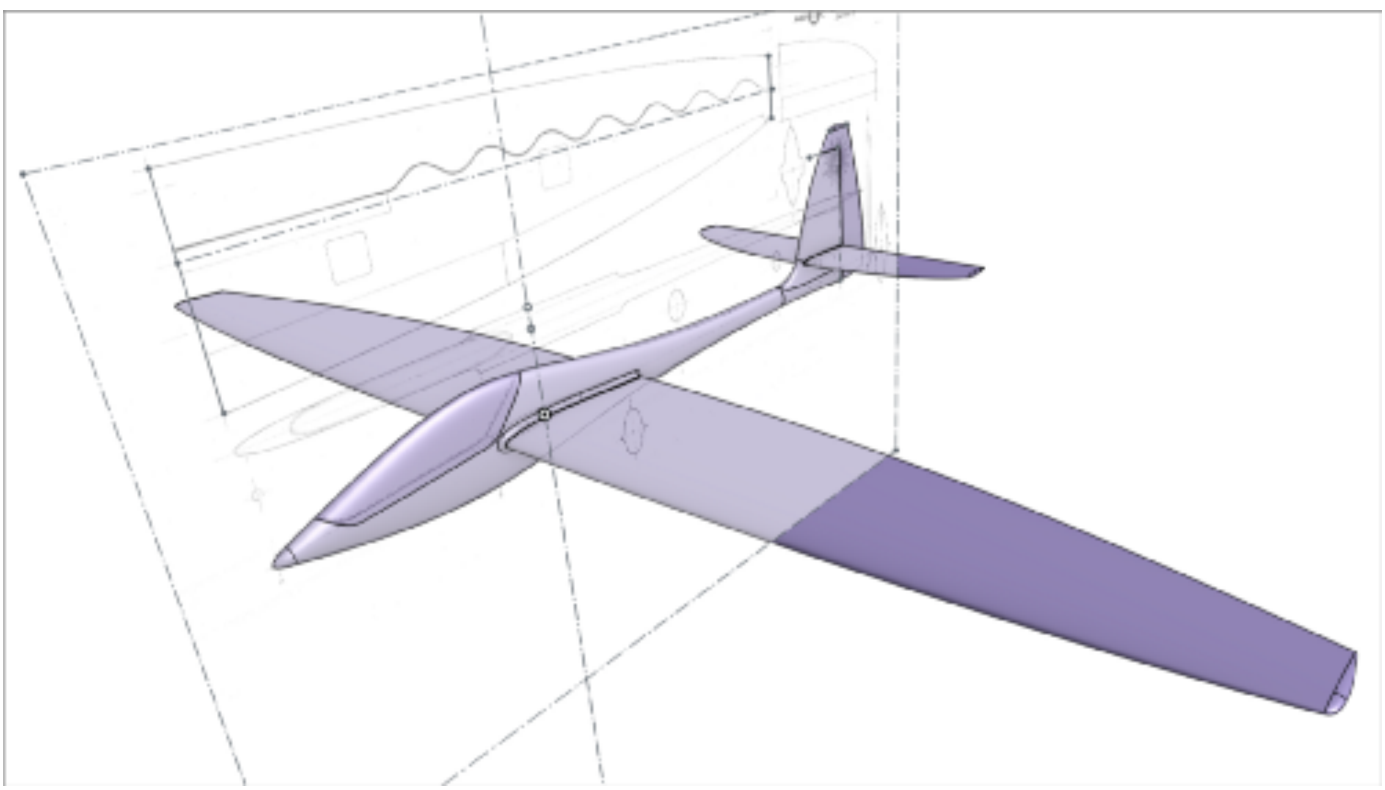
Next step, the sketch up:

1. Sketch — just hard lines on the back of a napkin when the inspiration strikes are good enough. I know not why, but 'inspiration' always seems to take me when sitting on the big white throne. So, I keep a pad and a pencil on the cistern, as I have found toilet paper is sadly lacking in strength.
2. Refine the sketch maybe by doing something as simple as superimposing another sheet of paper (or napkin) over the first…give it some curves maybe — change the proportions?
3. Further refinement — further paper.

4. Emergence of the concept — put the plane in proportion — make the wings and empennages right for the fuselage — use other designs for reference maybe.
5. Remember you don't have to be Da Vinci to get a good design — Bugger about with it…just keep wasting paper until you think you are feeling good.
6. Then do it again until you are SURE you are feeling good.

> *Takeaway: Keep playing with your design — it only costs time.*

Last, the drawing…the über beast comes out of its lair:



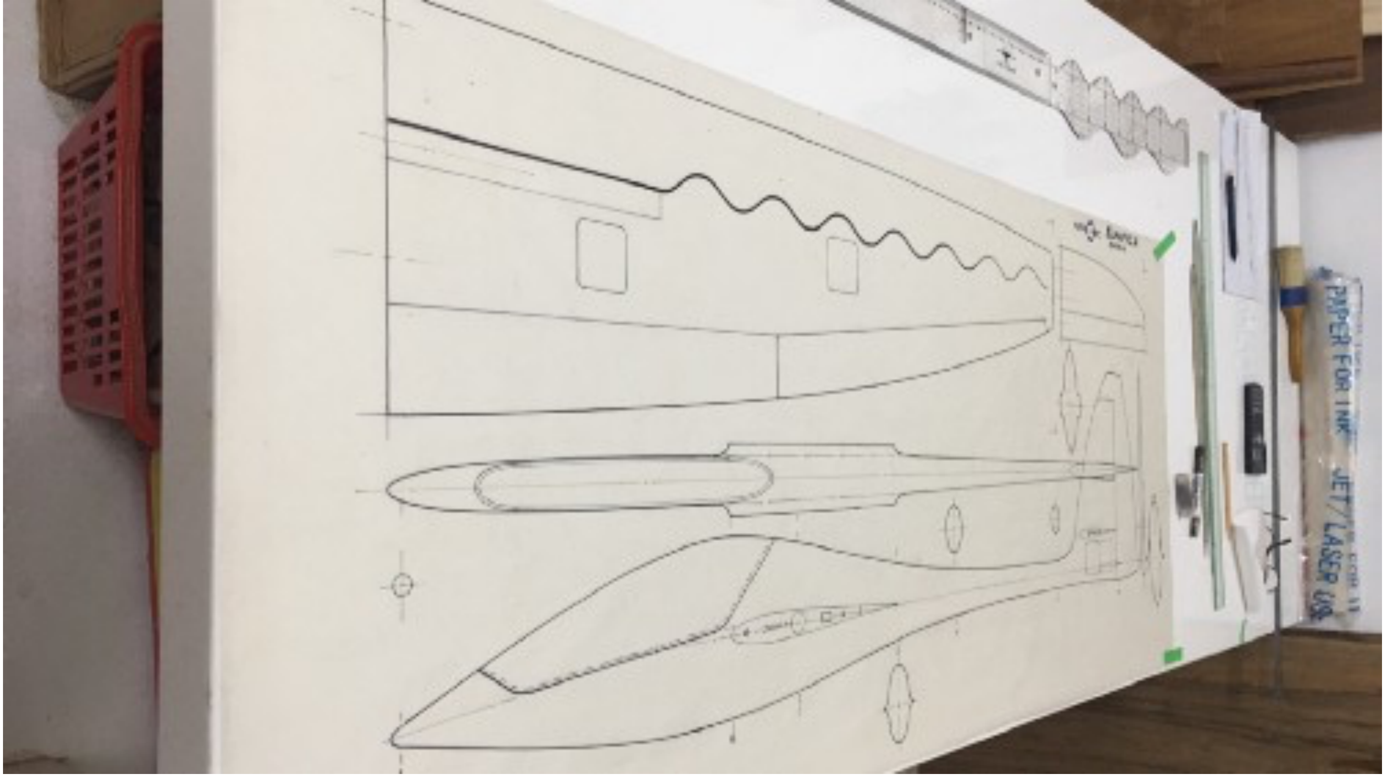


Figure 8 and Photo 9*: The line drawing is transformed into CAD in full size.*

I tend to do formal line drawings on actual paper. One reason for this is that my CAD ability is not as good, or more importantly not as fast as my draftsmanship. Then I plead with my super-fast super-good CAD guru to render the whole caboose to digital format.

Make the CAD or line drawing but remember…it's yours… you can do what you like with it. If you don't like it, change it until you do. There is nothing worse than seeing the complete model and then the dreaded "Wish I'd's…" come out. If you are anything like me you will never make what you can utterly claim to be your masterpiece. There will always be something to make better next time and that's the absolute beauty of it.

> *Takeaway: Get creative…forget the minnows…let’s see fully toothed barracudas!!*

Cheers!

***Photo 10**: Designer Dr James (Doc) Hammond with an Aresti 80; close to Tick Point California in 2018.*

*This is the first part of a four part series. Coming up in the April issue of RCSD, author James Hammond provides his take on designing for a medium-sized (80" to 100”) slope all rounder. Don’t want to miss it? Best [subscribe to our mailing list](#)! All figures and photos are by the author unless otherwise indicated. Now, read the [**next**](#) article in this issue,*

*return to the **previous** article or go to the **table of contents**. Downloadable PDFS: article issue*

MicroMAX, the Pocket F3F!

Promises kept by offering exceptional flying qualities for its size.

Pierre RONDEL

The MicroMAX ready for a memorable flying session in a gorgeous place in the French Alps.

The MicroMAX is a project initiated by Henning Schmidt (Sansibear.de), designed by Christophe Bourdon, and manufactured by Anton Ovcharenko (OA Composites). The idea came initially from the 1m hand thrower called *Strike*, but this time optimized for the slope, with the possibility to double the flying weight, while using the latest construction techniques in F3K competition, with materials such as UHM (ultra-high modulus) carbon on a machined Rohacell core. So let's see if this MicroMAX has managed to concentrate both F3K and F3F glider DNA in a 1.15m glider. I must admit that it is a daring challenge!

A Quick Look at the Kit

Photo 1: The MicroMAX kit arrives complete, with all accessories.

The kit arrived two days before Christmas in a sturdy wooden box, just in time to be under the tree. The kit is gorgeous and so cute with this very nice and unusual but very original moon grey metallic color. The wing is in one piece, where the concept could have been taken even further with a two piece wing, but this choice is perfectly understandable for many reasons. It has a big cartoonish MicroMAX logo with neon colors, although the neon pink and orange mix is not the best color combination for my taste. The servo compartments are prepared; the aileron horn location and the control outputs are also drilled. The wing is maintained on the fuselage by two metal screws. In the front centre of the wing there is a recess for the wing servo connector.

The fuselage is very innovative at the rear end: the fuselage section is reduced in width over the last 4 cm to provide an elevator exit with a direct connection to the elevator horns, which therefore remain outside the fuselage. This is a very simple but clever solution for a small glider. The end of the piano wire is simply bent, and allows the V-tails to be easily assembled or removed for transport. The captive nuts are already in place to receive the wing. The tail joiner is simply glued to the outside of the fuselage in a slot molded for this purpose.

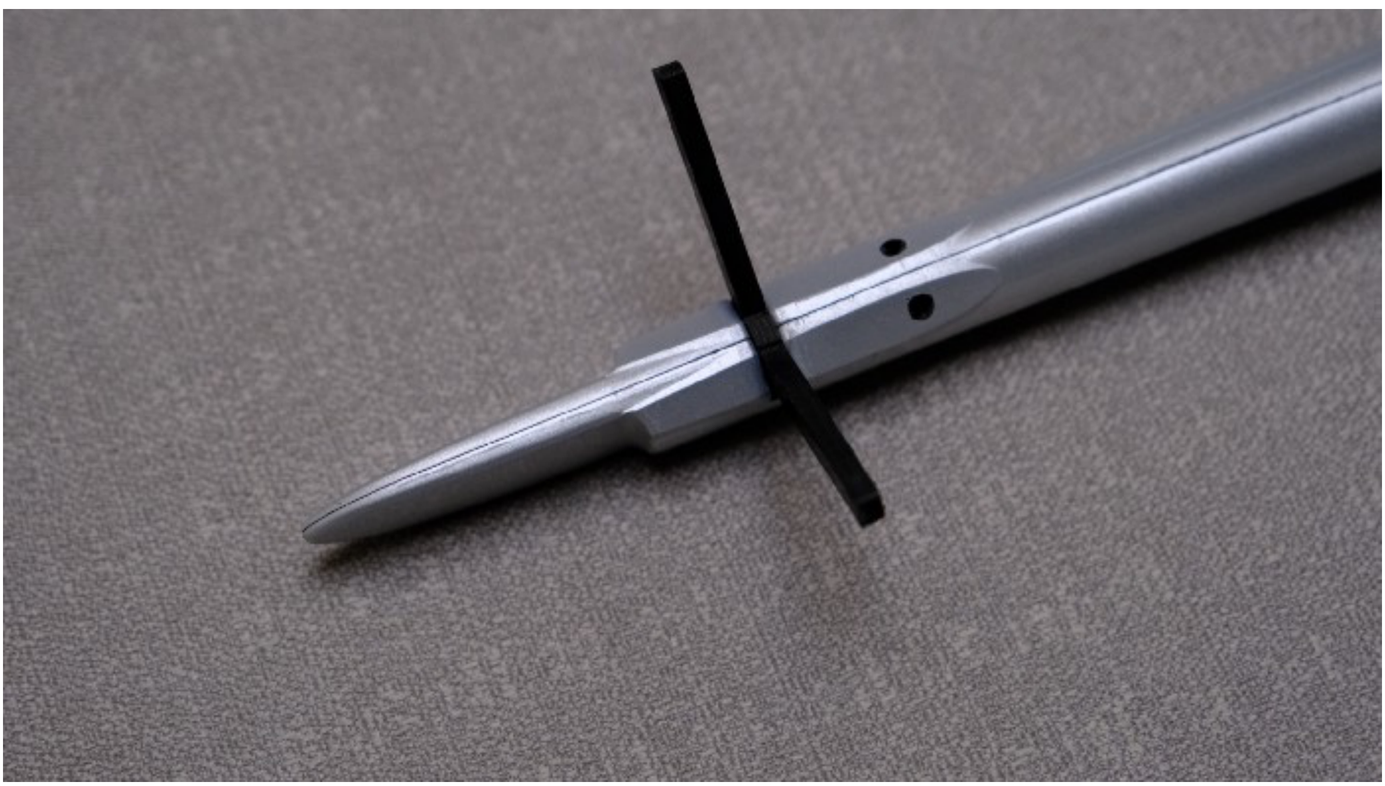


Photo 2: The tail joiner is glued to the outside of the fuselage in a special recess.

All the necessary accessories are supplied in the kit, including receiver-side servo cable extensions, connectors, elevator piano wire and plastic sleeves, aileron piano wire, epoxy fuselage servo plate, servo covers, carbon elevator and aileron horns. The finish and fit are excellent, as you would expect from an F3K construction. The weight of the components is as follows: Fuselage + nose cone: 30.5 g, Wing: 103.25 g, Tail: 5 g each, V-stab key: 1.35 g, total 145g.

Assembly

Photo 3: 4 MKS HV75K-N servos and 1s LiPo battery.

Installing the radio in such a tiny glider is unusual for me, especially in the fuselage where you have to place two servos, a four channel receiver and a battery, not forgetting all the wires, and plugs. This is where you realize that a single servo connector takes up a lot of space! It is therefore imperative to choose the radio elements carefully because, for example, the height of the servos becomes important, as does the size of the four channel receiver, or the size of the receiver battery, not forgetting the minimum operating voltage. For my part, I opted for the excellent MKS HV75K-N (without mounting brackets) in the fuselage or wings, and a Tattu LiPo 600mAh 1s battery, the receiver and servos accepting an operating voltage of 3.6 v.

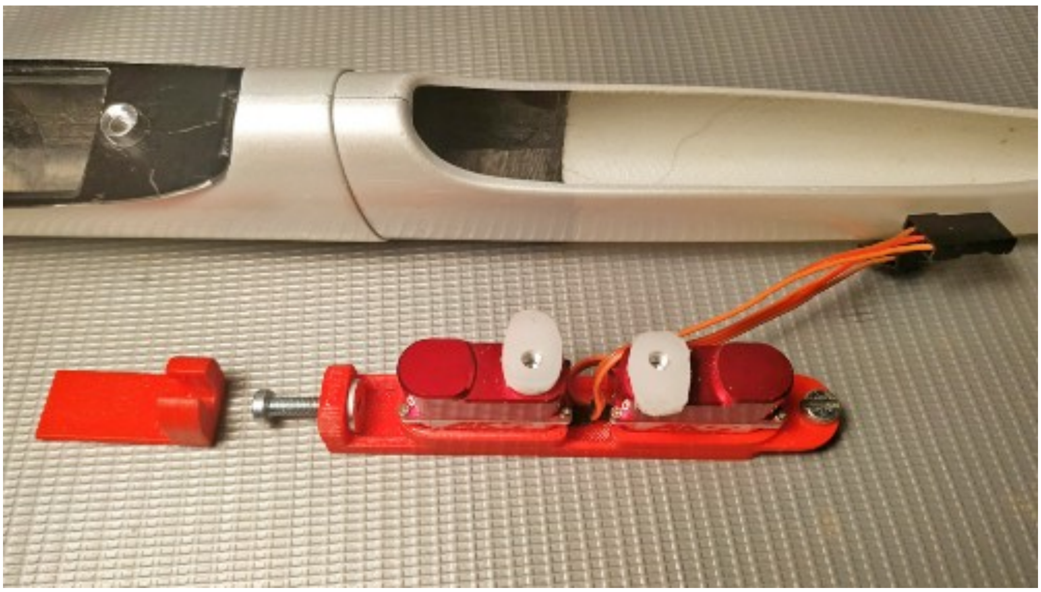


Photo 4: The 3D printed servo tray, of which I provide the link to the STL file.

I also decided, in order to optimize the space, to design and 3D print a removable servo tray. The idea is to free up some space on the side of the servos for the wires and servo connectors. I made a few prototypes before finalizing and validating it. It uses two short (3 mm) MPJet captive nuts. The front nut is glued in the fuselage and reinforced with some fiberglass strands. The second captive nut is located at the rear of the plate. The second 3D printed part is glued into the fuselage with cyanoacrylate glue. Installation of the servo plate is easy: simply slide and snap the rear screw head into the fuselage part and screw both sides together with a screwdriver. The servos are simply held on the plate with a little rapid epoxy. If desired, you can download the STL file.

The plastic control sleeves are glued in place in the fuselage with a little cyanoacrylate glue, after cutting them to the right length. When installing the elevator control piano wire, I had a small problem with the holes in the elevator horn being a little too large (1 mm) for the 0.8 mm piano wire. To solve this little problem, I glued a second carbon plate (from the servo cover scraps) on the horns and re-drilled to 0.8 mm.

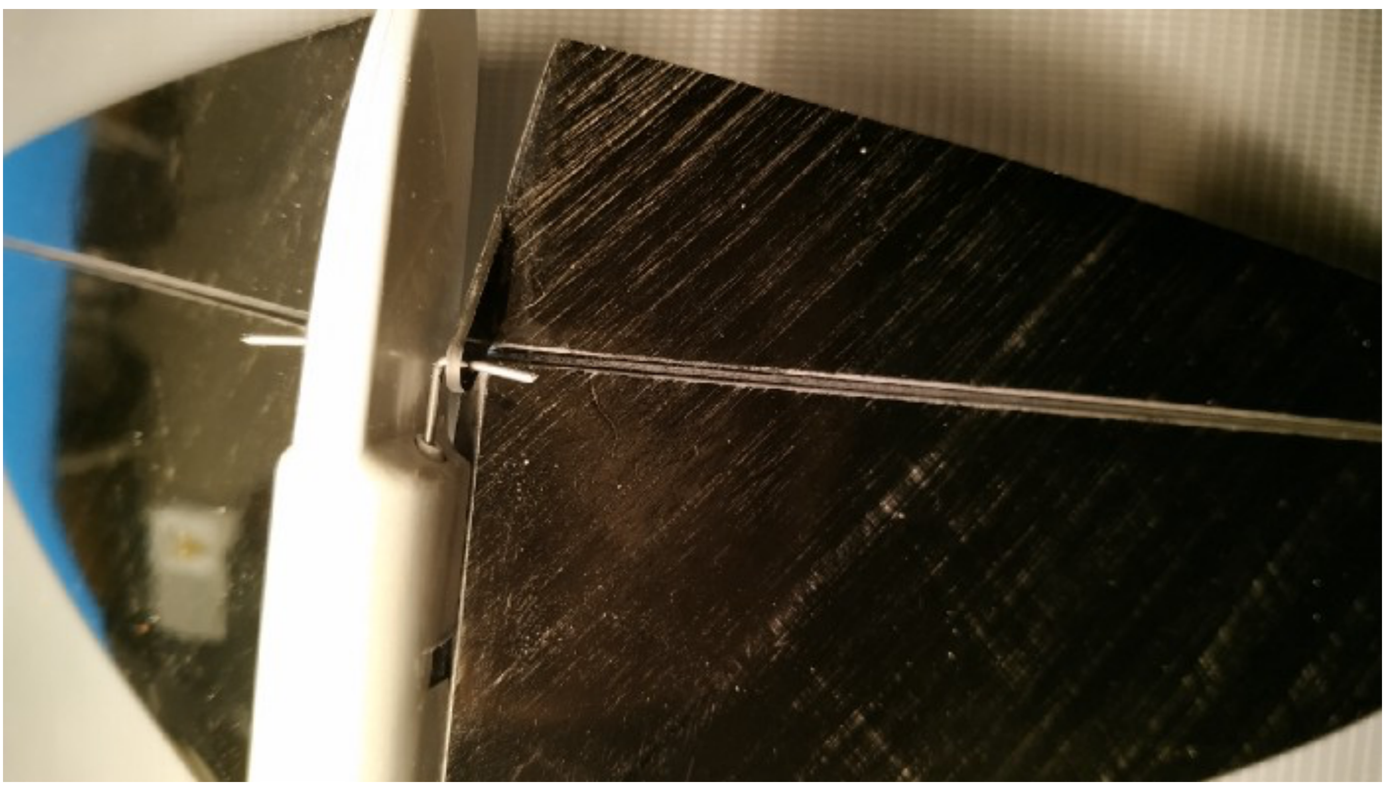


Photo 5: The particular shape of the back of the fuselage and the very well thought out

control exit!

MKS HV75K-Ns servos are simply glued in place with the servo arm in the neutral position and in order to have more down travel for the airbrakes. The control is a piano wire bent into a Z-shape on the servo side, and bent into an L-shape on the control surface side. Simply drill the passage from the servo compartment to the control output with a small round file and glue the carbon horn in place with the control connected on both sides. You can then go on to solder the servo wires to the 4-pin connector (at 90°) and glue the connector to the centre of the front of the wing. Thin servo covers are cut to size and then held in place with a little transparent adhesive.

Photo 6: The aileron servos in place, just glued with rapid epoxy.

Finally, back on the fuselage, after preparing the female connector with the cables to the receiver, I just widened the hole and left the connector free.

Photo 7: The space in the fuselage is really limited!

I ended up with an empty weight of 227gr, with only 8gr of centring lead for a 65mm CG.

For the ballast, I found an aluminium profile of the right size, which allowed me to cast 2 lead ballasts: one of 85gr, and a heavier one of 190gr. It is however possible to reach 250grs with a two parts ballast. The ballast is secured to the underside of the fuselage with a 3mm screw.

Photo 8: The two ballasts, 85gr for the smallest and 190gr for the heaviest. It is possible to go further with a 2 pieces ballast

Like a Larger Plane!

Photo 9: The author and his MicroMAX, really a great pocket glider!

The first flight of the MicroMAX was done in less than ideal conditions, with no wind, grey skies and snow on the ground, but it allowed me to see some of the glider's flying capabilities.

The first thing that I noticed is that the glider flies like a much larger glider, is precise in all axes, stable and allows to fly almost at a standstill or to accelerate and fly fast. Its size allows it to tighten the circles around the wing tip, like an HLG. Flaps in the thermal position are particularly effective, so I lowered them a little to 2mm. The glider quickly puts you at ease and despite the 1.15m wingspan you find yourself covering long distances and exploring a significant flying volume, and on the other hand just circling in front of you.

Photo 10: The MicroMax sitting in the snow and waiting for its maiden flight, which will be the next day.

The same day, curious to see how the glider could fly with a bit of wind, I decided to go to another slope, better exposed to the wind, but unfortunately also with freezing and negative temperatures allowing me to fly only 5 minutes despite my gloves. However, this allowed me to continue to discover the abilities of the MicroMAX: even when empty, therefore very light, the glider penetrates the wind well, accelerates quickly and has excellent energy retention for such a small size! I was able to do 4 loops in a row without any effort, and also tested the roll and 4 steps roll without any problem. The rudder is efficient for a V-stab and even allows you to fly with the rudder alone in certain circumstances.

Photo 11: Winter atmosphere but superb panorama for the MicroMAX tests.

For the next flight session, a few days later, it was with snowshoes and a 2km walk in 25 to 30 cm of fresh snow that I reached the flight site with much better conditions and an absolutely superb landscape to continue exploring the capabilities of the mosquito! This time I decide to use 85gr ballast for a 3 to 5 m/s wind. First observation, the MicroMAX takes the load with a disconcerting ease, and allows having even tighter trajectories, even more energy restitution, more speed and acceleration, but keeps its good behaviour at low speed and its ease of piloting. Turning with a bit of speed does not require any snap-flaps which I finally use very little. Well, after this good flight session alternating passage, aerobatics, some F3F type basics, it's time to go home because the curfew is at 6pm! What better than a little video to illustrate the text:

Video 12: Flying the MicroMAX in 5m/s of wind with 85gr of ballast.

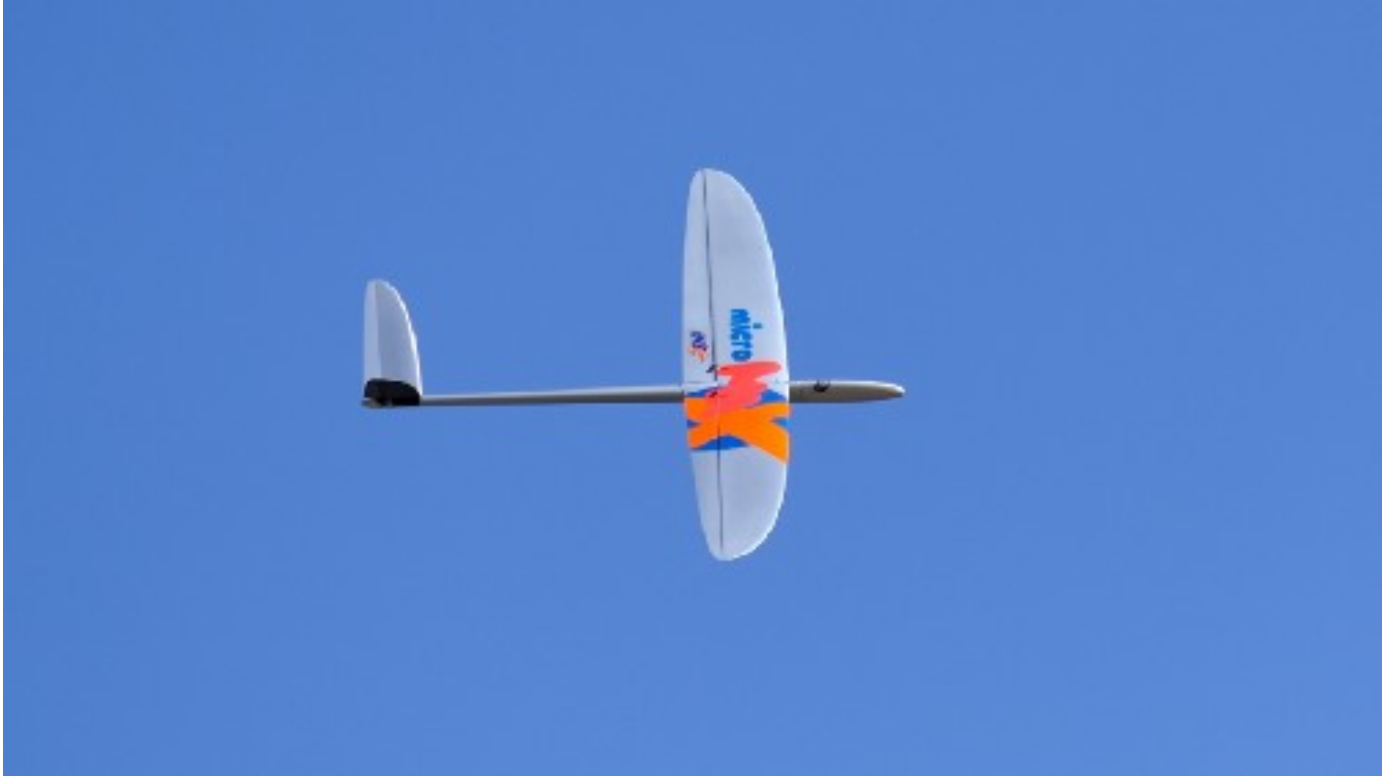
One to two weeks later, this time there is more wind, and I decide to use 190gr of ballast for a wind around 8m/s, but decreasing later in the afternoon. Once again the glider takes the ballast with obvious ease, and shows its muscles. The wing does not bend under load, energy retention is even better, the straight speed even higher. Surprisingly, the MicroMAX does not get "heckled" by the wind and remains unperturbed on its trajectory despite its 1.15m. Rolls, loops, Cuban eights, vertical eights, reversal, F3F type turns on the edge, nothing seems to stop it.

Photo 13: 1.15m of muscles !

It swallows the distances and is at the 4 corners of the flying volume in a few seconds, climbs, dives, does aerobatics, in short provides an intense pleasure of piloting inversely proportional to its size! Later in the afternoon while the wind is decreasing and the ballast should reasonably be reduced, I voluntarily decide to leave the 190gr and see how the glider behaves. Well … it continues to fly well, certainly it does not climb as high as quickly, but the extra weight does not seem to bother him in the least, it's amazing! Serge, my club mate who shares the slope with me that afternoon, will have the opportunity to fly the MicroMAX while I am behind the camera taking some pictures. He told me that he too is impressed by the glider's flying capabilities.

Video 14: Flying the MicroMAX in higher wind with 190gr of ballast this time.

I have since been able to try it also on the dark side of the slope, i.e. in "dynamic soaring", and the qualities of energy and speed restitution as well as its stability in trajectory make it possible to envisage making some turns of DS for fun. The wind was unfortunately not strong that day, but the MicroMAX “boots up” quickly enough, i.e. it doesn’t need much to maintain speed and circle behind the slope. Finally, ailerons down to 45° with the proper elevator compensation, allow short landings, even in the hand.



Photos 15 though 21: The MicroMAX proved to be an exceptional glider in terms of flight performance considering its size. It is capable of flying in all wind conditions.

Conclusion

The MicroMAX keeps its promises by offering exceptional flying qualities for its size. The only counterpart is to choose the radio elements with care because the space is counted in this so small fuselage. But in the end, the pleasure of flying the MicroMAX is immense and you will undoubtedly be amazed as I was. It fits all mounted in the car or dismounted on the rear deck. In short, the MicroMAX has all the assets to become a companion of all your outings to the slope! Good flights to everyone!

Photo 22: Size comparison with a 3 meters F3F glider, the Cosmos.

Characteristics:

- Wingspan: 115 cm
- Length: 74 cm
- Chords: 143mm/125mm/10mm
- Wing area: 13.5 dm2
- Wing loading: 18,0–38,0 g/dm2
- Empty weight: 230–250gr
- Ballasted weight: up to 410–500gr
- Construction: Rohacell and Carbon 40g/dm2 UHM wings, IMS Carbon fuselage
- Distributors: SansiBear.de or Hyperflight.co.uk

Photo 23: The MicroMAX ready for its next adventure.

Settings : (- means UP, + means DOWN)

- CG : 65 mm
- Elevator : + / — 9 mm
- Rudder : + / — 10 mm
- Ailerons : — 12 mm / + 7 mm
- Camber Thermal Position : + 2 mm
- Camber Speed Position: -1 mm
- Snapflaps : + 3 mm
- Butterfly : Ailerons : -18 mm / Elevator compensation : + 4 mm

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My Southwest Classic F5J 2021 Experience

I'm already dreaming of attending again in 2022.

Ryan Woebkenberg

A gaggle of F5J models and the majestic mountains in the background during the practice day

For years I had followed the Southwest Classic RC Soaring contest that was conducted in the Phoenix Arizona area in the February timeframe and had longed to leave cold and snowy Indiana for the warm and sunny southwest for a few days of RC soaring competition. With the benefit of a bit of unused airline credit I traveled to Phoenix, Arizona for the Southwest Classic F5J 2021 held February 20 and 21, 2021. I had a fantastic time at this very well organized contest. Because I had such a great experience I am writing this article to hopefully inspire other RC sailplane enthusiasts to make their own trips to future RC sailplane competitions.

My trip started a few months prior with some travel planning. I recently acquired a 3.1 meter Graphite from an estate sale and with a bit of measuring I noticed that when fully disassembled it would just fit inside a custom made box that would be under the 62 length + height + width airline class for “standard luggage”. My brother in law agreed to make a custom wooden box for this plane so that I could use it to airline transport the Graphite. To protect the Graphite in the box I made up bags from aluminized windshield reflectors, bubble wrap, and spare packing materials from various different consumer items to keep the parts of the plane centered in the box and to keep the plane parts safe.

I brought a large hiking backpack as my carry on bag. I made a box from chloroplast that just fit my transmitter, stopwatches, transmitter charger, and spare receivers and F5J switches. In addition to the transmitter box my backpack also contained my laptop and its charger, a lipo charging bag and 3 sets of motor packs for my Graphite, a

Hyperion charger, my hiking GPS, and a small jump pack intended for jump starting automobiles that I use to power the Hyperion charger, and 5 days worth of clothing.

Thursday February 18, 2021 I flew from Cincinnati to Phoenix on Frontier using airline credit that I had previously been granted by Frontier. My flights were without any problems, delay in my checked model box, or damage to it. The checked bag attendant quickly accepted the wooden model box and my backpack made it through security without any concern or delay. My friend and fellow RC soaring pilot Ed LaCroix picked me up from the Phoenix airport Thursday evening and served as my host. In preparation for the next day’s practice session I inspected my Graphite Thursday evening to confirm there wasn’t any damage during transportation and partially assembled it for the weekend’s flying.

Photo 1: This field is unbelievably massive by the standards of residents east of the Mississippi

We arrived at the event field on Friday about 9 AM for practice. After greeting some of the local pilots we quickly set up Ed's popup canopy, chairs, and table. After setting up our workspace for the weekend, Ed assembled his Vertigos and I completed field assembly of the Graphite by attaching the wing and wing tips.

The contest organizers had already started setting up the landing tapes and I spent the day getting comfortable with the Graphite. Having acquired the Graphite just a few months prior to the contest I had only about 15 flights on the model given the weather in Indiana this winter. The first thing that was obvious to me upon flying it in Arizona was how difficult it was to see. The Graphite’s wing is transparent blue and the fuselage is white and in the sunny conditions in Arizona I quickly lost orientation on the model. The issues I was having seeing the plane meant I didn’t range the plane out very much on Friday.

I eventually made thirteen practice flights during which I focused on testing out each of my batteries and making sure I was adjusted to the huge open space that is Arizona when making my landings. I have known that pilot’s who are used to fields with trees, buildings, etc. around to use as visual indicators of distance find making the same precision landing in a featureless wide open space to be more difficult. By the end of practice, I had only made one 10 minute simulated contest round. But since the thermals had started to pop I was able to fly the entire flight close and worked multiple bubbles.

On the drive back to Ed’s place we discussed the issues I was having seeing the plane. When making the practice flights I discovered that when I could see the bottom of the

Graphite's wing I could easily make out the two yellow sections of trim Monokote the previous owner had applied. Since Ed had several types of self-adhesive trim Monokote in his shop, we made plans that evening to add more to the tops of the wing tips to try to help my seeing the plane. I ended up adding a bit of yellow and black trim Monokote to the tops of the wing tips and also added some squares of trim monokote to the rudder of the Graphite to try to help with the fuselage disappearing into the sky when viewing it from the side.

Photo 2: My Graphite after adding some trim Monokote to help with orientation and keeping it in sight

We arrived at the field on Saturday for the first day of the contest and I quickly put the wing on the Graphite and made a test flight. The addition of the trim Monokote greatly improved the Graphite's visibility and my ability to see it and discern orientation. I observed during the test flight and from watching other planes of pilot making practice flights that the air appeared to be fairly flat. If there were thermals they were too weak to effectively work with my older generation plane.

During the pilots meeting it was announced that the contest had 35 pilots which were organized into three flight groups. Since this was only my third F5J contest and there would be 11 pilots launching at once with me, I decided to take advantage of the Graphite's very strong powertrain to stay out of trouble. Immediately after the start horn sounded I powered the Graphite and climbed near vertically to stay clear of the other planes while aiming at a height where I thought I could make the 10 minute task. In the first two rounds I launched to 219 and 258 meters and just barely had enough height to make the 10 minutes and score landing points. Unfortunately in both rounds one pilot launched to about 130 meters which meant my scores in those two rounds were 798 and 634 points. In round three and four I launched a bit lower but was only able to make about nine minutes leaving me with 750 and 800 point rounds.

By the final two Rounds of the day the wind had started to increase and I was only able to make about six minutes from 200+ meter launches. In Round 6, I flew in the third flight group and only managed a six minute flight from a 229 meter launch as the wind had been steadily building. I did score my best landing of the contest on this round, a 50. I wasn't the only pilot in this round to suffer from the strengthening winds. Three pilots had landings beyond 75m from their launch position. Unfortunately, as required by the F5J rules, landing further than 75 meters from the launch position means a pilot scores zero points for that flight.

Video 3: Mass launch of first flight group of Round 1.

After the third flight group of round 6 the contest organizers wisely chose to stop flying for the day. By then the wind had increased to about 15 miles per hour but with higher gusts. As soon as it was announced the contest was being stopped for the day we all packed up our planes and lowered or packed up our sun shade canopies. By the time we had packed our planes and lowered our canopy the wind and the gusts had increased to the point where lowering the scoring canopy was legitimately scary. Fortunately we were able to disassemble all the planes and sun canopies without issues.

Photo 4: Pilots ready their planes before day two.

Day two started similar to the previous two days with soft conditions in the morning but with a bit more wind. I had my only real major mistake of the contest in the first round of day two. I missed my landing and also fumbled shutting off my motor at the end of the motor run causing me to have a temporary off then on throttle blip resulting in the dreaded "dashed lines" display on the ALTI because of the in flight motor restart resulting in a zero score for round seven. It was entirely my fault and something I will work harder to really drill in the muscle memory of motor operation going forward.

Within a few hours strong organized thermals started to appear for the first time at this contest. In the last three rounds most of the pilots made the ten minute target time and the launches were starting to get lower with several launching sub 100 meters and making the task time. For me round ten was my best round of the contest making a 9:56 from a 201 meter launch and scoring a 45 landing. I finished the preliminary rounds in 28th place. My objective at this contest was to have fun and learn a lot and that objective was definitely accomplished. My friend Ed finished the prelims in fourth place which meant he would be participating in the flyoffs.

Flyoffs for F5J are conducted similar to preliminary rounds except the task is fifteen minutes instead of the ten minute task used in the preliminary rounds. Contest scores start at zero for the contestants competing in the flyoffs. The CD announced that the flyoffs would consist of three rounds for the top twelve pilots and they would let each pilot pick which launch spot he would launch from in order of highest scoring prelim score. My friend Ed chose the fourth lane closest to the flight prep area and he chose to have me serve as his timer/caller/helper.

As with the previous preliminary rounds thermals were developed and available for the flyoff rounds. That didn’t mean that the fifteen minutes was guaranteed but it did mean that a number of pilots were able to launch to under 100 meters and climb out and work one or more thermals to achieve the target task. Each round of the flyoffs saw multiple pilots make the fifteen minute task time. The wind had calmed enough by the flyoffs that the wind direction was dominated by thermal pull. This was evident by the launch direction as called out by the contest organizers for round one and two of the flyoffs being completely opposite of each other. Pilots also landed in completely opposite directions on at least one of the flyoff rounds. Because of these conditions most pilots had a similar read before the start of each round and typically most of the pilots launched to the same area where their observation of the shifty wind told them a thermal should be. The relatively obvious read of the conditions didn't guarantee a fifteen minute flight because as the thermals moved away from the launch area in at least some of the rounds pilots would need to work more than one thermal to keep the plane visible. Also with twelve planes often trying to work the same thermal from a sub 100 meter launch that meant that keeping space between planes to avoid a collision meant that it might not be quite as easy to climb out as it would be if there weren't as many planes all jockying for position in the relatively low thermal.

The first round was won by Jon Garber with a 14:58, a 45 landing, and an 83 meter start. He wasn't the lowest launcher in round one to make the target time but his combination of a relatively low launch and landing at the 45 with just a few seconds left to go on the clock won him that round. Eight of the twelve pilots made the fifteen minute target. Two of the twelve had seven minute flights and two of the twelve landed early and more than 75 meters from the start location for zero flights.

The second round was again won by Jon Garber with a 14:57, a 50 landing, and a 42 meter start. In this flight group all but one pilot got within thirty seconds of the fifteen minute target. Unfortunately, Matthew Aurand had a flight battery failure that caused his model to crash off field for a zero flight.

In the third round Jon Garber won it again for a perfect flyoffs. He went with the lowest successful launch height of the contest at 23 meters and capped it off with a 14:58 and a 50 landing. His low launch meant that he had to really work to climb out and was at times just a few feet off the ground before he was able to climb higher. Like the first round of the flyoffs eight pilots made the fifteen minute target with two pilots not able to climb out in a thermal and landing further than 75 meters and two additional pilots landing at the landing tape but not able to make the fifteen minute task time.

Photo 5: Ed LaCroix holding his Vertigo and 5th place award.

Since Jon won each of the flyoff rounds he obviously won the contest. Second place was Lenny Keer and third place was Ali Kahni. It was a real honor for me to time and call for my friend Ed LaCroix who finished fifth by launching conservatively high, between 100 and 145 meters, to assure he would be a little higher than most of the other pilots so that he could cover the air they were working and also have a little less congestion with other planes trying to climb out.

On Monday I flew back to Indiana and my trip back was a mirror of my trip out. Again the bag check attendant accepted my model box quickly and without issue and again I quickly went through security with my backpack without issue or delay. When I arrived back in Cincinnati my model box was waiting for me and arrived undamaged and with the plane inside it safe and secure. I had a great experience on this trip and I hope my recap encourages other RC sailplane pilots to plan their own soaring adventures.

In conclusion, I would like to say some words of thanks to the folks that made this contest possible for everyone and this trip possible for me in particular. First, thanks to the management at Evergreen Sod for allowing the EVFF club to use this field. I would also like to thank Darwin Barrie for CDing this event and Randy West for scoring. Matt Mahoney, Bob Parks, Don Scegiel, Ed Olague, and Tim Thomas from the EVFF club also served important roles in making sure this contest ran smoothly, fairly, and all of the contestants were well fed. But most of all I would like to thank Ed LaCroix for serving as my host, chauffeur, teacher, helper, and overall great friend. Without Ed's support and encouragement I probably would still have the Southwest Classic on my "bucket list" of RC Soaring contests to attend. I'm already dreaming of attending the Southwest Classic F5J 2022!

All photos and videos are by the author. Read the ***next*** *article in this issue, return to the* ***previous*** *article or go to the* ***table of contents****. Downloadable PDFS: article issue*

Pre-Flight Check

Because you know you should.

Rene Wallage

Just a few adjustments to the Tx settings, before the maiden flight.

Be honest, raise your hand if you ever crashed your model due to stupidity. Ok, anyone not raising his hand is either very lucky, has flown for less than a month, or is lying.

We've all done it. Call it what you will; a glitch (my speciality, although with 2.4 that doesn't work that well anymore), dumb thumbs, forgetting something like switching on the Rx, the list is endless. Or, like I did a couple of weeks ago, set up a brand new glider (a Schwing Corsa) in the comforts of my salon at home, than on the slope made some adjustments to the ailerons differential values just before launch, launched and realized within the first 3 seconds that the value change I did, reversed ailerons: left was right and right was left. So the maiden flight was very short, and painful. I put the wreck in the car, and flew my e-Typhoon... The wreck stayed in the car for more than a week. I just couldn't get myself to take her out of the car. I did take some pictures though, and saw that the damage is repairable.

Post launch, after a few ‘minor Tx adjustments’. Luckily, the walk of shame was short.

A few years ago, I wrote here about proper pre-flight checks, and how it saved my Bird of Time.

As I didn’t save my Schwing Corsa, this calls for a refresher.

Pre-flight checks are vital. My late father was a pilot instructor in the airforce (T6, P51D), and taught me to fly 1:1 very young. He was old school, and wasn’t afraid to use his hands to show me how big a mistake I made. I learned to fly the Super Cub often while leaning forward, so his hand couldn’t reach the back of my head… And he drilled it in to me. E-v-e-r-y s-i-n-g-l-e flight, whether it’s your first or your 6th of the day, you do a full pre-flight, including a walk around. Count the wings, blades, wheels, everything. What should move, moves. What shouldn’t, doesn’t. Once in the cockpit, checking stick movement, look at the surfaces to see they work, and move in the right direction. Say it out loud: “Stick left, left aileron up — right aileron down”, etc.

The models we fly (big or small) stay in the air because of the same aerodynamic laws as full size ones. Ever been hit by a model that’s landing? I have. It was my own EPP Unicorn flying wing (it’s foam, what can happen?), and hit me squarely in the shins. It *HURT*! Models *can* cause injuries, and even death…

That being the case, it stands to reason that we, model airplane pilots, have a responsibility and should follow the same routine as full size pilots.

So make yourselves a checklist. Mine goes something like this:

Before packing the car: Tx charged? Rx batteries/flight batteries charged? What is the state of the rubber bands, where are spares? (if you use rubber bands to hold down the wing)

While loading the car: See any damage on the model(s)? (most damage occurs during transport and between storage and car)

While unloading the car: See loading the car…

While assembling your model:

- All parts fit easily?
- Moving parts (ailerons, flaps, rudder, elevator, etc) are properly attached? (give them a tuck)
- TE and LE are straight and undamaged? (close your eyes and run a finger over them)
- Is there play on the moving surfaces? (this could cause vibrations at speed; you don’t want that, believe me)
- (If you have a motor) Check that the prop is undamaged, and moves (folds) freely.
- Everything that should be screwed in, is.
- Everything that should be taped, is.
- Insert the battery

When it’s all assembled, and you shake the model, does anything rattle that shouldn’t?

> ***If any of the above is not the way it should be, fix it. Now. Or don’t fly the model and fix it at home.***

Switch on your Tx. Have you chosen the right model? Motor is off (if there is one)? Flaps are neutral? Mixes are off?

Switch on Rx. Are all surfaces neutral? The next bit, do out loud:

- Aileron stick left; left aileron up right aileron down.
- Stick center; ailerons neutral.
- Aileron stick right; right aileron up left aileron down.
- Do this with all moving surfaces, flaps, airbrakes, landing gear, tow release.
- Are the throws correct? Do flaps come down equally?
- If you have elevator/flaps mix, check it.
- If you have ailerons differential, check it.
- Check all your mixes, and their directions.
- Check that all surfaces return to neutral when the sticks are released.
- Check flight conditions.
- Check high rates / low rates.

> ***If any of the above is not the way it should be, fix it. Now. Or don't fly the model and fix it at home.***

Now we're ready to launch. But before we do, while standing at the lip of the cliff, holding our glider (or a helper is holding the glider), the wind is howling around your ears, and trying to wrestle you glider out of your (or your helper's) hand, for the last time, check the directions of the surfaces out loud.

Then, ***and only then***, you can call for launch!

One day you'll thank me!

All photos are by the author. Read the ***next*** *article in this issue, return to the* ***previous*** *article or go to the* ***table of contents****. Downloadable PDFS: article issue*

- Set a central point on a servo exactly.
- Find out the signal lengths required for a particular maximum and minimum deflection.
- Measure the time a servo takes to reach maximum deflection.
- Test servos at the field, using a standard XT60 lipo flight battery.
- Run a long test on a possibly faulty servo.
- Take receiver signals from a standard pulse width modulation (PWM) channel or from SBUS or PPM.

The tester can handle up to eight servos. There are four separately controllable channels *S1* to *S4* and four more that are just paralleled with *S4*. It can also take external PWM, PPM and SBUS signals from receivers and other devices such as an Arduino.

There are three controls. The first, called *P1*, is a silver rotating knob used to operate the servos that are plugged in. The second is labelled *OK*. This has a central button used to select or open something and a part you turn to move between options or to change a value. The third is labelled *EXIT* which speaks for itself.

ToolkitRC ST8 Servo Tester

A useful and reasonably priced piece of it.

Peter Scott

What’s in the box. (image: AliExpress)

I bought this recently-released device from AliExpress for $46USD. It took 17 calendar (not ‘working’) days to arrive from China. It is well made and fairly robust but I think it would be sensible to keep it in its very solid box if taking it to the field.

Photo 1: As it arrived.

The manual in the box is useless. It is important to download the full manual which isn't wonderful but is better. I used to tell my adult students that a manual (computer in that case) is like sex. When it's good it's wonderful, but when it's bad it's better than nothing. Click *Downloads* to find the latest manual (V1.0 at the time of writing).

What It Can Do

- Test all servos up to 8.4 V and 2 A as standard, and others at higher voltages and currents using a special lead.
- Measure the current drawn by servos under different conditions.
- Find the safe movement for a servo.
- Match servos for critical situations.

- Set a central point on a servo exactly.
- Find out the signal lengths required for a particular maximum and minimum deflection.
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Photos 2 and 3: The left and right ends of the ST8 respectively.

More Extreme Servos

A high torque, digital or coreless servo might take more than 2 A. If so, you must power it from the XT60 *OUTPUT* port and make up a special lead. However no picture or specification is given for this lead, so I had to guess what was needed and I have provided details of that below. Higher voltage servos can be tested, up to 28 V.

Time to Play

The first thing I did was to connect the ST8 to my computer using a micro USB lead. My computer recognised the ST8 but I wasn't ready to update the software so left that for the time being. There is always the danger of 'bricking' the device if you don't know exactly what you are doing. As it is so new there is unlikely to be an update.

I connected a 3S lipo to the *INPUT* socket. The screen lit up and the tester beeped. You need to find or make an XT60 extension lead for the battery, as shown below, or it is awkward to pick up the tester.

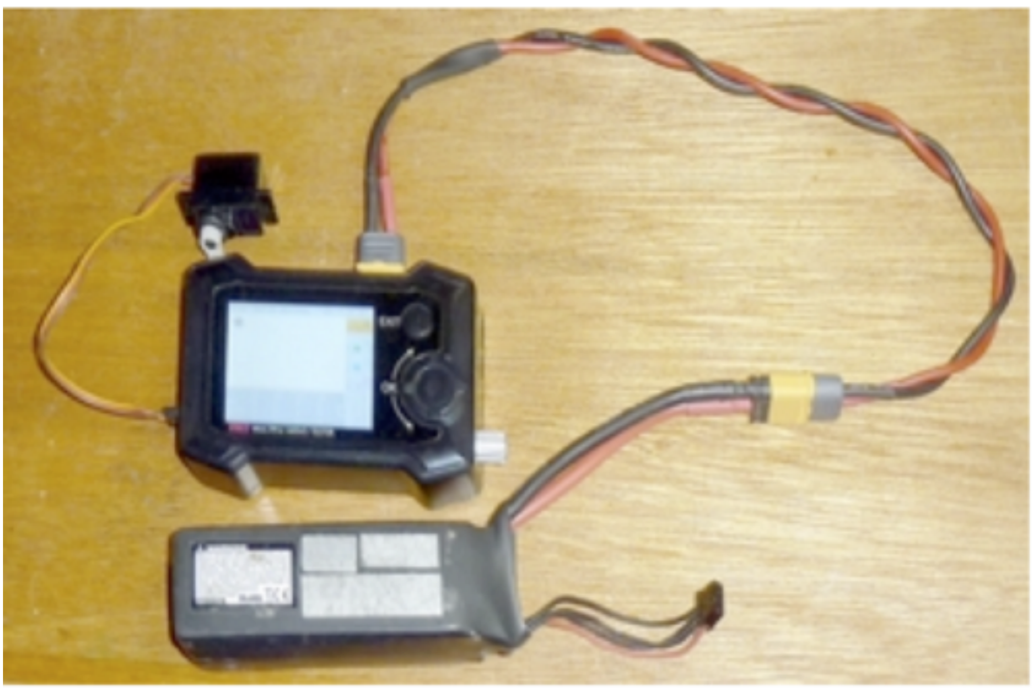


Photo 4: The basic testing setup.

Pressing *EXIT* moved to an oscilloscope type screen. The internal noise signal is displayed at the bottom. Down the right hand side of the screen are the four servo channels *S1* to *S4*. Each is colour coded. Each connects to one of the JR-style channel sockets on the side.

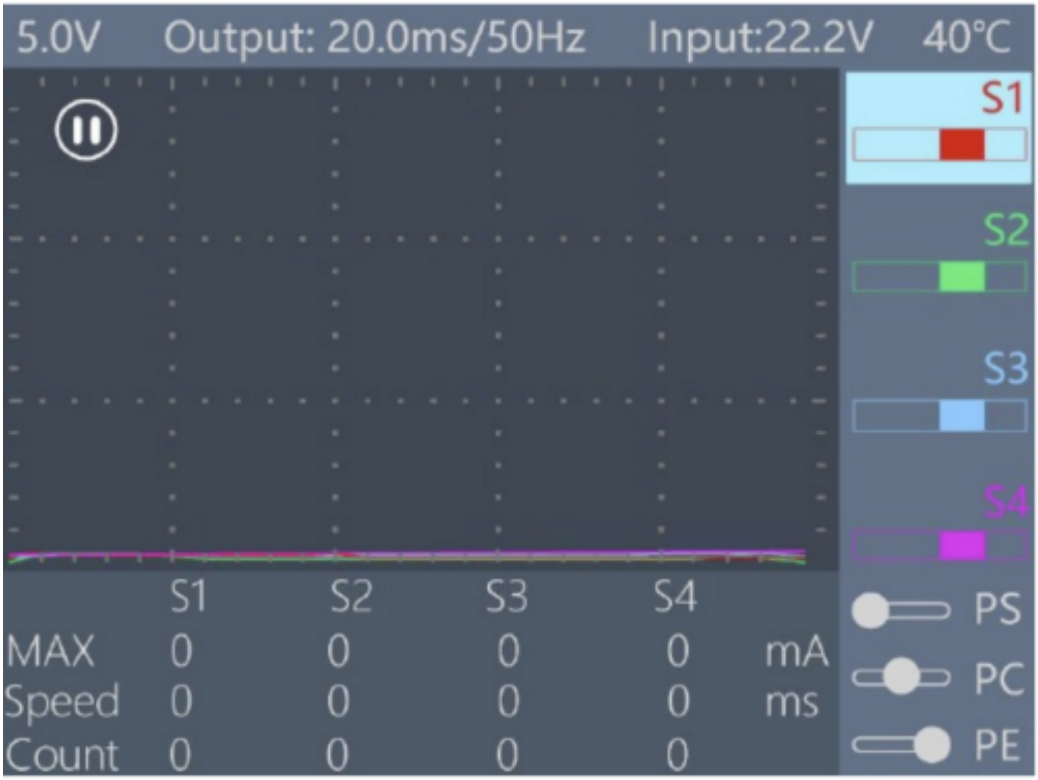


Photo 5: The default display.

Then I plugged an old servo into *S1*. Turning the *P1* knob on the side made the servo move, and the PWM signals being sent to it displayed as a red, vertical bar chart rapidly moving across the screen. The height showed the current drawn. Slow movement produced spaced out bars and rapid ones made them closer packed and taller. The current for *S1* was shown at the bottom of the screen, as *MAX mA*.

Photo 6: The display while tests are running.

I pressed *OK* and got a screen similar to Photo 6. This showed that the input signal being sent to the servo was coming from *P1*. It also showed the length of the PWM pulse currently being sent and the maximum and minimum values. Note that microseconds are shown on the screen in the simpler to display *us* unit format rather than the more correct *μs*.

Along the top of my screen it said:

5.0V Out: 20.0ms/50Hz Input:12.1V 36°C

So it defaults to 5 V outputs and the standard PWM signal cycle time.

By burning out a servo, I had discovered a while back that cheap testers output the same voltage as you power them with. Not this one. The output voltage can be changed as you will see later.

As it appeared safe, I then connected four different 9 g micro servos into channels *S1* to *S4*. Each of these channels has a different colour. When the pulses are displayed on the screen, they displayed in the corresponding colours. The screen becomes a simple oscilloscope. Not a very useful one, as you see later.

Turning *P1* made the servos move. The red bar showed the PWM pulse length in µs. At the bottom, the display showed the current draw, which I found surprisingly high for 9 g servos at up to 1.6 A. The faster I turned the knob and the faster the servos moved, the higher the current. Gentle movements such as you use in normal flying showed lower readings.

Here are the data from the four analogue and digital servos. The last value stays on the screen for a couple of seconds after you stop moving P1.

	Make	Model	Fast mA	Normal mA
S1	Hobby King	HK15178 (analogue)	950	200
S2	Tower Pro	MG90S (digital)	1000	600
S3	Corona	CS-929MG (digital)	1600	600
S4	Tower Pro	SG90(analogue)	500	150

Figure 7: The current draws of the array of 9 g servos which were tested.

It is important to know what maximum current the servo draws under normal use at high speed, and stalled, perhaps caused by a stuck control surface. You can then decide if you need to use a power box to avoid the currents overloading the battery eliminator circuit (BEC) or the receiver.

Changing the Signal

I then wondered what the large knob labelled *OK* was for. I decided it was now wise to remove all but one disposable servo. I pressed *OK*. I then turned *OK* button and found that I scrolled around the *Input* and the *Output* PWM signal timings.

There were two boxes under *Output*, one for the low pulse and the other for the high. This allows us to set the servo range of movement. I scrolled to the 1000 µs box and pressed *OK*. By turning *OK* I changed it to 1300 µs. I pressed *EXIT* and scrolled to high and changed it to1700 µs.

As you would expect, the servo movement was a lot less when I turned the *P1* knob.

With *P1* fully turned clockwise, I then increased the maximum pulse to 2200 µs. The servo of course moved further but didn't buzz. This would be a good way to check the maximum safe range of servo travel. Increasing the signal to 2400 µs gave nearly 90º deflection but the servo started buzzing so I stopped there and went back to 1000 to 2000.

Having got so far using the classic suck it and see principle, I then needed to RTFM. In other words Read The Friendly Manual. At least I think that's what the F means. I continued to pl… er investigate.

Setting up the Servo Output Channels

You can control the servo(s) under test using *P1*. You can also put signals into *S5* on the right from a receiver, or other sources such as an Arduino. These can be PWM, PPM or SBUS. There are built-in (internal) signal sources for testing as well. You can select which source goes to which output channel. Each channel may be set up totally differently.

The first thing to do is select which servo channel, *S1* to *S4*, to set up. Let's start with *S1*:

1. Start from scratch by restarting the tester.
2. Press *EXIT*.
3. *S1* should be selected. If not, turn *OK* until it is.
4. Press *OK* to select the *Input/Output* panel.
5. Press *OK*.
6. *P1* is already selected.
7. Press *OK* again and the characters *P1* are highlighted for edit.
8. Turn *OK* and you scroll round to: **Key** to use values from buttons PS/PC/PE; **Internal** for Linear and Stage used for soak testing; **S5** which allows you select PWM/PPM and channel/SBUS and channel for the S5 port.
9. Press *EXIT* to accept the value and leave the setup.

S1 has four options available: *P1*, *Key*, *Internal*, *S5*. *S2*, *S3* and *S4* have an additional option — to be the same as *S1*. The four channels to the left of *S4* are parallels to, and set the same as, *S4*.

System Setup

Hold down the *OK* button until you enter the *Setup* screen. There are nine things to change of which probably five are of interest:

- *VoltageOutput***:** This defaults to *OFF* but can be set to a voltage higher than 5 V and must be set if using the

XT60 main port for high current servos.
- *CycleCount***:** This is for soak testing and is 5000 by default. You can change it.
- *LowestInput***:** This determines what voltage the supply battery can go down to before the tester switches off. Set it according to the safe minimum for the battery you are using, for example 11.3 V for a 3S lipo.
- *SafeTemperature***:** This is used when the main port is used. It switches off the tester when the temperature gets too high. It defaults to 70°C but can be changed.
- *CycleCountClear***:** This sets the *CycleCount* back to zero.

Soak Testing

This is the nerdish name for running a device or component continuously, and possibly under stress, for an extended time to see if it works properly or fails. It is particularly useful for checking old, suspect or crashed servos.

1. Set the *Input* to *Internal.* It is probably in *Linear* mode.
2. The servo moves continuously and the *Count* at the bottom of the screen goes up by one for each cycle.
3. Press *OK* and scroll to *Stage*.
4. The servo now jumps from one extreme to the other, again being counted.
5. To leave an option choice press *EXIT*. You could leave it running for hours but that would be more than a

lifetime's flying so hardly a worthwhile test. You can set the number that the testing stops at. This was described in the **System Setup** section, above.

6. To set the count back to zero for a new test hold down *OK* and select *CycleCountClear***.**
7. Move back to *Linear*.
8. Turn *OK*.
9. The number next to *STEP* is highlighted. You can now set the length of time of each step.
10. Turn *OK* in steps up to 10 and watch how the movement speeds up.
11. Press *OK* and turn *OK* to get to *SPEED***.**
12. Again press *OK* and turn *OK* to change the value. As you move up to 10 you see the speed go down.
13. Press *EXIT* to quit.

Clearly if you want to hammer a servo under test setting *STEP* high will do it. Don't ask me what the numbers mean. I just know what happens.

Tests on a Range of Servos

I then tested several large and small servos, at high speed, for current draw in mA. Compare these data with those for the 9 g servos listed above.

Make	Model	Draw mA
Turnigy	TGY-778MG (slim wing servo)	700
AeroStar	AeroStar ASI-621MG (coreless)	2050
Tower	Pro MG958	3500
Turnigy	555MG	1050
Futaba	S3003 (ancient analogue servo)	950
Corona	DS-238MG	1300
Turnity	TGY-4409MD	2200

Figure 8: The range of servos (other than 9g) which were tested.

I was cautious when testing the large servos in case I blew up the tester. It seems that you can safely do very brief tests at currents higher than the specified 2000 mA maximum on the *S1* to *S4* ports. The tester didn't get warm. In any case its temperature is displayed on the screen and it switches off if it rises too high. I think it wise only to connect one large servo at a time. Doing it this way is at your own risk of course. I certainly wouldn't do a soak test. I'd use the *Output* power XT60 port which will be described later.

Current draw is a reasonable guide when matching servos, though timing might be more important for some aerobatic flyers.

In the manual you see pictures of the screen with enlarged signal traces. I have failed completely to find out how to do that. The manual doesn't mention it and I have given up trying to do it by pla... experimenting.

PS/PC/PE Positions

When you select *KEY* as the *INPUT* you can then scroll using *OK* to the three values stored in *PS*, *PC* and *PE*. These can beused to measure the time a servo takes to move from one position to the next. Normally they would be left as 1000, 1500 and 2000 µs as these values give full 60º deflections.

1. Set *KEY* as the input for *S1* and set *S2* to *S4* to use the settings for *S1*.
2. Press *EXIT* to get the main screen.
3. Turn *OK* to move down to *PS*.
4. Press *OK*. The servo jumps to a the extreme low position (1000 us).
5. Turn *OK* to move down to *PC*.
6. Press *OK*. The servo jumps to the central position. The time it took in milliseconds (ms) is displayed under *Speed* at the bottom.
7. Move to *PE* and test again. You can jump between the *KEY* positions and see the times displayed.

I did this with the original four servos and found, unsurprisingly, that they were different. What was a surprise was that the times varied for each servo without any apparent pattern. The servo with the least variation was the cheapest one. The two digital (D) ones were worse than the analogue (A) ones. Variations were (%) 32, 95, 79, 68 (A, D, D, A). Perhaps it is to do with the order in which the PWM pulses were sent to the servos.

Then I tested the fastest servo I had, a coreless Aerostar ASI-621MG. I hoped it wouldn't blow up the tester. The speed averaged 0.16 s for a 60º swing, which was very close to the specified speed of 0.152 s at 4.8 V. The variation was way better at 8%. Current was about 2.6 A.

My final test was to see how much the same model of servo varied. I used four brand new Tower Pro SG90 9 g ones. One didn't work at all, which was worth knowing. It went in the bin. The others showed quite a range of variation, perhaps not surprising as they are cheap. But it does show the wisdom of matching up pairs of similar servos.

High Power Servos

For high power servos try a slow deflection first. If it is clear that more than 2000 mA are needed then make up a lead, as described below.

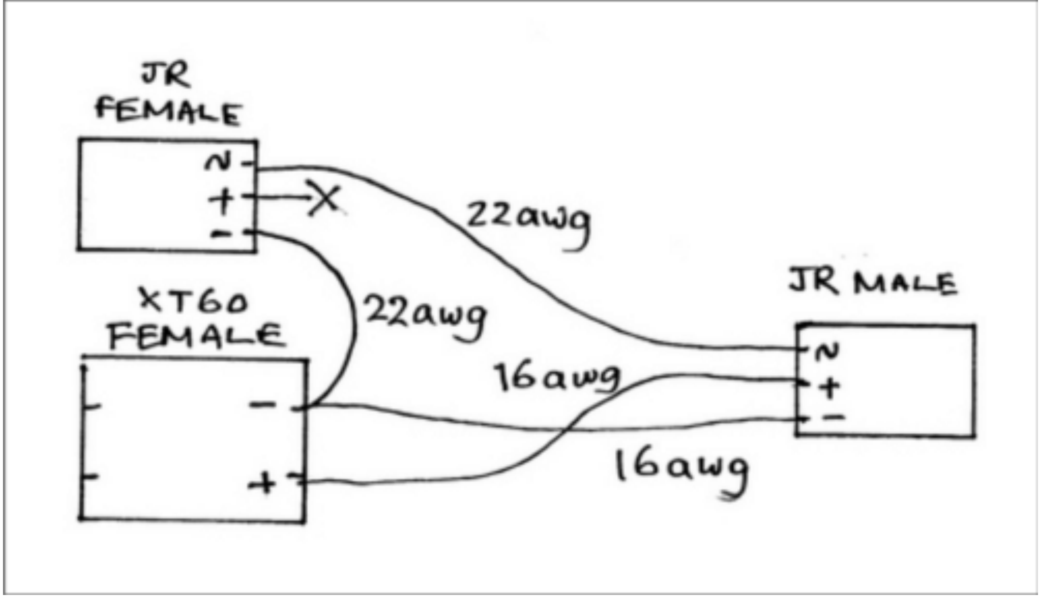


Figure 9: Wiring diagram for the high power test lead.

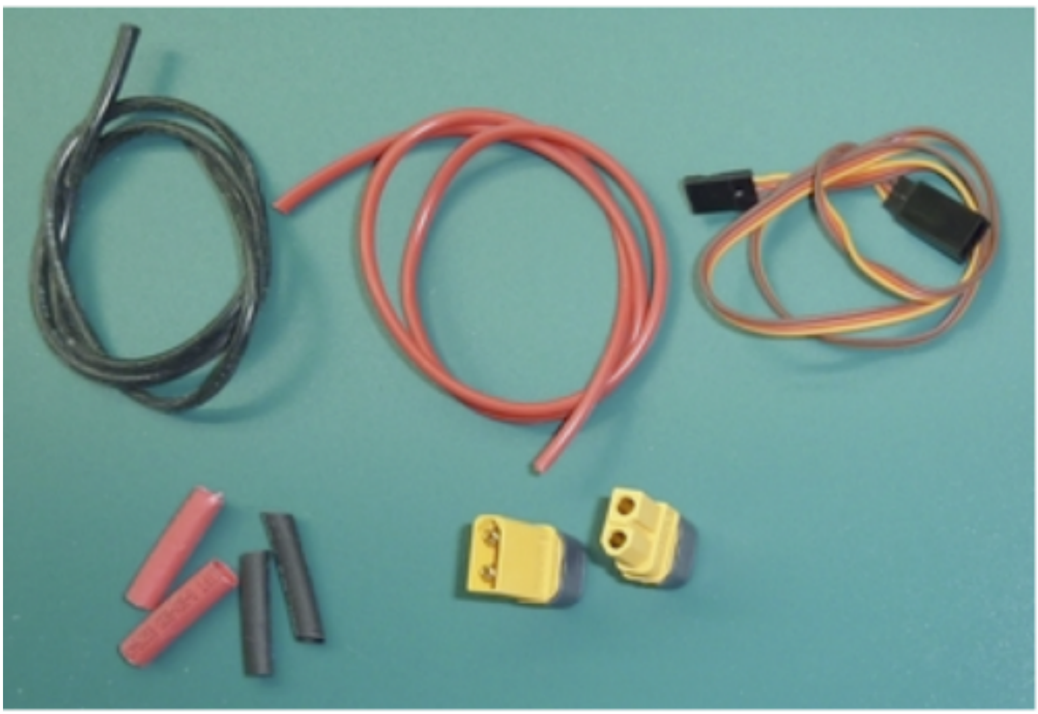


Photo 10: The bits you need.

A 500 mm 22 awg servo extension, 500 mm each of red and black 16 awg silicone covered wire, an XT60 female connector and various bits of heat shrink. Puzzle question: Which is the redundant part in Photo 10? Note the use of male and female correctly refers to the metal parts, not the outside case as some non-electronically-knowledgeable people use to confuse us. Or perhaps it's so we buy the wrong thing and have to place another order?

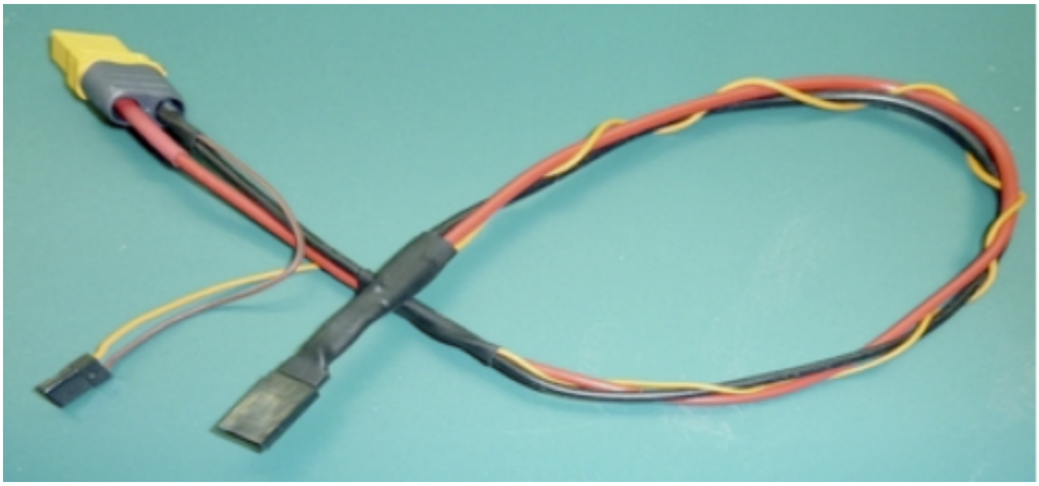


Photo 11: Here they are assembled.

Note that, because of the heat shrink, you need to mark which side of the JR plug is the signal pin. I had to alter the above lead to show that. I checked the cable for continuity and shorts with a multimeter and then it was time to try it out.

Photo 12: And finally, here it is plugged in.

I decided to try this out with the Aerostar ASI-621MG. The first step was to turn on the *OUTPUT* socket. I went into *Setup* and switched the socket on at 5 V. I plugged the servo in using the lead I had made. It worked. I used the speed test as above and got the same results for timing. I did not get any useful data for current though, as it showed about 450.

This arrangement is useful for when the servo shows a current significantly more than 2000 mA on the normal test. It allows you to test servo speeds safely. It shows you that you need a bigger BEC or a power box. But it does not tell you the current drawn.

Taking Signals from a Receiver

I decided to send a standard PWM throttle signal from a FrSky X8R receiver throttle channel 1. I chose this channel because the transmitter stick isn't spring loaded soI can set it to a value whilst I study it. The receiver wasconnected to a battery so I used a female to female servo lead with the red wire removed (yellow and black in the picture). This how it looked:

Photo 13: My setup for testing signals from a receiver.

It worked, once I set S5 to PWM rather that the default SBUS. As I moved the throttle stick the servo moved and the vertical signal bars scudded across the screen. However apart from finding the exact values of throttle maximum and minimum signals I don't think I learned anything new. In the manual there are pictures of servo signals expanded on the screen. I was hoping that I could find a way to do it, but failed. Perhaps it's a software version problem? None of the YouTube videos covered it either, but then they usually aren’t a great deal of help anyway.

A Version (not aversion)

Any techie will tell you that version 1 of any software or hardware is never properly finished. Way, way back, the BBC very cleverly named the operating system for its first model B computer ‘version 0.9’. When the bugs had been ironed out they released version 1.0. The OS was burned into a erasable read only memory chip (EEPROM). Back then computer enthusiasts knew how to rewrite the chip when the new version came out. Apart from those from Apple, which had already started to lock up its products, computers were open for people to change. So I imagine, and hope, that when the updated ST8 operating system version 1.1 appears my criticisms, limited though they are, will be sorted out.

Summary

This is a useful and reasonably priced piece of kit with a few rough edges in its software. The manual could be a lot better and you will have to make up at least one special lead. The key question is whether it is too complex to be of use to someone who just wants to do simple tests on ordinary servos. My answer is ‘no’, it’s fine. Also, please note I have no connection, financial or otherwise, with the makers or distributors of the items mentioned in the article.

Unless otherwise noted, all images are by the author. Read the ***next*** *article in this issue, return to the* ***previous*** *article or go to the* ***table of contents****. Downloadable PDFS: article issue*

Clevis Tool

This is one of the handiest tools I've ever made.

Tom Broeski

Everybody needs one (or several?) of these and here's how to make one.

Years ago I tried a couple clevis tools that were just too short or awkward. So, I decided to design my own. One of the toughest jobs was reaching in to get the clevis off of a bellcrank in my older planes and ones like my SBXC. It needed to be long enough, but not too long.

Left: After playing around a bit, I found that 1/8″ stainless steel rod, anywhere from 8 to 10″ long was just fine. I settled on 9″ (half of the 18″ rods I had laying around). **Right**: Next thing was to flatten one end and start making it curved.

Left: I found that using a propane torch aided in the process. **Right**: I flattened it to about ¼″ wide.

Left: I started the curve. **Right**: I got the main curve looking right.

Left: Then I re-curved it to start the final shape. **Right**: I then curved it back to the final shape.

Left: Next, I cut the groove. **Right**: It was important to make sure it was deep enough to get good lifting height.

Left: The clevis needed to just fit. Not too tight, not too loose. **Right**: The tool worked the best with the curve up.

Left: It allowed the clevis to be easily lifted off. **Right**: Now I needed a way to put the clevis back on. I flattened the other end to about 3/16″

Left: Bent it about 80 degrees. You can bend it up to 90, but the edge of my vise was a bit rounded. It actually turned out easier to remove, after installing the clevis, with less than a 90 degree bend. **Right**: I just inserted it in the clevis and twisted it straight.

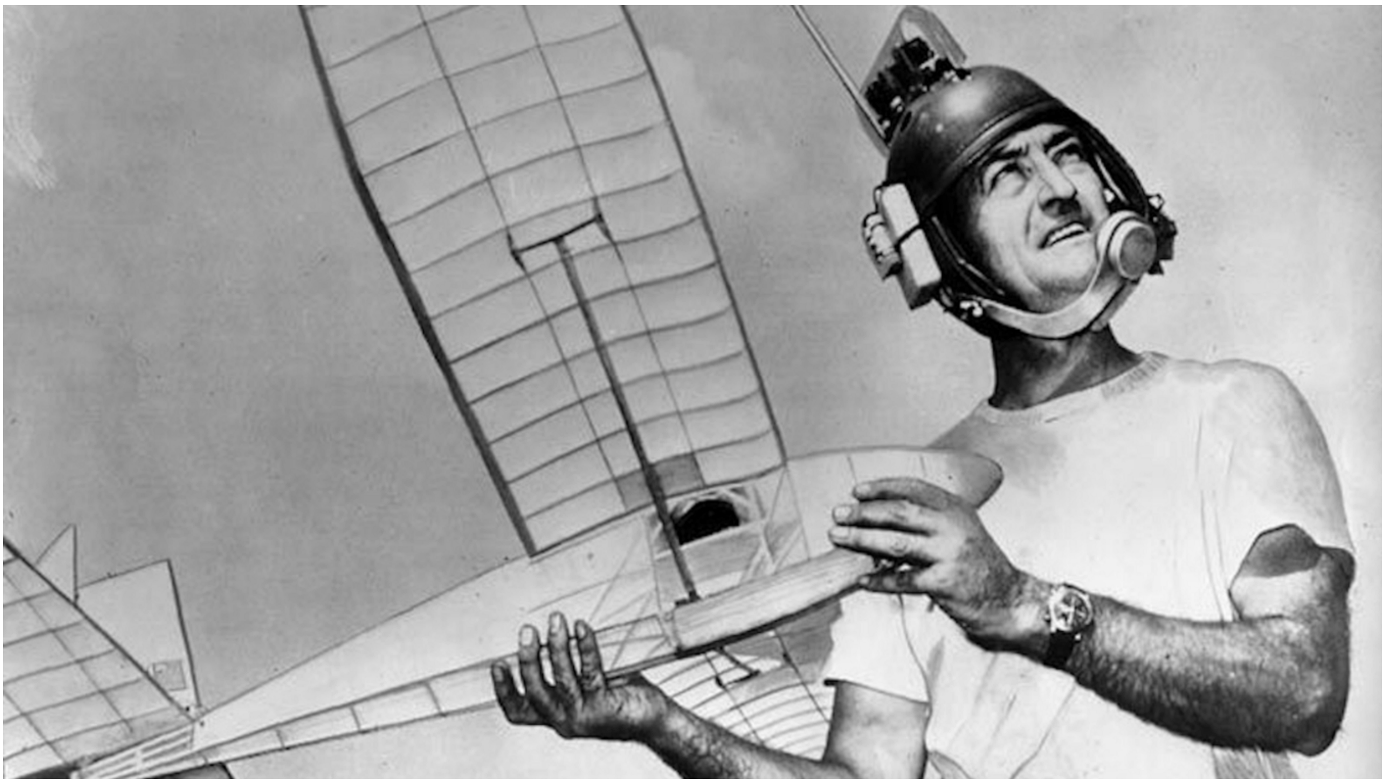
Left: Worked like a charm. The clevis was really easy to put on, even reaching way in on some of my planes. **Right**: I made some in polished stainless, put gun blue on some, and have a bunch of rough quick ones stuck here and there.

I made a bunch over time. You should have a number of them for the shop and tool kit. It saves you from saying "@#! I wish I had that with me."

Where Did All Those Drones Come From?

Thoughts on the collision between the old world and the new.

Terence C. Gannon



Jim Walker shows off one of his experimental Sonic Control Gliders in Oregon in the 1940s.

One of my earliest memories — I must have been five or six at the time — was when my father decided it was time to pass along his lifelong love of all things that fly, and bought us a Guillow's Javelin. My brother and I were absolutely *not* capable of assembling the delicate balsa wood frame, not to mention attaching the diaphanous green and yellow tissue.

So really it was more of an exercise in Dad building, and us watching, but the smell of the dope on the tissue was intoxicating. More so than even I realized at the time.

> *"Picking dollar bill-sized shards of balsa wood out of the grass just so you can glue them together again teaches you something really valuable about loss and recovery and never, ever giving up."*

We took the finished product out beside the Trans-Canada highway in suburban Montréal, wound up the rubber motor and watched, transfixed, as it curled into the summer sky. Seeing the translucent, green and yellow profile against the sun is an image as vivid today as it was back then. I was totally, completely and utterly hooked. That it still holds the same fascination 50 years later means, in my mind, it is one hell of a hobby. Or maybe it just takes that long to finally get good at it.

Later in my youth, having spent a dusty, hot Vancouver summer mowing lawns, my brother and I, with our parents help, finally managed to scrape together the money to buy the kit of our dreams — a 'Boss T' sailplane along with a

Heathkit radio control system. We built it together in our shared room and it took seemingly forever to finish. We finally took the results of our year's labour to the flying field and almost instantly transformed it back into a kit trying to recover from a bad launch. Picking dollar bill-sized shards of balsa wood out of the grass just so you can glue them together again teaches you something really valuable about loss and recovery and never, ever giving up.

We tied our fair share of tissue bags of flour to our model airplanes and tried to figure out ways of dropping them off. We loved to see that little puff of 'smoke' as they hit the ground. So it didn't come as any great shock when a couple of decades later, the radio controlled airplanes of my youth were reborn, writ large in matte grey paint, air force markings and given menacing names like Reaper and Predator. First they only had that ominous, Orwellian, unblinking, all-seeing eye but it was really only a matter of time before they started strapping Hellfire missiles on them. Radio controlled warriors rarely seen or heard before they made their presence felt.

> *"A drone…more accurately known as a multi-rotor, is what you get when you take an airplane and remove as much of the hardware as you can."*

Suddenly realizing, way too late, I had unwittingly let yet another fantastic career option slip through my fingers, I visited with a Professor at the local university who specialized in the development of what are, no doubt about it, just sophisticated radio controlled planes. His office was a sunny, beige version of J.F. Sebastian's damp, nightmarish lab from Bladerunner. The contact folder on his desktop was tantalizingly opened to the very card of the same local hobby shop I frequented. Entrails of various projects lay scattered around his office, and I remember thinking, "wow, if I had known I could do this for a living, I would have stayed in school."

A drone, or at least one kind of drone more accurately known as a multi-rotor, is what you get when you take an airplane and remove as much of the hardware as you can. They are flying software, more than anything else. This also makes them subject to all of the frailties of software that we hear about with increasing frequency. There's a reason that commercial aircraft can land safely after losing great chunks of their primary structure: they are built like tanks out of really tough stuff, manned by humans with an ability to reason and a will to live.

A drone, on the other hand, is subject of the whims of the misplaced comma. Literally, not getting the code right at least most of the time could be the difference between a drone getting sucked into a jet engine, or not. It could be the difference between landing safely out of harm's way or plowing into the assembled, suddenly dumbfounded crowd which it then proceeds to devour with whirling Kevlar knives. I think of these contingencies with complete horror and know that statistically it is really just a matter of time before they, and worse things, begin to happen.

And I'm a fan.

The inevitable reaction, of course, is to try and put this genie back in the bottle. Surprisingly, for a country that routinely turns on itself when debating the rights and freedoms associated with other technologies, the US federal government recently mandated the registration of all drones over 250 grams — a little over a half a pound. That is without a significant whiff of opposition to what, on the face of it, is a fairly sound idea. However, it does seem just a tweak shy of ironic that if there are two guys in a field, one with a drone and one with a 12 gauge trying to blast it out of the sky, the guy with the transmitter in his hands is the more likely of the two to spend the night in jail.

What's bad about the idea is that it does not distinguish even a little bit between the 40 pound, carbon fiber, flying Chop-o-matic and an ever so slightly larger version of that Guillow's Javelin. We are now in the realm of unintended consequences. With our desire to quickly rein in what we have unleashed, the kids and their folks standing in the field on a summer's day with their model airplane will be the baby getting turfed out with the proverbial bath water.

> *"What's bad…is that it does not distinguish…between the 40 pound, carbon fiber, flying Chop-o-matic and an ever so slightly larger version of that Guillow's Javelin."*

At first I thought perhaps — *just maybe* — reason and good common sense would prevail. I hoped that 50 years after my personal 'first flight' I would still be able to wander down to the local park and steer around my 21st century version of the Guillow's Javelin without fear of doing hard time. Then I thought of the guy on YouTube who, with what is seemingly the 21st century version of the flour bomb, attached a real gun and flamethrower to a drone and I thought…*nah, ain't going to happen*.

It was entirely unexpected when just recently, as midlife grinds on, I found myself craving the inimitable smell of balsa wood, tissue paper and dope with its attendant slightly narcotic, why-do-you-think-they-call-it-dope effect. I also think of the smell of freshly cut grass, families, summer evenings and rubber powered stick-and-tissue airplanes curling through the sky and wonder if, like the days of my youth, they are lost forever.

This essay originally appeared in the The Selected Curve, *and is reprinted here with the author's permission. It was also featured as an* *episode* *on the* *Not There Yet* *podcast. Guillow's®, Kevlar® and Chop-o-matic® are all registered trademarks of their respective owners.* *Read the* ***next*** *article in this issue, return to the* ***previous*** *article or go to the* ***table of contents****. Downloadable PDFS: article issue*

The Trailing Edge

Wrapping up March and looking forward to April.

The NEW RC Soaring Digest Staff

Stretching the day into evening with a flight over the Bristol Channel on Lundy Island in the UK. (image: Mike Shellim)

Mike Shellim, who provided the enigmatic shot for our *Events* page, also kindly provided this month's beautiful image for *The Trailing Edge*. Mike writes: "Lundy is a tiny island in the Bristol Channel with a beautifully rugged landscape. It's ideal for cliff soaring, and the annual expedition there has become something of a tradition amongst keen slopers here. No motor vehicles may be taken across, and it has a single tavern called the Marisco which becomes the centre of life after nightfall. The pilots in the photo are Jack Cubitt (left) and Andrzej Tabero."

So that's another for our bucket list — how about yours? Thanks so much for that, Mike.

We also want to humbly thank all the contributors to this month's issue: more so than we can possibly say, this publication would not exist without your efforts. For readers, please don't forget to add a few *Claps* for those stories you really enjoyed. Also, *Responses* are a great way to interact with the authors to offer your encouragement and ask questions about the story. Reader engagement is the holy grail for writers so please…engage away! And please consider contributing a story of your own. The April deadline is **2021–04–18**.

We mentioned our Events page above and we should have added that we welcome new events being added. Just send us your details and we'll make sure your listing goes up promptly. We support new listings with our social platforms, so it will really help get the word out.

If you really appreciate and enjoy the high quality reading experience for which we strive each month, consider supporting RCSD through a purchase at our still-rough-around-the-edges store. We have *RCSD Cover Photo T-*

Shirts for both January and February on sale now. All proceeds support the operating costs of RCSD.

In the near future we also hope to roll out our Corporate Sponsor program. This is intended to provide a platform for quality, relevant vendors to support RCSD over the longer term while getting their message out in a unique, effective and tasteful way. If you feel Corporate Sponsorship might be a fit for you, please get in touch and we can chat how about we might be able to help.

If you don't want to miss the April issue when it comes out, please subscribe to our mailing list. Also, follow us on Instagram and Twitter for even more complementary content.

That's it for now — how did we do? Let us know your thoughts. Thank you all so much for reading and until next time...fair winds and blue skies!

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