This magnificent picture was taken on 2021–06–11 by Alexandre Mittaz after a mid-afternoon, one hour long thermal flight in the Val d'Hérens / Valais / Switzerland. The aircraft is a Drops388 from DropsFactory in Germany. Its wingspan is 388cm, weighs in at 5.8kg unballasted and is constructed with hardshell carbon fiber wings. To provide a sense of scale, Alexandre's wife can be seen at the extreme left of the photo (you'll have to look really, really closely).

In The Air

Is great flying right on your doorstep?

Terence C. Gannon Follow
Jun 12 · 6 min read

One of the occupational hazards of this job is that I have a steadily growing list of 'must see' places to visit on this gorgeous Big Blue Marble of ours. I am truly fortunate to get to see (in some cases before it's seen anywhere else) some truly breathtaking photos of what clearly are the best places to fly in the world. If I can ever gather the courage to get on a plane again — and I win the *MaxMillions* to pay for it — I could easily stay busy travelling the world for the rest of my life and not even scratch the surface of great flying sites. Take, for example, Alexandre Mittaz's photo which headlines this month's *In The Air*. If there is a scene which is more idyllic, I can't imagine what it is or where it is. I've even suggested to my wife that we simply sell our house, pack our bags and move to Switzerland permanently. Until, of course, I discovered there's a reason why there aren't many Swiss listings on the @*YourCheapDreamHome* Instagram feed.

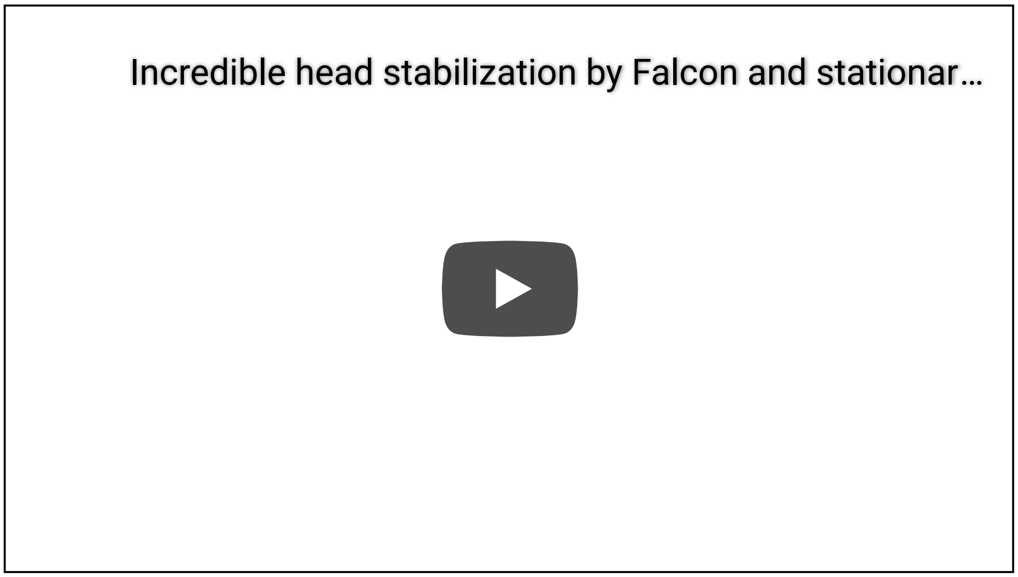
I moved to Calgary, Alberta over 30 years ago, and for quite a few years after I arrived here, I lamented the fact 'there was no where to slope fly'. That condition went on for quite some time until, for reasons I am not readily able to explain, I began to look at the urbanized, prairie landscape through different eyes. I realized the reason I couldn't find a good place to fly is that **they are everywhere**. It was one of those classic cases of not being able to see the forest except for all of those pesky trees that kept getting in the way. I started keeping track of potential sites and while the vast majority I have not yet had an opportunity to try — *yet* — there are something like 25 sites which have real potential.

In retrospect, what likely changed the way I looked at my home town's offerings with respect to flying sites was the advent of small, lightweight, efficient and highly maneuverable designs like Mike Richter's *Alula*, for just one of many examples. Aircraft which, happily, fit under the 250g threshold where many of the new array of civil aviation regulations kick in as I described in last month's *In The Air*. Yet another great reason to be thinking about the *250g Grand Challenge* which I mentioned in that column as well.

For the sites I have tried and have had success there are three specific techniques which I use to assess the lift potential before I commit an aircraft (that is 'money') to a new slope:

The first is simple geometry: if there is a clean run up to a slope of even a modest inclination and the prevailing wind is blowing within anything close to 30 degrees of the fall line, there are precious few ways for the wind to go but up. It's not a perfect science, by far, but I'm still surprised at the reliability of this method to determine that the lift 'must be there'. And then have it turn out that it actually is. I'm not always good enough to exploit it, of course, but that's on me, not the quality of the opportunity.

Second, a bottle of kids' blowing bubbles is always close at hand in the car and my wife, Michelle, has waited patiently many a time as I walk around a potential site and start blowing soap bubbles and studying their flight path intently. The kind soul she is, she has even explained to passersby that I am not actually a lunatic as I wander around, seemingly aimlessly, in the long grass, stopping occasionally to produce another cloud of 'tiny bubbles' (with apologies to the great Don Ho). Bubbles not only are the single most accurate method of determining wind direction (see previous paragraph) but if they go up there is a pretty good chance you will, too.



Thing you're as good as this little guy? No offense, but you're not. None of us are. (video: YouTube)

Finally, there is a trick that was taught to me by an old flying buddy of mine back in the late 1970s — George Cotten of Victoria, BC —who studied birds on potential slopes and made this very sage observation: for gulls and raptors who are already up there looking down on you — and undoubtedly laughing their asses off — study their tails, not just their wings. If the wings and tail are both steady, there's a good chance you'll be keeping company with them shortly. If the wings are steady but the tail is twisting, you'll do just as well to move on. There are times we have to face the fact our feathered friends are just way better at this thing that we do than we are.

So until such time that those lottery numbers come in and you can afford that big RV and launch out on the endless road trip exploring all the great flying sites you have seen and read about, first look around your home town. There may be places to fly which are walking distance from where you already live. Oh, an important note: be really smart in the use of these sites for this purpose. Always obey prevailing city and other ordinances and by-laws, of course. If you're a good citizen who is being careful and considerate, nobody will be in a position to complain about this green, clean and interesting recreational use of the site. You may even be able to create a couple of converts!

And what about you? Do you have a tip or technique for exploring a brand new, potentially unflown slope? Or perhaps a method of picking out potential candidates? Let us know or better yet, contribute an article and share your wisdom with the RCSD readership. We would all love to hear from you!

In This Issue

I have said it before but it bears repeating every month: I am humbled and gratified by those great contributors who are making RCSD one of their online homes. We have another great issue with probably too many highlights to list them all. But I'll try:

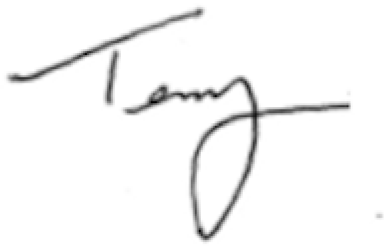
Way back in the first issue of the NEW RCSD, Phil Cooke reported on the Power Scale Soaring Association (PSSA)'s September event at the Great Orme in Wales. I'm thrilled to welcome Phil back as he reports on their first post-pandemic event from just last month. As always, it's hard to say which Phil does better, pictures or storytelling, because he does both so well. James Hammond returns with his fourth and final instalment in his *Designing for…* master class. This time 'round, James covers aircraft which would be suitable for that beautiful Swiss landscape above. Fear not, though, turns out that James is going to be back next month after all — see his latest for a hint as to why. Pierre Rondel adds to his previous and very well-received article on the STGmodel *Orden*. It's gone electro! In particular, check out the video in that article…it's fabulous. Bob Dodgson also returns with the second of his three part autobiography along with that signature, modern twist we have added. Last but certainly not least, Michael 'RC Soaring Diaries' Berends provides in-depth coverage of his new *Windburner* and *RPM* from Australia's Kevie Built RC Planes.

But wait, there's more! We also have more event coverage from the *2021 New England Scale Soaring Aerotow* by Steve Pasierb. Peter Scott writes another one of his inimitable reviews, this time for the FrSky Electronic Speed Controller. Broeski is back with yet another smart tip which will have you face-palming yourself punch drunk. Finally, Norimichi Kawakami provides the next part of his *1/3rd Scale Mita Type 3 Production*

Notes in both Japanese and English. And in the 'really pleasant surprises' department, Norimichi has provided a really neat bonus article. For that, you will just have to dig through the June issue to find that gem.

So, with a bit of luck, something for everybody. Thank you so much for reading and I really hope you enjoy what we have managed to cobble together for you this month.

Fair winds and blue skies!



*This month's stunning cover photo is from Stéphane Ruelle, and was taken on 2021–06–06 at the site of the US GPS Triangle Nationals at the Siskiyou County Airport in Montague, California. Stéphane will have a full report on his attendance at the event in the July issue of RCSD. Now, without further ado, here's the **first article** in this issue or go to the **table of contents** for all that other good stuff. Downloadable PDFS: just this article or this entire issue.*

Chris Collis' North American Rockwell OV-10 Bronco cuts an unusual shape into the skies above Llandudno.

An Energetic Return to the Slopes!

Phil Cooke and Al Gorham report from the first slope event of the year hosted by the UK's Power Scale Soaring Association — 21st/22nd May 2021

Phil Cooke Follow
Jun 14 · 12 min read

It is very clear the spirit of the PSSA community has not been eroded one bit by the COVID lockdown. The lengthy enforced grounding we all had to endure due to travel restrictions in the UK meant this was an eagerly awaited meet, and despite a mixed weather forecast it played out to be a well-attended opener at the start of our delayed 2021 flying season.

Day 1 — Saturday

30+ pilots gathered at the top of the Great Orme, Llandudno, North Wales on Saturday morning for the event brief at 10am — covering not only the handful of rules we employ to enable safe, continuous operation of PSS models at a public site, but also the ongoing Covid governance details as well as the newly required CAA registration checks and Article 16 compliance requirements. Although social distancing is easy to self-manage in such a big, open space we agreed to apply further mitigation with limits in the pits of two models being rigged by each pilot at any one time and similarly we limited the number of pilots in the active flying box to six.

Saturday provided good strength (15–25mph) northwest winds which saw us flying from the lower 'Café slope' ledge — a great lifting cliff face with a steep drop to the Irish Sea but one with limitations due to the shape and size of the landing zone — not best suited for maiden flights or approaches with the bigger or less manoeuvrable PSS models. Flying commenced immediately after the brief and continued impressively right up until sundown on the Saturday, pilots wanting to extract every last minute of opportunity in the ideal conditions, knowing that Sundays weather was forecast to be quite different!

One 'silver lining' evident with the enforced break from flying activity was the number of newly completed models on show and in action throughout the weekend. New models of all types across a wide range of scales — the levels of ingenuity and fidelity in the quest for scale realism is always inspiring and something which this group of modellers clearly continues to thrive upon!

Models on Show

I'll start with the North American F-86 Sabre, the model type and short-kit selected back in 2019 as the subject of the PSSA's 2020 Mass Build, an event still not run (delayed due to COVID) and currently deferred until September 2021. More and more models are now reaching the point of completion, and there were at least half a dozen examples of the type brought to this event — although only Martin Gay and Peter Garsden were seen flying their Sabres on the Saturday. I'd not seen Peter's model fly before, it's modified from the all built up plan with the utilisation of a lost foam fibreglass fuselage which saw Pete complete and test fly his model much sooner than the rest of the group building the lite-ply and balsa planked fuselage.

Photo 2: Bob Jennings provides the launch for Peter Garsden's new F-86 Sabre built from the G&M models kit.

Pete's F-86 is finished in the flamboyant scheme from the 4th Aerobrigata Italian Airforce aerobatic team 'Cavallino Rampante' circa 1956 who flew five Sabres in close formation. With an AUW of 4.5lbs it flew brilliantly early in the day showing great pace and agility cruising up and down the slope. Later in the afternoon Martin flew his now well proven, all silver prototype airframe to equally good effect, before a group of Sabres were gathered as one for the camera with builders swapping notes and learnings from this latest group pursuit.

Photo 3: A taste of things to come — PSSA Mass Build F-86 Sabres begin to dominate the slope!

As well as the wide range of schemes already clearly evident, I was particularly taken by the modified two-seater TF-86 prototype (built by Martin and Gordon Studley) with it's longer nose and huge double canopy! A very rare machine indeed! We eagerly await the Mass Build event in September where we hope to amass many more Sabres together upon the Great Orme.

Andy Meade had completed his new Gloster Meteor Mk3 just in time for the event which was sat rigged in the pits and looking superb bathed in the Welsh sunlight. This is an impressive airframe — at 1/7th scale, conventionally built up from Andy's own drawings it spans 69" and has an AUW just over 10lb. I was very keen to photograph the model in the good light during the Saturday morning session.

Photo 4: PSSA member Andy Meade lends some scale to his fantastic new Gloster Meteor.

It’s fitted with working flaps and a complex rudder, split either side of the mid-mounted tailplane just like the fullsize. This stunning new model was wisely not test flown on the unforgiving NW Café slope we were operating from — Andy awaiting the opportunity to fly from the South West slope later in the weekend! The model is finished in 25g/m2 glass cloth and resin and painted with acrylics with decals from Callie Graphics. Andy explained that the plans will soon be available for purchase through the PSSA website (see *Resources* section at the end of this article).

Chris Collis was flying with us once again and like last time we met at the Lleyn in 2020, he’d brought with him his pair of huge Avro Lancasters — each spanning 134” and with an AUW of 25lb. These would both be aired later in the day but prior to that Chris also campaigned a brand new O/D model in the characteristic shape of the North American Rockwell OV-10 Bronco.

Photo 5: The OV-10 Bronco on finals into land at the end of its successul maiden flight

Fully built up and with a span of 60” this rugged shaped model enjoyed a successful maiden flight and looked great in the sun with its USMC three-tone desert camouflage.

PSS encompasses all types of aircraft, some more naturally suited to slope use than others, so considering their clean, sleek lines I’ve always thought it odd we don’t see more business aviation jets flown from the slope. Dave Gilder has improved that situation with his latest build in the shape of the Cessna Citation Bravo. This large-scale model has been converted to PSS from the Hero Eagle EDF power kit and Dave has repainted the model to represent the aircraft flown in Switzerland by the TCS Air Ambulance Service.

Photo 6: Cessna Citation Bravo built and converted to PSS by Dave Gilder

It spans an impressive 71” and has an AUW of 8.75lbs, the large fuselage and engine pods are all formed in fibreglass and it has a fully built up wing and tailplanes. As yet unflown, Dave did rig the model at the event for the camera and I think it holds huge potential as a great, rugged performer from the slope!

Formation Flights

Although there are no formal timed display slots at our 'Fly for Fun' PSS meetings it's quite common for similar aircraft types to be flown together when the opportunity arises and this meeting was no exception with two separate performances being worthy of note.

Photo 7: Tim Mackey's Airbus A380 gets away as the second of three flown together

Prior to lunch, Tim Mackey and Steve Kemp both flew their Airbus A380 models built for PSS from the Windrider EDF kit. These 72" span, all foam models are well proven from the slope and have been flown together before to great effect, their size and stability lending themselves really well to a series of gentle formation passes. Tim's model is finished in the legacy Airbus Industrie house colours and Steve has finished his model in a recent Emirates livery. Building upon this spectacle, Dave Gilder also launched his Airbus A380 built for PSS from the slightly smaller Hobbyking EDF kit and recently refurbished in the latest QANTAS livery.

Photo 8: Airbus formation flight (left to right) Tim Mackey, Steve Kemp & David Gilder.

These three similar models went on to hold the spectators attention for 20 minutes or so with a series of formation and tail chase passes which looked superb against the clear skies we were blessed with. The end of this impressive flight was signalled with a series of three controlled circuits and descents into the tight landing zone, characterised by the underslung engine pods 'knocking off' by design as each of the aircraft slid to a stop in the short grass!

Later in the afternoon Chris Collis enlisted the help of Andy Meade and myself to fly his large Avro Lancasters together as a pair. Andy and I familiarised ourselves with the models transmitter set up before helping see both airframes moved over from the car park to the launch area. Prior to the flight we agreed a plan to fly from the current site but to land these large, heavy models higher up on the upper South West slope which has a much more generous landing zone — however to get there we would have to walk and climb to the upper shelf whilst the models were kept safely in flight out over the North West slope. With that part of the flight plan agreed we committed to launch.

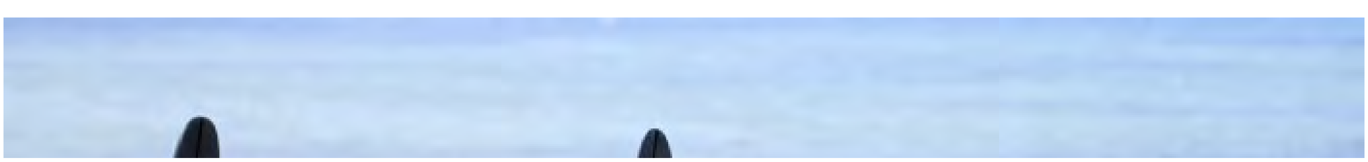


Photo 9: Final checks before the second large Lancaster is launched out to sea.

At 25lb AUW each model required its own paired launch crew but once safely away the two models were quickly trimmed out and united in safe formation cruising up and down the slope and looking very realistic indeed! Out to the left hand side of each circuit the late afternoon sun was playing beautifully against the aircrafts' satin finish and the models looked superb making that slow right hand turn back towards us out over the sea.

Photo 10: Lancaster duo, Chris Collis owned models flown here by Andy Meade and Phil Cooke.

Andy and I enjoyed a 20 minute flight consisting of a number of gentle formation passes very characteristic of the full size Lancaster. Both models proved nicely controllable particularly with a few degrees of flap added to regulate the speed and with coordinated aileron and rudder turns — I think we both thoroughly enjoyed the opportunity to fly these impressive models together for Chris and all who were stood watching. Although we were still revelling flying up and down the Café slope close in to the cliff face the time had come to enact our landing plan and both models were allowed to push out and climb to height a little before we set off on our hike to the chosen landing zone.

Photo 11: Low level bombing run.

With a small party of guides (including Chris) we made our way safely across the Great Orme's perimeter road and then steadily up the steep face of the main NW slope behind us, all the time keeping the two identical looking Lancasters flying out over the North West slope. After a 10 minute climb we found ourselves back on top of the South West slope with the vast open area now exclusively available to us — into which we could circuit and bring the Lancasters safely in to rest. I must admit I was very relieved to be able to keep the model I was flying above the changing horizon as we climbed to the higher landing zone, and once we'd regained our breath from the climb Andy and I readied ourselves for the consecutive landings. Both models were brought home safely, one of the models touching down in some of the longer heather which resulted in a little damage to the tail but all in all a great success!! Chris was clearly over the moon with the spectacle we'd just realised for him seeing both of his large models operated together as a pair!

Flying continued at pace all afternoon in good conditions, but as early evening arrived we saw a swing in wind direction from North West to our most favoured South West slope — and those who were still in attendance enjoyed some superb conditions back up on the main tank-track site from where we flew until sunset.

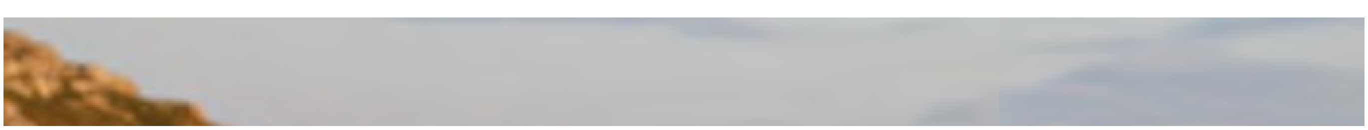


Photo 12: Tim Mackey launches Bob Jennings Fouga Magister during 'golden hour' — sublime.

In particular the final hour of light generated some sublime photographic conditions and some very memorable moments with Bob Jennings flying his 'Tiger Stripe' Fouga Magister against a superb sunset horizon as well as a clear moonlit sky! Jet Provosts and Mustangs were also in action revelling in the great conditions. As a small group we flew on until very last light, some forced to derig and load their cars by moonlight! What a superb days flying we'd all just enjoyed!

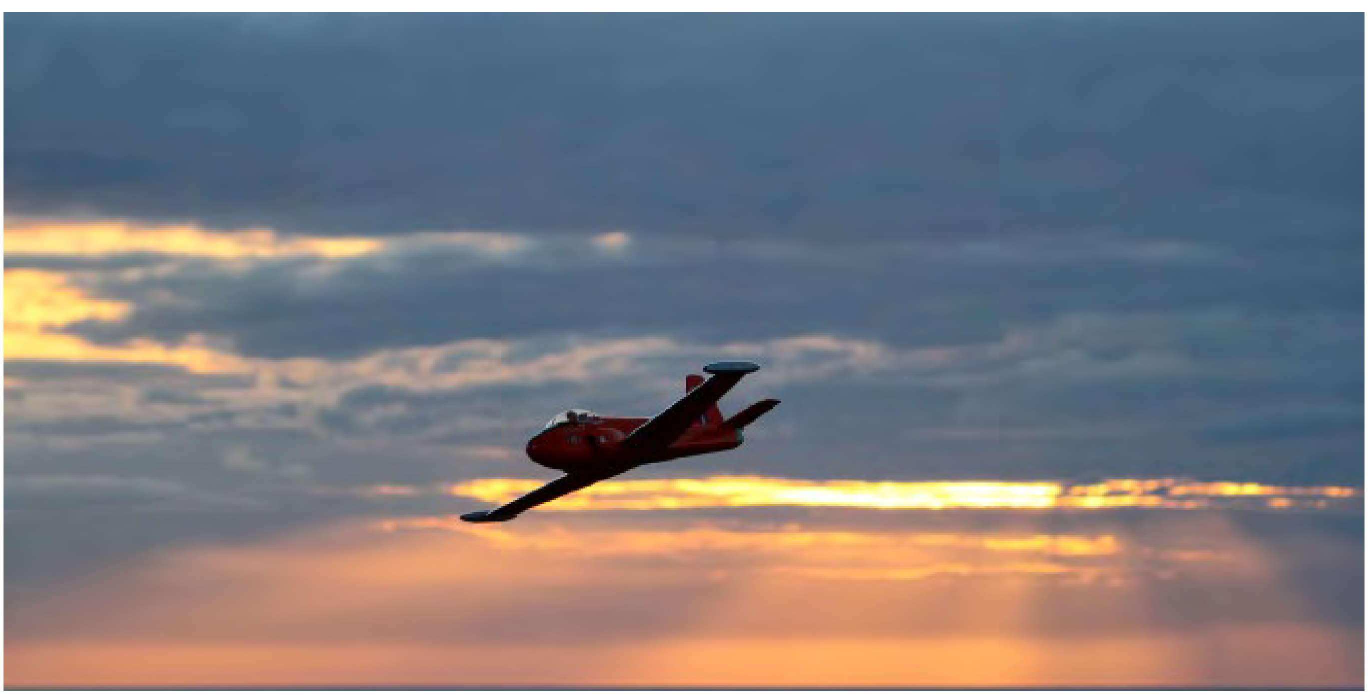


Photo 13: Phil Cooke's small scale Jet Provost darting about in the final rays of daylight.

Day 2 — Sunday

Sunday dawned with a weather system which looked frustratingly accurate to the forecast. Winds were from the southeast (the only wind direction which isn't ably supported on the Orme for flying models of our type) with accompanying heavy rain showers which looked aligned to be with us until early evening. Conditions were forecast to improve around 6pm, with the skies due to clear and the wind due to swing back round to the ideal southwest direction — but there were many hours of poor weather to endure before that. As a result, only a handful of modellers ventured up the hill on the Sunday morning, and a few of those departed at lunchtime (myself included!) But those who stayed on were richly awarded with another 'golden hour' evening session — fair play to all that stuck it out!

The following wording is kindly provided by PSSA member Al Gorham:

Those that were able to stay on (and who weren't dispirited by the ceaseless rain) were rewarded with a brightening sky from the Holyhead direction. I had a quick proving flight in light drizzle with my Hawker Tempest at 5.15 and found the wind was bang onto the slope and generating superb lift. By 6pm, the rain had stopped, replaced with golden sunlight and models were eagerly being readied and brought to the slope.

Steve McLaren aired his A-4 Skyhawk, Jet Provost and especially his Folland Gnat. The silver and fluorescent orange RAF trainer scheme showed up extremely well with the Gnat performing brilliantly as always. Harry Twist enjoyed his maiden flight with a Shorts Tucano which has had 'several' previous owners. She went away smoothly into a long and successful flight, the first of many under the control of her latest owner I'm sure!

Bob Jennings brought a Heinkel 162 Salamander built from a Neil McHardy plan, Bob having made some modifications to the engine pod shape to improve scale appearance. The model did look a natural glider though and it was so good to see her leave my hand steadily from launch without a click of trim needed. The Salamander looked superb zipping around and it certainly had a unique silhouette! Sadly, a slight mishap occurred on landing, but Bob knows the model is such a lovely flyer I'm sure he will have her repaired and back flying ASAP.

Andy Meade warmed his thumbs up by performing his own maiden with the large P-51D (ex Matt Jones conversion from the Blackhorse power kit). Again, the evening light showed this model off so well with it's natural metal type finish.

Photo 14: Andy Meade concentrates late in the day at the start of another maiden flight. (image: Shona Meade)

Andy then produced the highlight of the weekend for me, as, aided by a launch from Bob Jennings, he got air under the wings of his O/D Gloster Meteor F3. I'm sure the accompanying pictures will tell the story perfectly, but this model has real presence and proved to be a very smooth flyer needed very little trim or adjustments during or after the first flight.

Photo 15: Andy Meade's Gloster Meteor F3 flies smartly through the LZ. (image: Shona Meade)

Indeed, the only thing missing was the distinctive Meteor 'blue-note' sound — which I am sure the other pilots watching on were hearing in their imaginations! Well done Andy — a very satisfying conclusion to your latest homebrew project, no doubt.

Another late finish on the slope then, but some truly memorable flying to round off another great weekend with the Power Scale Soaring Association.

More photos from this Great Orme PSSA event can be found on Flickr (see *Resources*, below)

There's a break now until the PSSA's next event planned at the Lleyn Peninsula 10th/11th July from which time the Association will run a series of events around the UK until mid October.

For more information on anything related to Power Scale Soaring or the PSSA please see our website or drop us a line on email using the links listed in *Resources* below.

Resources

- Additional photos (Flickr)

- Power Scale Soaring Association (PSSA) (website)
- Power Scale Soaring Association (PSSA) (email)

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

Alpina getting the old heave ho. (image: Gerard Risbourg)

Designing for an Alpine Soarer

The hills are alive…with sailplanes designed for for the rigours of mountain soaring.

James Hammond Follow
Jun 9 · 16 min read

This is the last in my series of four articles on design, but fear not, there is more coming. In an article in the near future, I'll be highlighting the Aeroic Sine Wave Spar (ASWS) — a feature now used to great effect in all my models. For this article I'm going to go through the design processes used in this case for my Alpenbrise (Alpine breeze) alpine soaring model. I don't really know how others do their designs, but what I can do is to let you in on how I do it; so, I do hope that this article will help to give you an insight into the thought progressions behind the model's development. Hopefully it won't be too boring. — JH

Alpine: Related to High Mountains

Photo 1: Can you imagine? The lift is all around you… (image: Hahnnenmoos Burger Hotel)

Well Then, What's an Alpine Soarer?

I'll answer my own question: they are designed to fly in the mountains and valleys; typically, an airframe that's larger than we have been dealing with so far. An alpine soarer is a model that's designed to have the ability to fly higher and further than any of my previous design studies, by utilizing the different kinds of lift that mountain sites provide.

Alpine Flying?

Before doing anything else, we have to try to understand the potential flying conditions that we are dealing with, as this will have a very direct effect on how we set out our model design. We have to realize that there can be real differences in alpine soaring when compared to slope flying. A mountain flying site can be a really diverse flying environment to let's say a hillside, or maybe an ocean-facing slope. One thing that remains the same is that our models are flying on updrafts of air. The sources of the updrafts can however, be quite unlike those associated with 'normal' slope flying.

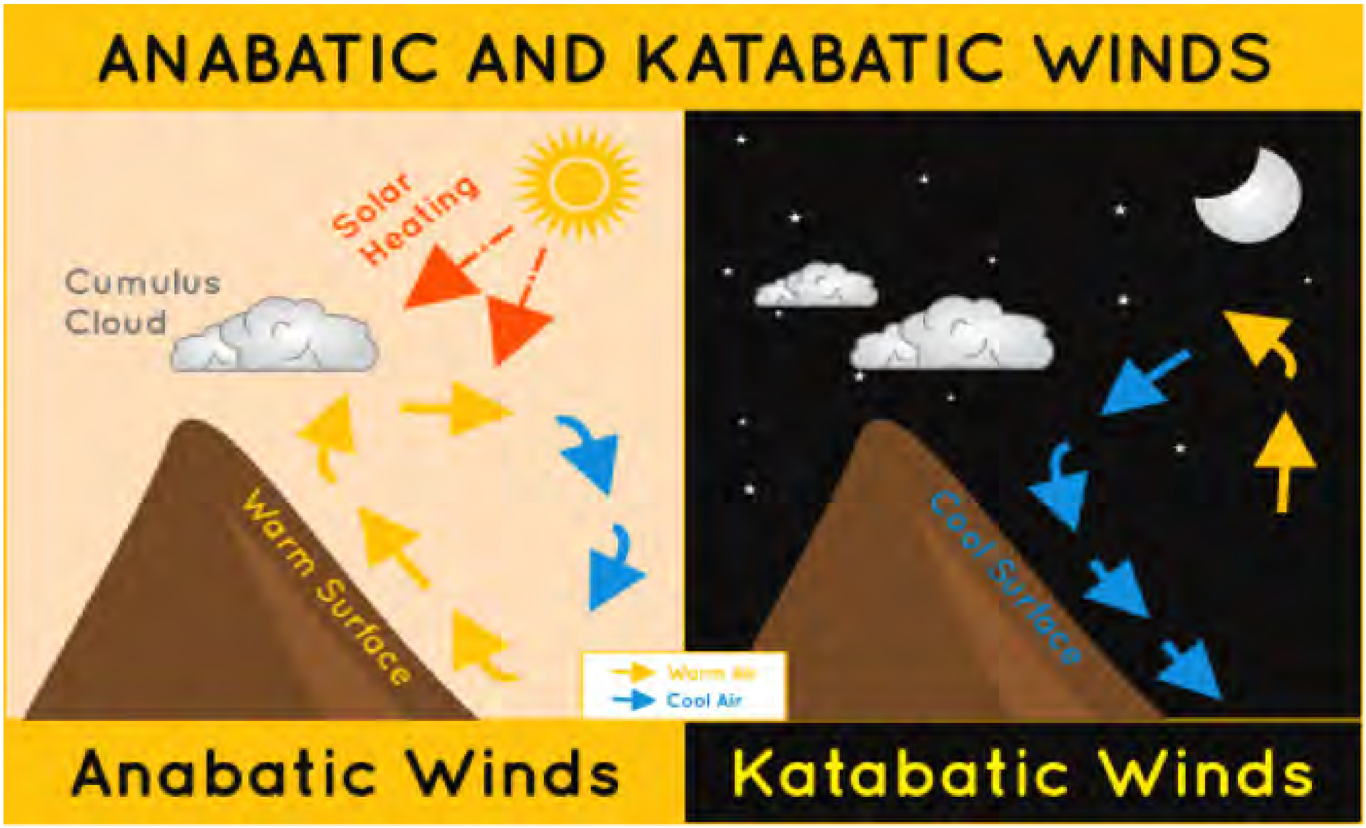
Lift

On a hillside or an ocean slope, most of the lift is coming from wind directed upwards by running into an angular obstacle, with the occasional thermal thrown in if we are lucky. However, on a mountainside, though we still find thermals — sometimes huge ones, typically the air is naturally flowing upwards as a result of thermal difference — hot air rises. Since the valleys are typically flat, may have roads, may be cultivated, and may have towns or villages; the temperatures at the lower elevations will normally be higher than those at higher elevations. Added to that, the surface of the mountainside over which we want to fly is probably being heated by the sun too.

Photo 3: The Famous Hahnnenmoos pass — would you like to fly against that backdrop? (image: Modellfluggruppe Wohlen)

Night and Day

Many alpine (mountainous) flying sites, especially those in Europe where alpine flying originated, have air constantly flowing up the mountainsides as heat rises. A good example in the USA is the Mammoth Mountain area where depending on the temperature differences, the daytime rising air flow can be sluggish or really quite fierce, but unless there are some really adverse wind conditions, the lift is almost always there. This is explained by simple thermal activity in the form of anabatic airflow (daytime) versus katabatic airflow (night time)



Drawing 4: (image: Pinterest)

Get the Feel

I have often stood on mountainsides in central Taiwan marvelling at how small clouds or skeins of mist seem to be rushing up the mountainsides all around me, or maybe on a distantly visible mountainside, but always quite fast — yet I can feel little or no actual wind. This is alpine lift. Sometimes you can't see it, most of the time you can't even feel it — but it's there. Now we know what we are dealing with, what do we need to make a model that will fully utilize this 'ghostly' lift?

Size Matters

The first thing to realize is that alpine lift can be very variable — even on the same day, in seemingly the same conditions, and it can be hard to gauge. So, to get the most out of it we need a model that's probably larger than the average slope model. A good example of a model that was specifically designed to fly in alpine lift conditions is the now classic Multiplex *Alpina* — as its name suggests. The *Alpina* flew incredibly well, it would hang in low lift, shriek through the air in good lift and was really very aerobatic — in short everything we would want, so it's a really good model to study if we want to make our own alpine soarer.

Grunt in the Front

Last but not least of the flying performance design considerations is the provision to easily fit an electric motor drive. This not only makes the model more adaptable, it also makes it suitable for the smaller GPS Triangle racing classes — though a propeller on the front does not please all of the purists! It's an easy provision actually as it only needs the front couple of inches of fuselage being perfectly round to be able to accommodate a spinner.

If we study a bit, we find that in fact, the actual differences between a small GPS class soarer and an alpine model are almost zero. Both fly higher and further than we would typically venture on a slope, and both are relying for the most part on non-slope type lift, so although I'm calling this an alpine soarer it could easily be classed as an alpine/GPS model. In addition, having a motor in the front and a larger battery to drive it; to many people represents 'payload' which is far, far, better than adding lead slugs in the front.

> Takeaway: Alpine flying is not the same as slope flying, though some aspects can be similar.

> Takeaway: Models fly higher and further, so they are better designed larger.

> Takeaway: Design your model with provision for an electric motor up front — you never know.

Multiplex Alpina: Possibly the First Alpine Soarer?

Photo 5: Alpina — the beautiful lines of a classic in every way. (image: Gerard Risbourg)

Wings

Four meters span (158") which would be large for a non-scale slope model, but it has a nice scale look. The aspect ratio is over 20:1 which again is pretty high, and more in keeping with scale or full-sized sailplanes.

Aerofoil

The aerofoil is a Ritz 3–30–12 which is a 12% semi symmetrical non-undercambered section with a slightly blunt leading-edge — which to our modern-day eyes may look a little strange or maybe dated on a glider. Nor is this a section I would have chosen, but the key point is, it works.

Fuselage

More like a slimmed down ASW or other scale model type rather than the broomsticks we use on our fast slope models. Lots of room for a motor if needed, retracting undercarriages, servos and radio gear, tow releases and the like. The general feeling is of an attractive scale type arrangement.

Horizontal and Vertical Stabilizers

Large and nicely proportioned vertical stab with a huge rudder. Horizontal stab oddly is of the all-moving (AMT) type. Again, this is not something which I would have done — but as usual it works well enough.

Performance

In short, a model that really did exactly what it was designed to do. With its long high aspect ratio wings its rarely caught out by light lift, with the thicker 12% section it will do spectacular big air manoeuvres with great energy retention, and on those low, fast, fly-bys, it sings a lovely song.

Overall Impression

This, to me at least, is very important. The original *Alpina*, as designed is a true classic and although there have been many attempts to improve on it with various 2001, 3001, 4001, versions, and now I see we have a 5001 version, I'll stick my neck out as usual and say that to me all of the 'improvements' have failed to retain the most important aspect that I am looking for which is the wonderful looks of the original — especially in flight. If the machine works…

Photo 6: Perfect proportions and outstanding flying characteristics…if it looks good… (image: Gerard Risbourg)

> Takeaway: For good start off information on what is good, take a look at the successful past and present designs.

> Takeaway: Learn from the models available, look at the specs, make use of the valuable lessons that can be found in them.

Now Let's Look at Our Own Alpine Soarer Design

Now that we have more understanding of what we need, and what has already been done, let's look at our own design.

Concept to Model

As many of you will now understand,what I tend to do before designing any model is to try to figure out what I want to achieve, and then to make a list of design points that I hope will achieve those goals. When that list, let's call it a 'design envelope' is completed — and assuming that all the things that I want are actually compatible with each other, I start sketching. The key point here to get all the technical stuff onboard first, and *then* tweak the boxes to make it look beautiful. You can have the most beautiful model in the world but if it won't fly well in the conditions it's supposed to, then its pretty useless. By the same token, a bunch of boxes just strung together is like a box of spare parts and unlikely to give much satisfaction.

Flying Environment Requirements

For alpine flying, let's imagine a flying place that has suddenly been 'de-restricted' and by that, I mean that most, if not all of the slope restrictions have gone. No more need to fly in the compression band, no need to fly so close to the edge, no need to avoid rotors or no lift zones, and as long as the model can be seen then it's mostly possible to fly further and wider than would be possible to fly on a simple slope. All that against a backdrop of snow topped mountains? I'm in!

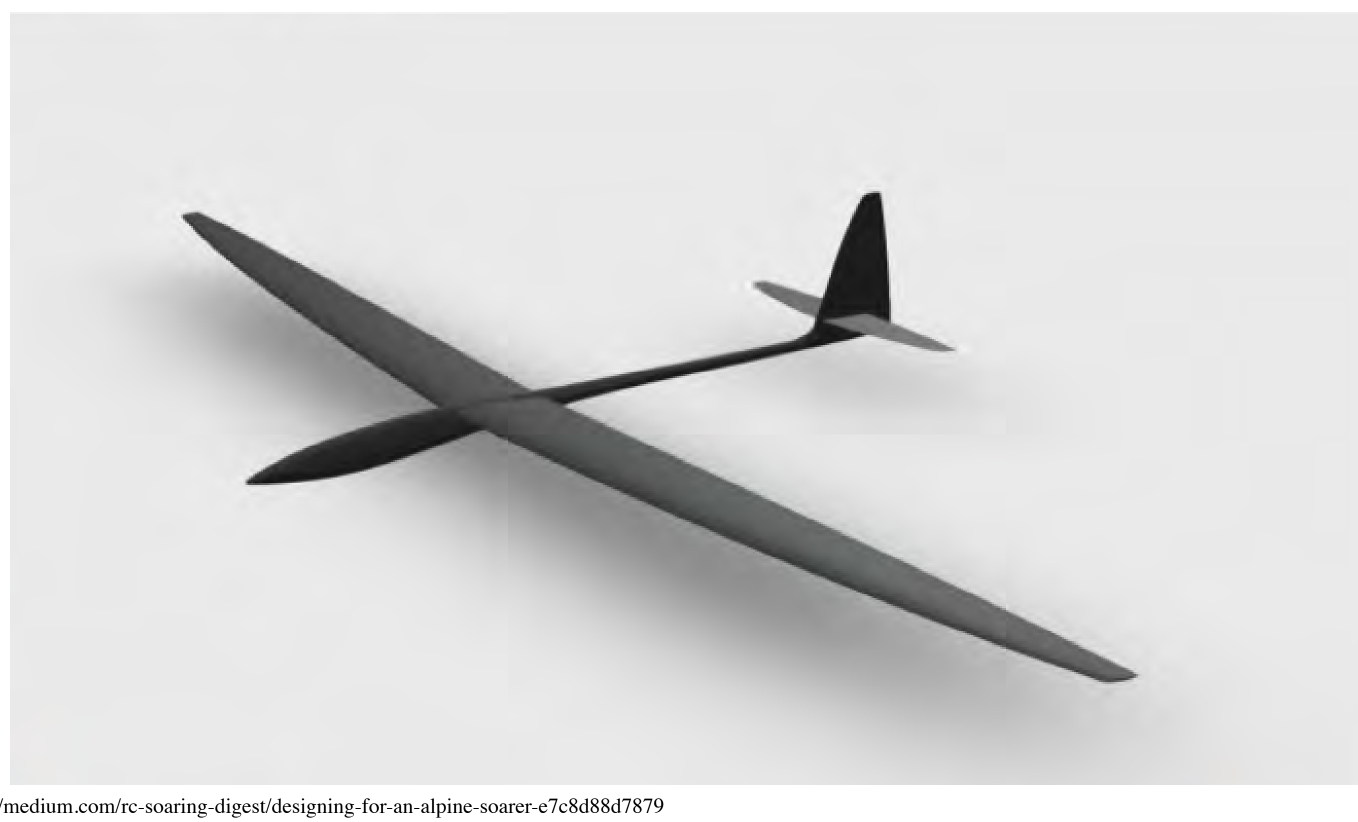
Make Your Mark

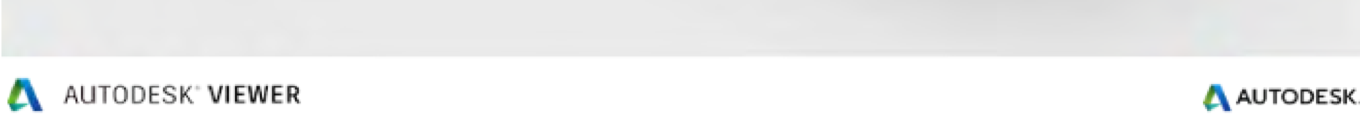
One point here, when designing a model for yourself, it's not always a good idea to try to do better than any existing design — unless of course you are a hardened competition flyer who will demand the sharpest of cutting-edge performance. Sometimes it's better to take the lessons learned from what's available and then use the parts that you like in your design, but please don't forget that you have a golden opportunity to put your own unique stamp on the resulting model.

> Takeaway: Take time to jot down the requirements personal and practical for your model before putting pen to paper.

> Takeaway: Only AFTER deciding your technical design envelope is it time to bend and curve to make your model beautiful.

Alpenbrise-2nd_Draft.stl





Drawing 7: Alpenbrise initial CAD rendering. (image: Dr. James Hammond)

The Decision Tree Is Planted

What Is Different From What We Have Done Before?

We'll be flying further, probably higher, maybe even faster at times than we would with a racing slope model. Bigger models are better we know, but bigger is also potentially faster and definitely more efficient, plus much easier to see at distance too.

Scale Effect

The bigger the model gets, the thinner, or relatively less viscous the air becomes, relative to it. That's why if a full-sized aircraft prototype is to be wind tunnel tested, then to give meaningful results the test model needs to be at least 33% of the full size. This is the area that we begin to enter with these larger alpine models, and so the aerofoil considerations change when compared to a fast slope plane.

> Takeaway: Try to study what you need and make decisions on each important part of the model design before drawing it up.

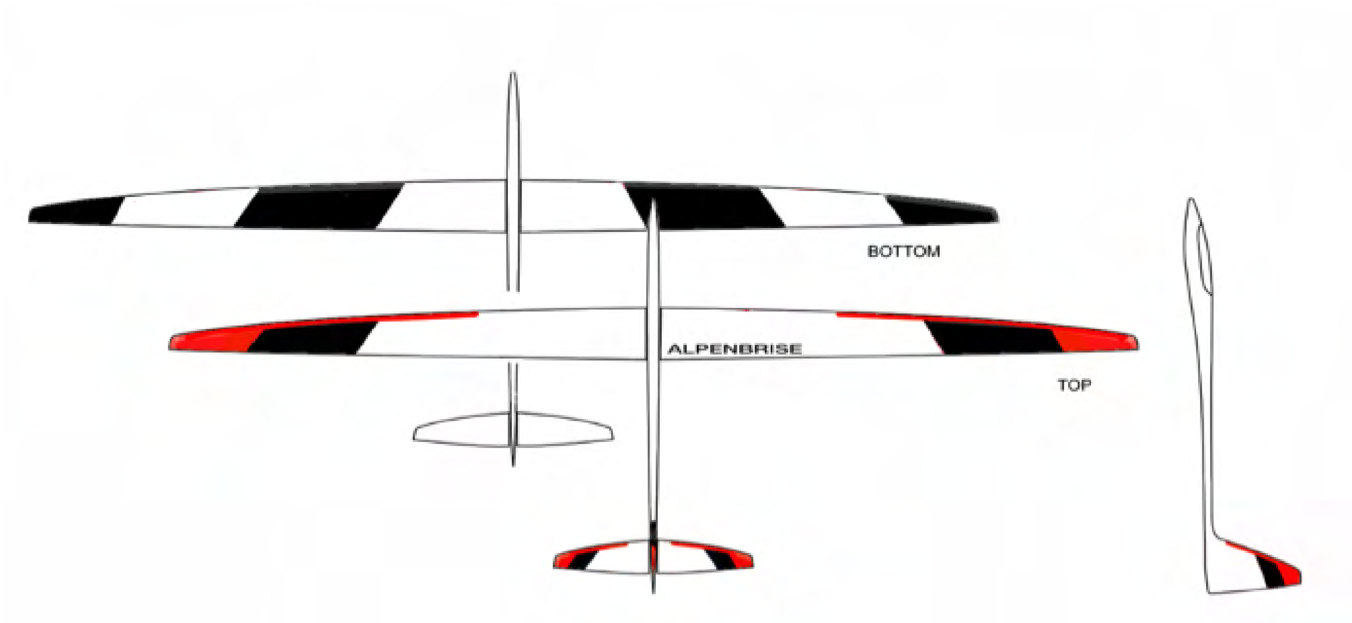
Wing Span

As usual the first decision on which everything else follows is how big are we going to make our new model. As this will be a specialist model, designed for its job, we need for it to be big enough to perform really well, yet not so large as to cause severe transport difficulties, so let's limit ourselves to four metres (150" to 160") right now.

Although bigger is better — *always* — any larger than this and for many, except possibly the super-scale enthusiasts, the problems with transport and storage, plus spouse/partner pacification could become a serious problem. Added to that the aerobatic performance, especially in roll and stall turns, tends to suffer if the aspect ratio is too great in favour of span. Last but not least on wingspan, let's face it, if we wanted a six- or seven-meter monster, then there are now so many ¼, or even ½ scale models out there — if you have the craving and the disposable budget.

Wing Planform Design

As any of you who have read any of my other articles in this series will understand, for any high-performance model that I design, I am a firm proponent of putting the wing area, which is to say lift, where it's needed and only where it's needed. There really is no point in having oar-like wings with loads of area out near the tips. It's just not needed there and can cause a wide variety of unwelcome problems.



Drawing 8 (image: Dr. James Hammond)

Aspect Ratio

Since fast turns are no longer critical on our alpine soarer, we can shift our attention a little to think about a wing that will be somewhere in the middle of the requirements for out and out speed, but also provide agile turning ability. I have designed my *Alpenbrise* to be in that ballpark at a little over 22:1 — so it's not up there in the scale zone of 25:1 or even higher, nor yet down in the three-meter performance area of 19:1. In this way with good chord — think 'lift' — distribution we will be in a good position for both speed and turning and at four meters the wing area will give a low wing loading that will be adequate for very light air operation if needed.

Chord Distribution

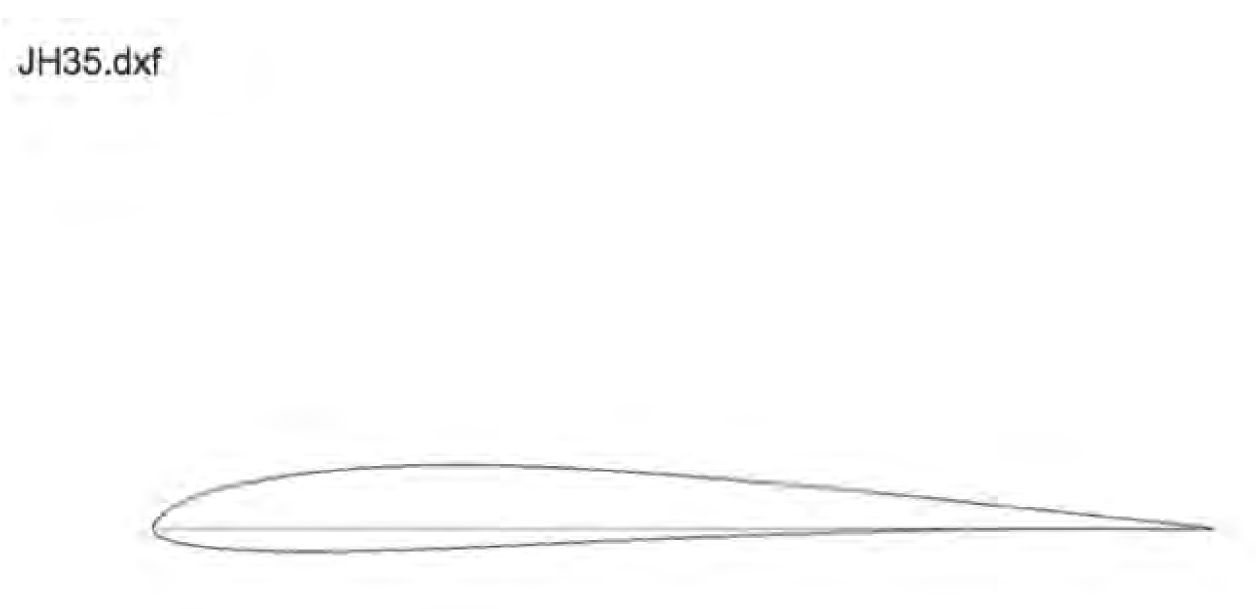
Many people have been concerned at first when they see the shape of my wings with small tips, but actually alarm has turned to happiness after they fly them.

Setting the lift in the right positions, in the amounts we need and no more makes a very fast yet well behaved wing, which will not only accelerate like a racing snake, but at the other end of the flight will also slow down well with no problems. I always plan the chord distribution on my wings to end up with a tip chord that is half the mean chord. There is no real formula for this but it works very well. As usual I design an elliptical curve with the leading edge sweep back roughly twice that of the trailing edge. As we have learned before, this slightly separates the MAC and the CG positions to give a nice stable yet responsive wing.

Aerofoil

This is a very important part of any design but as I have mentioned in previous articles, it is not the be-all and and-all, not yet does it have the greatest influence on the overall performance as that honour belongs to the wing planform design.

This is a larger model than we have been talking about before, and it will operate in a different environment, so logically it might need a somewhat different set of performance goals — similar to say a racing model but not exactly the same.



Drawing 9: JH35 High lift/high response aerofoil. (image: Dr. James Hammond)

Thickness and Camber

Where we wanted to get a nice balance of lift versus drag on our fast slope racer, the chord length on the alpine model has increased and this gives us more scope. As the alpine airframe gets bigger, and the drag influences on the model become less of a consideration, we can now begin to consider aerofoils with more thickness and more camber. This also helps with the construction as a thicker aerofoil gives a thicker spar and internal construction can be made stronger but without much weight penalty.

Which Section?

For the new *Alpenbrise* model I'm using a new section: JH35–9 which was a result of some recent research that was not actually aimed at models, but seemed to have all the parameters I'm looking for to use for an alpine soarer.

Photo 10: Beautiful lines even 40 years ago. (image: Gerard Risbourg)

In fact, there are suitable sections such as the HQW series by Dr. Quabeck, the RG 15 by Mr. Girsberger, and many others and the selection becomes easier as we enter the larger airframe performance envelope. Low drag, good lift, no drag bucket, around 9% thickness or even thicker with the right aerofoil. As a hint, I think if I were starting out, what I might be tempted to look at would be the GPS model sections as the performance requirements are very similar to that of an alpine soarer. The original *Alpina* used a Ritz 3 section.

Drawing 11: My 'Alpenbrise' Alpine/GPS soarer — hopefully a tribute to the great Alpina. (image: Dr. James Hammond)

> Takeaway: With a larger alpine soarer, we are beginning to get into the realm of full-sized sailplanes.

> Takeaway: Typically, thicker sections can be used on larger models than those we need for their smaller brethren.

The Back End

Horizontal Stabiliser

Here we need to consider the stabilizer aerofoil to be used, the tailplane area and whether to go for an all moving tail (AMT) or a conventional elevator setup.

Stabilizer aerofoil choice is not too hard and there are many sections to choose from: A symmetrical aerofoil of between 7 to 10% is required. As usual I use my JHSYM-9 at a controversial 9% thickness — probably more thickness than most people would go for, but as mentioned in my other articles, there is method in my madness. Through testing the aerofoils WITH elevator movements, I quickly found that the thicker aerofoils actually have less drag and more control response than the thinner ones. This is likely due to the way the air flows around and separates on the thicker section when the elevator is deployed compared to a thinner section where it can have an entirely different separation path.

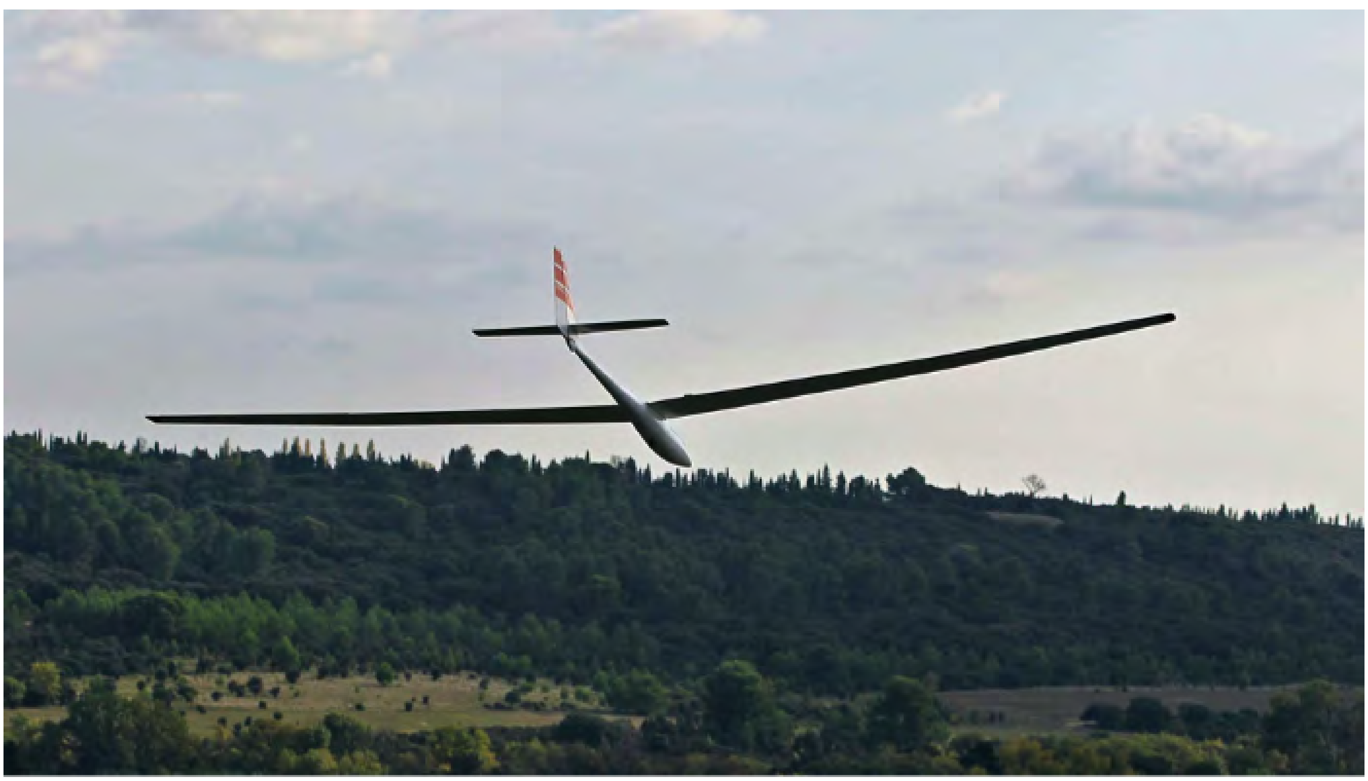


Photo 12: Off we go… (image. Gerard Risbourg)

Stabilizer Area

If you go for 10% to 15% of the wing area, you'll be on safe ground. In this range, the stabilizer will be big enough to be effective, but not needlessly over large.

To AMT or not to AMT?

For control effectiveness I can tell you — through many long hours of wind-tunnel and practical flight testing — that the elevator setup is more effective in every way than the all-moving tailplane (AMT). On the other hand, the elevator type can be a bit trickier to make with its hinges, and to actuate — but I'm assuming that if you do actually get to making a model then this is well within your capability. The AMT works well enough for most people, and is a lot less work. Your choice, but for me it's always the elevator type. The elevator chord should be suitable for the aerofoil section but normally 25% is good.

Stabilizer Shape?

As usual, follow the wing shape that you have used as much as possible — this is not only for looks, but also effectiveness as the things that we have discussed for the wing shape are all valid for the stab too.

Cross-Tail, V-Tail or T-Tail?

It's entirely up to you. There may be some control advantages to the cross- and t-tails while there might be a very narrow drag advantage to the v-tail configuration. Personally, I like the cross-tail as it's a bit more robust than the t-tail and works better than the v-tail. But practically, on this size of model, there is no significant advantage to differentiate one from the other so it really comes down to the designer's preference. Have to say though…t-tails look really cool!

> Takeaway: Thinner horizontal stabilizer aerofoils do not necessarily have less drag, and may actually lessen control response.

> Takeaway: A tail volume of between 10 to 15% of the wing area will work well.

> Takeaway: Elevator setups work better than AMT type.

> Takeaway: Elevator or AMT, make the stabilizer shape similar to the wing shape — the same rules apply.

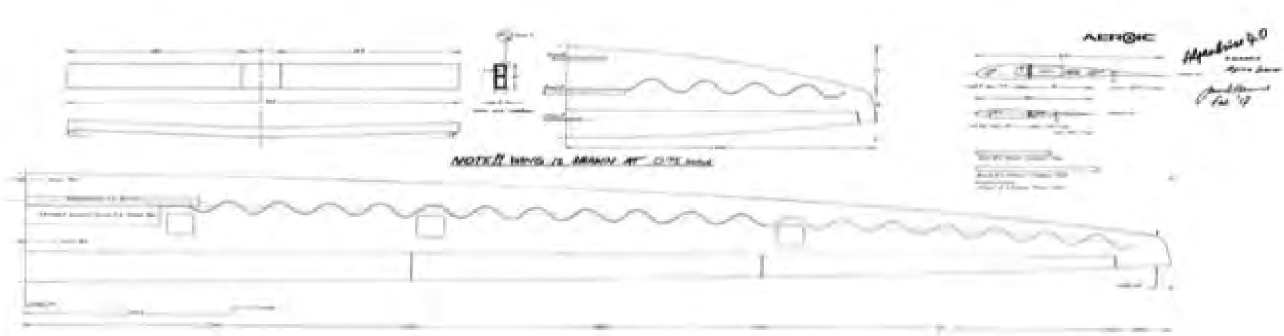
> Takeaway: There is no practical difference between cross-tail, t-tail and v-tail.

Building the Flying Surfaces

Wings/Tails

The most important part for success, construction of the wings and tailplane(s) should follow conventional practice with a cored glass laminated structure, carbon reinforcements where needed, and a decently designed, possibly box type spar with good UD carbon spar caps. Carbon used for the wings should be of the highest modulus available.

And Now for Something Completely Different



Drawing 13: Get a wiggle on...the ASWS in the Alpenbrise wing. (image: Dr. James Hammond)

The Aeroic Sine Wave Spar (ASWS)

Here is where I depart from the norm yet again with a unique and I think vastly improved spar design. From about three years ago, all of my designs have featured a Sine Wave Spar. No, it's not my original idea, and in fact versions can be found in different forms on several military airframes. Then why 'Aeroic Sine Wave Spar'? I hear you query. Well, one, I am the first one to use this idea for commercially available model sailplanes, and two, my design is similar in principle, but completely different in practice when compared to full-sized applications.

Photos 14, 15 and 16: The ASWS under construction and installed in the completed airframe. (images: Dr. James Hammond)

The Future

The Sine Wave Spar and in particular the Aeroic Sine Wave Spar (ASWS) will be featured in its own separate article in an upcoming issue of RCSD. Watch this space!

Food for Thought: Other Commercial Alpine Soarers

Photo 17: Mistral 4.3M. (image: Paritech GMBH)

Above is the Mistral 4.3M from manufacturer Paritech, in Germany — another purpose designed alpine soarer, that as you can see from the nose has had an electric motor installed, thus increasing its versatility. This model also comes in a 4.6M version.

Photo 18: Condor (image: Paritech GMBH)

Above, at the other end of the purpose-designed scale, this is the impressive *Condor*, also from Paritech in Germany — at nearly 7 metres, 275 Inches — or almost 23 feet, it's a biggie! Wow!

Photo 19: Ikura 4M (image: Aer-O-Tec)

Another, purpose designed alpine flyer, this time from Aer-O-Tec in Germany. The *Ikura 4M* a beautifully set out model which uses a lot of advanced design techniques on the wings. This aircraft has a real 'presence' when in flight.

*Read the **next article** in this issue, return to the **previous article** in this issue or go to the **table of contents**. Downloadable PDFS: just this article or this entire issue.*

RTGmodel adds an electric option to their new F3F design.The Electro Orden doing a fly by at the slope.

The Orden Goes Electro!

RTGmodel adds an electric option to their new F3F design.

Pierre RONDEL Follow

Jun 8 · 6 min read

With the new F3G category coming up, every model which offers an electro fuselage is now raising the interest of pilots. Not only for competition, but for sport flying, such electro F3F/B gliders can save you the afternoon, and in some situations save your plane.

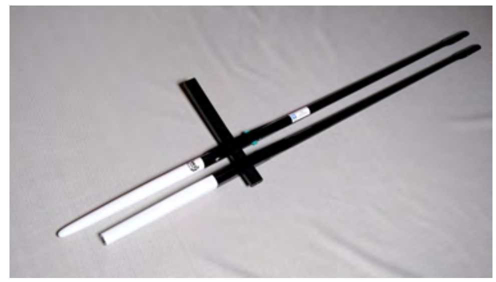
RTGmodel recently introduced an electro fuselage for its flagship model, the *Orden*, that I reviewed two months ago in RCSD (see *Resources* at the end of this article for the link).

Consider this new article as an add-on as I will not come back on the rest of the model assembly, and will focus only on this e-fuselage.

So let's have a look to this new fuselage which brings a smart innovation in the radio installation.

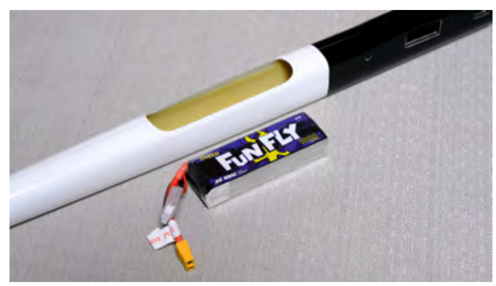
Molding quality is, as with the glider version, top notch. The front part, 2.4 Ghz friendly, is more square to easily host the battery. Spinner diameter is 30mm, with a nice aluminium part that fits perfectly.





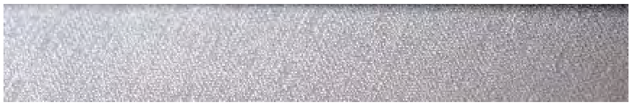
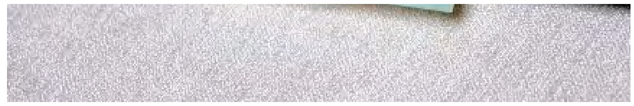


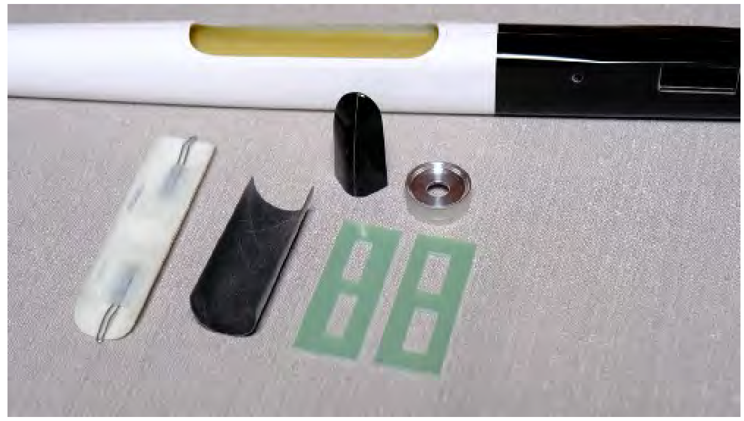








Photos 2 to 18: Details of the fuselage and comparison side by side with the glider fuselage.

The fuselage features a very smart elevator servo tray that you insert by the side. Two epoxy trays are provided, one for 10mm servos (e.g. MKS MKS HV6100) while the other one is made for another brand and model of servos.

This layout frees lots of space on the front side for the battery (I guess that a 4S battery made of 2 x 2S battery is possible.) On my side, it will be a 3S 1800mAh battery.

In fact, I have decided to use the same combo than for my e-Quantum, that is to say:

- Motor TS 1520–12T + microEdition 5:1 from Reisenauer
- ESC SunRiseModel 60A BEC 7.4V (Reisenauer)
- Propeller GM Competition 16x10

Photo 19: GM competition line 16×10 folding prop at the bottom, compared to the standard GM propeller of the same size.

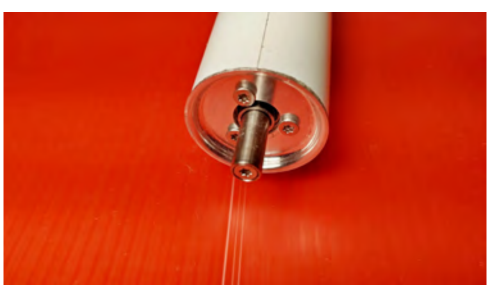
- Accus Tattu 3S 75C 1800 mAh or Tattu Funfly 3S 100C 1800 mAh

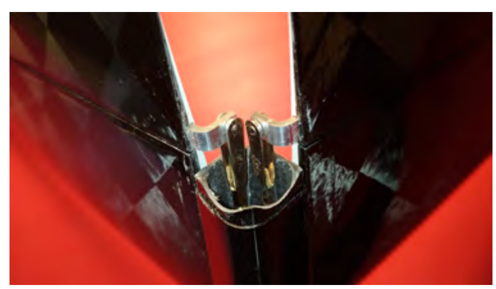
Photo 20: My setup ready for assembly.

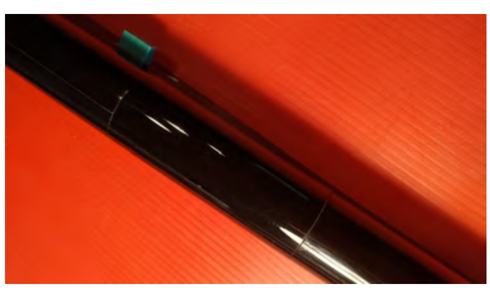
I took the opportunity of a rainy holiday week to stay in my workshop and complete the assembly of the electro fuselage.

Photo 21: Simulation of the power train on ecalc (image: Ecalc.ch)

The assembly went well but the installation of the elevator servos needs particular care and attention as it is very, *very* tight. I had to grind the opening in order to insert the servos in place once the tray glued with rapid epoxy (R&G 30 minutes). Below are some pictures of the elevator servo installation:







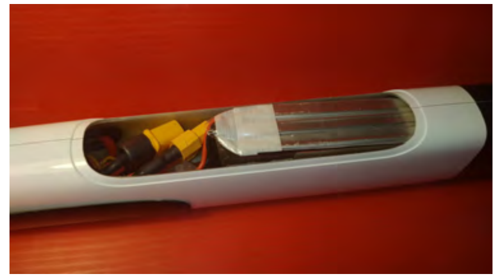



Photo 22 to 30: Some pictures of the assembly.

I installed the antennas on each side of the fuselage at 90° to each other. I think this should work even if the battery is located between the antenna. On the front or rear side, antennas are not masked. On the side the battery envelope is acting as a reflector to the antenna so reception should be fine. Testing will tell if it works. If you have any doubt you can always exit the antennas, but on my side I'm always afraid to damage them, that is why I prefer to keep them inside the fuselage.

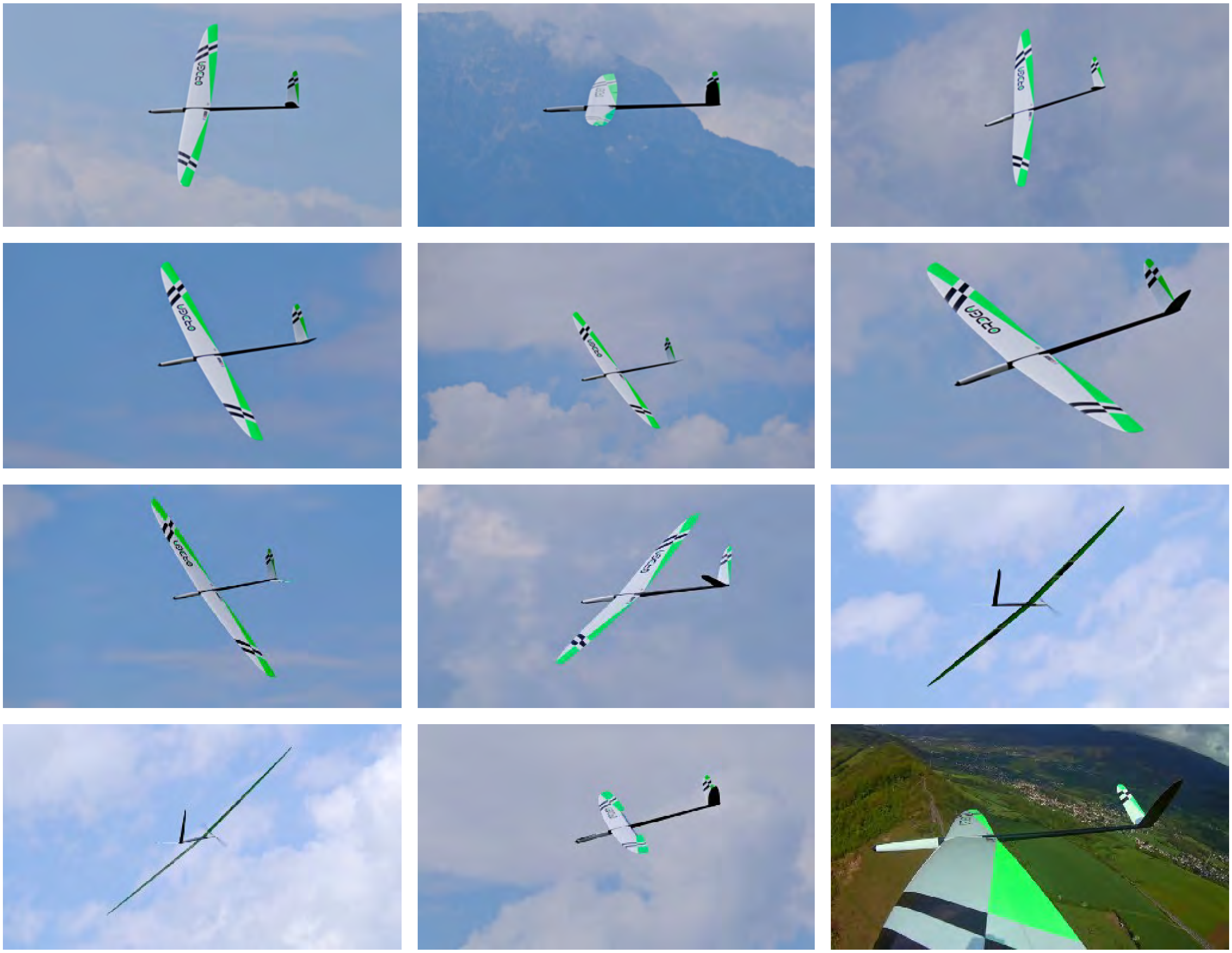
Photo 23: The installation layout, and the position of the antennas.

On the scale, I'm reaching 2.3kg flying weight with the standard wing (double carbon C80 wings). This is 150gr heavier compared to the glider version. I needed to add 30grs in the nose to obtain the 99mm CG. This means eventually you can use a 20 to 30gr heavier and more powerful motor (i.e EZ1530 instead of my EZ1520).

Photo 24: the Electro Orden ready for maiden.

I had no surprises with the maiden flight of the *Electro-Orden*: With the same CG and same settings, it just behaves exactly the same. The *e-Orden* is particularly silent when the propeller is folded, thanks to the GM competition folding prop.

I just needed one battery 1800mAh for the whole afternoon. Good climbing rate, as it was on the e-Quantum (exactly the same setup).



Photos 25 to 38: The Electro Orden in flight.

More pictures are available on Google Photos (see *Resources* section at the end of this article.)

To complement the pictures in flight, here is a video. Many thanks to my club mate Didier for providing all the video footage using his Mavic drone and Osmo Pocket that afternoon.

Flying the Electro Orden of RTGModel

Video 39: A short video showing the Electro Orden in action.

The Final Word

The electro fuselage is the ideal complement of the *Orden*, and will allow you to fly the *Orden* in any situations, and conditions with no risk. More generally, I warmly recommend you, if you own already a F3x plane, to buy an electro fuselage it if exist.

Resources

- Orden by RTGmodel, Fly Different! by Pierre Rondel.
- RTGmodel (*Orden* manufacturer's website)
- Additional photos on Google Photos.

All images by Joël Marin & Pierre Rondel unless otherwise noted. Video courtesy of Didier Trouilloud. *Read the **next article** in this issue, return to the **previous article** in this issue or go to the **table of contents**. Downloadable PDFS: just this article or this entire issue.*

Electro Rtgmodel Slope Soaring F3g F3f

The pitot-static tube as well as the pilot's-eye-view camera installed in the ⅕ ASK-18 configured for Auto Soaring.

Auto Soaring

An introduction to this cutting edge technology in the world of RC soaring.

Norimichi Kawakami Follow

Jun 12 · 7 min read

Introduction

In the RCSD May issue, Mr. Peter Scott introduced some very attractive applications of the Arduino microcomputer technology to RC airplanes. Here is another application of the microcomputer and sensor technology to RC airplanes wherein you can fly your RC glider in many styles including Auto Soaring.

I admit that the true fun of RC soaring is to predict where the thermal is, fly your glider into it and control the aircraft to stay within the thermal considering the best bank angle and other factors. But I believe that to experience and work with new technology is another interesting aspect of our RC hobby. After I completed the 1/3rd Mita construction (which some of you may have been reading about here in RCSD) I took on the challenge of using this new technology. Let me explain how you might experience this new technology as well.

Do I Need Computer Knowledge?

No special knowledge is required. What is required is to get a flight controller (FC), a GPS/compass sensor and, if necessary, a power module.

The FC is a module on which a microcomputer, memory, sensors — such as 3-axis gyro, 3-axis accelerometer, compass and barometer — are packed. The microcomputer calculates and sends commands to servos by executing the program stored in the memory and using data from the sensors. The gyro determines the attitude of the plane, the compass its heading, the accelerometer measures X,Y and Z directional accelerations and the barometer measures the aircraft's barometric altitude. Taking GPS data, the FC knows where the aircraft is and its velocity vectors in relation to the earth.

There are many kinds of FCs available, many of which are listed in the *ArduPilot Hardware Options* listed in the the *Resources* section at the end of this article.

What Kinds of Flight Are Possible?

You can fly your airplane in many regimes of flight. These are referred to as flight modes. The flight modes are grouped in two categories: assisted flight and autonomous flight.

In the assisted flight modes, the FC assists you by increasing aircraft stability or maintaining its attitude so you can fly it much more easily than fully manual flight. Straight and level flight is a typical mode of this assisted group. You can fly your aircraft straight and level even in a harsh wind. There is also acro mode, circle mode and others from which to choose.

In the autonomous flight modes the aircraft flies autonomously, which is to say with your hands entirely off your RC transmitter's controls. The FC assumes all responsibility for controlling the aircraft according to the specified mission. It can even automatically take off or land and fly through specified waypoints on a map. The autonomous flight mode in which we're interested, of course, is Auto Soaring.

What Program Is Used?

The program used in conjunction with the FC is *ArduPilot* which is free, open source software. If the FC you purchase does not have *ArduPilot* installed, you are free to download it and load it into your FC.

The Ground Control Station

One more element is required, which is the Ground Control Station (GCS). This is a normal PC with special software such as *Mission Planner* or *QGroundControl* installed (see *Resources* section, below). Both of these packages are also free and open source and you can download either one and install it. The GCS is used to download the *ArduPilot* program, calibrate sensors, calibrate the RC transmitter's sticks throw ranges and assign flight modes to the RC transmitter's switches, for example. If you want to fly your aircraft through predefined waypoints, you can use the GCS to specify these waypoints using Google Maps along with altitudes and flight speeds. These mission data are uploaded on the FC using a USB cable before flight and stored in the memory.

If you connect telemetry devices on both PC and aircraft, you can communicate with the aircraft while it is flying. You can monitor its flight path on a map, check its flight speed, altitude, attitude, heading. You can even change control parameters mid-flight.

The FC has a micro SD card and stores various flight data such as position, speed, altitude, attitude, RC inputs, servo outputs, battery voltage and current for the motor. You can download these log data with the GCS and analyze these data after flight.

Auto Soaring Flight Parameters

There is a parameter SOAR_ENABLE in the *ArduPilot*. When you set this parameter to 1, the glider will Auto Soar. With this parameter, you must specify additional parameters which define the Auto Soar profile:

SOAR_ALT_MAX and SOAR_ALT_MIN define the thermal hunting maximum and minimum altitude. Flight is limited to within these altitudes. SOAR_ALT_CUTOFF is the altitude where the motor is cut off and the glider begins gliding. If the glider can't find any thermals and its altitude reaches the SOAR_ALT_MIN, the motor automatically turns on and the glider begins to climb again. During gliding, when the aircraft determines by the data from accelerometer and barometer that it gains vertical speed more than SOAR_VSPEED, it starts auto thermal centering with bank angle SOAR_THML_BANK and soars with the thermal. The parameters SOAR_POLAR_B and SOAR_POLAR_CD0 are the polar curve coefficients of the glider.

How To Get Started

Here is a high level overview of the steps required to setup Auto Soaring:

1. Acquire the hardware (FC, GPS/compass, power module, telemetry devices).
2. Install this hardware and connect them with your RC receiver and servos.
3. Download the GCS and install on your PC.
4. Download the *ArduPilot* software and install on your FC.
5. Setup your hardware (sensor calibration, RC stick calibration for example).
6. Flight test in various flight modes.
7. Set soaring parameters and you can fly Auto Soar.

You can find a detailed explanation of each step at the following site in the *User Manual* documentation found in the *Resources* section at the end of this article.

An Example

Let me show you my case study as an example:

The Glider

This is the glider I used to test the Auto Soaring. It is a 1/5th scale of the ASK-18 which has 3.2m wingspan and around 2Kg gross weight.

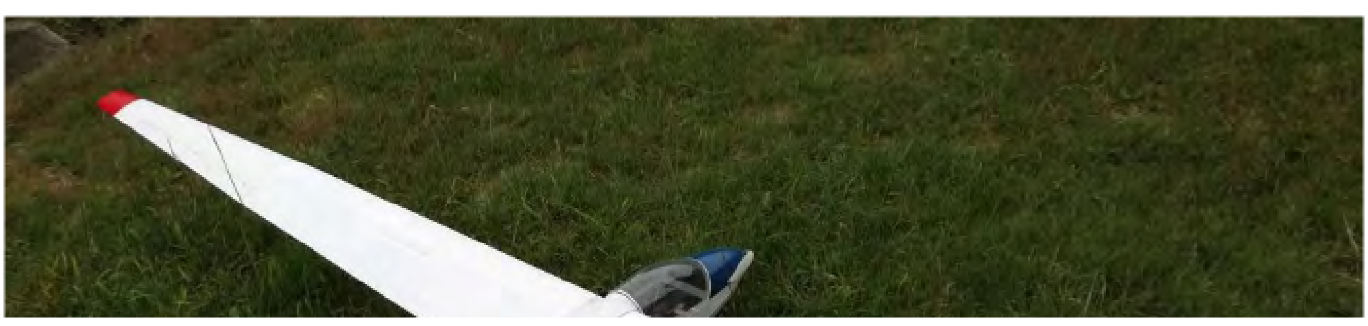


Photo 2: ⅕ scale ASK-18 by which I tested the ArduPilot Auto Soaring function.

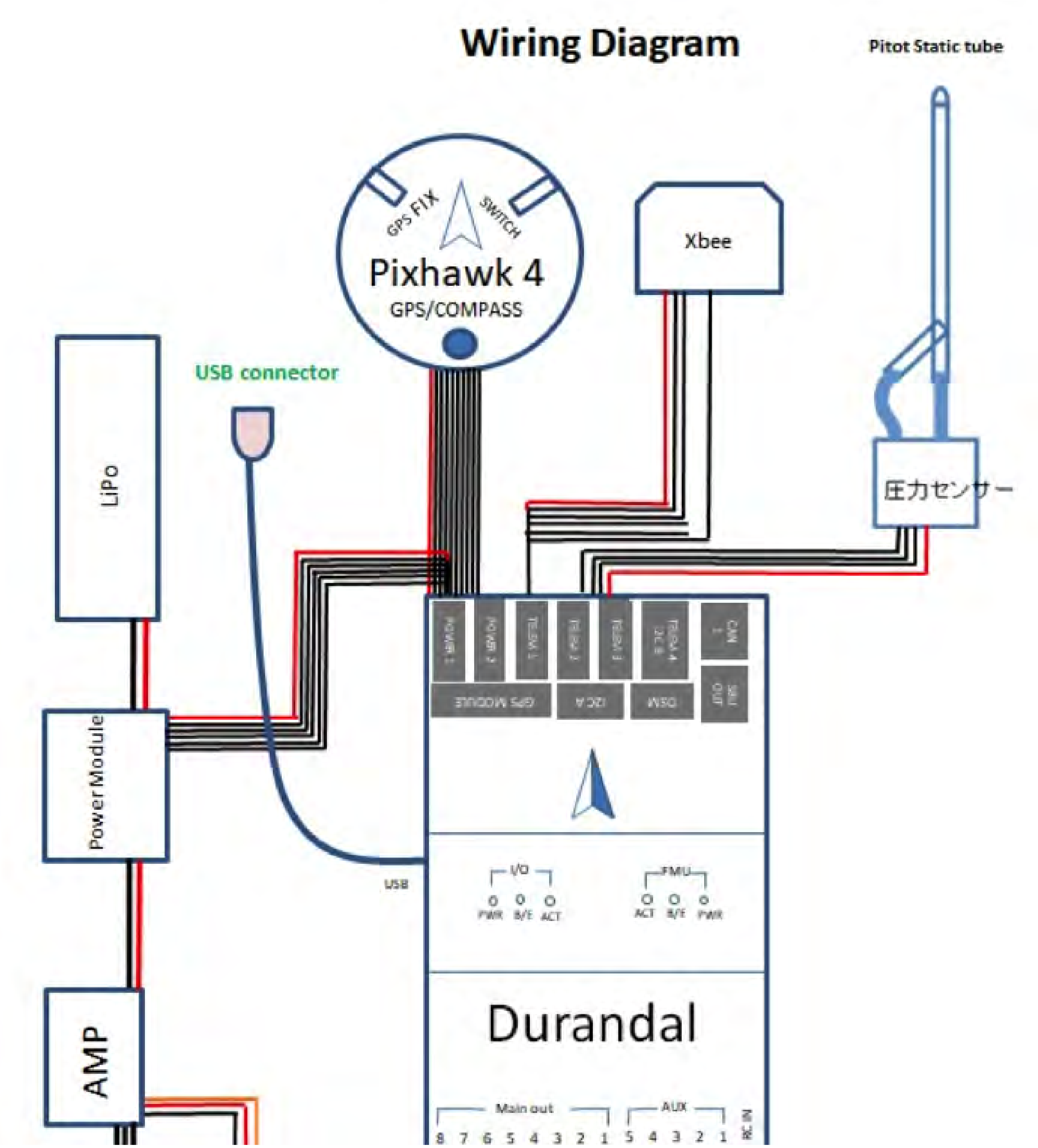
The Hardware

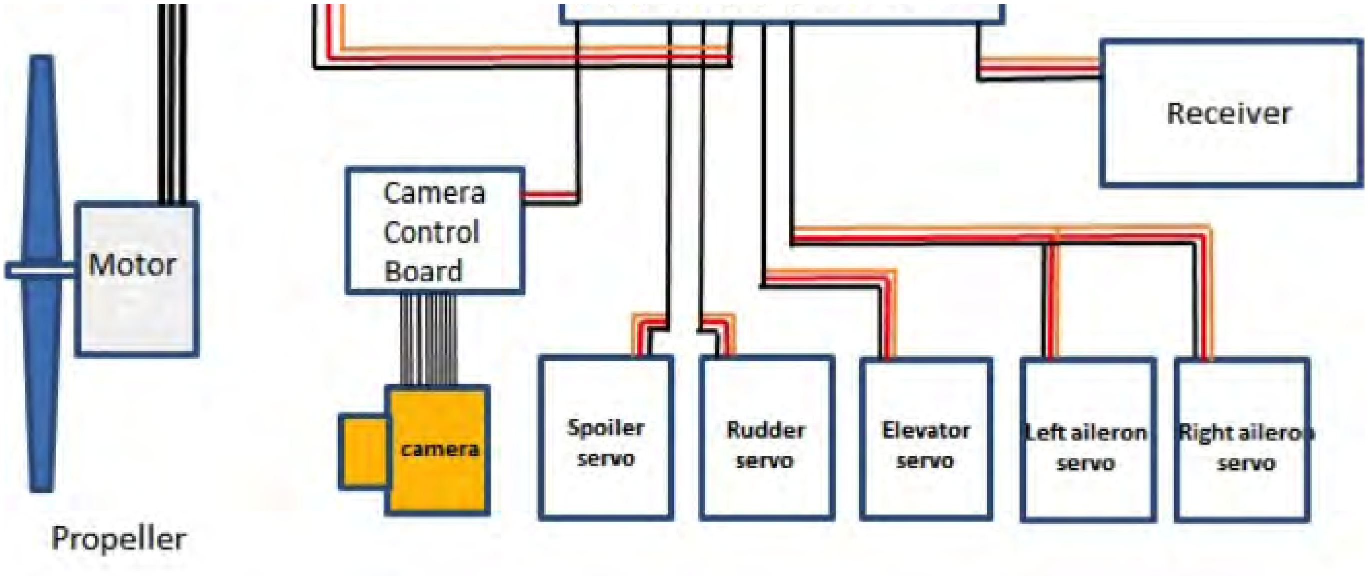
I purchased a Durandal FC, its power module and a Pixhawk 4 GPS/Compass module from Holybro. Photo below shows these this along with its connecting wires. Links can be found in the *Resources* section at the end of this article.

Photo 3: The hardware I purchased.

Wiring Diagram

The above hardware was installed on the ⅕ scale ASK-18 glider and was connected following the wiring diagram below. In addition to the above hardware I installed a pitot-static sensor for airspeed measurement, an Xbee telemetry device and a mini camera to take flight video.





Drawing 4: Wiring diagram for the ⅕ scale ASK-18. (image: Durandal)

Installation

This picture shows the FC, camera and pitot-static sensor installation.

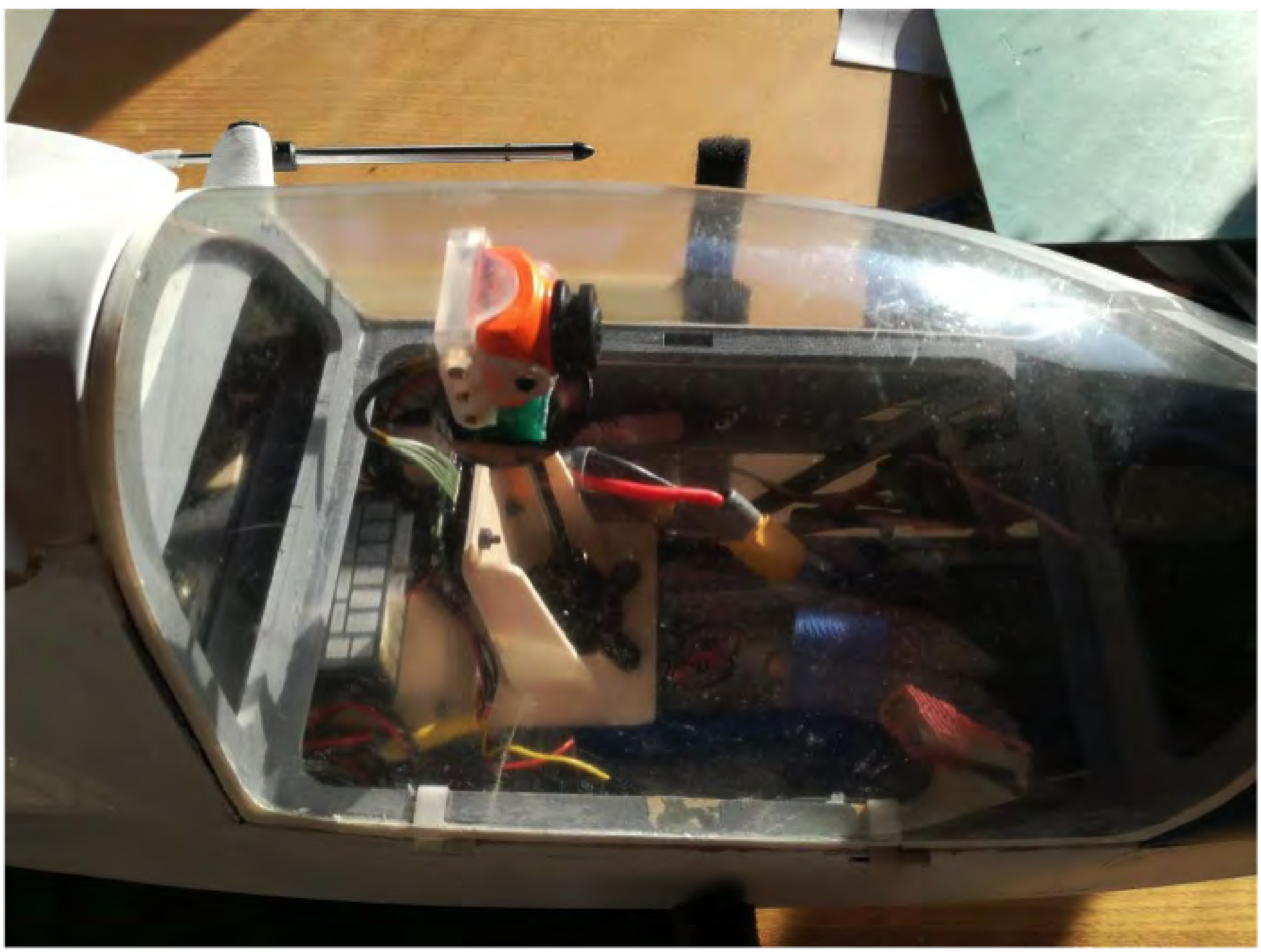


Photo 5: FC, camera and pitot-static tube installation.

Flight Test

With the above configuration, I conducted a series of *ArduPilot* Auto Soaring function tests.

Below is a case where the test was successful. This is the flight path the ASK-18 flew which was stored in the SD card of the FC.

Figure 6: Auto Soaring flight path.

The white dotted square lines are lines connecting the waypoints. The ASK-18 glided along these lines. The yellow flight path is the area where the glider soared automatically (Loiter mode).

There are three Loiter groups, and the top one is the most successful case, where the glider caught a medium strength thermal and climbed 45 meters during eight turns in about two minutes and 15 seconds..

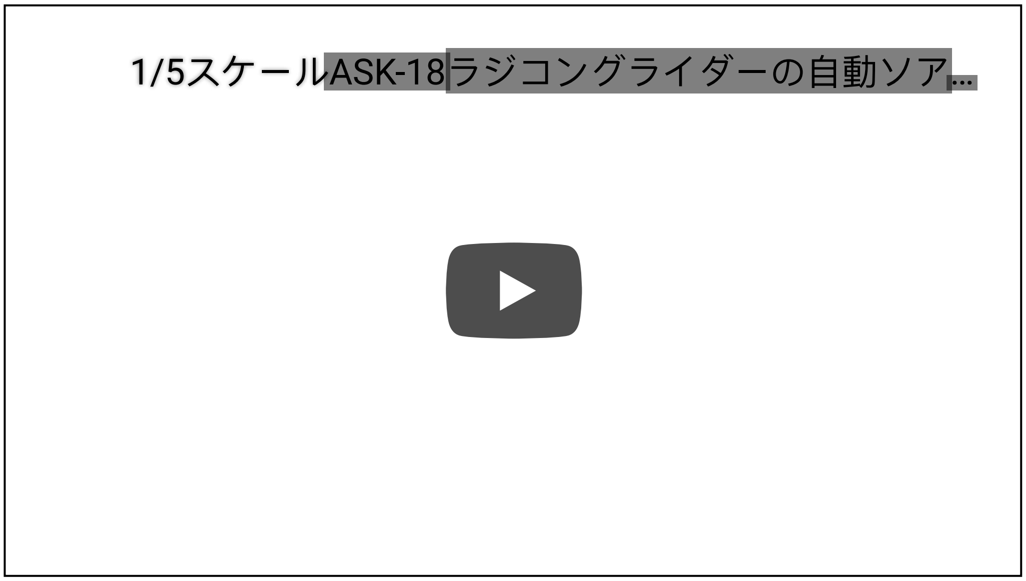
In the middle altitude part, because it was not a strong thermal, it went up for the first 10 seconds or so, but after that, it slowly flowed to the north (left side of the screen) while decreasing the altitude at the descent rate of about 0.1m per second.

Below is the airspeed logged during this flight correlated with the flight mode.

Figure 7: Airspeed log.

In Figure 7, the vertical axis represents both the aircraft's airspeed (m/sec) — that's the orange line — and the numeric value of the flight mode, which is the green line. A flight mode of 5 is manual control, 10 is gliding flight, and 12 soaring flight. It is clear that both gliding and soaring are flying at the specified 10 m/sec.

There are many peripherals and free software in the *ArduPilot* ecosystem that provide many kinds of data analysis. Below is the flight replay animation using one of such peripheral software and flight log data.



Video 8: Flight replay animation.

What I have provided in this article is a high level overview which does not provide cover many of the details you will require. However, I hope this article has at least sparked your interest in this technology and that you take this next challenging step.

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Resources

- AutoPilot Hardware Options
- User Manual Introduction
- Mission Planner GCS
- QGroundControl
- Durandal Flight Controller

- Pixhawk GPS Module
- Mita 3 Project

All images and video are by the author unless otherwise specified. Read the ***next article*** *in this issue, return to the* ***previous article*** *or go to the* ***table of contents****. Downloadable PDFS: just this article or this entire issue.*

"12 Dodgson Designs planes flew in the 1988 Western States Soaring Championship in Modesto, CA and 6 of those shown here trophied. Left-to-Right: Steve Callup, Brad Clasen, Shawn Lenci, Bob Dodgson, Steve Clasen and Dave Banks who won 2nd place." (image: Bob Dodgson)

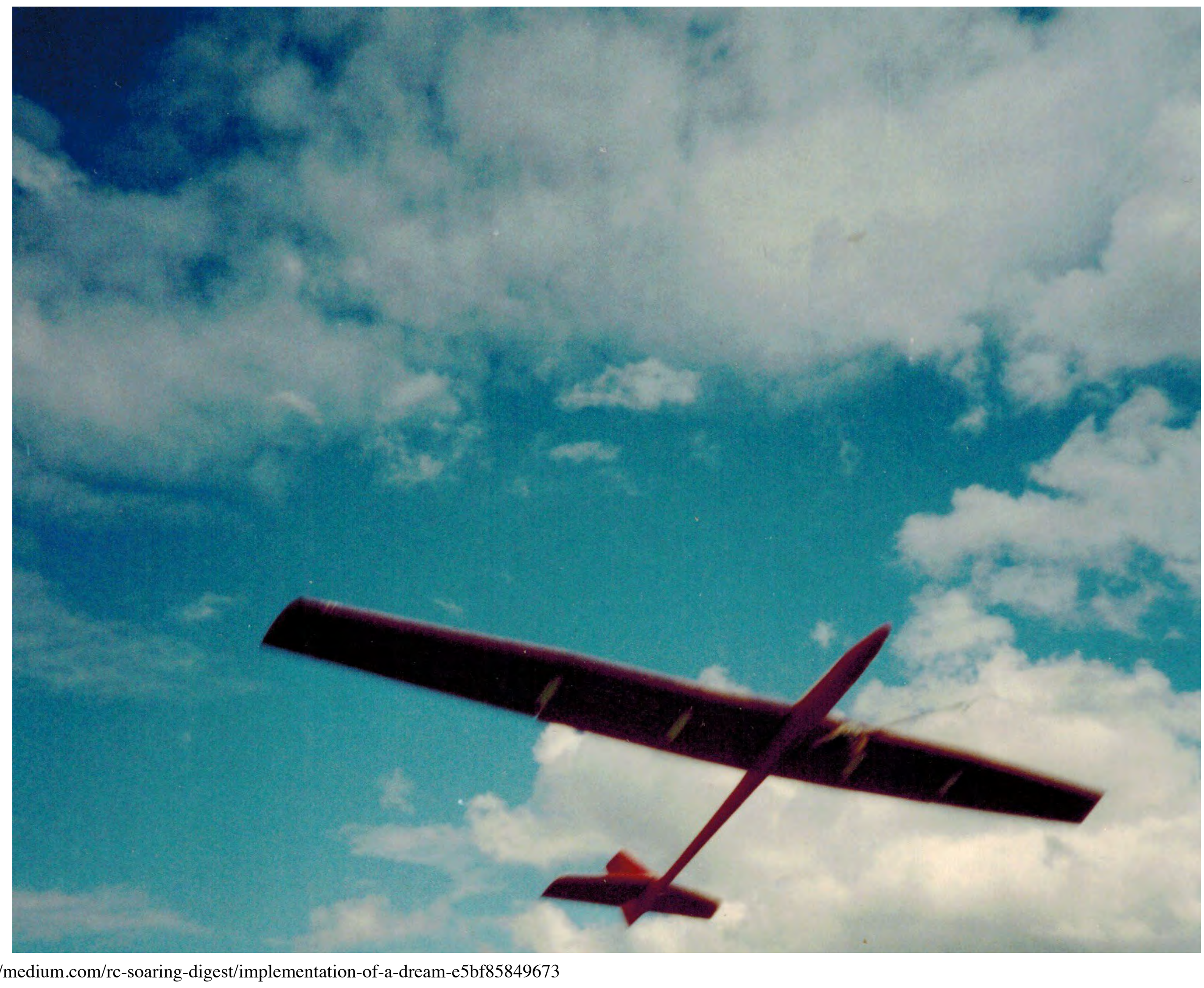
The Implementation of a Dream

"In 1970, Sandy and I quit our jobs, rented out our houseboat on Lake Union in Seattle…"

Bob Dodgson Follow
Jun 13 · 10 min read

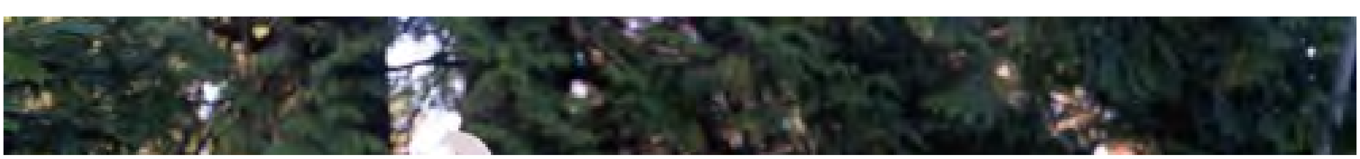
This is the second part of a three part series. To get the whole story, you'll want to read the first part (if you haven't already) and then this article. Once again, we're featuring author and reader photos of Dodgson Designs aircraft and we thank all of them for the opportunity to present them here. — Ed.

In 1970, Sandy and I quit our jobs, rented out our houseboat on Lake Union in Seattle, piled our six-month-old daughter Heather (Todi) into our VW camper, and headed out for a six-month tour of the United States, on a very limited budget. I had sold my first four-channel plane to Larry Nuss before I left, and I had designed a new glider to take with me. The new glider had the same control system but two sets of wings. The long set had a span of about 120 inches and an NACA 4412 airfoil. The short set of wings (100 inches) had a semi-symmetrical airfoil. They were interchangeable on the fuselage as it had no fillet and was flat at the point the wing root contacted the fuselage sides, as on the later Todi and Maestro gliders. The flaps and ailerons were mixed with the forerunner of the Dodgson Coupler, which was devised, in part, by an innovative Seattle flyer and mechanical engineer Sandy McAusland from my own sliding bell crank platform. The Dodgson Coupler was to become the first two control mixer available to the model airplane industry.



"Walt Volhard launching Dodgson Saber at 60 Acres Park, 1991" (image: Waid Reynolds)

Our trip was plagued by radio problems. However, I did get some good flying at Torrey Pines, California, where I met some notables like Fritz Bien and Kelly Pike. After six months of being cooped up in our camper with a young child, Sandy and I were hardly speaking to each other on our return to Seattle. Needless to say, I had no desire to resume work as an architectural draftsman, so I put in for unemployment compensation while I cogitated on the alternatives. I discovered that while my planes were as good in light slope lift as any before my trip, that upon my return the Monterey had been introduced and it was superb as a light-life slope machine. I also discovered that Larry Nuss, who was now flying my original four-channel glider with the Eppler 387 airfoil, was out-flying my new gliders and he was getting performance from the ship that had eluded me. His secret, come to find out, was that he lost the lead nose ballast I had in it and was inadvertently flying with a much further aft CG.



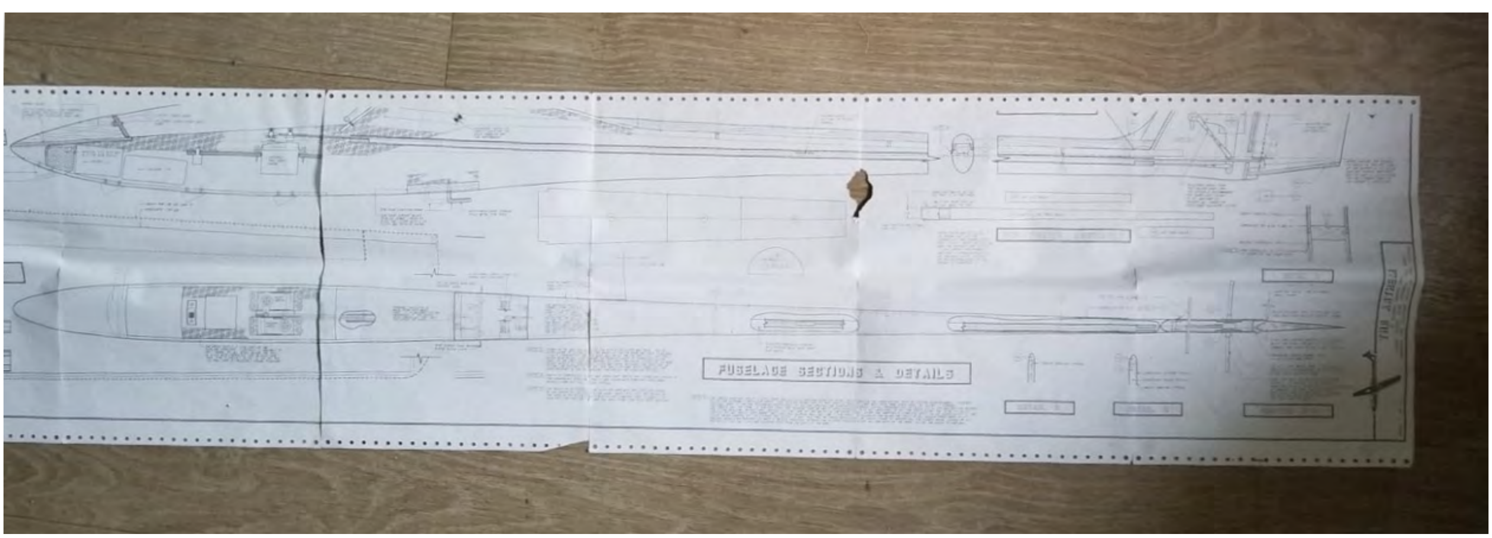
"Megan Dodgson with the First Windsong ever built that I flew to second place at the 1983 Nationals." (image: Bob Dodgson)

Don Burt, who had been brought to the United States from Scotland by Boeing as an aerodynamics engineer, played a prominent part in my life at this time. He also had designed several gliders with multi-channel control. The Boss T had polyhedral wings, but it had flaps and it had ailerons that were coupled to the flaps so that they moved about half as far as the flaps moved. Don Burt's T2 had two-channel control and polyhedral, but it had flaps coupled to elevator and ailerons coupled to rudder, so it got a lot of mileage out of those two channels.

Don had all the design books by Horner, etc., and had been a well-known Free Flight competitor in Scotland. We spent many hours discussing the merits of different design concepts, wing tips, control systems, etc. In the end, we had several basic differences of opinion as to the configuration of the best high-performance glider.

"My yellow Windsong." (image: Craig Christensen)

Don decided that he would kit his T2 and Boss T in a small kit run. The idea seemed totally outlandish to me, but I started thinking that if Don Burt could do it, why couldn't I? My latest design after the six-month sojourn was a winner. It could hold with the Montereys in light slope lift and yet it could move out, was fully aerobatic, and had two sets of wings with flaperons. It was to become the Todi. The original fuselage was of shaped balsa, covered with Monokote. (I still have it.) I had no fiberglass experience but wanted to make the pod of fiberglass. I wanted to make the tail boom of balsa but couldn't figure out a good way to do so. Ralph White, who now owned Flight Glass Models, generously and kindly instructed me on how to make molds and fiberglass fuselage shells. Don Burt gave me the basic idea of rolling the balsa tail boom, but it took many frustrating experiences before I developed the hardware to do the job.



Dodgson Anthem plans apparently printed on a dot matrix printer. (image: Tim Egersheim)

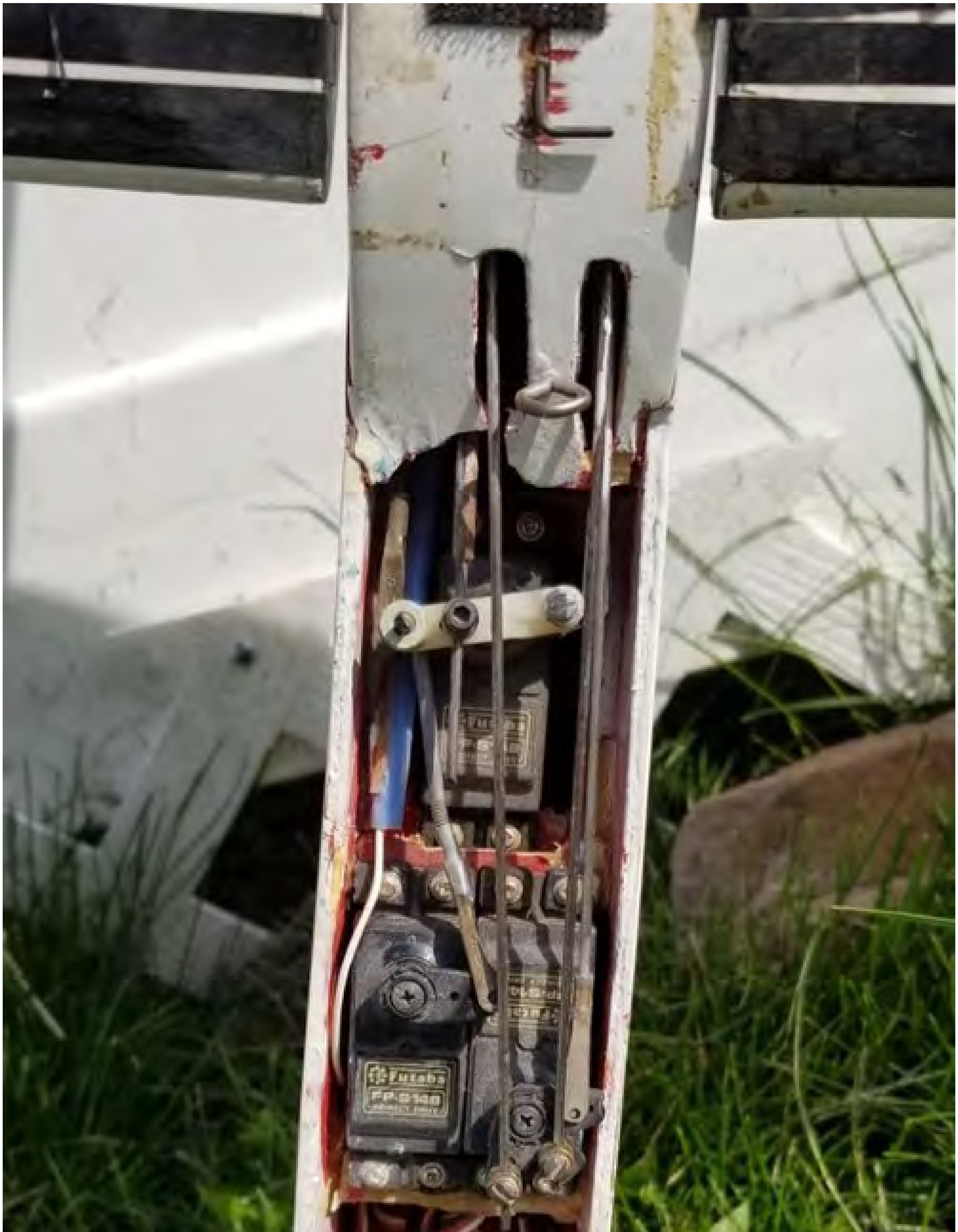
It took several weeks of work, but I finally got my first Todi kit together, plans and all. I placed a tiny 1/12-page ad in Radio Control Modeler (RCM) magazine, for about $50 and started getting catalog requests. Soon, orders started to trickle in. From early 1972 to the end of 1972, we made our kits where we lived — on a 400-square-foot houseboat on Lake Union. The fiber glassing and the sawing were done on the covered portion of the deck while the materials were stored inside. All parts and the kit assembly were done inside the tiny houseboat. The first Todi had been ordered by John Davis, one of my slope-flying friends. He constructed it and when the great day for the test-flight arrived, he called me and we went to the slope.

"From top-to-bottom: Todi, Maestro, Lovesong, Saber, Camano, Camano-shell, V-gilante, Pivot." (image: Kristopher Harig)

This was the moment for which my ego had been waiting — the day when I would see my creation, built and flown by someone else, soar to glory! John threw it out over the slope with a steady hand. It was a success. But wait. Suddenly the glider went into a series of gyrations and crashed. John said it was the squirliest glider he'd ever seen. After several similar attempts, John gave the glider to me in disgust. I was totally crestfallen. This was 1972. I took John's Todi home, put my radio in it and flew the glider. It flew great. I told John, and he didn't believe it. I had to conjure up several witnesses. Finally, John took the Todi back and somehow discovered that his antenna wire in his transmitter had broken. The problem resolved John's Todi flew fine. In fact, at the 1983 model show in Puyallup, Washington, I heard from John Davis that he was still flying the №1 Todi kit from 1972.

"This picture was taken at the 1983 National Soaring Society 'Soar In'. Me holding the white WIndsong won 1st place." (image: Mike Hansow)

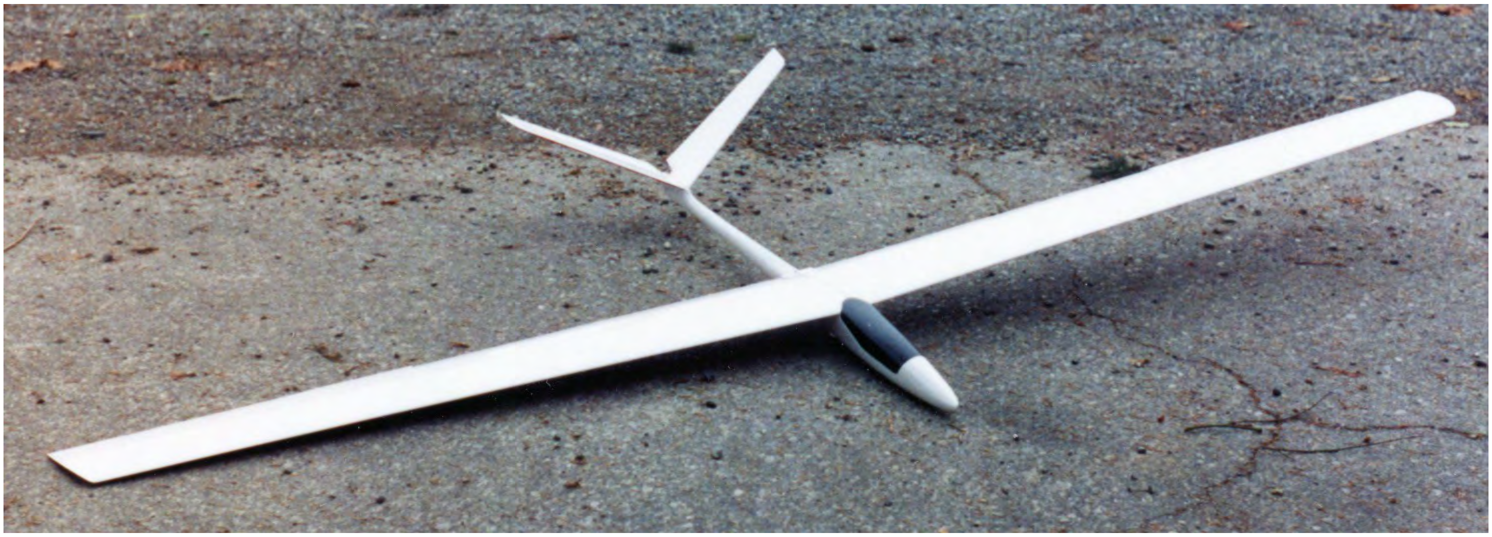
The Todi was born on the slope but it had all the necessary ingredients to be a thermal champion. I now wanted to put the Todi to the test in serious thermal competition, but I had had little experience with winch tows and no contest experience. My early winch tow memories still give me nightmares! The concept of the turn-a-round had not yet been born, so the winch box was placed at the far end of the field with a highly trusted person left there to operate it. You hooked your plane on the line, waved to the winch operator, watched the line tighten and then off the plane would go full bore to the top of the line, if you were lucky.



“What is this wizardry?” (image: Tim Egersheim)

Steve and Larry Nuss were the first boys in the Seattle area with one of these marvelous winches. It was only their constant enthusiasm that enticed me out, Todi in hand, to observe winch launching first hand. Larry had a Dandy two-meter glider with which he was going to show me how easy and safe this launching technique really was. Steve was running the winch. Finally, the moment came when Larry signaled the winch man that he was ready. With a surge of power, the Dandy sprung to life. It catapulted about 20 feet into the air and then did a snap roll on tow. Unshaken, Larry calmly continued on up the line to get a reasonable tow. “There, see how easy it is!” said Larry looking over at a quivering mass of humanity, holding a Todi that immediately went, unflown, back into my car.

At the annual slope flying bash, the second for me, on Badger Mountain (near Wenatchee), I heard that there was to be a thermal contest in Spokane as a part of the Spokane Internationals, a well-known power contest at that time. This, I thought, would be the golden opportunity to showcase my new Todi. I would simply breeze in with my wonderful multi-channel bird, win a decisive victory, impress the heck out of everyone and get great material for my advertising. Sandy, my supportive wife and I, drove for six hours and got to Spokane only to find that no one knew anything about the contest. Finally, we found out that we were two weeks too early. As luck would have it, the Spokane Barons were holding a glider contest that weekend anyway to sharpen their flying skills in preparation for the big contest.



"This is my 100" V-gilante." (image: Bob Dodgson)

We decided to stay and fly in this local contest, since we were already there and had nothing else going at the time. At the field, on the morning of the contest, I was chuckling to myself upon seeing the sorry assortment of gliders represented. Some flyers were even entering converted power planes, with the engines removed. There were a few Cirruses around though and they were good planes. Also, the first Airtronics kits were represented. They were the original Olympic 88 and 99. Harley Michaelis was there with one of his beautiful, published designs.

Among many other sterling performances through the years, Tom Neilson not only won the 1987 Nats, flying his Windsong in open class, he won the Hi-Johnson trophy for the highest score and he won the Dan Pruss trophy for being on the winning team.

Dave Johnson and Tom Brightbill completed the winning team and all were flying Dodgson Designs gliders! Oh yes, the Craig Robinson Built Windsong Tom Neilson was flying won in 3 categories in the static judging, too --including best sailplane!

Interestingly, Ed Berton and his Windsong placed 2nd at the 1987 Nats --so Windsongs were 1st and 2nd! Ed also won the big 1988 Tangerine meet!

"Tom Neilson and his Windsong won the Nationals in 1987." (image: Bob Dodgson)

The first flight was a three-minute precision, which I figured would be a snap. I got a terrible launch and it was readily apparent that I was having a radio range problem, which demanded that I not stray very far away. Even so, I had no trouble getting the three minutes. In fact, I did so well that I got about four minutes and couldn't understand why I got zero flight points for this heroic effort. Finally, it sunk in what a precision flight was all about. My first flight was probably my best of the contest. I came off tow a few times, the winches were down at the other end of the field operated as described earlier, and I was having every problem known to a green contest flyer.

To compound my problems, most of the early Spokane Contests required that the launch be Rise- off-the-Ground (ROG) rather than throwing the plane from the hand. This type of launch was fostered by the LSF nationally and was used in their big annual California contests. Many articles were written in the magazines telling how much safer this ROG launch was than the hand-held launch. My own observations were that you were lucky to get three successful launches out of four with the ROG system. It was scary, you couldn't get as high and anything could happen in the first few feet while the plane was getting up to flying speed. Eventually both Spokane and LSF abandoned the ROG launch, much to my relief.

"Dave Banks carries his 'song through a fleet of Dodgson gliders as another 'song is launched. Doug Buchanan behind him. circa early 90s" (image: Waid Reynolds)

At the end of the contest, I had finished 15th out of 16 entrants. Even the converted power planes had beaten me. Either Harley Michaelis or Randy Holzapple won the contest as I recall. I went home a broken man. No one was impressed with either my amazing glider or me. I knew that my design could outperform the other planes at the contest, but no one else could have seen the potential from my dismal showing. Alas this was to be my fate on many more occasions over the next 15 years.

"Our daughter Megan holding the Orbiter-2 that won Handlaunch at the Nationals in 1995 flown and slightly modified by Steve Cameron. The original Orbiter was designed by Eric Jackson and kitted by Dodgson Designs. With the Orbiter-2 shown below we incorporated the fiberglass tail boom like the one with which Steve Cameron won the 1995 Nationals." (image: Bob Dodgson)

I knew that I had to go back and fly in the Spokane Internationals to redeem myself, so two weeks later we returned. There were about 40 entered in the glider portion of the contest. Several flyers were there from the Portland area, and five flyers of note from California.

This contest was a different story. I wasn't having any radio trouble at this field and I knew what a precision flight was. I had also been practicing landings. At the end of the first day, I was in the lead. My glider was a hit; even George Steiner and Greg Allen from California were going to buy kits. By the end of the contest, however, I had managed to drop to third place, the first two places going to the Allen boys from California. So ends the saga of Dodgson Designs . . . the beginning.

The third and final part of this series is coming up in the July issue of RCSD. This article was originally published in the April 1983 Northwest Soaring Society Newsletter edited by Dean Rea. Bob updated and submitted it to the AMA History Project in 2002. RCSD would like to thank both Bob and the AMA History Project for permitting the use of the AMAHP document as a source for this series of articles in RCSD. In particular, we would like to thank Jackie Shalberg, Archivist and Historian for the National Model Aviation Museum, for the assistance in making these arrangements. — Ed.

Read the ***next article*** *in this issue, return to the* ***previous article*** *or go to the* ***table of contents****. Downloadable PDFs: just this article or this entire issue.*

The Windburner right before it's first flight. (image: Michael Berends)

RC Soaring Diaries

Some speed from Down Under: The Windburner and RPM from Kevie Built RC Planes.

Michael Berends Follow
Jun 15 · 11 min read

After being involved in RC soaring for 40 years, I've had a chance to do pretty much every type of discipline the hobby has to offer. Although I thoroughly enjoy the grace and romance of gently guiding a glider from thermal to thermal under a sky of puffy cumulus clouds. The wild child in me has the 'need for speed' and dynamic soaring (DS) is something that I can't get enough of!

The first time I ever heard about dynamic soaring was roughly 20+ years ago. There was talk about Joe Wurts reaching amazing speeds flying on the back of the slope. The place where we were always told to stay far away from as it took your glider and slammed it into the ground due to all the turbulent rotor that was on the backside of the hill. There was descriptions of how this was accomplished in magazines, such as this, but none of it really made sense to most of us. I just couldn't wrap my head around crossing between different energy zones in an elliptical path to obtain insane speeds. Even with the drawings and diagrams provided I was just left scratching my head and doubting everything I read.

That all changed one day when I was at a friend's house after a slope soaring session and he turned on the TV, popped in a VHS tape and I got to see what DS flying looked like for the very first time! There was Joe Wurts flying at speeds so fast it appeared as if the video was on fast forward with the glider emitting roaring sounds as it ferociously tore apart the air at these insane speeds!

This was a life changing moment that started my dynamic soaring pursuits. Although the beginnings and learning process were difficult and frustrating at times, the rewards in the end have been absolutely amazing!

After flying a number of different types of gliders on the 'dark side', including EPP (expanded polypropylene) DS planes and a variety of composite ships. I have never owned a composite glider that was designed specifically for dynamic soaring. So for this season I decided to invest in a few fast ships to help me hit some higher speeds and reach some new goals.

The first ship that came to mind was the *Windburner*, produced by Kevin Bennet of Kevie Built RC Planes in Australia. I had followed this sleek flying wing for quite a number of years. Here's what Kevin had to say about it:

> *"I wanted a fast plank which was easy to build and just as fun and easy to fly for dynamic soaring. It started off as a 40" plane with a lost foam fuselage. From the very first* Windburner *I realised I had something special. So I made a plug for a fuse and increased the wing size to 48". The wing was made from a plastic laminate material which is a skinny laminate of 0.5 mm. It flew so well that it broke the 48" tailless world record. So then I decided to make a hollow moulded wing version. From then on, the* Windburner *has gone from strength to strength. I've refined it to make it faster and faster over time and so far it*

> *has broken not only the 48" world record but holds the outright world record for a tailless aircraft."*

After 10 years of watching this little marvel break 200 mph, then 300mph and eventually smashing it all with the current 48" world record speed of 341mph for a 48" wingspan glider. I knew that I finally needed one.

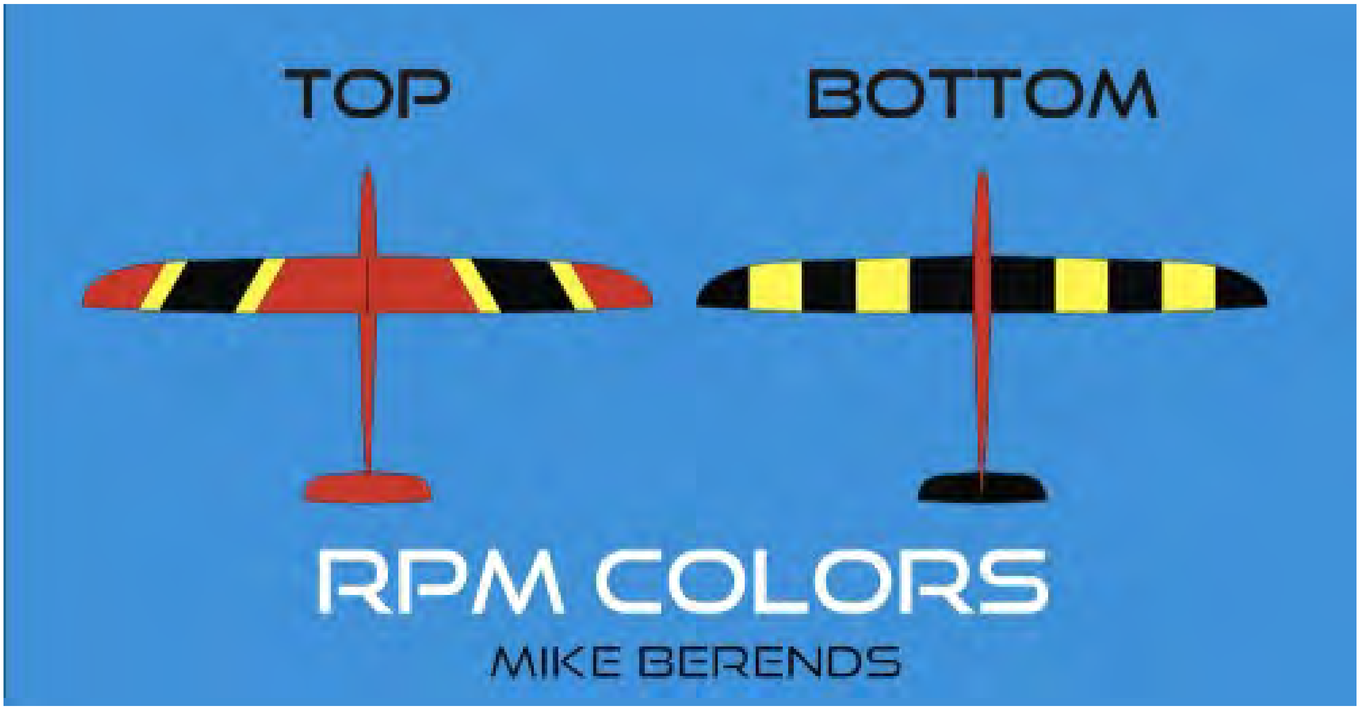
So, I reached out to Kevin, who is a super nice guy, and put in an order for one. He told me that he had to finish up a few *RPM* gliders first which is the new plane he is producing. This had me wanting to dive in and know more about the *RPM* and really liked what I saw, so I was quickly swayed into putting in an order for an *RPM* too!

The *RPM* is a 71" DS plane that was designed to push the 300mph mark. It wasn't designed to crush world speed records but to be a stable platform that you can put into the air and find the 'groove' at your site on the given day, before you break out the heavy hitters. It also flies well on the front side unlike some of the other DS ships in it's size category. It all sounded great to me so I couldn't resist!

The process was started which spurred lots of conversations with Kevin. A new friendship was building and the airplanes weren't even started yet! This is one of the beautiful things with this past time. It's not always about the planes and the flying, but also the friendships and people you meet along the way. Some of my best friends are people I've been flying with for decades, creating good memories both on and off the flying field.

I quickly found out that he was an extremely genuine guy with a passion for everything he does. Not only a fine craftsman with the gliders that he produces but also puts the same pride into other things he does outside of the hobby. As a matter of fact, through our conversations it was found that we both have built theatrical props for movies. Some of Kevin's handiwork can be seen in one of the installments of *Pirates of the Caribbean*.

As he was finishing some of the other planes that were ahead of mine, I had a chance to come up with a color scheme, something he does for all the people that order from him. I really wanted to make sure that these planes were vivid and stood out against not only the sky but terra firma, as half your flight is typically below the hill. Wanting to keep some of the beauty of the bare carbon fiber, I opted to go with red and yellow with black stripes for both ships. Top and bottom differ to keep good track of orientation, red the primary color on top with diagonal accent stripes. Yellow and black 'invasion stripes' on the bottom. All easy to see even on a cloudy day with flat lighting.

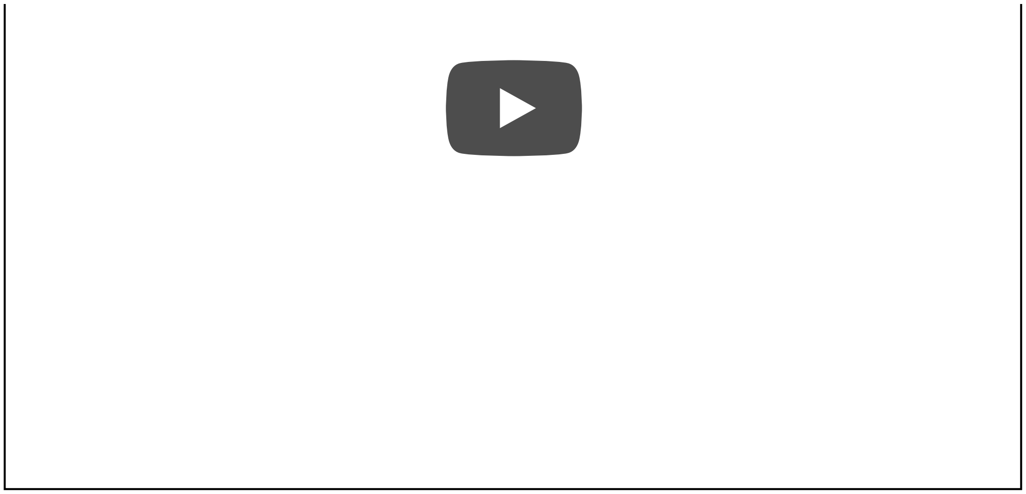


Drawing 2: The picture of the vivid color scheme that I designed. (image: Michael Berends)

The morning soon came when I woke up to some messages and photos that Kevin had started on my planes. The excitement started and as the days unfolded the photos just kept coming. It was just great to see all the pieces of composite cloth, resins, paint and molds all working together to give birth to my new speed machines. I was along for the ride during the whole process and even though I was familiar with building molded ships, and have done some myself, Kevin had some techniques that he has honed over the years that were very enlightening. He has always shared his knowledge and has an active YouTube channel where has has published some of his builds.

Here is one of his videos showing how much work goes into a *Windburner* wing:

Laying up a hollow molded wing.



Video 3: Laying up a hollow moulded wing. (video: Kevie Built RC Planes)

From a world where I've always built the majority of my own composite gliders for light weight, I was amazed at how much carbon and glass cloth were put into these planes. Layers and layers stacked on top of each other. I was clearly seeing why his planes had a reputation for being extremely strong. Stories of cartwheel landings on top of rocky slopes where they were picked back up, had the dust blown off and sent back in the air were common.

Photo 4: RPM composite fabric layup. (image: Kevie Built RC Planes)

> "I was amazed at how much carbon and glass cloth were put into these planes. Layers and layers stacked on top of each other."

Photo 5: Windburner wing in the mold. (image: Kevie Built RC Planes)

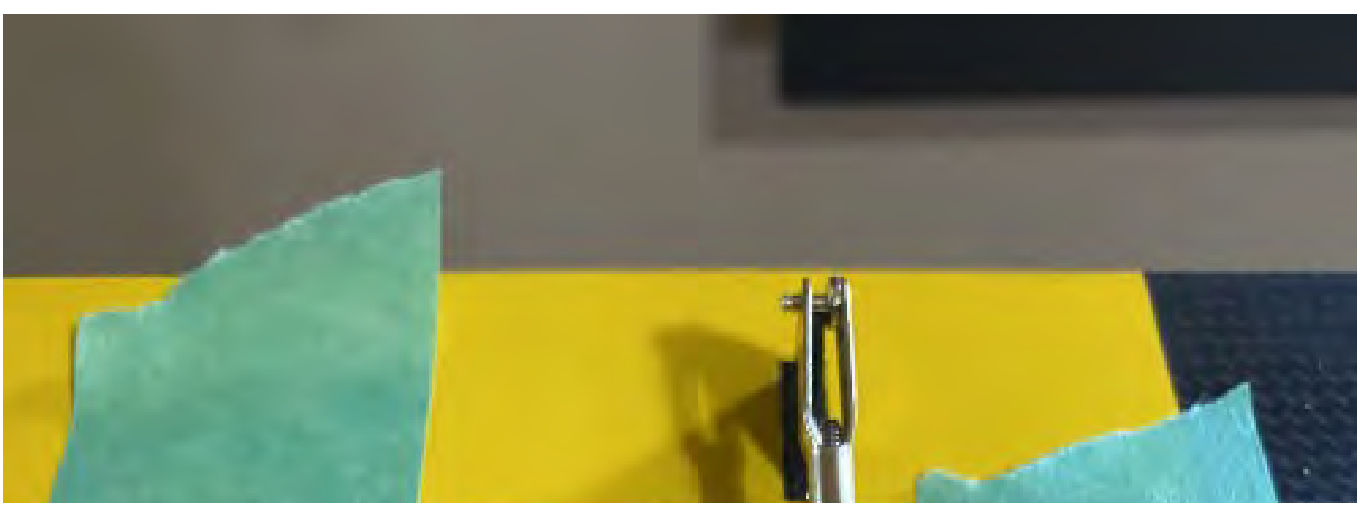
After an enjoyable few weeks of watching the progress, the planes were completed. After seeing the finished pictures I was really happy with my color choices. They looked exactly as I envisioned them. He replicated the pictures perfectly. He even took the time to make some custom *Maple Leaf* decals to honor their new home in Canada.

Photo 6: Both planes completed and ready to ship to their new home half way around the world. (image: Kevie Built RC Planes)

I received word that they had been packed up and shipped out. I was eager for them to arrive but knew that their trek would take awhile. I was pleasantly surprised when the package tracking showed that it was actually moving very quickly across the world. It was received at my door in just over a week.

Once the package arrived, in a very sturdy box, I carefully opened it up to find all the pieces neatly wrapped for protection and fully intact. The first thing I noticed was how robust everything was. All the pieces were built like tanks — literally rapping my knuckles on the wings with no worries of any denting or damaging. The wings were like carbon riber *Ginsu* knives ready to slice the air like butter!

After ogling over the workmanship of my shiny new machines it was time to start getting radio gear into them so they can take to the air. I had already ordered some KST X10 servos and had them on hand ready to go. They fit in all the servo bays easily and mounting them was done as recommended. First scuffing up the cases and then using epoxy to lock them on the wing skins with a fillet attaching them to the spar for rigidity. The supplied carbon control horns then needed to be mounted into the control surfaces. This was accomplished by marking out their location on the skin of the wing surface, then using a rotary tool to carefully cut through the skin and making sure that the slot went all the way down to the bottom skin but not through the bottom skin, which took some patience but worked out really well.



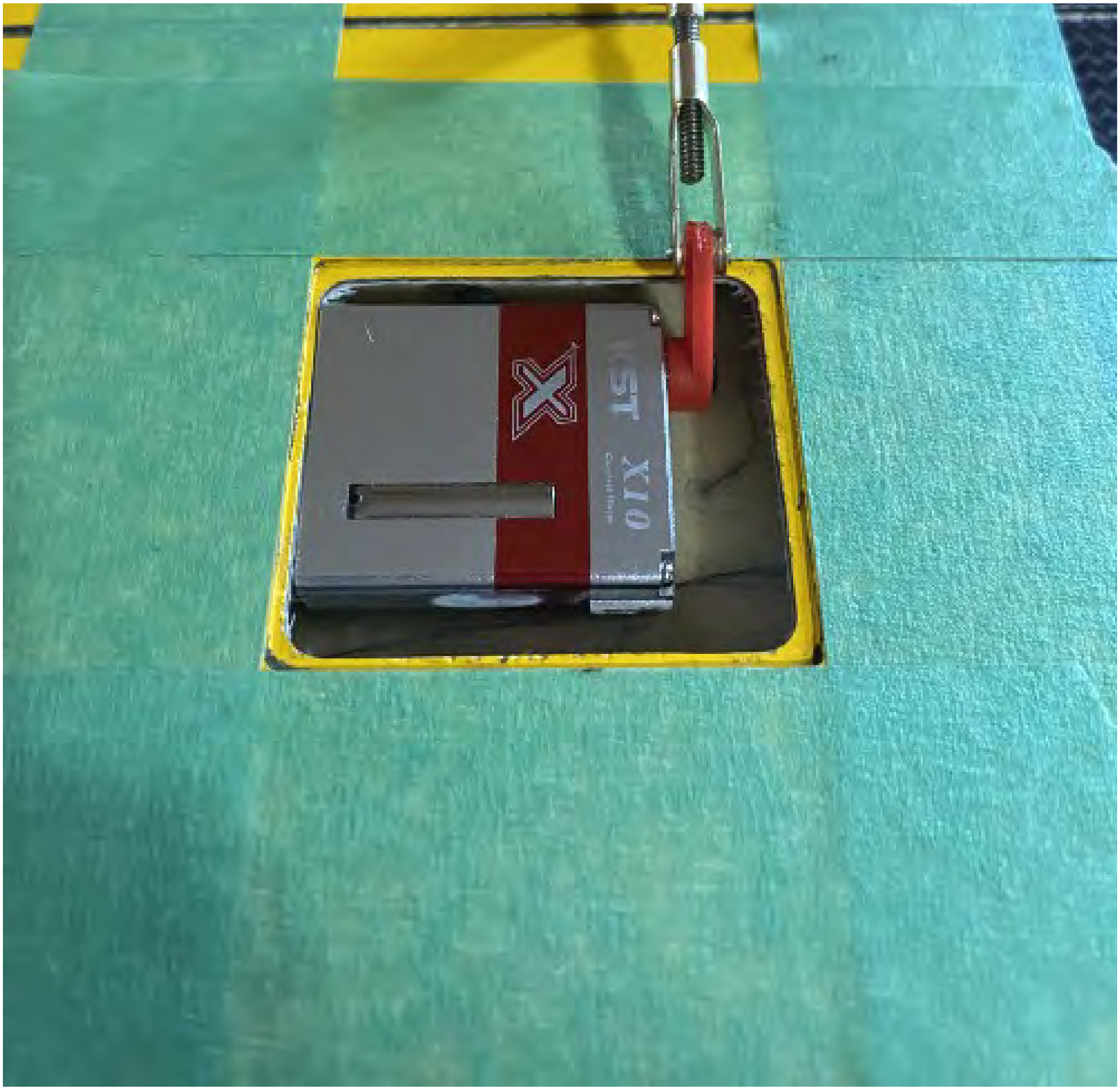


Photo 7: KST X10 servos were used on all surfaces of both planes. (image: Michael Berends)

The control horns were then cemented in place with an adhesive that I've never used before but about which I was informed by a fellow *RPM* owner, *JB Kwik-Weld*. At first I was a little apprehensive but after doing a few of them I knew that it was the right choice. Much like a five minute metal epoxy, it allowed me to mount all seven control horns in less than two hours one after an other in succession. Using masking tape and taking it off within a few minutes of potting the control horns gave me nice fillets with crisp edges. This will now be my preferred way of mounting control horns in the future. No taping and propping things in place until the epoxy cures. Each horn takes around five minutes and you're ready to move onto the next one. So a big shout out to Jeremy DeFrisco for that tip! Thanks my friend!

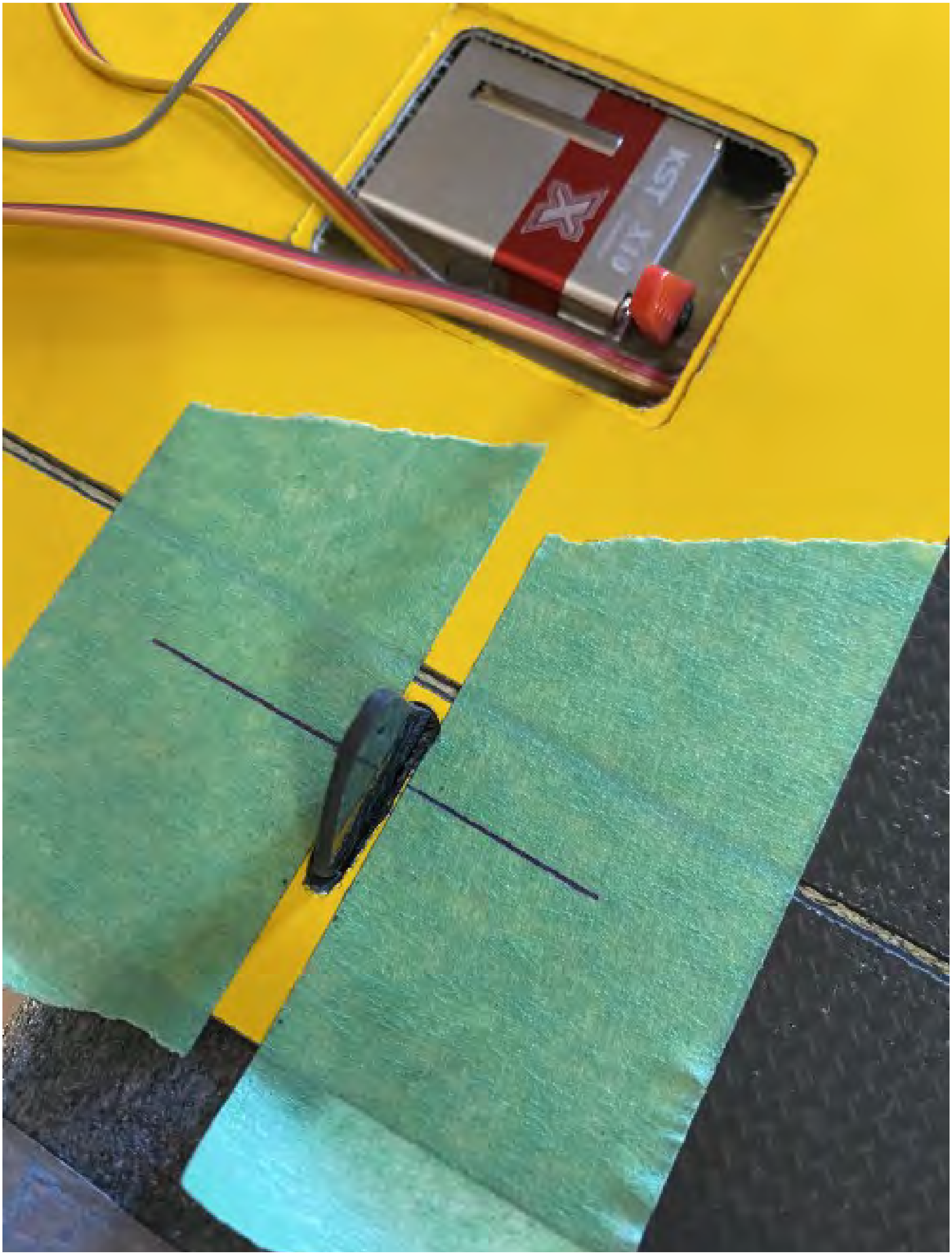


Photo 8: Control horn put in place just before potting in place with JB Kwik-Weld. (image: Michael Berends)

After that was accomplished all that was left to do was to make some 4–40 pushrods and install them. Easily done with threaded rod and good end links. One end was screwed on and secured to the rod with *JB Kwik-Weld* to prevent it from turning and the other end was left to rotate in case any adjustments needed to be made. Kevin was always there to guide me through the whole process and with his help that was in the form of diagrams, messages and pictures of his own plane, the geometry of everything worked out perfectly! Getting proper flap geometry can some times be troublesome but I was so happy to see that everything worked out first attempt and hassle free. Once again a good testament to the amount of care and customer service that he always provides with a sense of cheer.

All control throws were setup exactly to the settings prescribed on the info sheets for the planes. This was easily achieved due to the proper geometry described earlier. Using the stroke of each servo to utilize the servos power and resolution properly.

Battery and receiver installation was nothing out of the ordinary. I chose to go with NiMH *Eneloop* battery packs for stable chemistry in case there is ever a crash. I would never have to worry about any type of fire hazard.

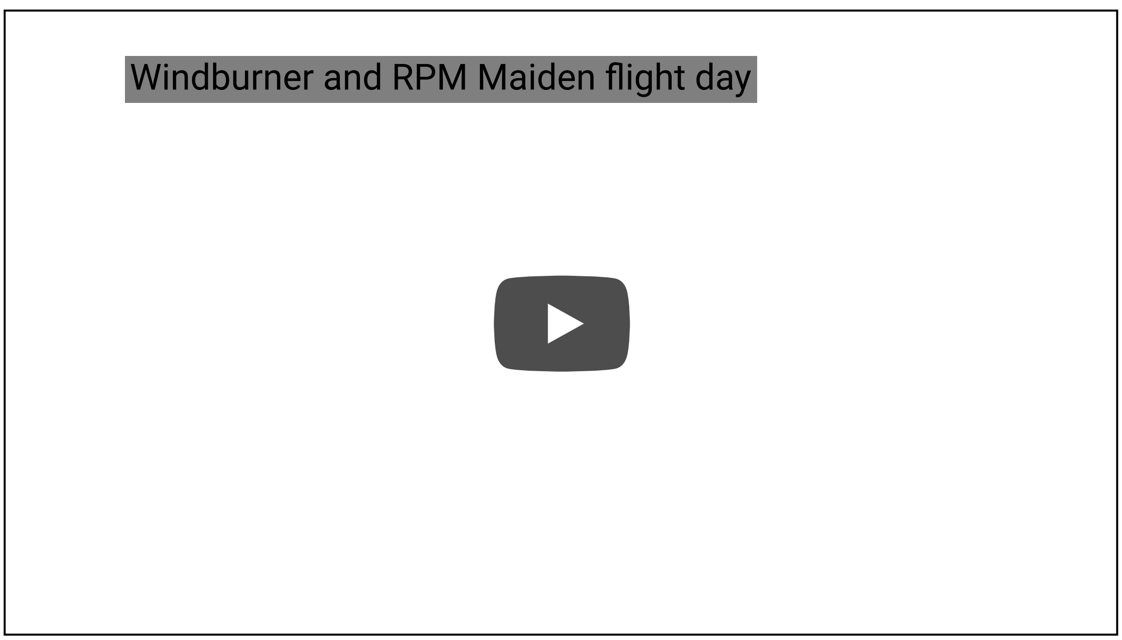
The last thing was setting up the proper center of gravity (CG). For this I made a quick balancing rig out a piece of scrap lumber and some dowels with nails sticking out of them, pointy side up. I wanted to insure a very accurate CG setting, especially with the *Windburner*. Flying wings are very sensitive to CG and even moving them a millimeter in either direction makes a difference. Multiple layers of masking tape on the bottom of the wing that was marked at the proper measurement protected the wing skin from the nail. Filling a small sandwich bag taped to the nose of the plane and slowly filling it with lead shot until it was almost balanced but still on the tail heave side was a good start. I then put the planes on their nose put all the weight in the nose and poured some epoxy on top of it letting it ooze around all the weight securing it in place. The final balance was done with small pieces so that I could remove or add weight as needed to fine tune.

That’s it! They were done and ready to fly. Assembly was enjoyable, straightforward and quick. It really took me very little time to get these beauties ready for the air. On top of having some new planes I also gained a number of friends around the world in the process. Other *Windburner* and *RPM* owners from around the globe helped me decide on radio gear, building techniques and a variety of other choices I needed to make on this extremely gratifying journey.

As of this date I haven’t had the chance to do any dynamic soaring with these flying razor blades due to scheduling and the very odd spring weather that we have seen here, but have had them out on the front side to feel them out and put them through their paces. They both flew well setup the way Kevin recommended with no changes needed other than some expo dialed in for personal taste. You can see the maiden videos on the link below!

Hoping to get these doing some dynamic soaring laps soon to see what kind of speeds I can reach! If you’re in the market for some DSing machines, get hold of Kevie Built RC Planes through his Facebook page (see *Resources* below). He will definitely help you out and get you some quality planes that you’ll be ‘rippin’ around!

Thanks for joining me again this month! Happy flying and we will see you next time.



Video 10: RC Soaring Diaries: RPM and Windburner Maiden Flights. (video: Michael Berends)

Resources

- RC Soaring Diaries (YouTube)
- Kevie Built RC Planes (Facebook)

*Read the **next article** in this issue, return to the **previous article** in this issue or go to the **table of contents**. Downloadable PDFS: just this article or this entire issue.*

Green Air! The 2021 New England Scale Soaring Aerotow

Big tow planes and even bigger gliders. What's not to love?

Steve Pasierb Follow
Jun 15 · 5 min read

As the United States continues to reopen from the pandemic, 30 pilots, several dozen spectators and a supportive local flying club made the May 2021 edition of this annual event a complete success. Four days of flying spectacular blue skies and big lift air was the capstone to a beautiful long weekend of weather.

The *RC Propbusters* located in Salem, Connecticut is a large fuel and e-power club located on a rented patch of land at the center of farm fields. The open spaces and surrounding areas which are ideal for a power club also provide perfect conditions for RC soaring. The combination of powerful tow planes powered by 100–150 cc motors continually towing and a nice range of sailplanes made for a great variety of aircraft to share the sky and fun viewing from the pits. Across the four days, participants flew vintage designs such as the *Reiher*, *Minimoa* and *Nemere* to *1–26*s and *K8*s to the sleek modern-day 6.6 and 8 meter *Arcus*, *DG-1001*, *Duo Discus*, *Shark* and a range of other glass ships. 1:3 scale models overwhelmingly dominated with a few much larger and a couple smaller.

Encouraging new flyers and thermal duration converts to towing is a big part of this event. Those interested in flying a range of electric sailplanes were also welcome to attend in the hope they will want to take a turn flying one of the giant scale sailplanes. We know it only takes a small taste to get someone hooked. Fortunately, there are always a few models up for sale should one seek instant gratification and a lighter wallet.

Towing power was provided by a diverse group of models including a nice pair of Hangar 9 *Pawnees* powered with DA-120 motors, a TopModel *Bidule 111* on DA-100, a Peter Goldsmith Design *Chmelak Z-37* on DA-150, an Aviation Concepts' 1:3 scale *Cessna 185* on DA-150 and an Aeroworks' *Carbon Cub* also sporting DA-150 power. Cannisters on all but the *Chmelak* were the order of the day. There was essentially little to no waiting to get a sailplane airborne. Emphasis is always on flying as much as those in attendance want or can tolerate!

Like other recent meets, one sign of the evolution in our hobby was seen as more front electric sustainer (FES) and retractable electric ducted fan (EDF) units are appearing in sailplanes. Among the EDFs zipping around over the weekend was a RC Flight Academy 6-meter *Duo Discus* on a Mig Flight JETEC 120 running 12S, a 5.33-meter EMS *Arcus* running a Schubeler unit on 12S,and a 4.4-meter *Valenta Fox* on a Mig Flight JETEC 90 running 10S. In the FES category, a 6-meter Mibo Model *DG-1000* had its maiden after adding a Torcman unit with NT530–35/14 turning a 18x11 propeller. While it flew beautifully, it was clear this model could step up to a 20x13 for more robust climb. A

Hangar 9 *ASH-31* 6.4-meter with FES also made many impressive rise off ground (ROG) takeoffs each day.

Lunch is often as important as good lift and kudos go to the club members who stepped forward to man the grill. Simple hotdogs and hamburgers were served with a good dose of humor and sarcasm provided to those waiting in the lunch line. On Sunday, one of the participants, Bob Morrow, provided sandwiches and snacks for all the hardy souls who stayed on for day four — or day five for those who arrived on Wednesday afternoon!

This event regularly draws participants from a 5–7 hour drive radius. The pandemic kept 2021 attendance down. The ample open spaces also see a number of camping trailers and tents while the less hardy head to hotels and a nice dinner in one of the nearby seacoast towns. All are looking forward to the 12th annual event in May of 2022.

The discussion forums at ScaleSoaring.com (see *Resources*, below) contain a complete listing of aerotow events in the eastern United States in addition to a wealth of information on scale sailplanes and tow planes. There are typically one-to-two large meets each month starting with Cumberland, MD in March right through the Turkey Tow back in Salem, CT in late November. The crew responsible for the New England Aerotow also put on the Sky High Aerotow at a gorgeous private flying site in Muncy Hills, Pennsylvania each September. Sky High is set for September 9–12, 2021.

Our sincere thanks to RCSD and Managing Editor Terence C. Gannon for helping to promote our events and for your kind support of everyone who loves the multifaceted hobby of RC soaring!

Resources

- ScaleSoaring.com (website)

- Sky High Aerotow (listing on the RCSD *Events* page)

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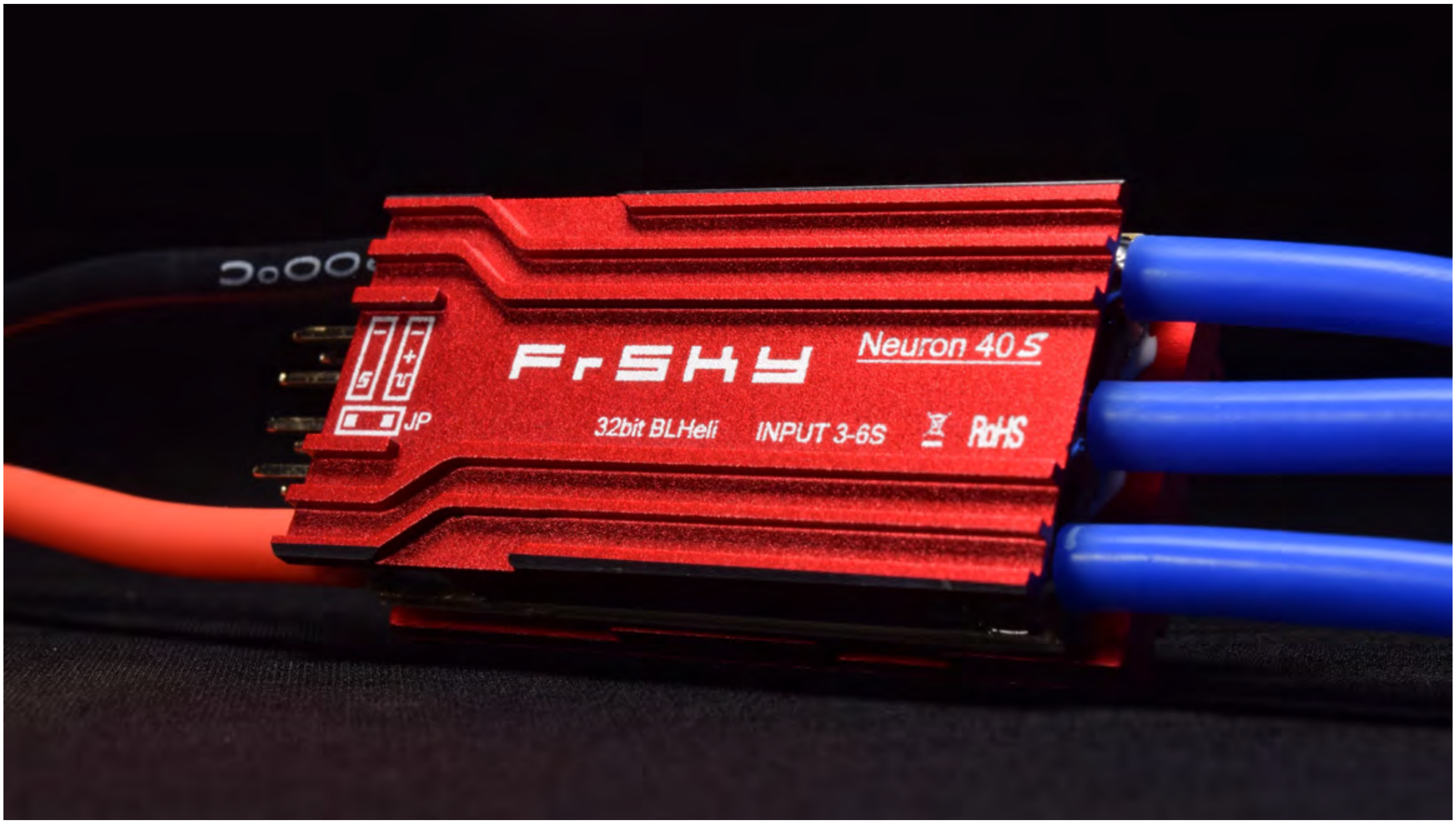


The FrSky Neuron 40S (image: Aloft Hobbies)

FrSky Neuron Electronic Speed Controller

It packs plenty of performance and features into a surprisingly small package at a reasonable price.


Peter Scott Follow
Jun 14 · 8 min read

First impressions were very good. The FrSky *Neuron* electronic speed controller (ESC) comes packed in foam in a solid plastic box, and is very strongly made with a thick aluminium plate top and bottom. All sides are open. There are two servo-style connectors for leads to go to the receiver — one for the throttle/battery eliminator circuit (BEC) lead pulse width modulation (PWM) and the other for the Smartport (S.Port) telemetry feed. You need leads with both ends female (socket rather than pin). You will need to cut the red core on the PWM lead if using a separate receiver battery, but this is a separate lead so you are not cutting one that is permanently connected to the ESC. The ESCs are compact with good heat sinks and are available in 40, 60 and 80 amp versions with 50% extra capacity for short times (burst). All versions are the same size and weight, though different prices, and can be connected to 3S through 6S lipo batteries.

I tested the *Neuron* 60 in detail. After soldering on XT90 and 4 mm bullet connectors and sleeving, the device weighed 76 g. This is exactly the same as a Turnigy *Plush* 60A, though of course the latter has no telemetry. The sizes are: *Neuron*: 60 x 33 x 16 mm *Plush*: 72 x 30 x 17 mm so the *Neuron* is just a bit shorter. Later in this article I will describe even smaller versions.

Photos 2 and 3: The Neuron 60 top and side views.

The *Neuron* includes a range of FrSky telemetry. I tested the telemetry using a Taranis *X9D* plus transmitter running OpenTx V2.2.2 and a freestanding *X8R* receiver. Initially no motor was connected, so the current, RPM and mAh consumption data were zero. I allowed the ESC to power up the receiver through the BEC and the voltage shown in RxBt telemetry was 4.9V. Using a voltmeter I checked whether this was the voltage sent by the BEC and it was, so the BEC appears to default to 5V, though the voltage can be changed. It can provide 7A.

After using `Discover New Sensors` on the Taranis all of the data appeared as follows:

Data Names	Values During Test	Description
EscV	16.71 V	Lipo voltage
EscA	0.00 A	Motor current
EscR	0 RPM	Motor speed
EscC	0 mAh	Power consumption
EscT	44° C	ESC temperature
0E50	2560804	'Encrypted BEC values' — presumably the ESC setup data

Figure 4: Observed values on Taranis transmitter.

As you see the data (sensors) have different names from the ones created by separate telemetry devices. You can change them if you want but they seem meaningful. All have the same device ID (17). If using two of these ESCs in a twin motor model you would have to change the device ID for one of the ESCs.

I then added the new data to a numeric telemetry transmitter screen. I decided also to add `EscA+` and `EscR+` so that I could have a reading of the maximum current and motor speed during the flight. These will be essential to make sure that I have the correct propellor fitted. To get maximum safe power I want about 95% of the maximum current for the motor when the prop is unloaded in the air.

Then I connected a sizable 4Max motor and ran it up, hand held, without a propellor. Sensors `EscA`, `EscR`, `EscC` now generated data. `EscR`, the RPM one, showed over 30000 RPM which puzzled me until I remembered that RPM has to be calibrated for the number of coils in the motor, and defaults to one. I edited the sensor to the six coil pairs for the Eflite Power 46 that it will be connected to when I install the ESC in a model. The defaults appear to work fine for fixed wing, though I think braking is set on as the motor stopped quite sharply. You will want this for folding props anyway.

Neuron S Versions

More recently FrSky issued updated versions of the *Neuron*, designated 'S'. I bought a *60S* and a *40S*. They are very much smaller as you can see from the photograph comparing the *60* and the *60S*. FrSky has done an amazing job squeezing the speed control circuitry and the telemetry into such a small device. The S has a jumper to select whether the BEC is used.

Photo 5: 60 — 76g 60 × 33 × 16 mm; 60S — 47g 45 × 22 × 12 mm. In both cases weights are with one XT90 and three 4 mm bullet connectors.

I have installed a *40S* in my Acrowot foam-e. It fitted perfectly in the original position. I don't need to connect the battery balance lead for voltage telemetry so the wiring is much neater. And now I'll know when I've used 1500 of the 2200 mAh in the battery 'cos the nice lady (Amber) will tell me. I used the default 5V BEC on the *40S*. I put the *60S* into a larger model. It was so much smaller and lighter than the current Turnigy *Plush* ESC that I was able to put it in a more convenient place and add a NiMH receiver battery and switch. As always, in both cases the telemetry data was found by the Taranis without a problem.

Advantages

Size

The dimensions of the *Neuron* are good compared with other makes especially the *S* variants. No further sensors are needed so the whole setup takes up much less space. Glider pilots might want separate variometer and/or GPS sensors, though the former is now built in to some FrSky receivers.

Weight

The *Neuron* is no heavier than most ESCs and you will not need to install other sensors with their associated wires. To match the *Neuron* you would need lipo voltage, current and speed/temperature sensors which add up to about 27g plus wires. We are not told what the current sensor will read up to, but I assume that it will be at least the current capacity of the ESC.

Cost

Neuron 40 £45.60 ($60), *40S* £55.20 ($70), *Neuron 60* £55.20 ($70), *60S* £60.00 ($78) *Neuron 80* £63.60 ($83). Unless you need an air speed, vario or GPS sensor, that's it. The cheapest FrSky sensors are: lipo £10.44 (2.8g), current £17.00 (17g), RPM/Temp £14.50 (6.7g). That's another £42 ($55) you would pay over the cost of a simple ESC. Dynamic soaring pilots unfamiliar with FrSky should not get excited by talk of an ASI sensor. It only goes up to 360kph (224mph). That's only mach 0.3.

Throttle Calibration Using the Transmitter

I fitted the *60* ESC into my motor test bed, running a Turnigy 3542 motor on a 4S lipo battery. To start I used a self-powered servo tester to provide the throttle signal. I connected the battery. The ESC made quite a few beeps but when I pushed the tester to full throttle the motor turned quite slowly. Clearly throttle calibration is needed for the non-*S* ESCs. The throttle on the *S* variant did not need calibrating. It presumably defaults to 1000 to 2000 ms.

While you will want to consult the documentation (which you should consider as definitive) here is my simplified summary of the procedure:

1. Push the throttle stick to maximum.

2. Connect the ESC battery.

3. You then get — wait for it — three fast rising beeps.

4. One long low beep — signal detected.
5. Four slow high beeps — measuring setting.
6. Three sets of four fast rising beeps — max throttle stored.
7. Silence.
8. Pull the throttle to minimum.
9. Four slow lots of two low beeps — measuring setting.
10. Three sets of four fast falling beeps — min throttle stored.
11. Then the startup, arming tones.
12. Three rising tones — power on.
13. One long low tone — signal detected.
14. One long high tone — zero throttle detected.

That's almost enough to orchestrate as the theme of a symphony. I wonder what would happen if I fed it to the phone app that recognises tunes?

And then, on throttle up, the motor ran full chat. There was no need to disconnect the battery to reset it. Next I connected the *Neuron* to an *X8R* receiver on the test bed, powered with a separate battery. I had to go through the calibration again for the *X9D* transmitter throttle stick. All the telemetry sensors produced good data after discovery.

I am getting to like the tune. Maybe I'll write a rap to it celebrating the joys of FrSky. Then a Spektrum, Futaba or Hitec lover can write another and we'll do a battle rap on the flying field.

Flight Testing

Setup

For flight testing I fitted a 60 in a Wot trainer with a separate receiver battery. This has an Eflite Power 46 turning a 13 x 8 prop. Motor current ratings are 40A continuous and 55A burst. I set up my telemetry screen to display current, maximum current, RPM, maximum RPM, consumption (mAh used) and battery voltage. The battery was a fully charged 5 Ah 4S Nanotech with internal resistances of about 3mΩ.

Current and Power

Full throttle current was 55A static and 40 to 50A in the air. This rose to 52A in manoeuvres. This makes the maximum power about 52 x 14.4 = 748W. The motor spec shows 800W. Cruise current was 20 to 30A in level flight and taxiing was around 15A.

Consumption

I also checked the consumption figures. I landed after nine minutes having used 3000mAh. The iSDT charger pushed in 2870mAh to full charge, so the error was 4%. This is excellent for a low cost device and good enough to rely on for maximum safe flying time.

RPM

According to the motor specification it should be 14.4 x 670 = 9648 (volts x kV). I checked that I had the number of motor coils correct for the RPM sensor. The spec gives 12 pole so I edited the sensor to 6 pairs and got a reading of just over 9000, so once again accurate.

Power

After carrying out the flight tests I realised that I could have recorded power as well. I created a calculated sensor called `Watt` by multiplying current and voltage and set the unit to watt W. I selected integer value so avoiding decimal places. I displayed `Watt` and `Watt+` on the screen, and carried out a static test. Clearly the current is measured in amps not milliamps as the simple multiplication gave watts. With a fully charged battery I got a reading of just over 900W. The full charge voltage is 16.8 so multiplying this by 55A gives 924W. Therefore the calculation seems to give a correct result. It also shows that under full charge the motor is being asked to produce slightly more than the specified power.

Word of Warning

Make sure you disable the power feed to the receiver if using a separate receiver battery. If not the ESC bursts into flames. Yes, I did exactly that.

Conclusions

This is a great advance by FrSky and I will only be buying the *Neuron* in future. The telemetry gives very good results. The *S* versions are astonishingly small.

Thanks for reading and please let me know your thoughts. Or if you want to have that battle rap next time we're at the field together.

The author has no connection, financial or otherwise, with the makers or distributors of the items mentioned in the article. Images are by the author unless otherwise noted. Read the ***next article*** *in this issue, return to the* ***previous article*** *or go to the* ***table of contents****. Downloadable PDFS: just this article or this entire issue.*

The Simple Stand with an Aquila XL. This article is about the Simplest Stand that replaced it.

My Simplest Stand

Perfection is achieved when there is nothing left to take away.

Tom Broeski Follow

Jun 14 · 4 min read

There are all kinds of plane stands out there. From PVC pipe, bicycle stands, to big boxes and the like. So far I've designed many plane stands and improved others. Some were complex and had lots of adjustments for use with and without wing support extensions. I found I really didn't use the stand without the supports.

A couple of years ago I designed the *Heavy Duty Stand*, a heavier version of the *Better Stand* I designed in 1997 — for more support and wider cord for my cross country planes — and the *Simple Stand* (see key photo above).

My recent goal was to design a really simple and small, yet totally supportive stand. The *Simple Stand* was close, but had some unnecessary curves and the base had angles that were difficult to cut and a bit harder to assemble. You adjusted it by moving the supports in and out. I found the *Heavy Duty Stand* worked a bit better, but had a lot of parts and I had to use my CNC to get the grooves right.

Soooooo…I eliminated the side curves, got rid of knobs and such and ended up with this one — my *Simplest Stand*.

Photo 2: My Simplest Stand. Perfection is achieved when there is nothing left to take away. (With apologies to Antoine de Saint-Exupéry for butchering his quote.)

You can copy it and adjust the dimensions to whatever suits you.

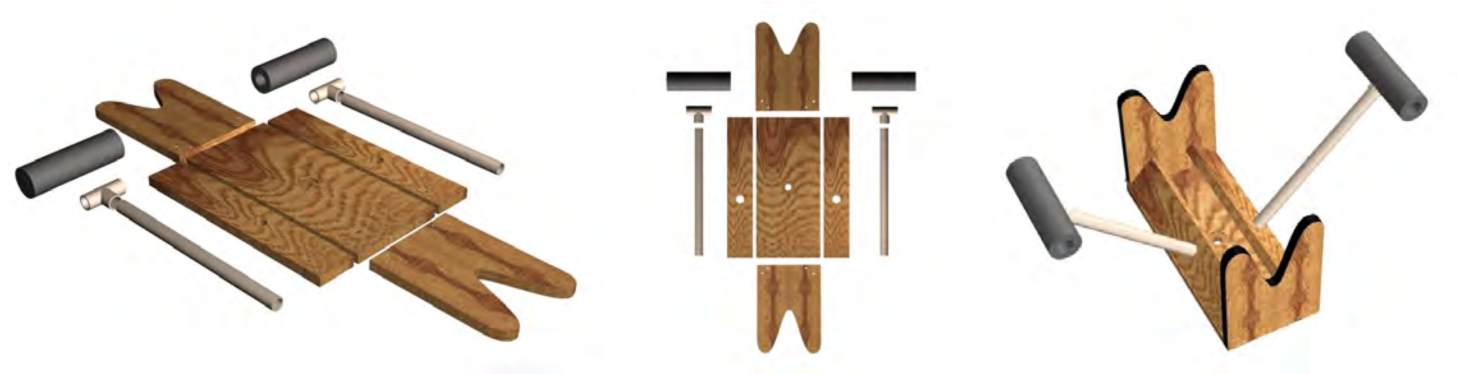
Photo 3 (left): The flat-heads hold the stand together. **Photo 4** (rig): I added a piece of 80 grit sandpaper to one end of each side part. If you have a really heavy wing, you might add a piece on each end.

Photo 5 (left): The pan-heads let the side supports adjust and are tightened when you have it positioned where you want it. **Photo 6** (right): All the stands have Velcro loop on the ends and use Velcro hook to secure the planes.

Parts List

- 1 piece — 5" x 11" x 1/2" plywood base with 1 1/4" center recessed 1/8" with 1/2" hole drilled through to accommodate a 3/8" T-nut.
- 2 pieces — 5" x 7" x 1/2" ply with V-grooves — Wider and deeper in front. Higher and narrower in back to fit most fuses.
- 2 pieces — 2" x 11" x 1/2" ply with 5/8" holes a bit forward of center to allow support without hitting flaps.
- 2 pieces — 1/2" ID pvc pipe 10" long with T's and 5" long pipe insulation.
- 2 lengths of velcro loop around the ends. A couple strips of hook to hold the plane down.

- 4 — #8 flat head screws counter sunk in ends (you can just glue and nail together if you want)
- 4 — #10 x 1 1/8" pan head screws. These hold the side pieces that adjust to hold the wing supports. I just tighten them where I want them. You can go though the trouble of using knobs, but I found it unnecessary.



Drawings 7, **8** and **9**: CAD renderings which provide most all the information you need to make your own.

Perhaps you can come up with a stand which is even simpler than the *Simplest Stand*. But that's going to be a challenge! If you think this can be improved, by all means, please leave a response to the article. Thanks very much for reading.

'Til next month!

*Read the **next article** in this issue, return to the **previous article** or go to the **table of contents**. Downloadable PDFS: just this article or this entire issue.*

1/3rd Scale Mita Type 3 Production Notes

The third part of a multi-part series.

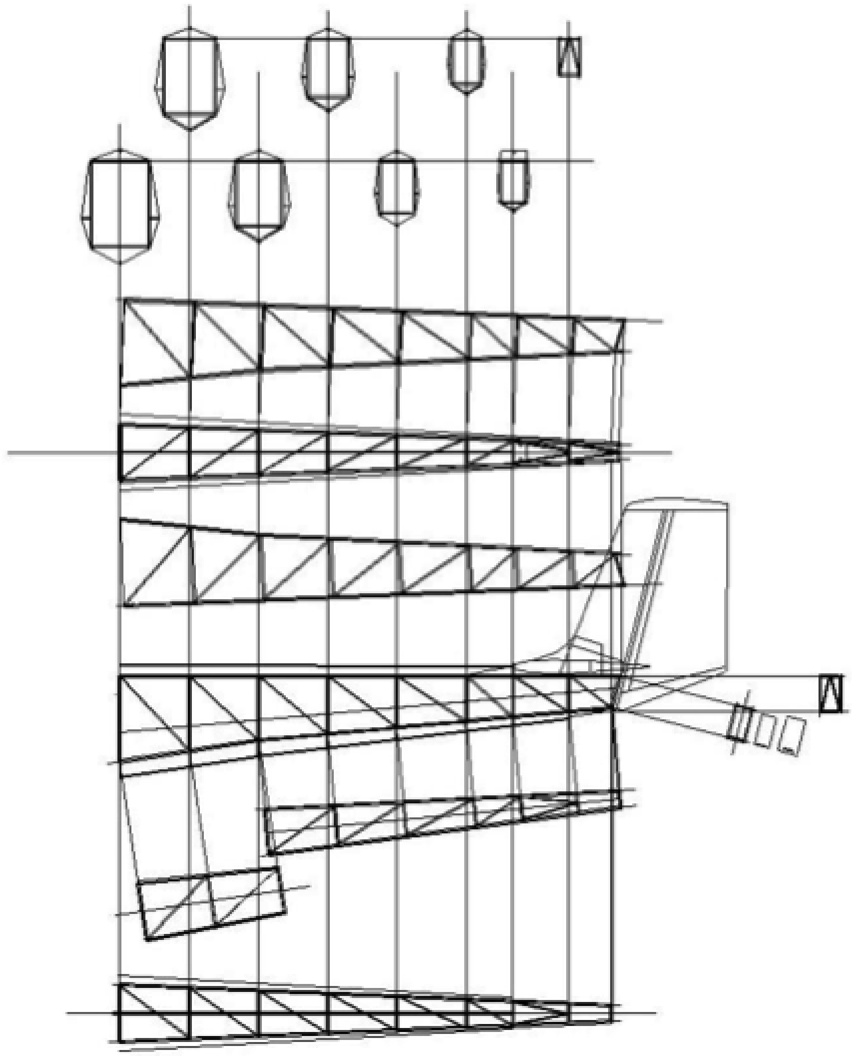
Norimichi Kawakami Follow
Jun 11 · 27 min read

You may want to read the second part of this series before proceeding to this article. Also if you prefer, you can read this article in its original Japanese.

Fabrication Part 5: Rear Fuselage

It was time to begin the construction of the rear fuselage main truss structure made of carbon pipes.

Structure of the rear fuselage



Drawing 10: Structural drawing of the rear fuselage

Drawing 10 is the structural drawing of the rear fuselage. The rectangular shape of the cross section is the main structural truss. This part is responsible for strength and rigidity. The upper and lower trusses have one longitudinal run each. The upper truss is supported by a single support rising from the center of the upper rectangular side, and the lower truss is supported by supports extending from both lower corners of the rectangle, forming a triangular truss structure. Slightly below the center of the left and right sides of the rectangle, there are plate-like longerons one for each side. These are covered by the outer skin, resulting in an octagonal cross-sectional shape.

The side view and top and bottom views show that the four longitudinal members that form the four corners of the main structural trusses run back and forth, and the vertical and horizontal members at equal intervals connect these longitudinal members to form a ladder-like truss structure. A single diagonal member is placed between each step of the ladder to provide torsional strength and rigidity.

Material for the main structural truss of the rear body

It was decided at the time of the basic conceptualization that all main structural trusses would be made of carbon pipes. The longitudinal members, which are the strongest members, will be made of 7×5 pipes (outer diameter 7 mm, inner diameter 5 mm), the parts corresponding to the upper and lower, left and right ladder steps will be made of 5×3 pipes, and the diagonal members will be made of 3.5×2 pipes.

Cutting Carbon Pipes

This is the first time for me to work with carbon pipes. I had some doubts about how to cut it, but I found that I could cut it rather easily by attaching a diamond circular saw purchased at a hundred-yen store to a mini-router and cutting the pipe while turning it. However, as black carbon chips will fly around during cutting, it should be done outdoors.

Photo 29: Mini router for cutting carbon pipes

The cut surfaces were shaped with a round file coated with diamond powder, which I bought at a hundred-yen store, because the joint partners were circular. This was difficult to do outdoors, so I placed a vacuum cleaner nearby to suck out the chips.

Fabrication of the top panel

The first step was to make the top panel of the rear body. I spread the full-size drawing on a flat board and covered it with a thin polyethylene sheet to prevent the glue from dripping on the board. I then nailed a thin piece of cypress to the board along the outside line of the longerons. This is for positioning the longerons.

Next, the ladder rungs are cut out, and the end faces of them are individually shaped with a round file to fit perfectly the longerons. The rungs have a diameter of 5 mm and the longerons have 7 mm diameter, so thin 1mm-thick cypress bars were placed under the rungs to adjust the height.

After I finished fitting all the rungs, I checked to make sure there was no floating, then dropped thin CA on the joints. This is a temporary fix, and the real fix will be done after everything is assembled with epoxy adhesive applied to the joints.

Next, the diagonal members are attached in the same way. The diagonal members are 3.5 mm in diameter, so the thin bar underneath should be thicker. The lower panel of the rear body was made in the same way. Photo 30 shows the production status of the upper panel.

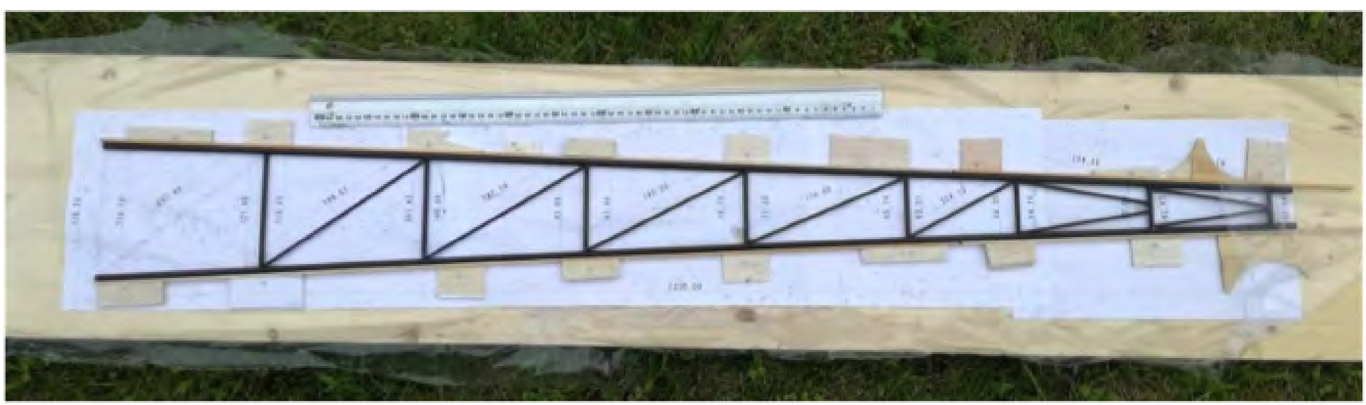


Photo 30: Production of the upper panel of the rear fuselage

> **Mistake №5:** *I was satisfied with the smooth production, but there was an unexpected pitfall. When I looked through the assembled upper panel from the rear, I found that the longeron, which should be straight, was bent!*

At first, I was puzzled as to the cause of the problem, thinking that it couldn't be because it was made by positioning a thin cypress guide. The cause was unexpected. The drawing was crooked! I only have an A4 printer. This printer can only hold 210 mm wide copy paper, but the length can be up to 1,100 mm using the user-defined function of the printer software. This upper panel has a maximum width of about 120 mm and a maximum length of 1,230 mm, so if you use long pieces of copy paper, you can get a full-size drawing in one paste. So, I cut three sheets of A3 paper into 210 mm wide and pasted them together to make a long sheet of paper about 210 x 1,200 mm, and printed a portion of just under 1,100 mm. Next I printed the rest on A4 paper, and then carefully pasted them together. This pasting was done with care, so there was no deviation, but the bend was in the area where the three A3 sheets were pasted together and printed.

When you put a long piece of paper into the printer, even if you put it in carefully, it will not go into the feed roll vertically, but will be at a slight angle. Therefore, while feeding the paper 1,100mm, the paper will come closer to the left or right and hit the edge of the paper feeder. So the paper is restricted to leaning to either side. This makes it difficult to print a straight line. At first glance, it was hard to find any problem with the 1,100 mm print, but when checked with a ruler, I found it had a waviness of 1–2 mm at maximum. Since I fixed thin bars to hold the longeron in place along this waviness, the resulting panel naturally had a waviness. The lower panel was short, so I confirmed that no such inconvenience had occurred. The upper panel is temporarily attached with CA, so it can be disassembled by impact. I took it apart, although I had taken great care in making it.

The Importance of Assembly Order

Before I started to reassemble the upper panel, I prepared the materials to make a jig to assemble the two lower panels, but then I realized that I was doing it wrong again.

The two lower panels are connected at an angle in a "V" shape, so I was thinking of making a jig with that angle and assembling them on it. Since the panels are large, I thought the jig would be quite large as well.

However, if you look closely at the drawing, you will see that the sides are on the same plane! This means that if I make the two side panels first in the same way as the top panel, I can connect them with vertical members and make the "V" shaped bend at the bottom without a jig. I felt ashamed of myself for believing, without thinking too much about it, that I had to make a total of three panels, one for the top and two for the bottom, and then assemble them on a jig.

> **Lessons Learned 3:** *The need for jigs changes depending on the assembly order. Examination of the procedure is very important.*

Photo 31: Making the rear fuselage side panels

Therefore, I decided to make the side panels instead of making the top panel again. However, since the two lower panels have already been fabricated, the fabrication of the side panels is slightly irregular this time. Photo 31 shows the production status.

The left side is the underside and the top is the right. In this photo, the right side panel has already been completed and attached to the bottom panel, and the left side panel is being made. The bottom panels are assembled by inserting jigs to make them stand vertically on a flat plate. For the printing of the drawing, this time, I cut A3 paper into 210mm widths, printed them one by one, then pasted them together. This way, the length of printing is 420mm, so the risk of printing crooked is reduced. This is the same procedure issue as *Lessons Learned 3*.

Finished rear fuselage main truss structure assembly

Finally the main truss structure of the rear fuselage was assembled after these mistakes and reflections.

Photo 32: The completed rear fuselage main truss structure

This time, the assembly was quite accurate. Photo 33 shows the front view.

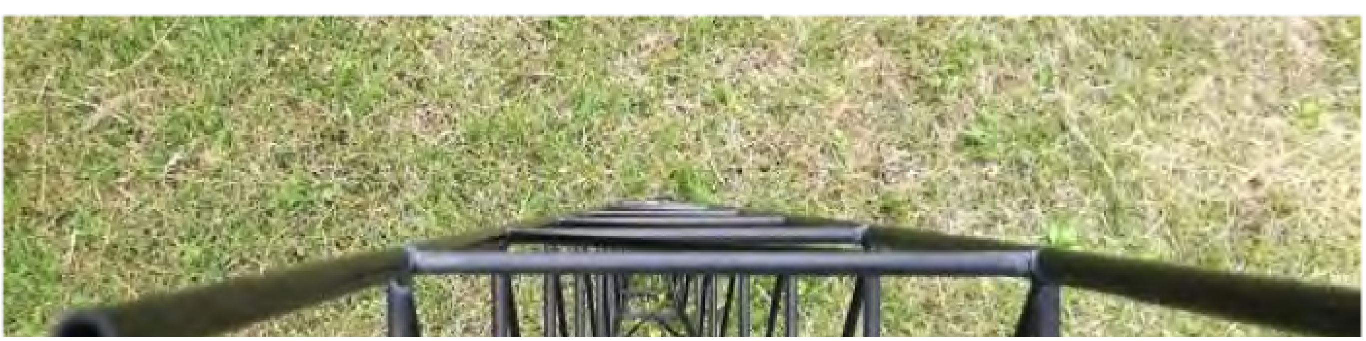


Photo 33: Rear fuselage from the front

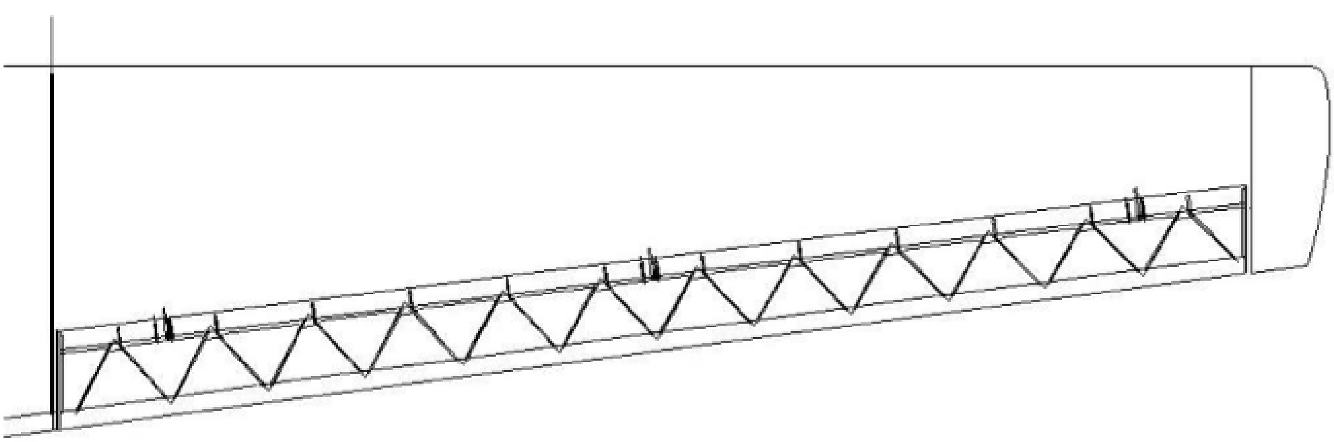
The longerons went straight through, and the upper, lower, left and right members corresponding to the steps of the ladder were assembled neatly.

Fabrication Part 6: Ailerons

Next, I started to build the ailerons.

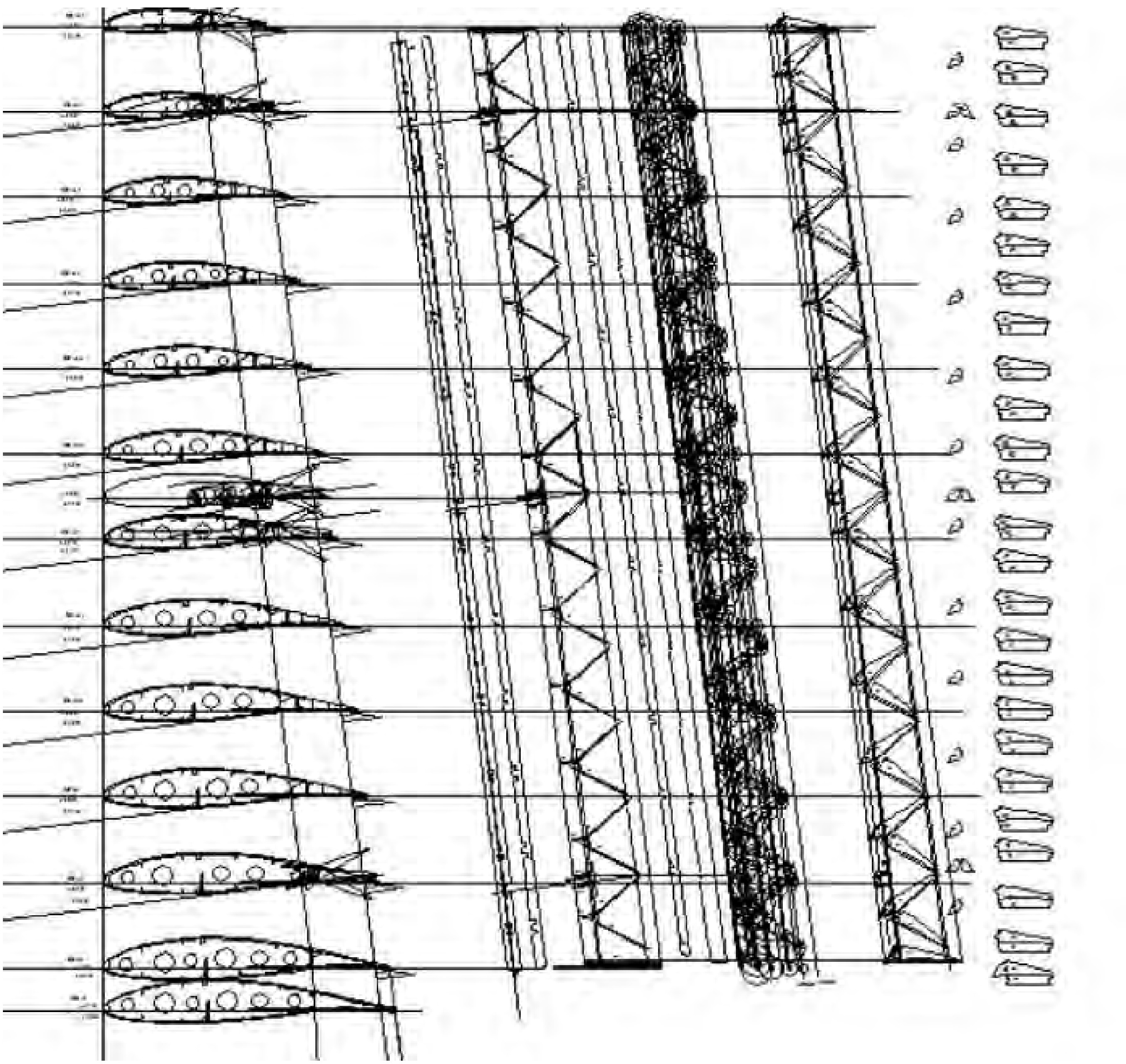
Design

Drawing 11 is for the right aileron. The length is about 1,100mm, the inner chord length is 90mm, and the outer one is 81mm, slightly tapered.



Drawing 11: Plan view of the right aileron

Although it looks simple at a first glance, the design of the ailerons was the most difficult part of the design of this plane. It is the same as the rudder and elevator in that all the ribs run diagonally, but the aileron has 26 ribs on one wing. Moreover, the innermost and outermost ribs are in the direction of the airflow. In addition, the leading edge of the aileron is parallel to the rear spar of the wing, so its cross section must be defined perpendicular to it. It was a difficult task to find this shape in 2D CAD. In the end, I spent about a month in June 2018 on this work. Drawing 12 shows the design process.



Drawing 12: Design process of aileron

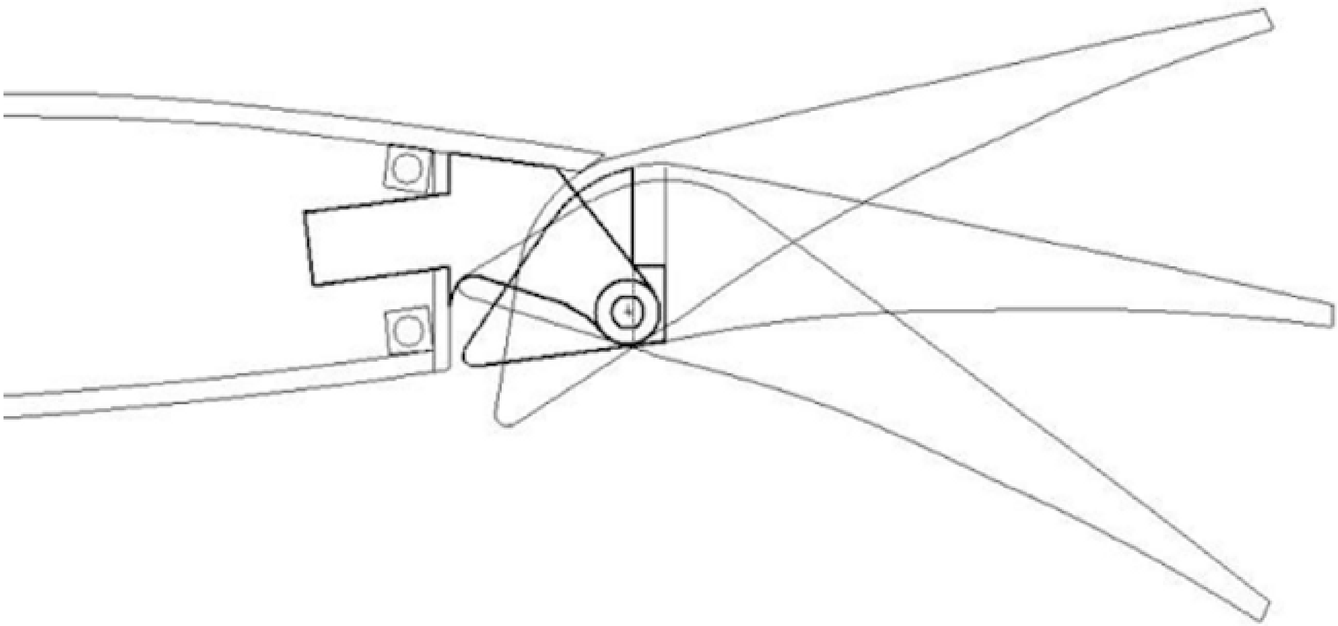
However, I cannot complain about such a thing. In the late 1960s, when the actual machine was built, there were still no CAD systems or calculators, and this work must have been done with a T ruler, triangle ruler, cloud ruler, compass, and calculation ruler. It is not hard to imagine how difficult this work must have been, and it made me keenly aware of how fortunate I am to be able to use CAD, albeit in a 2D format, and how much I respect the patience of our predecessors. Today, 3D CAD is in full swing, so my hardship may be a waste of time depending on how you look at it.

What troubled me in the design was the leading edge structure and the hinge type. Since it is a frise-type aileron, the top surface is connected to the aileron spar with a radius, but the bottom surface extends about 20 mm forward of the spar (see drawing 13 below). In other words, the cross-section of the leading edge is triangular, bounded by the spar, top and bottom surfaces. By the way, the height of the spar is only about 15 mm, even though it is 1/3 the size of a large machine. I was wondering how to make this.

There are two options. One is the method used for the elevator, which is a one-piece structure made by attaching 20 mm thick solid wood to the spar and then shaping it. The other is the method used for the rudder, which is an assembled structure with small ribs built vertically on the spar and the upper surface planked with balsa about 1.5 mm thick.

The one-piece structure is advantageous in terms of securing rigidity, but it is difficult to shape the 1,100 mm long, slightly tapered with the bottom surface not perpendicular to the spar but protruding downward with good accuracy. In the assembly structure method, the ribs are small, about 16 mm x 13 mm, and I was worried about whether the accuracy could be maintained with these ribs. In the end, I decided to use the assembly structure method without being able to find a decisive factor.

For the hinges, I had initially decided to use Robertson's rod hinge system. This is a simple and reliable hinge, but it is difficult to ensure the accuracy of the installation position. Holes are drilled in the wing rear spar web and the aileron leading edge, and the hinge ends are inserted to fix the hinges. It was thought that the hinge mounting holes could be drilled a little larger and fixed while observing the clearance during assembly, but this would be difficult because the shape is difficult to access for gluing. In the end, I decided to make my own hinges similar to the ones used in the elevator. This hinge is relatively easy to secure the hinge position accuracy and has the advantage that the aileron can be removed. The wing tips of the main wing are removable, and the ailerons are inserted from the outside and held by the wingtips.The shape of the frise-type aileron and the hinge adopted are shown in Drawing 13.



Drawing 13: Aileron installation diagram

Fabrication

Photo 34 is the hinge I made.

Photo 34: Aileron hinges

The hinges extending from the main wing are made of carbon and 3Φ bamboo string (upper side of Photo 34), and the hinge supports for the ailerons are made of acrylic plate (lower side of Photo 34). The elevator had two hinges on each wing, but the aileron is longer and has three hinges on each wing. The dimensions of each hinge are slightly different. In this photo, the paper patterns for cutting out the carbon are still attached, which look dirty, but if you remove it, you might make a mistake. Cutting out the carbon was so difficult that my hands turned black.

After cutting out the ribs, jig parts, spars, and trailing edges, I constructed first the assembly jigs on the full-scale drawing, as usual. Next, the ribs were sandwiched between the spar and the trailing edge on the jig. The spar and the trailing edge material have cutouts to insert the ribs into. When all the ribs were inserted, a L-shaped steel bar was placed on top to hold the ribs close to the jig and then secured with CA. Then I inserted the front edge ribs vertically into the spar and fixed them in place to attach the lower plank material. After that, the upper plank material is attached to finish the assembly of the aileron. The front edge at the hinge position was notched 12mm wide, and acrylic hinge holders were attached. The completed aileron assembly is shown in Photo 35.

Photo 35: Finished aileron assembly

At the time of design, I was worried about the bending and torsional rigidity of the airelon, since it is only 80–90 mm wide and a little bit more than 10 mm thick, but 1,100 mm long. Initially, I had considered using two servos per wing to deal with torsion if the rigidity was insufficient, but it seems this is not necessary. Photo 36 shows the accuracy of the aileron rib assembly.

Photo 36: Accuracy check of the aileron rib assembly

There is still some shaping to be done on the trailing edge, but thanks to the assembly jig, the ribs are nicely aligned. However, there was some dissatisfaction with the accuracy of the shaping of the front edge where the small ribs were planked. Later, I shaped it with sandpaper and repaired the large distorted part with putty.

Aileron modification

Later, through Mr. Suzuki, an OB of the Tokai University glider club, I received the structural drawing of the actual aircraft. Looking at this drawing in detail, I found that there was a mistake in the aileron that I had made. The mistake was in the handling of the ribs that sandwich hinges. In Photo 35, nothing has been done, so the leading edge is notched at the hinge positions, and the strength and rigidity of that area is significantly reduced. It turns out that in the structural drawing of the actual model, triangular plywoods are planked between the ribs in this area to prevent the loss of strength and rigidity. The 1/3 model has small ribs, so it is difficult to cut and plank them. Therefore, I filled the spaces between these ribs with balsa blocks (Photo 37). This greatly improved the strength and rigidity of the hinge area.

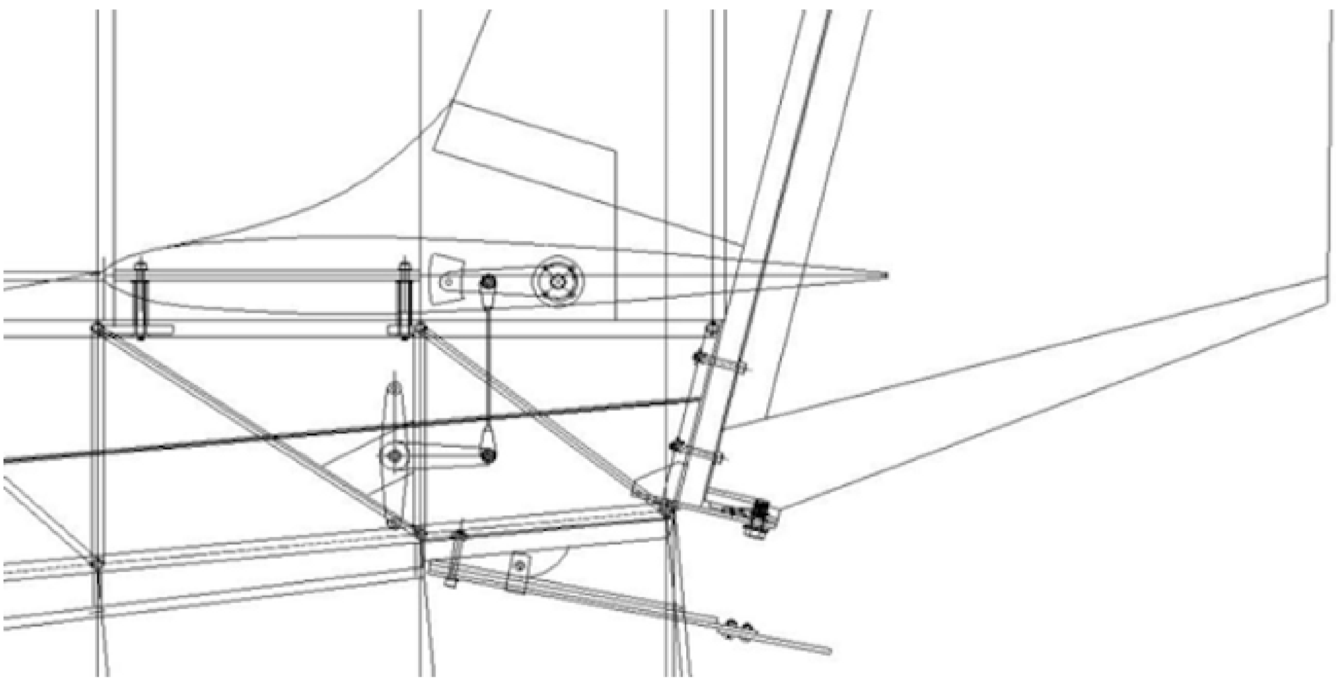
Photo 37: Ailerons after modification

Fabrication Part 7: Tail fin attachment mechanism, etc.

I started to cut out the ribs of the outer wing, but there are 36 ribs for one wing and 72 ribs for both wings. So, for a change of pace, I made the attachment mechanism of horizontal and vertical tail fins, elevator link mechanism and tail skid.

Design

First, I drew the drawing.



Drawing 14: Tail fin attachment mechanism, etc.

The horizontal tail fin has a 4mm thick plywood plate embedded in the center as a mounting point. Three posts with outer diameter of Φ7 and inner diameter of Φ3 are built on the upper surface of the rear fuselage to touch the plate. M3 bolts are inserted from the upper surface of the horizontal tail, pass through the plate and the posts, and are tightened into the claw nuts at the bottom of the posts.

Vertical tail fin is attached to the plate at the end of the body with two M3 bolts. Vertical tail must be orthogonal to the main wing, so, at this stage, only one bolt is used to fix the vertical tail fin since the main wing is not completed yet.

The tail skid has the same structure as the actual vehicle, with three 2mm-thick carbon plates for the springs and 2mm-thick aluminum plates for the ground sliding parts.

In the actual model, the bell crank for elevator operation is made by welded steel pipes. Initially, I tried to make a similar structure using carbon pipes, but I found making a hole in the pipe would cause the pipe to split longitudinally, so I decided to make it using 2mm thick carbon plates and a Φ5 carbon pipe. The elevator horn is connected to the bell crank by a link with rod ends, which are used in RC helicopter control systems.

Tail skid and elevator bell crank

Photo 38 shows the skid and bell crank fabricated per the drawing.

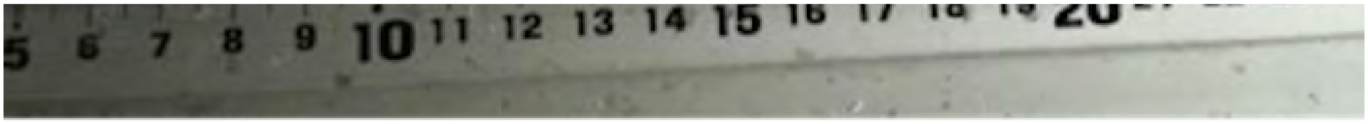


Photo 38: Tail skid and elevator bellcrank

The skid was mounted on a solid piece of pear wood. The three plate springs are fastened together by a forwardmost bolt and are only held together by the middle blacket to allow them sliding each other and creating spring effect.

Tail fins attachment strut, etc.

Photo 39 shows the tail fin attachment struts and other parts installed on the rear fuselage and the tail fin temporarily attached to it.

Photo 39: Tail fin attachment struts, etc.

The reason why the posts are long is because most of them fit inside the horizontal tail fin. In the photo, you can see the claw nuts for the vertical tail fin mounting bolts and the receiving plates for the elevator bell crank. The bell crank is fastened with a M3 bolt through the 3 mm diameter DURACON bearings inserted in the receiving plates.

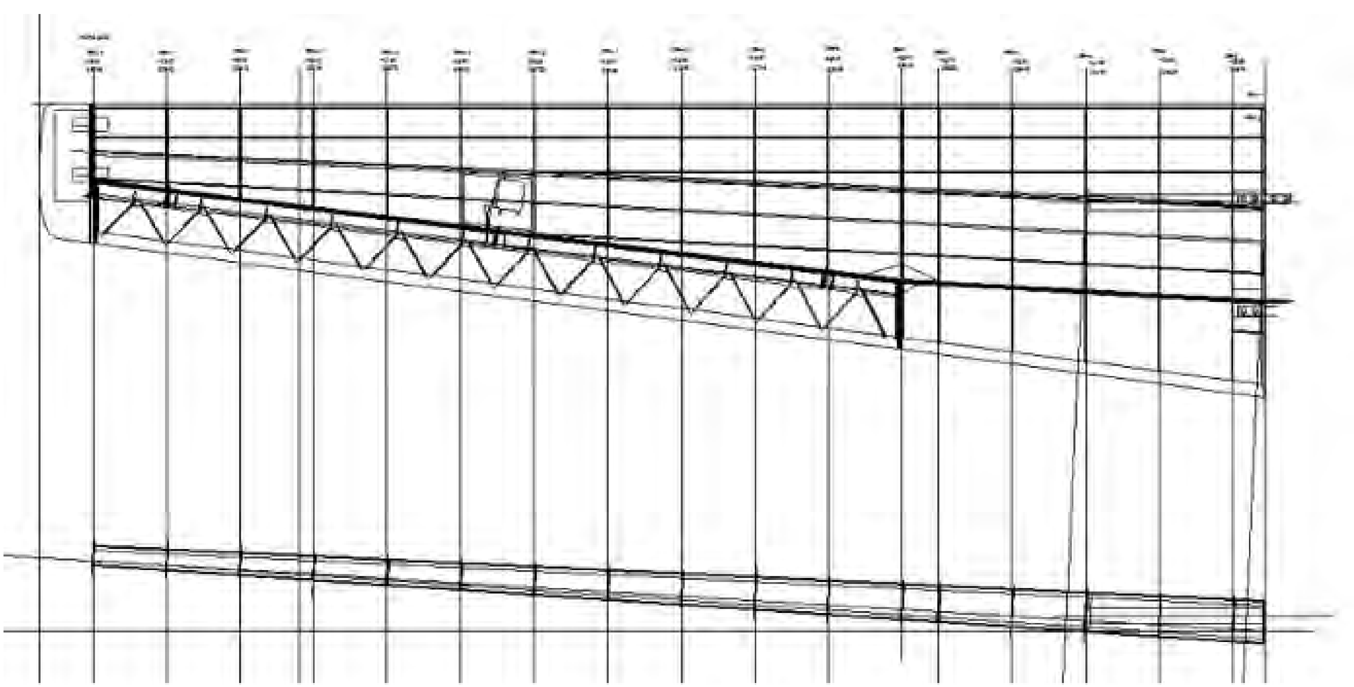
Photo 40 is the test installation of the skid and bellcrank.

Photo 40: Skid and bellcrank installed

Fabrication Part 8: Outer wing rib assembly

I finally finished cutting the outer wing ribs and assembled them.

Drawing of the outer wing



Drawing 15 is the drawing of the left outer wing.

The outer wing is tapered so that the innermost edge has the same 400 mm chord length as the center wing, but the outermost edge is 180 mm. Therefore, the taper ratio is 0.45. The length of the wing is 1,667 mm. As the tip 70 mm is the wingtip, the length of the rib assembly is a little bit under 1,600 mm. Between this span, 18 ribs are placed. The ribs are basically cut from 2.5 mm thick balsa. However, those near the root where the areas after the rear spar are not planked have 3mm thickness.

Since the wing is tapered, the spars are swept forward. The front spar flange is made of carbon pipe with 5mm square and Φ4 cavity inside, and that of the rear spar is 4mm square and Φ2.8 cavity. The spar webs are made of 1.6 mm thick plywood. There is a wing connecting pipe placed at the front spar web.

The center wing has no dihedral angle, but the outer wing has an angle of 3.45°. However, the connecting pipe should not have a dihedral angle. The front spar web is cut to insert an aluminum pipe for the pipe support. This cut must be carefully designed so that the support pipe can be inserted into the web horizontally which has forward and dihedral angles.

The area forward of the rear spar is planked with the same 2mm thick balsa sheet as the center wing.

Ribs cutted out

Photo 41 shows the ribs for one wing that have been cut out.

Photo 41: Ribs for the outer wing (for one wing)

The ribs from №1 to №7 have a full airfoil shape, but the ribs outside of №8 are only forward of the rear spar because the aileron is attached. The ribs 12 and 13 have one extra piece cut out between the front and rear spars for the aileron servo access panel between them.

Spar webs and leading and trailing edges

Photo 42 shows the cutted out spar webs, leading edge and the trailing edge.

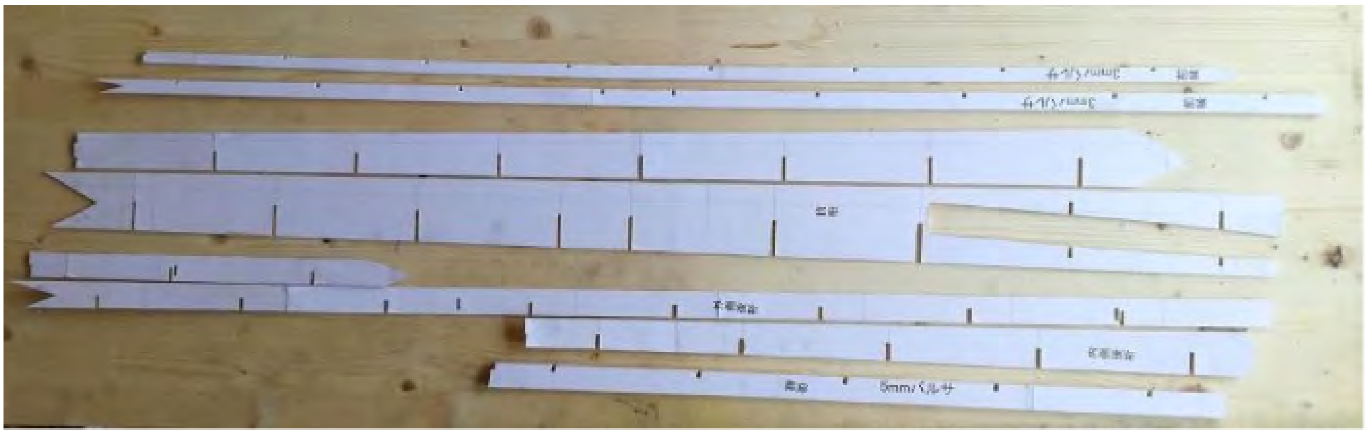


Photo 42: Outer wing spar webs and leading and trailing edges (for one wing)

The spar webs and the front edge are about 1,600 mm long, but the materials, plywood and balsa board, are sold in 900 mm lengths. Therefore, these need to be cut out in two parts and then joined together. There are numerous cutouts in each part, where the ribs interlock. Note the cutout near the root of the front spar web. This is the area where the aforementioned support pipe shall be inserted. The diameter of the support pipe is constant at 21 mm, but because the web has a forward angle, the width of the cut is curved to become wider toward the outside.

Assembly jig components

Photo 43 shows the components of the assembly jig.

Photo 43: Outer wing assembly jig components (for one wing)

The main parts are cut out as one piece with the ribs. These are held in place by the front and rear frames, and assembled into a stair-shaped box. The front and rear frames are also cut out in two pieces and connected. The main parts have protrusions at the front and rear, and the frames have small windows.

Above photo shows the components of the left outer wing. In fact, the number of parts is double because I cut out the right wing as well. It took a little over two weeks to cut out all the parts.

The thickness of plywood and balsa, which are not industrial products, varies slightly from one sheet to another. In many cases, the lumbers are cut slightly thicker than the nominal thickness. As a result, parts that are cut to nominal dimensions may not fit together properly as they are, so they must be slid together piece by piece.

Fabrication of the outer wing assembly jig

The first step was to assemble the assembly jig. Photo 44 shows the assembly of the cut-out parts on the full-scale drawing.

Photo 44: Assembly jig of the left outer wing

This is the left outer wing assembly jig. Those parts of the jig that receive ribs have one degree of washout. If the ribs are aligned exactly with the jig and assembled, the outer wing with the correct twist will be completed.

In the process of assembling this jig, I noticed a slight problem. The length of the jig parts was different from the length of the full-size drawing. I placed the parts precisely at the innermost №1 rib position and assembled the parts sequentially toward the outside. However, the rib positions on the drawing gradually deviated from the actual positions of the parts. At the outermost №18 rib position, there is a 3–4 mm difference between the drawing and the cutout position of the part.

The cause is the stretching of the drawing. The season in which I assembled this was the height of summer in August. Because of the high temperature, the printing of the drawing was done in an air-conditioned room. The assembly of the jig had to be done in my workshop where there was no air conditioner. I used a simple hygrometer to measure the humidity in the room with and without the air conditioner, and found a difference of about 20%. I looked up data on the rate of paper expansion and contraction due to humidity on the Internet, and found that paper expands and contracts by about 0.2% at 10% humidity. The length of the outer wing jig is 1,600mm, so 0.2% is 3.2mm. I do not know the exact humidity of the paper when the drawing was printed and when the jig was assembled, but based on the above discussion, it is not surprising that there is a gap of 3–4 mm.

I understood that such a deviation was unavoidable in the current work environment and proceeded with the work as is.

Meshing of ribs and spar webs, etc.

Finally, the outer wing is assembled. First, the ribs, spar webs, leading edge and trailing edge were meshed together. Photo 45 shows the meshing of the right outer wing. The metal fitting at the right end is for attaching the wingtip, and is made from a 2mm thick aluminum plate. The plan is to insert this part into the wingtip.

Photo 45: Meshing of ribs and spar webs, etc.

In this state, no glue has been applied yet. Each part has just been engaged. The positional relationship of each part is accurate, but the angular relationship is inaccurate, because the parts are precisely cut in the interlocking position. Especially for assemblies like this outer wing, where the ribs and spars are not orthogonal, there is a large angular misalignment.

Angle adjustment and bonding of ribs and spars

Place the ribs and spar webs in this engaged state on the assembly jig and correct the angle of the ribs and spar webs to match the jig. When an almost accurate angle is achieved, embed the spar flanges and place two or three heavy steel L-shaped steel bars on top to adhere to the jig. Once it is confirmed that each part is on the jig accurately enough, drip CA adhesives on each part of the engagement and adhere them.

Photo 46: Outer wing rib assembly with angle adjustment completed

Since the outer wing attaches to the center wing with a dihedral angle of 3.45°, the №1 rib is not vertical but tilted by 93.45°. The spar web at the corresponding position was also cut out at that angle, but the angle was checked by applying a jig before gluing.

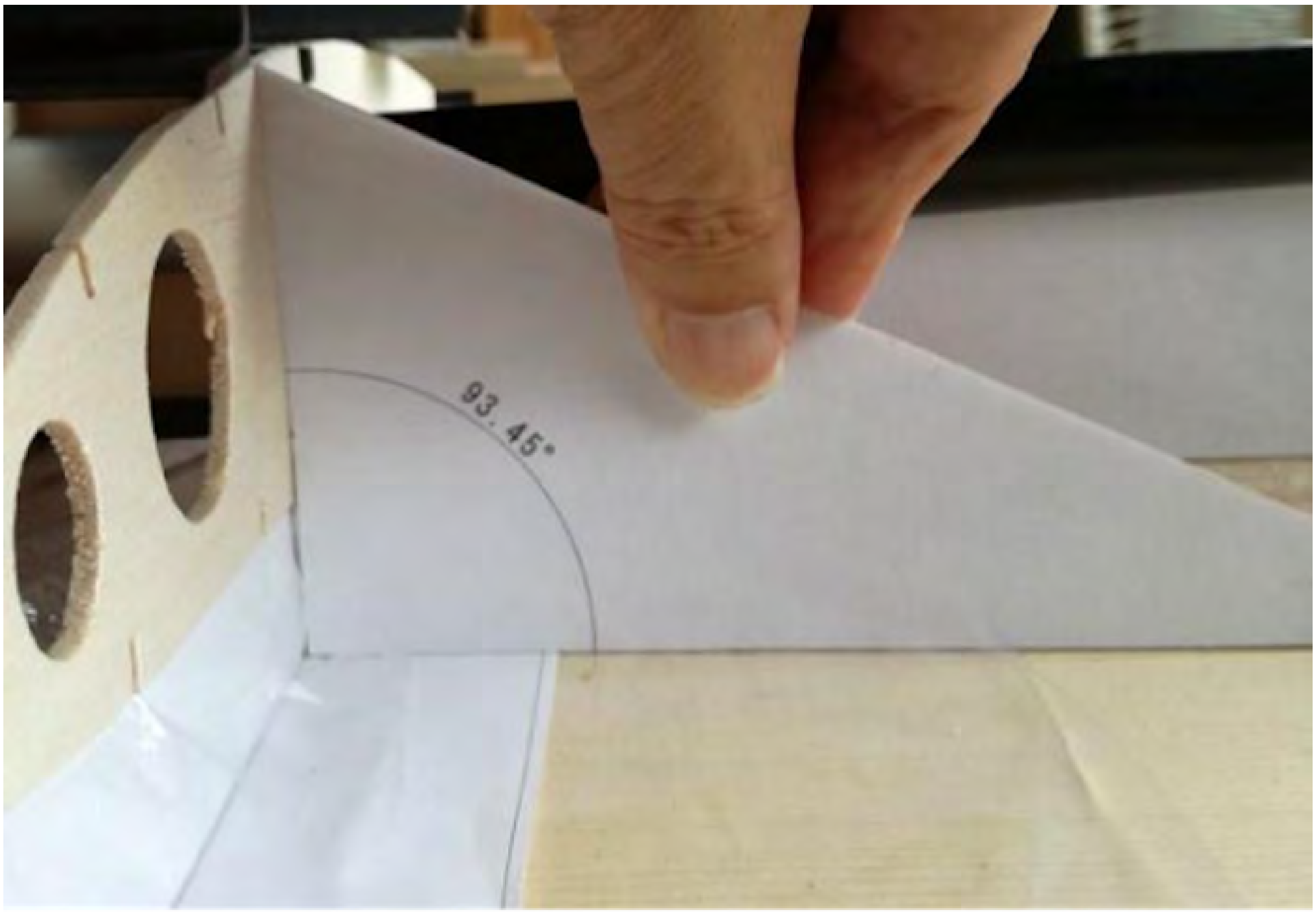


Photo 47: Adjusting the angle of №1 rib

Installation of the connecting pipe support

Next, I installed the pipe support. 21mm diameter holes are drilled in the corresponding positions on the №1 to №3 ribs. The front spar web has a slit to hold the support, so it can be attached quite accurately. However, since the connecting pipe determines the dihedral angle, I inserted the connecting pipe and applied a jig to check the angle before gluing it with epoxy adhesive.

Photo 48: Checking the angle of the connecting pipe

Assembly of the outer wing skeleton completed

The assembly of the outer wing skeleton has been completed through the above process. The assembly accuracy is good, the carbon spars are straight and the rib heads are aligned.

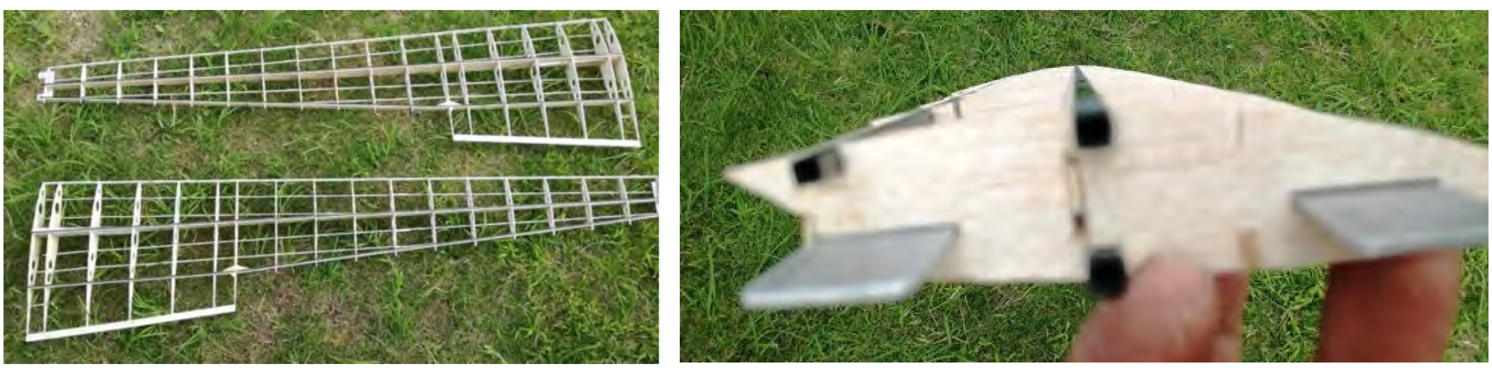


Photo 49: Completed outer wing rib assembly

I temporarily installed the aileron on the left wing (IPhoto 50). Since there are three aileron hinges, I was afraid that it would be difficult to install, but I confirmed that it could be done without much trouble. The operation of the aileron is also smooth.

Photo 50: Aileron installation check

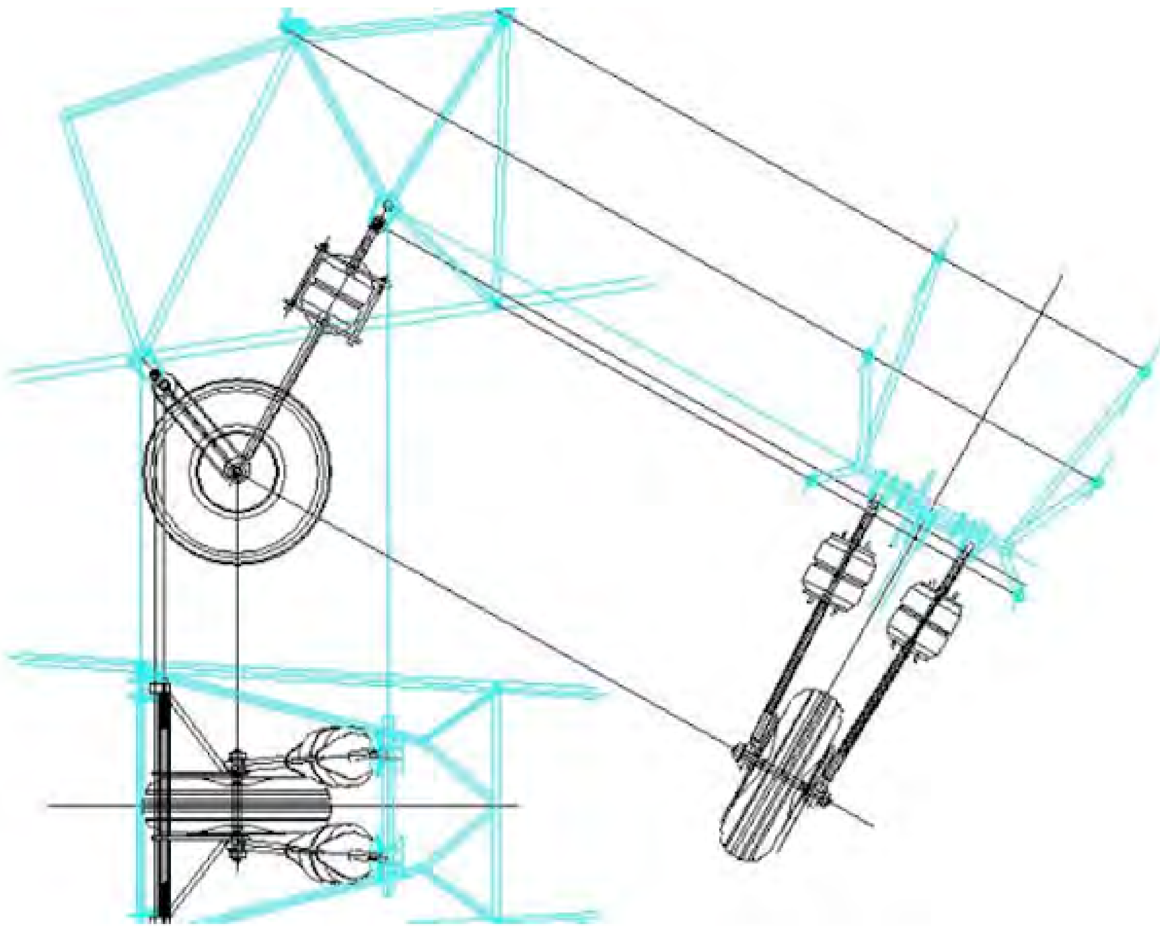
I took a commemorative photo of it alongside the center wing skeleton I had already made. It is about 140mm shorter than the finished product because there are no wingtips yet, but it is still very large.

Photo 51: Finished main wing rib assembly

Fabrication Part 9: Main Landing Gear Assembly

Drawing

This is the drawing of the main landing gear assembly.



Drawing 16: Main landing gear assembly

The main landing gear is a single-wheeled type, and its axle is supported by two support plates extending forward, and two struts extending rearward. The other end of the support plates are fixed to a horizontal axle perpendicular to the fuselage center line, and short stays are fixed to both ends of the axle. Two diagonal members are fixed between the support plates and the axle to prevent the wheel from shaking in the left-right direction.

Two large rubber shock absorbers are installed in the middle of the pillars extending aft and upward to cushion the landing impact. The pillars extending upward from the rubber dampers are attached to the trapezoidal truss structure inside the fuselage. The elevator and aileron control links are also attached to this truss structure, but in this model, the ailerons are driven by servos installed in the main wing, so only the elevator link will be attached.

Parts Fabrication

The main wheel is a 5-inch diameter wheel made by Duplo. The support plates and pillars are attached to it through the 5 mm diameter axle. The axle was made by one of my RC friends, Mr. Takamura, who is good at metal processing. The support plates and pillars are made from 2mm thick carbon plates and 5, 6, or 7mm diameter carbon piped. Rod ends with 5mm bearings are used to attach the axle, and 3mm bearings for the attachment of the rubber damper to the trapezoidal truss.

First, these parts were fabricated and purchased.

Photo 52: Main landing gear components

For the rubber damper, I bought a 40 mm diameter, 40 mm long rubber cylinder at a home center, and asked Mr. Takamura, who has a mini lathe, to drill holes and process the surface.

Assembly

Once all the parts were made, I assembled them. Since there are only a few parts, it is easy to assemble. Photo 53 shows the assembled main landing gear.

Photo 53: The completed main landing gear assembly

The outside of the damper is held in place by two M3 bolts. Between the upper and lower restraining plates and the bolts, there must be some slippage during landing, so a DURACON bushing is inserted.

I am satisfied with the completion of the main landing gear assembly, which is quite close to the real thing. The finished weight is 353g. This weight is within the target weight of the front body.

Fabrication Part 10 Aileron Counterweight

Aileron counterweights on the actual aircraft

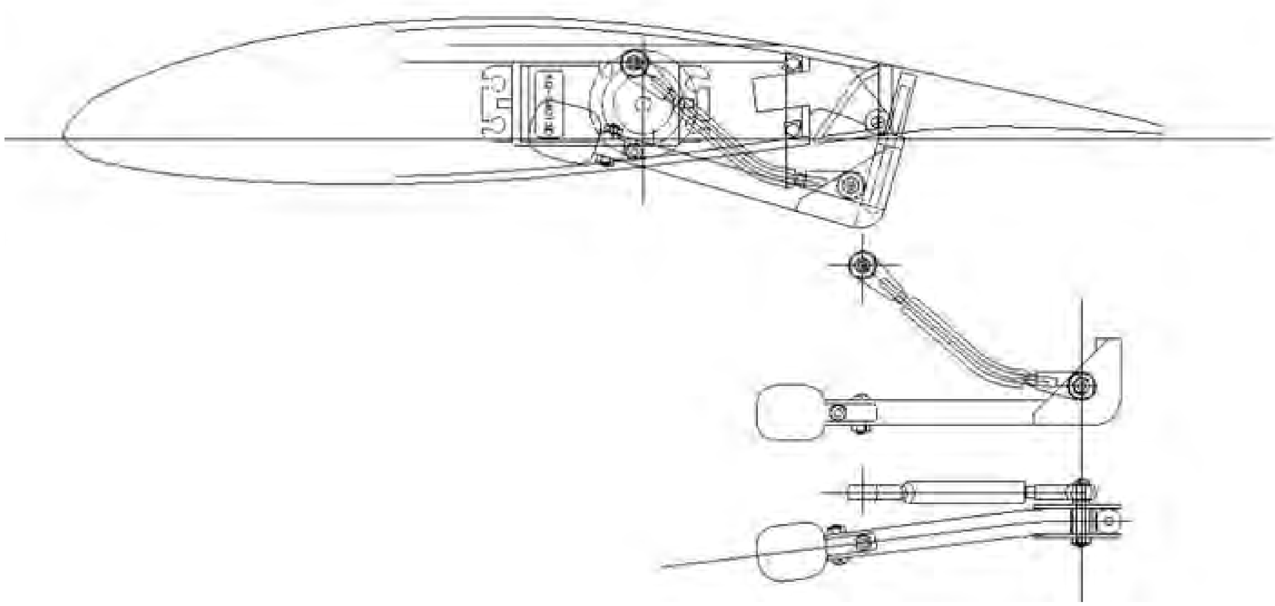
Aileron counterweights are installed on the actual aircraft to prevent fluttering of the ailerons, and they add an accent when you look at the main wings from below.

Photo 54: Aileron counterweights on the actual aircraft

The counterweight is a steel weight bolted to an arm extending from the horn where the aileron linkage is attached. This weight pops out from the underside of the wing when the aileron is raised, but is normally hidden inside the wing. For this reason, there is a hole in the underside of the wing for the weight to be stored. The photo on the right shows the weight when stowed, looking up from under the wing. The aileron control rod also sticks out from the underside of the wing, so it has a hole drilled in it as well. The purpose of this fabrication is to make a model of the counterweights, aileron horns and rods.

Drawing

First, I drew a drawing as usual.



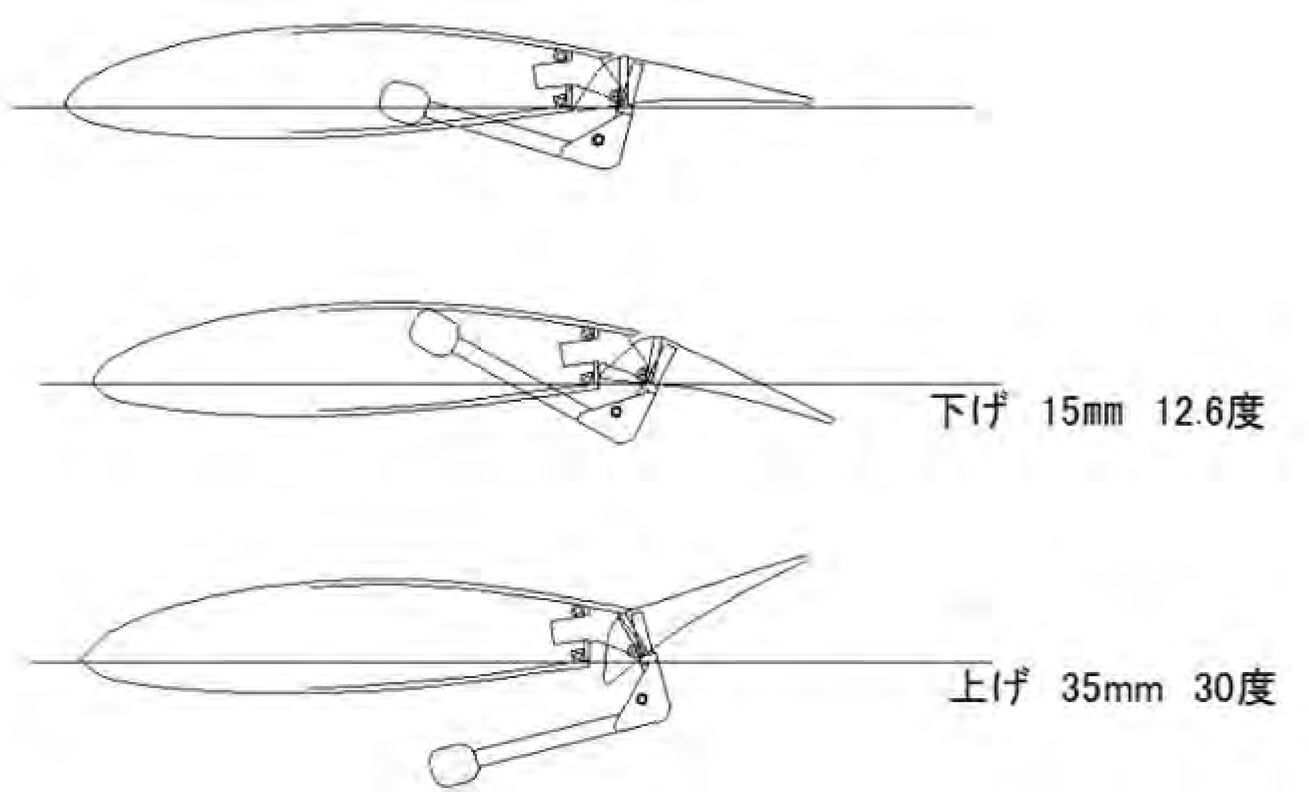
Drawing 17: Aileron counterweights and links

As I was drawing this drawing, a question arose. I had assumed that the aileron should be mounted so that it can move up and down by 20 to 30 degrees, but this would cause the counterweight to stick out on the upper surface of the wing when the aileron is lowered. Aileron differential is also often used, but its purpose is to reduce the angle of the downward aileron from that of the upward aileron in order to avoid adverse yaw caused by the higher drag of the downward aileron than that of the upward raileron. Adverse yaw is the yawing moment that causes the nose of the aircraft to point in the opposite direction of the intended turn. For example, if you want to turn right, you raise the aileron of the right wing and lower the left wing aileron to bank right. If the upper and lower aileron angles are the same, the drag of the left wing with downward aileron will be greater than that of the right wing with upward aileron. This will cause the nose to point in the opposite direction of the intended right turn, making the aircraft extremely difficult to control. In order to avoid this problem, the lower and upper angles of the ailerons are set differently, and the ailerons of my 1/5 Mita model are set in such a way.

However, the ailerons of the actual model and the 1/3 model are of the frise-type. This type of aileron was devised to eliminate the aforementioned adverse yaw, and the aileron leading edges protrude from the underside of the wing when the aileron is raised to act as resistance. I had assumed that the aileron up and down angles would be the same since the frise-type ailerons would no longer cause adverse yaw. However, the counterweight is stored in the wing, and if the angle is the same, it can only be moved by 10 or so degrees at most.

I asked the Shizuoka Aviation Museum to check the airelon angle of the actual aircraft and found that it has a differential. The downward angle was 12 to 13 degrees while the upward angle was almost 30 degrees, which was quite a differential. It is unclear whether the differential was used in combination with the frise-type aileron because it was not enough to prevent adverse yaw, or whether the differential was used as a result of avoiding the counterweight from protruding from the upper surface of the wing,but this clarified my question and allowed me to proceed the design.

Drawing 18 shows the aileron operating range of the 1/3 model. The aileron control rod is perpendicular to the leading edge of the aileron that has a forward angle due to the tapered outer wing, but the counterweight strut faces the airflow direction. Therefore, the counterweight struts are bent to open outward. The aileron control rods are also bent so that they do not hit the bottom of the wing trailing edge. The drawing 17 was made based on these factors.



Drawing 18: Aileron operating range

Parts fabrication

Photo below shows the parts manufactured based on the drawing.

Photo 55: Aileron counterweights and related parts

The counterweights are machined from a round aluminum bar and are hollow inside. Lead will be melted and embedded in them. The aileron control rods are made of a 5 mm diameter brass rod. The aileron horns to which the post and rod are attached is made of 0.5 mm thick brass. A 6 mm diameter brass spacer with a 2 mm diameter hole is attached to the rear of the horn's triangular shape, and a 4 mm diameter rod with a 2 mm thread is embedded in the aileron. A long M2 bolt is inserted from the bottom of the spacer and attached to this rod.

At both ends of the aileron control rod, attach the adjustable rod ends used for RC helicopter linkage, and fit them into the 5 mm diameter balls attached to both the servo and aileron horns.

Completed assembly

These parts are assembled and soldered.

Photo 56: Finished aileron counterweights, etc.

I still have not melted the lead into the aluminum counterweight. I was satisfied with the result, which was almost exactly what I expected, but later when I actually installed them on the aileron, I discovered a problem and had to recreate them.

> **Mistake №6:** *The problem is that the restraining force in the direction of rotation is weak and a little force will cause it to rotate.*

There are two causes.

1. The whole thing is made mainly of brass, so it is heavy and has a large inertia force.
2. Weak restraining force in rotation because it is attached with a single M2 screw.

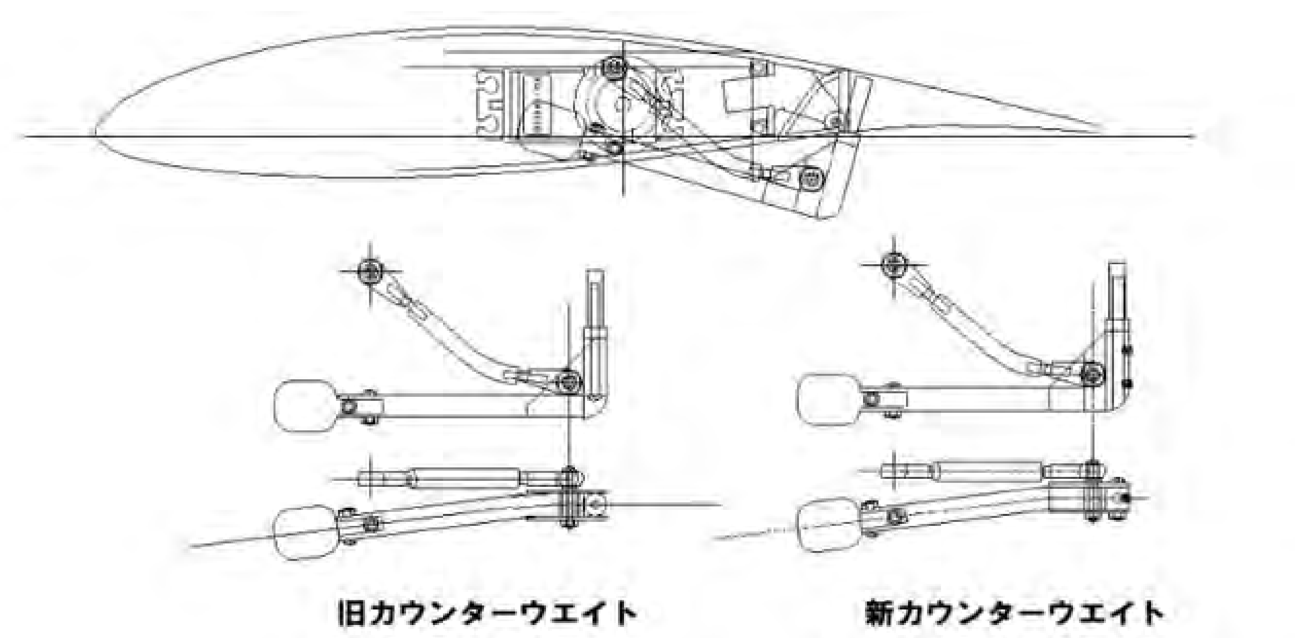
Re-worked aileron counterweights

I made an improved design with the following measures to address the two causes above.

1. Make the whole thing mainly of aluminum to reduce weight

2. Change the mounting method to inserting the counterweight into the 3mm piano wire and fixing it with two immobilizing screws.

A comparison of the old and new counterweights is shown in Drawing 19.



Drawing 19: Comparison of old and new counterweights

Photo 57 shows a counterweight that was re-made based on the new drawing.

Photo 57: Remade aileron counterweights, etc.

The brass part is embedded in the aileron. A 3mm piano wire is fixed in this part and extends downward. The piano wire passes through the aluminum prism at the rear end of the horn where the counterweight is installed. You can see two screws on the aluminum post that hold the piano wire in place. The curved rod with rod ends on both ends connects to the aileron servo, which moves the aileron together with the counterweight.

Although it is called a counterweight, I did not melt lead into it to reduce inertia. Since the speed is much slower than the actual machine, I thought there was no need to worry about fluttering, so I gave priority to reducing inertia. The holes were filled with putty. The weight of the completed new counterweights is 19g each. The old one weighed about 35g. The new counterweights are now 46% lighter.

*This is the third part in this series. Read the **next article** in this issue, return to the **previous article** in this issue or go to the **table of contents**. Downloadable PDFS: just this article or this entire issue.*

Bob Jennings' Fouga Magister in the moonlight at the Great Orme. (image: Phil Cooke)

The Trailing Edge

Wrapping up June and heading into July.

The NEW RC Soaring Digest Staff Follow
Jun 14 · 3 min read

I said to Phil Cooke, who provided the beautiful photograph for this month's edition of *The Trailing Edge*, "the only problem we're going to have with this is convincing readers it's a model glider and not the real thing." But Phil tells the story so much better than we can:

> *"The moonlit Magister! Bob Jennings flying his 1.7m span PSS Fouga, built from the Island Models kit and complete with working nose light! The photo was taken well after 9pm during the last half hour of daylight at the end of a successful PSSA event on the Great Orme*

> *in May. The forecast for the following day was, by contrast, very poor and a small group of flyers elected to miss their evening meal and fly on until dark to capture the very most from the day. Slope soaring scale models can be so enthralling, it's very difficult to leave the slope in such perfect conditions. De-rigging and loading the car in the dark is equally challenging as we soon found out!"*

It's a unique, moving and inspiring image, Phil, and thank you for the opportunity to use it. It conjures up perfectly the notion of 'summer night' as we approach the solstice and the attendant desire to stretch out a magnificent flying day as long as we possibly can. If we're really lucky, beyond sunset and into the moonlight as the PSSA folks did.

Once again, we want to thank all those who contributed the great articles for this issue and to you, the readers, for reading them. Hopefully you wrote some *Responses* or added some *Claps* for the authors so they know you appreciated their hard work. June is done and the inexorable march towards July begins. For those who would like to contribute an article (or two, like Kawakami!) the July deadline is **2021–07–11**. If it seems like these deadlines come really fast, it's because they *are* coming really fast. By December of this year, we hope that issue and subsequent issues come out on the first calendar day of each month — very easy to remember and anticipate.

All proceeds from the sale of this product directly support the operating costs of the NEW R/C Soaring Digest.

I guess the one downside with RCSD is all the advertising you have to wade through to get to the good stuff. Oh, right, **there isn't any**. We think that's the ideal experience for the reader and we're quite sure you agree. However, that doesn't mean RCSD doesn't cost anything to produce — it costs quite a bit, actually. So you'll forgive us if we hawk a little merch to help keep the wheels spinning and keep RCSD free. But you can help out, if you so choose, with the purchase of one of the soon-to-be-collectable *RCSD Cover Photo T-Shirts*. You can get the January, February, March and April editions now and May and June will be out shortly just as soon as we have our new, European-based manufacturing ramped up.

Also, we're still putting together our *Friends of RCSD* program (previously known as the *Corporate Sponsorships* program). If you feel that it might be a program for you, with all of the corporate goodwill spin-offs that go with it, we would love to hear from you so please get in touch.

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

So 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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