Radio Controlled

Soaring Digest

May 2022

Vol. 37, No. 5

The New RC Soaring Digest

May, 2022
Vol. 37, No. 5

Click on any row to go directly to that article.

In The Air

RC soaring is not a crime.

Terence C. Gannon

A clip from ‘Slope Soaring Over Costco’. See Resources section below for full video. (credit: M. Klement)

There’s a Costco big box store not too far from where I live which stands just east of a great slope that runs due north and south for about two or three city blocks. The crest of the slope runs parallel to a road which is home to mostly light industrial tenants and low volume retail, so most times in the evening the street is empty. There’s a couple of parking spots at the north end of the slope about 20 or 30 paces from the best place to launch. My wife Michelle can sit in sheltered comfort parked parallel to the fall line. There, she can either knit or read while she also watches me stagger around the slope trying to make the best of the flagging evening breeze.

Any wind blowing from the east through south-southeast creates choppy but workable lift — not ideal, but when weighed against the convenience and seclusion the slope offers, it's one of my favourite spots to fly. Raptors and crows seem to agree, as they can be seen laughing their asses off at me way below, struggling to stay aloft. The Costco roof, when it has been baking in the summer sun all day, can even kick off some almost-workable thermals. If the work schedule only allows 40 minutes on a warm summer evening, it's perfect. It ain't Pacific City — not even close — but it's gritty urban soaring at its finest.

I sometimes wonder, as the airliners working Calgary International Airport's runways 17/35 pass in the distance, whether I am running afoul of the to-the-surface Class C airspace that surrounds CYYC. That would definitely be a fly in the proverbial tincture. Admittedly I am not *so* concerned that I actually stop flying, but I figure my little foamy flown tight into the slope really isn't a hazard to navigation for anybody. Except those raptors and crows, of course. Reckless, some might say, but my excuse is that I am a vestigial holdover from the pre-drone-triggered-regulations past. Back then, so long as you used your head, were respectful of your neighbours and avoided any proximity to airports, almost any open space was a potential flying field. It's a hard habit to break.

Don't get me wrong: I am a firm believer society is generally a little better off if we all follow the rules. I file and pay my taxes mostly on time, set my cruise control for no more than 7km/h over the speed limit and I park between the stripes in a parking lot even when it is completely empty. In other words, I like to think of myself as a generally law-abiding citizen. At least for the laws that actually make sense. Give me a rule to which I can reasonably comply, and I'll follow it.

So when I received a rather ominous-looking broadcast email for the

President of the Model Aeronautics Association of Canada (MAAC) with the subject *MPPD-15 Altitude Limit Policy*, my heart first went into my throat and then sank shortly thereafter. Opening it, I was informed of "*MAAC's decision to institute a default altitude limit of 700' for all MAAC RPAS operations, namely radio-controlled flying models*".

What the...?!

In order to not fall victim to the folly of making snap judgements based on a headline — who ever does that, right? — I steadied myself on some nearby furniture lest I swoon, breathed deeply into a paper bag and read on:

> *...many existing and potentially other sites that may be approved to operate at higher altitudes, which is why we have included a simple Altitude Waiver Request Form in MPPD-15. This will allow clubs with disciplines operating above 700' AGL to request a more suitable limit, and to open the discussion of what common sense precautions are needed to be responsible at those altitudes and in the specific airspace...*

Oh. So that means that so long as a group of like-minded glider guiders is willing to fill out the simple, one page form with some very reasonable questions and wants to fly on a field they've likely be flying on since — well — forever then it's pretty much business as usual. At least that's my interpretation of it.

A number of years ago I wrote *Where Did All Those Drones Come From?* (and reprinted it here in RCSD) which painted a fairly bleak picture of a dystopian future for anything that flies without the aid of a human pilot. I concluded that missive with mournful thoughts of "*rubber powered stick-and-tissue airplanes curling through the sky and wonder*[ing] *if, like the days of my youth, they are lost forever.*" In other words, whether a future trip to the local city park with a DLG may result in hard time. I genuinely feared

that's where things were headed.

The news from MAAC therefore comes as a huge relief.

To bring this full circle, let me return to the launch zone above Costco — is flying on this slope 'legal' or not? Fortunately, the MAAC email had a big chunk of the answer for that, as well: *RPAS Wilco*. I had some vague notion of this free mobile app (a least the name rang a bell) but I had no specific knowledge of what it did or how it worked. But it was promoted as the officially-sanctioned way of determining the status of a particular flying site with respect to restricted air space, which was good enough for me to initiate a download from The App Store.

Turns out that *RPAS Wilco* is a live, digital map with red-shaded regions for restricted airspace up to 400 ft above-ground-level (AGL) and blue-shaded regions for restricted airspace from 4800 feet above mean-sea-level (MSL) and up, respectively. Therefore, I can finally stand at the top of my favourite slope with my *Alula* in one hand and *RPAS Wilco* in the other, and know exactly where I stand with respect to the law.

Case in point: based on a 'site survey' completed with *RPAS Wilco* at the *Col de Costco* I'm good to at least 400 AGL. Maybe even the new 700 foot default altitude mentioned in the email, given that the blue-shaded region kicks in at about 1300 feet above the launch zone at the top of the slope. Life is good.

For those who think that either the 400 or 700 feet altitude limit is too restrictive, I beg to differ. The left is 'at the surface', whereas the middle is 400 feet and the right is 700 'above ground level'. Candidly I can't make the Dream-Flight 'Ahi' out clearly at either 400 or 700 feet. Therefore, if I can at least see the Ahi at altitude unaided when it's right over head, it almost has to be below 400 feet AGL. Your mileage may vary, of course. (credit: M. Klement)

There are, however, a few additional boxes which need to be ticked to fully green-light sanctioned flight ops at this location: the Costco site is 1.9NM from the helipad at a local hospital. That will have to be covered off with some paperwork. Also, the whole issue of surface access to the site must be resolved. Who actually owns the *Col de Costco* is as yet undetermined, but it seems reasonable that permission could be granted to use the otherwise vacant site in such a low traffic, basically industrial area.

On the flip side, there are sadly a few sites I have flown in the past which are no longer options. I also know that **for sure**. But I'm not going to bitch and whine about my 'freedoms being taken away'. Life teaches you don't always get exactly what you want — compromise is simply what you have to do to live in civil society. But given the *Handmaid's Tale* future I visualised in my earlier essay, I'm relieved that this thing that we love to do has no prospect of being a crime at any time in the reasonable future.

At least so long as we also continue to use our heads and are respectful of our neighbours.

Obviously, the article above is very specific to Canada. The experience of readers in the over 90 other countries in which the *New RC Soaring Digest* is regularly read will be different and likely unique to where you live and fly. I urge you to engage with your local community to determine where things stand with respect to your particular jurisdiction. But the story in Canada is not an altogether bad one. In fact, I think of it as actually having a happy ending. Therefore there's at least the promise it can be so for you, too. Or perhaps even better than what has already been achieved here in Her Majesty's chilly dominion across the sea.

Furthermore, if you care to write-up the state-of-the-nation in your particular part of the world, please consider passing it along to the New RCSD, and we'll run that and let others in your neighbourhood know where things stand.

It's really important to stress the situation here is a result, in no small part, of the tireless volunteer efforts of MAAC working in collegial cooperation with the competant and reasonable professionals at Transport Canada. I am more re-assured than ever that all involved in these efforts are truly committed to safe skies, open and available to all for all manner of aerial persuits.

New Publication Deadline

After one too many all-nighters getting the latest issue of the New RCSD out, I was on the verge of a bloodless (hopefully?) coup when it was suggested "why don't you just move the submission deadline to the middle of the month?" As with all things new and different, the visceral reaction was that would never work. Until we thought about it for something like, I dunno, three seconds. Problem solved. Decision made. From here on in, and until you hear

otherwise, the new deadline for RCSD submissions is the end-of-day **on the 15th of the month** preceding the month in which the story runs. Of course, if you can't make the 15th, we'll still happily accept your article for the issue *after* the next issue.

Events

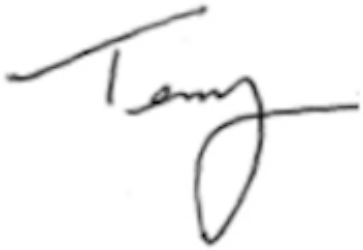
One of the commitments we made when RCSD launched into 2022 was to do as much as possible to encourage grassroots participation. This will be aided in no small part (hopefully!) by our *Club in Focus* articles, our *Clubs* page, and starting this month, with renewed attention on **not**-virtual get-togethers featured on our *Events* page which appears on the main navigation bar (and linked in *Resources* below).

Given that it's coming up so quickly, make particular note of the ***Sky High Spring Aero Tow*** in Williamsport / Muncy, Pennsylvania on May 12–15, 2022. That's still a couple of weeks away at the time of this writing, so still lots of time to make plans to attend. The flying field, based on Jeff Duhaime's beautiful picture, looks absolutely out of this world!

Please **let us know** if we can add your event to the RCSD *Events* page!

Okay, RCSD readers, I have once again overstayed my welcome, I'm sure, so please scroll to the bottom of this article and have at the May issue. We feel fortunate to have you as our audience and we are deeply thankful to all who helped make the May issue the success I know it will be.

Until next month, fair winds and blue skies.



Resources

- ***Slope Soaring Over Costco*** — the full video for the clip featured in the key GIF above.
- ***MAAC MPPD-15 Altitude Limit Policy*** — the document which was the trigger for writing this article in the first place.
- ***RPAS Wilco*** — the Apple app mentioned in the article which is used for determining the status of air space around your favourite Canadian flying site. Also available for **Android.**
- ***Where Did All Those Drones Come From?*** — the dystopian future I forecast a number of years ago that now seems much less likely given recent developments.
- ***Club in Focus*** — as often as the NewRCSD receives submissions, one or more of these articles will be featured in each issue.
- ***Clubs*** — once it has been featured as a *Club in Focus*, the organization then gets added to this page for future reference.
- ***Events*** — Much more than your grandfathers events page — you should really take a look. Have an event you want to add to the page? **Let us know!**

Cover photo*: The outstanding photo is by multi-RCSD-contributor Raymond Esveldt. Unfortunately, the details of the photo are lost to history, according to Raymond, with "taken during an aerotow event a few years back in the Netherlands" being his comment. Perhaps there is a reader out*

*there who can provide more? But regardless, thanks to Raymond to permit this beautiful photo to be used for the May, 2022 cover. Also, you are welcome to download the May cover in a resolution suitable for computer monitor wallpaper (**2560x1440**).*

*Here's the **first article** in the May, 2022 issue. Or go to the **table of contents** for all the other great articles. A PDF version of this edition of* In The Air*, or the entire issue, is available **upon request**.*

Letters to the Editor

There's lots in the mailbag this month, some of which is really 'meta'.

The NEW RC Soaring Digest Staff

We hit the motherlode when we heard from Simine Short (see her letter below). She provided us with a treasure trove of stamps to add to our montage. There are five new ones this month. Can you spot which ones?

Needs Glider Transition Training Material for Spektrum NX-Series

My name is Bob Mandeville and I'm a new reader. I just discovered your site yesterday but please don't take that as a 'slight' to your publication. I surfed across it because I was starting to indulge in my recent decision to explore RC soaring. AAMOF, I immediately passed this along to a friend who is in a similar situation. Within the last 24 hours, he's already ahead of me in

reading your back issues!

My reason for writing is to ask for a bit of assistance. For background, I'm a fairly accomplished power-plane pilot (20+ years) but an absolute neophyte when it comes to anything more than simple sailplanes like a *Bixler*. In order to test the waters of 'real' sailplane soaring, Santa put a FMS ASW-17 2.5M under the Christmas tree and I am anxious to fly it. Granted, it's not an elegant machine but it's a good stepping stone towards flying more sophisticated soarers. I'm starting it's build-up soon.

My friend and I have recently gotten new Spektrum NX-series transmitters. We were both exploring the menus soon found that programming a sailplane is not the same as programming for power. We understand basic concepts like `Crow`, `Camber` and `Reflex` but we don't understand how or why to program these setups in transmitters whose menus are so convoluted. I began to wonder how many others like us might be out there as well?

Can you tell me if anything been written for programming the NX-series or other transmitters for sailplanes for someone with our (admittedly low) level of expertise? What I am hoping to find is some kind of guidance, hopefully in your publication, that would not only show the 'how-to' but also the 'why' for the programming. If this isn't available yet, perhaps this might spark an article or series of articles for those of us who are somewhat clueless wannabe glider guiders who wish to up their game and step into a new realm of RC flight.

For the record, my intent was not to find a *Camber for Dummies* article out there, but rather to find something for us 'power' pilots who are reasonably educated in the ways of RC transmitter programming, but who are expanding into a new area and looking for guidance from someone who has

been there, and not having to make (wrong) guesses on our own.

Thanks, in anticipation, for RCSD readers help with this!

Best Regards,
Bob Mandeville
Brockton, MA

Bob — while nobody here in the home office is aware of any such material, we're hoping that your letter might turn something up or, better yet, prompt a reader to become an RCSD contributor and write one. It sounds like a really valuable resource! — Ed.

Source Material for 'Glider Mail' Still Available

Enjoyed reading the latest issue and also seeing the article *Glider Mail*. For those readers who are interested, my book is still available from various Amazon sources, as well as the American Air Mail Society. Cost is about $12. And this is what the cover looks like. Again thanks for the extra publicity!

Simine Short

Simine —thank you for writing in and we're only too happy to pass this

information along to readers. We should also add that Simine is editor of the Bungee Cord *which is the excellent quarterly publication of the Vintage Sailplane Association which we have linked in the* Resources *section below. — Ed.*

More Boss-T Love

When I was just a lad, I wanted to fly a big RC glider but I only had a two-channel radio. So when I saw a kit for a 120" span plane called *Boss-T* that could be flown (so it said on the box) with just two channels I had to have it!

Many years later (the *Boss-T* having long gone to the great building board in the sky) I made contact with Don Burt and asked if he still had any copies of the plan. He did, and I ended up with an old dyeline print — Don even dated it so it would qualify for vintage comps.

When Terry mentioned the *Boss-T* in RCSD, I told him I used to have one of those — and still had the plan. Unfortunately the dyeline printing was not just fading (as all dyeline printing does), the paper itself was falling apart after 50 years. It was a big plan so when I laid it out on the table, it would overhang both sides and where it had been folded, it started coming apart simply under its own weight.

Any idea of redrawing the lines with ink was hastily forgotten and all the pieces were glued to some spare sheets of foam-board. They were then scanned and pasted together, you can see the finished result is a mosaic of hundreds of individual images. Hopefully this can be redrawn and we may yet see more of these big lightweight (35oz) floaters in the air.

Best Regards,
Steve Kerry
Kingston upon Hull, UK

Steve — thanks so much for sharing this story of how the plan came to be in the article. Also, it provides me with another opportunity to publicly thank you for your efforts in this regard. — Ed.

Resources

- ***Vintage Sailplane Association*** — from their website: "The purpose of the Vintage Sailplane Association (VSA) is to promote the acquisition, restoration and flying of vintage sailplanes by its members, and to assist the National Soaring Museum in the preservation of soaring history and the promotion of vintage sailplane activity."
- ***American Air Mail Society*** — from the website: " Here you can find 47 different categories that have appeared as Sections in the American Air Mail Catalogue from the 1st Edition in 1935 through the 7th Edition with the latest volume published in 2017…"
- ***Glider Mail*** — as it appeared in the April, 2022 issue of the New RC Soaring Digest.
- ***Don Burt's Groundbreaking Boss-T*** — also as it appeared in the April, 2022 issue of the New RCSD.

*Send your letter via email to **NewRCSoaringDigest@gmail.com** with the subject 'Letter to the Editor'. We are not obliged to publish any letter we receive and we reserve the right to edit your letter as we see fit to make it suitable for publication. We do not publish letters where the real identity of the author cannot be clearly established.*

*Read the **next article** in this issue, return to the **previous article** in this issue or go to the **table of contents**. A PDF version of this article, or the*

*entire issue, is available **upon request**.*

An Epic Maiden

Have you ever been crazily obsessed with a new airplane? I have.

Mike Poser

This article originally appeared in the November-December 2021 edition Model Aviation Canada*, the official publication of the Model Aeronautics Association of Canada. It is reprinted here with their permission and our thanks. — Ed.*

Meet *Twister*, a Euro-built three-metre 'moldie' —a slope glider molded from carbon composite. I think they named it *Twister* because of how fast your head has to spin to keep up with it.

After its sheer size, what is most striking about this soaring beauty is its

immaculately clean design. All elements support the designer's mission to minimize drag. IDS control linkages are internal. The finish is mirror smooth. The elegant lines stream the air. From its first high speed pass over my home field in North Vancouver (NVRCFC), I was in love.

Twister uses an Integrated Drive System (IDS) in wing to eliminate the drag of external control horns.

Twister has an electric motor for launching from flat fields. After testing and trimming in North Vancouver, *Twister* begged to be unleashed where it can soar — in the big outdoors on the side of a mountain.

My favourite slope beckoned for the maiden alpine flight — a five-hour drive from Vancouver — but well worth the trek. I gathered my flying and camping gear, crammed it all into my trusted red Jeep Cherokee and headed out to experience my dream flight adventure.

I arrive at the spectacular site, located five thousand feet above the Similkameen river valley, in the interior mountains of BC. Sunny skies and a fifteen-mph wind straight on to the hill make perfect conditions for the maiden. I watch the hawks effortlessly gain altitude, so I know slope and thermal lift are abundant.

Like many alpine slopes, the landing here is tricky — it is the side of a mountain, after all. There is only a small ridge plateau to set down on before you fly back out into the lift zone. I am only a very occasional sloper and it has been several months since my last sloping session. So I practice first with my Phoenix, a two-metre foam beater I use for probing out lift. I complete a few landings to make sure I still have it wired.

It is late afternoon by the time I am finally ready to maiden the *Twister*. Wind and weather are perfect. I know the *Twister* will fly faster and with more

agility than any sloper I have ever flown. A few last-minute control checks to calm my nerves and I am ready to launch. I stand alone on the mountain — just me and my big red and white glider.

Suddenly I hear a ruckus in the air behind me. An immense flock of migrating cranes arrives, whooping and screeching some six hundred feet above the launch site. They work the mountain lift to gain altitude, swirling around in the sky like a tornado. The sun glints off their light-colored bellies. It is a spectacle.

"I'll never again have such a big audience," I chuckle to myself. This is the moment. I launch. *Twister* climbs straight out as if gravity did not exist. I reach two hundred feet above the slope, level out and begin to trade altitude for speed. *Twister* builds momentum in big descending circuits.

Slope soaring is all about energy. The magic is in converting the power of the wind into exhilarating high speed flight. In strong lift virtually anything will fly on the slope, but flying a molded composite glider is an experience like no other. The speed, sound and precise handling of a moldie is like tearing up the road in a Ferrari.

Twister banks sixty degrees, almost knife edge. She whistles through consecutive figure eight turns, easily over eighty mph. Energy retention is superb. She carves over the alpine terrain with the precision of a ski racer. I am lost in the thrill.

"Signal strength eighty percent!" My transmitter's synthesized voice warning rudely breaks *Twister*'s spell on me. The model has built-in telemetry that monitors key flight parameters. Telemetry is new to me and I am startled by the unfamiliar warning. I have already thoroughly range tested the radio so I continue flying. I don't want this joy ride to end!

I tighten the circuits to keep the plane closer to me — just in case. The glider builds more speed. I break out of the circuit into a graceful axial roll without losing any energy. There is so little drag on this airframe.

"Signal strength seventy percent!" the Spektrum transmitter warns me. I have been flying ten minutes now with no sign of a control glitch. These warnings are starting to get to me. A few more laps.

"Signal strength sixty-five percent!" *Twister* could stay up all day in this never-ending lift, but I decide to investigate and risk an early landing.

The trick to landing here is to descend into the gulley behind the main slope, work off the speed and then skim up the hill and land at the crest. It usually takes a few go-rounds to get it just right. Too fast and you overshoot and fly back out into the lift. Too slow and you risk stalling below the crest and slamming into the steep part of the slope. Unfriendly rocks there would make this a tragic mistake.

I bring *Twister* around behind me, drop flaps and aim toward the landing area. I discover that the big flaps, which slowed the plane to a virtual crawl in North Van, have much less effect here in these strong alpine conditions. So I wash off more speed and go around, lower this time. Even with full flaps deployed, *Twister* refuses to come down. The thin wings are so slippery. This glider just wants to fly!

I guide *Twister* deep into the gulley, climb up the back and she slows at last. One more turn, just this side of a stand of trees and then head back up the slope to land. Just like I did with the smaller glider…no need to worry…lots of space between the glider and the trees.

Whack! *Twister* clips the tip of the tallest pine, some hundred feet up. The glider spins ninety degrees and dives into the tree. The top of the pine

shakes. The gulley echoes with the sound of cracking branches. I am stunned; utterly in disbelief in what I have just done.

It was pure pilot error. And a hard lesson. After flying the smaller plane, I simply hadn't compensated enough for distance with this massive glider!

After I stop cursing, despair sets in. There I am, alone on a mountain. My cherished *Twister*, still in one piece, is impossibly out of reach. No way can I climb that tree. What to do?

Twister was my first electric high performance moldie. It had taken months to build as COVID delayed the arrival of critical components. I invested countless hours of research into proper set-up techniques. I fitted it with top-of-the-line gear. I couldn't just leave it there to be blown down someday and be found in pieces by a hiker.

As the light starts to fade my despair gives way to resolve. *Twister*'s story cannot end here. I must retrieve this plane intact…somehow.

Paragliding is popular in this area so my first thought is to call Search and Rescue (SAR). Surely the local SAR folks have dealt with paraglider tree rescues and can refer me to a specialist. I have one bar of cell reception. I hold my breath that the call will go through. It does. The SAR technician is amused by my request but unable to refer me to anyone. He suggests I call an area arborist.

I attempt an internet search for local arborists, but the data signal up here is fickle. It drifts in and out like the thermals. I wait for my iPhone screen to load. I dial several tree specialists. No response. It is now past business hours and getting dark. I worry that the glider may blow down in the night. Ripping itself apart as it crashes through the branches. As a last resort, I send out a text instead.

`Retrieval from large tree needed. Can you help?` I am deliberately sketchy on the details so as not to scare off a potential rescuer. Within minutes I get a response from Scott.

`Cat?` he asks.

`Glider` I respond.

I text him my general location and a picture of the tree with the glider barely visible at the top.

`Dude, I am $200/hour. Driving up from Penticton. Gotta rearrange other jobs` he responds.

Yikes.

`How confident are you that you can reach the plane and safely lower it down to me?` I ask.

`Confident!` he quickly replies. We negotiate on the price and quickly reach a deal. Scott will arrive at 7am in the morning.

Mercifully, the wind calms. The glider appears to be settled in its perch for the night. I feel hopeful.

By now it is dark. I find a flat spot close to the tree to park the Cherokee. I crawl into the back and bunk down for the night. In the darkness, I do not realize I have parked my red metal monster over a badger hole. The poor little guy must be as stunned as I was when that giant pine stole my glider.

I awake to the sounds of scraping metal as the badger works to dislodge my vehicle. I move the Cherokee and after a well-deserved scolding by the badger we part as friends.

Scott arrives right on time. He is accompanied by assistant Austin and canine pal Daisy. Scott has a big smile, an engaging Kiwi accent, and a can-do attitude. His confidence is contagious. My hope goes up a notch.

We get to the base of ‘the tower’. The tree is still holding my glider hostage. I explain to Scott how to remove the wings and provide him with a wing bag to lower them down through the branches. I am still imagining that the damage to the airframe is minor.

“How big is this glider?” he asks.

“About ten feet” I answer. Scott’s eyes glaze over. He looks up at the skinny treetop. I can see he is struggling with the thought of disassembling a ten-foot plane on a treetop eighty-five feet high.

“What if we set up a zipline?” Scott suggests, “Austin can walk the line out, away from the tree. I’ll tie the glider on to a sling and slide it down to you.”

“Brilliant!” I say, “Let’s do that.”

Fully equipped with ropes and climbing gear, mountain man Scott makes his way to the treetop; pruning and cutting obstructing branches as he goes. He gently climbs the last portion so as not to shake the tree and have the plane fall out before he gets a grip on it.

Scott climbs toward Twister while Austin and Daisy look on.

"It looks pretty beat up," he calls down, "Must have hit hard. One wing is badly chewed."

Sigh! My hopes fade of *Twister* emerging unscathed. Turns out that the thin carbon wing skins, which provide great stiffness, crack like eggshells on impact.

Twister on the zipline.

One more branch and Scott reaches the plane. It is wedged firmly into the treetop. He carefully pulls it free and attaches a sling. He clips it fully assembled to the zipline and releases it.

Twister, freed at last, finishes the remaining eighty-five feet of its landing, tethered. It arrives into Austin's waiting hands. Maiden flight complete!

Left: Austin, triumphant. | **Right**: Scott (holding Twister), Austin and Daisy.

I settle up with Scott and he offers me a discount to help pay for the repairs. He is genuinely sorry to see the damage. His empathy touches me. Wow! I thank Scott and Austin heartily.

The fuselage and tail emerged unscathed from the ordeal, thanks to Scott's

careful handling. Both wings suffered severe leading edge damage on impact.

It is possible to repair molded wings, but they never look or fly the same. I plan to order a new set of wings from the importer, Soaring USA.

Some might say that launching a delicate glider off the side of a wooded mountain is a fool's errand. If the trees don't get you the rocks will. But for me, nothing brings as much joy as a great day on the slope.

Twister will fly again!

Resources

- ***Author's Note:*** I later learned that the Spektrum 'signal strength' warning can be safely ignored. How ironic!

- ***Twister E*** — More details on the aircraft featured in this story from the listing on the *SoaringUSA* website
- ***Scotty Tree*** — the go-to source for RC glider retrieval services in the greater Okanagan area.
- ***Model Aviation Canada*** — from the website: "the official publication of the Model Aeronautics Association of Canada, and is published six (6) times a year by Morison Communications."

*Read the **next article** in this issue, return to the **previous article** in this issue or go to the **table of contents**. A PDF version of this article, or the entire issue, is available **upon request**.*

Orcrist | A 2.5m VTPR Glider

Part II: Building, cutting and skinning the tail and wings.

Marc Panton

*Readers may want to familiarise themselves with the **first part of this series** before continuing with this follow up article. Also, click any picture in any RCSD story for a higher resolution image. — Ed.*

Following on from Part I where I focused mainly on the fuselage, this month's update is focused on the tail area and the wings.

The Tail

The vertical stabiliser itself is pretty mundane: a plank of hard/stiff balsa cut

and butt jointed to align the grain along some of the stress lines, with an infill to make it triangular/normal tail shaped. A vertical spruce post makes up the final part giving the future rudder something hard to be hinged from and adding a little stiffness to the whole ensemble.

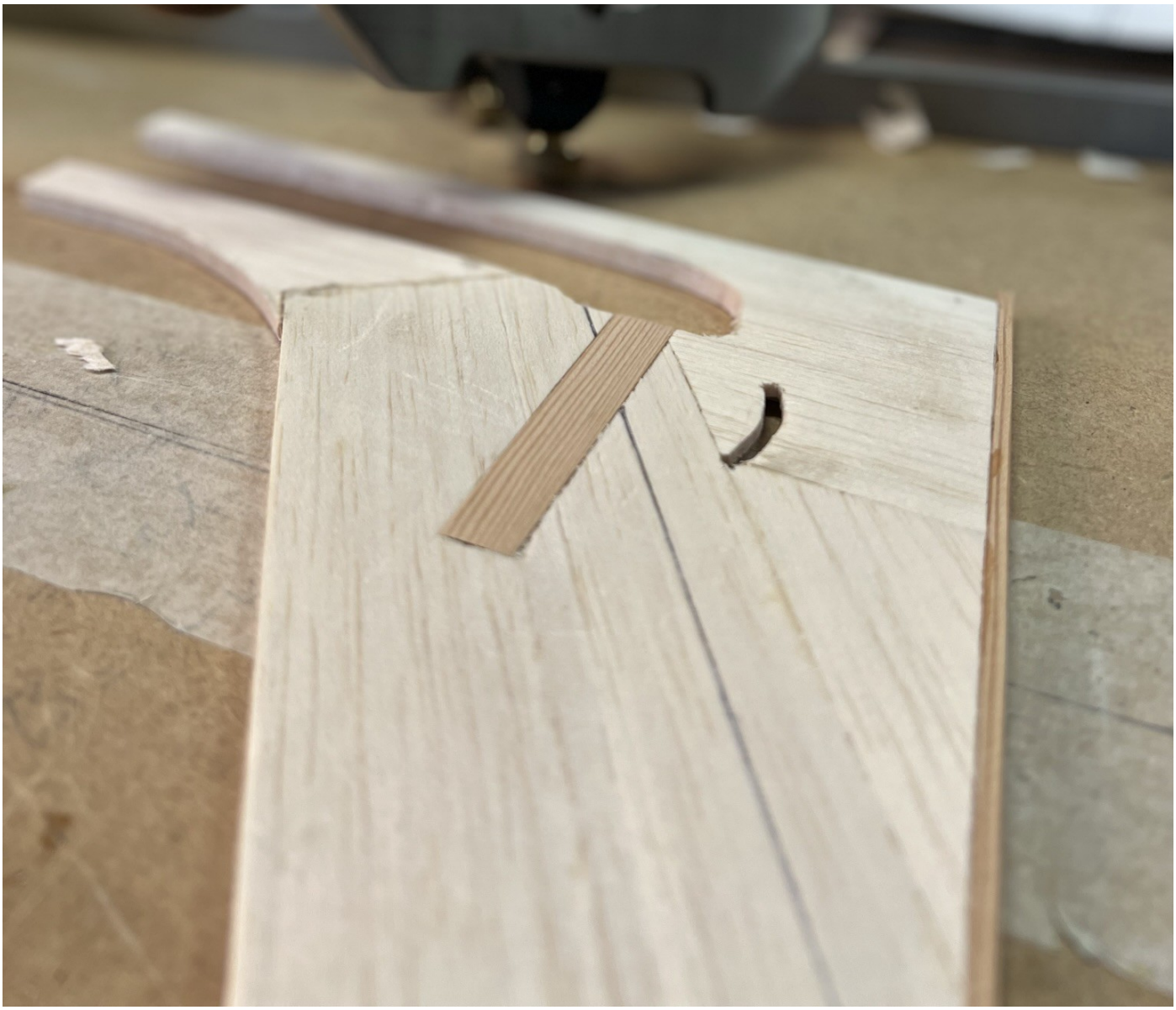
Where it gets a little more complicated is the elevator. The plans call for an all moving tailplane (AMT) and for the control mechanism to be hidden in the tail and fuselage. An AMT in a moulded glider is straightforward: the tail tends to be hollow and there's plenty of room for the bell crank (the 90 degree control horn the centre of which things pivot round, made from 1.6mm PCB board) and the associated strengthening and linkages. With the *Orcrist* we face a few trip hazards:

1. The tail is quite narrow
2. It's made of balsa
3. It's solid

My solution was to use the Dremel router to carve out a rebate where the bell crank would be located. A thin shim was then fashioned to fit over the bell crank which helps to keep things aligned. Lastly, a spruce strip was rebated vertically into the back of the tail to offer a more substantial brace against the AMT wobbling over time as the hinge wore down the balsa. This was further stiffened with a section of brass tube to act as a bearing and with additional spruce fairings of the same section as the tail surfaces on either side of the brass tube. I hate it when AMTs wobble!

The final step was to skin the whole vertical stabiliser in 0.6mm ply, adding stiffness and robustness, while hiding all the AMT linkages. Obviously the linkages and brass sleeve were fitted and commissioned before the skin was glued in place!

A rebate for the bell crank and a shim to cover it.



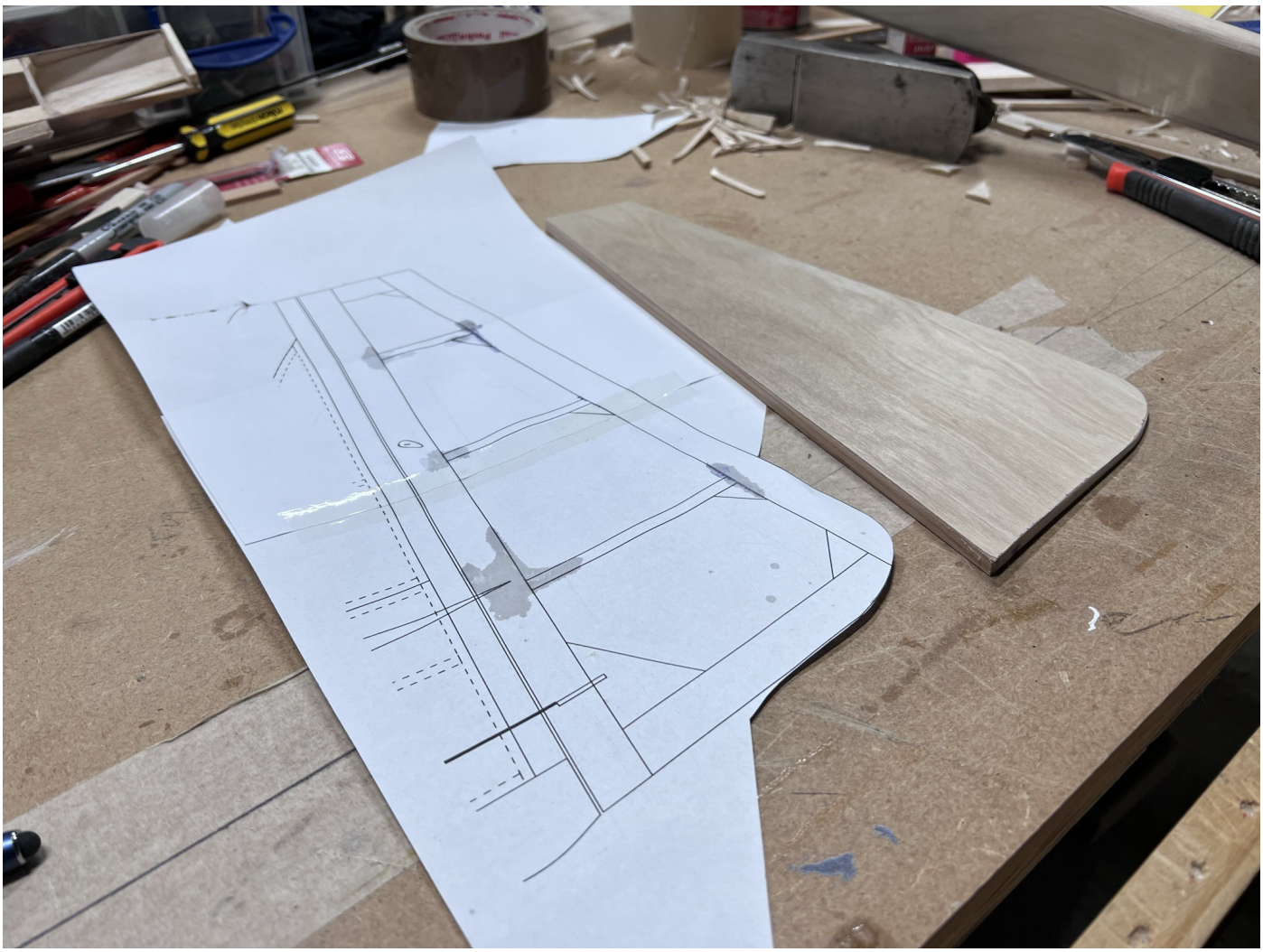
Recessing the spruce upright for the hinge to sit in. The hinge will also be sleeved with brass tube as bearing—there shall be no slop!

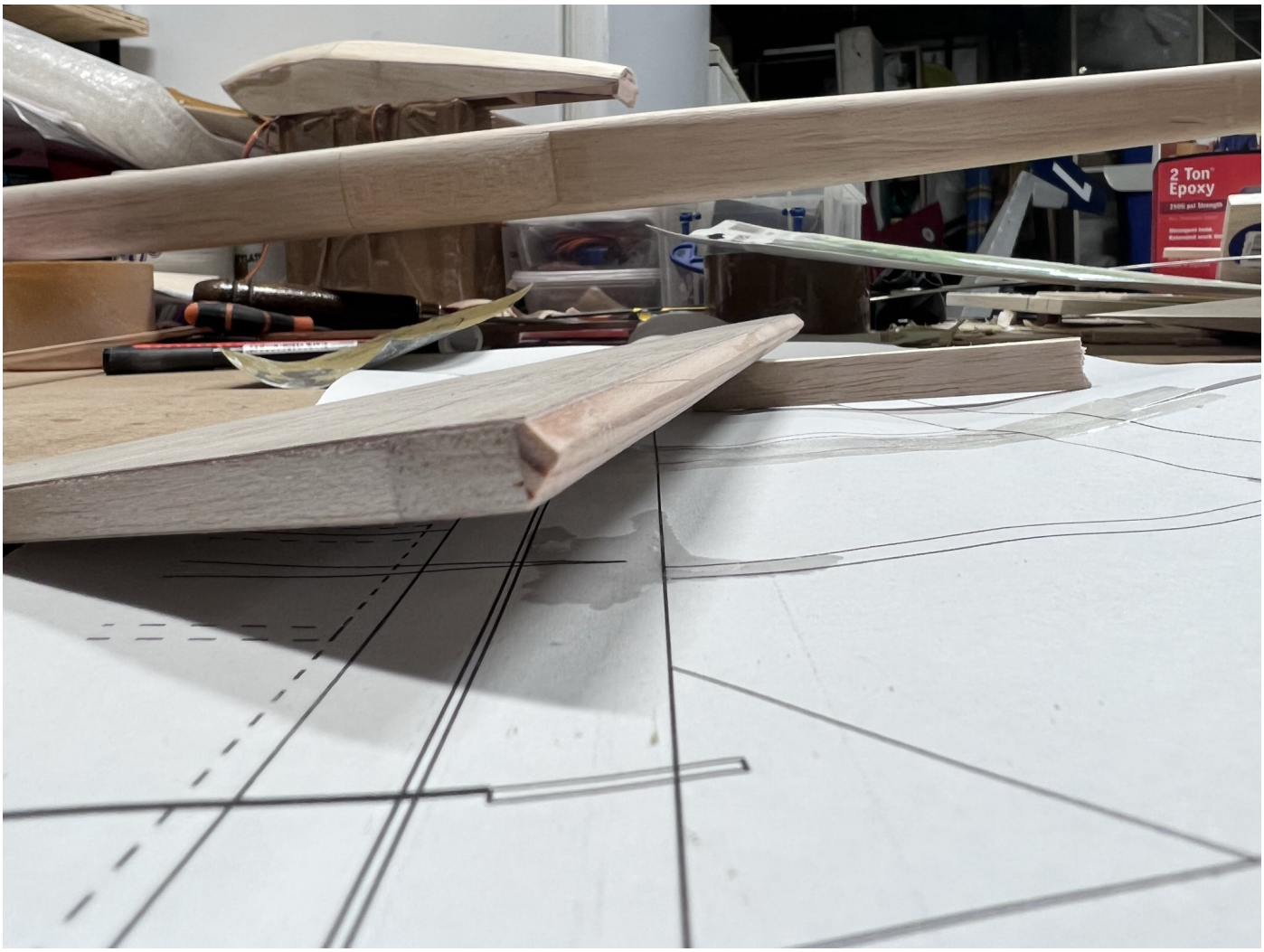
The Rudder

With a near enough completed tail, my attention turned to the rudder. By this stage I was conscious that the tail was a little heavy. With hindsight, I could have added a few lightening holes to the vertical stab with no ill effects. In an attempt at weight saving, the rudder was therefore built up from (mostly) scrap as opposed to using a single solid slab of balsa. At the bottom, inboard end, additional wood was retained to give the control horn a good surface to

be glued too.

As with the vertical stabiliser, a spruce post was attached to ensure a good strong anchor point for hinging. Once shaped, the whole rudder was skinned in the same 0.6mm ply and the spruce post bevelled to allow movement once the cyanoacrylate (CA) hinges were in place.





Skinned with 0.6mm ply. The hardwood post gets a bevel to allow for movement once hinged.

All Moving Tail

The AMT mechanism required some imagination, some woodworking and a dash of engineering. The AMT surfaces were a cake walk by comparison! A single 3" wide plank of hard / stiff balsa with only two cuts and two glued butt joints yielded the two complete surfaces. To these, a pair of routed rebates were made, not quite all the way through, to accept a pair of brass tubes. With these epoxied in place, the leading edge (LE) and trailing edges (TE) were given a sanded profile; rounded to the LE, tapered to the TE.

> ***Top Tip*** *Packing tape makes a great mask to avoid sanding areas you*

> *want to preserve.*

Lastly, the two AMT surfaces were skinned in 25g/m² (0.75 oz/ft2) glass/epoxy to add a little chord-wise stability (the grain ran span-wise) and sanded smooth ready for a primer/filler base layer.

25g/m² glass and epoxy top and bottom surface for protection and a little stiffening.

AMT Finishing Touches

The next step was to finalise the fairings either side of the vertical stabiliser that added to the rigidity of the AMT. A secondary benefit being it adds clearance between the AMT surfaces and the fuselage should I ever modify

things to extend the AMT throws. (Google `rc glider mad stab` to see some of the mods people do!)

Getting the Horn

The last piece of work on the tail was to make a control horn to match the rudder and the control run fitted in Part I.

There could potentially be some quite large forces applied in flight, so I was keen to ensure there was a large surface for gluing, but at the same time, I wanted to minimise the change in angle of the control rod as it exited the fuselage and in turn, had to restrict the height of the horn from the surface. You can see below the evolution from mock-up to finished horn, again made from 1.6mm PCB board cut and shaped with the bandsaw and filed by hand.

Rudder control horn cut and sanded to shape; recessed into the rudder.

A Diversion — The Canopy

Taking a break from the work on the tail, I turned my attention to the canopy. The plan left things a bit open to interpretation (so I thought initially) and I ended up making it up as I went: lots of balsa stock and then shape with lots of sanding back to what I thought ‘looks right’. With hindsight, I could have just used the same flat sheet and triangle section, but the result would have been a little more square than the rounded section mine ended up as. I’m happy. What do you think?


or balsa

Blocked form balsa canopy top, sanded to shape, then liberated.

With the shape there, the final step was to separate it from the fuselage. An accurate cut through the two formers and it was liberated! From there, I added thin ply facing, doubled internally for structural rigidity (this is a well handled part) tin the same way as the other ply sides were in Part I.

Now that I had a structurally sound, properly shaped canopy with a layer of 25g/m² glass and epoxy. I added a few layers of spray filler with a quick wet sand between each layer with 240 grit paper which resulted in a nice smooth surface. I couldn't wait to give it a top coat of *French Blue* (seems appropriate) to see what the end result might look like.

Attaching the canopy for flight use was a head scratcher for me, I have seen complicated spring clip systems. I've seen clips and slide arrangements too, but none seemed to lend themselves to this shape and arrangement. In the end, I used three magnets, spaced evenly from nose to tail of the canopy giving a firm but hand-releasable fit. Alignment is taken care of with small doublers attached to the formers. According to the magnets packaging, 6kg of force is needed to release the three pairs — should be secure in most of the situations it will end up in!

The Wings

The wings of the *Orcrist* are a semi-symmetrical blend of SC17 at the root to a SC17s section at the tip. The plan included templates for a hot wire cut foam wing core.

I've cut a few cores over the years but I'm no expert, particularly when it comes to wide spans and differing chord at the root and tip. To help with the cutting, I built a swing arm/drop arm mechanism a few years back to help keep things correctly ordered (with a shorter tip chord, the rate at which each end of the hot wire moves is not equal, the shorter chord tip needs to move slower than the root). There are **many** videos and forum post dedicated to swing arm hotwire cutters. Google `foam core swing arm hot wire` | `foam core gravity hot wire cutter` | `foam core feather cut hot wire` or similar and you will quickly get the idea.

To use the swing arm cutter, you need a template for each end of the core for the hot wire to follow. As the name implies, the wire is hot, so the material these templates are made of needs to be heat proof (or at least resistant from 200C through to about 400C). Plastics are great to work with and easy to shape, but they'd be toast in this use case. My preferred material for this is aluminium sheet, but I have also used ply and have read about people

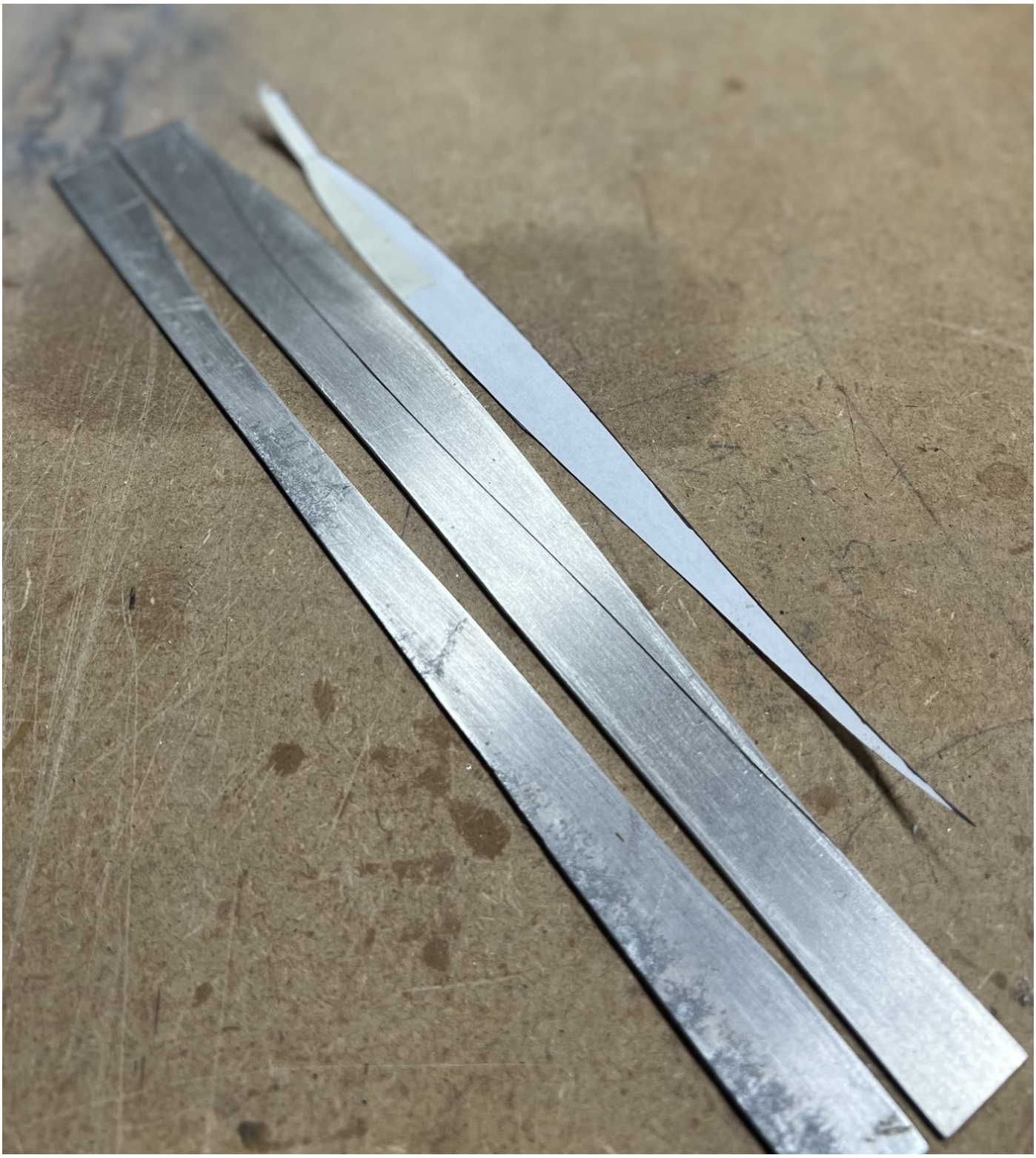
using melamine sheet.

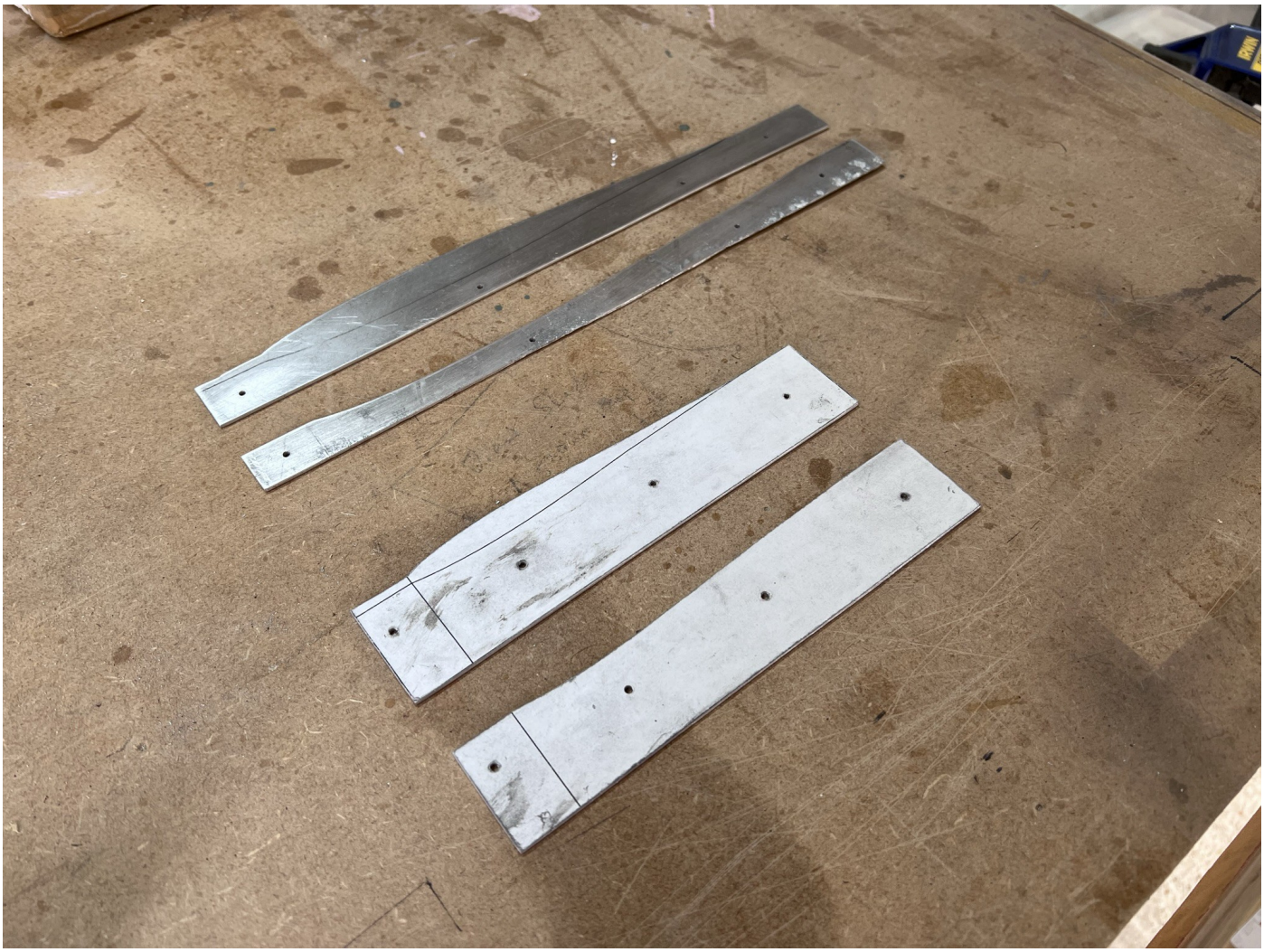
The idea is you have either an outline of the section and the wire traces top and bottom in two passes, or you have two templates for each end, top and bottom and make two passes. I opt for the latter as I find it makes alignment easier to have a lead-in/lead-out to each cut and that's not possible with a single template.

Hot Wire Foam Templates

I printed two sets of plan templates for each end and glued them onto the aluminium sheet. The bandsaw makes light work of the rough shaping resulting in an 'upper' and 'lower' template for each end. All the while, ensuring the bottom of each upper/lower is constant.

The roughly shaped templates are then fine tuned by hand with various files and eventually 80 and then 240 grit emery paper. The aim here is an accurate representation of the aerofoil section, but also a smooth edge for the wire to transition along; any rough parts or snag traps will cause issues in the cut and may ruin the whole core. Very minor ripples can be sanded out of the cores, but if the shape is wrong it's toast!

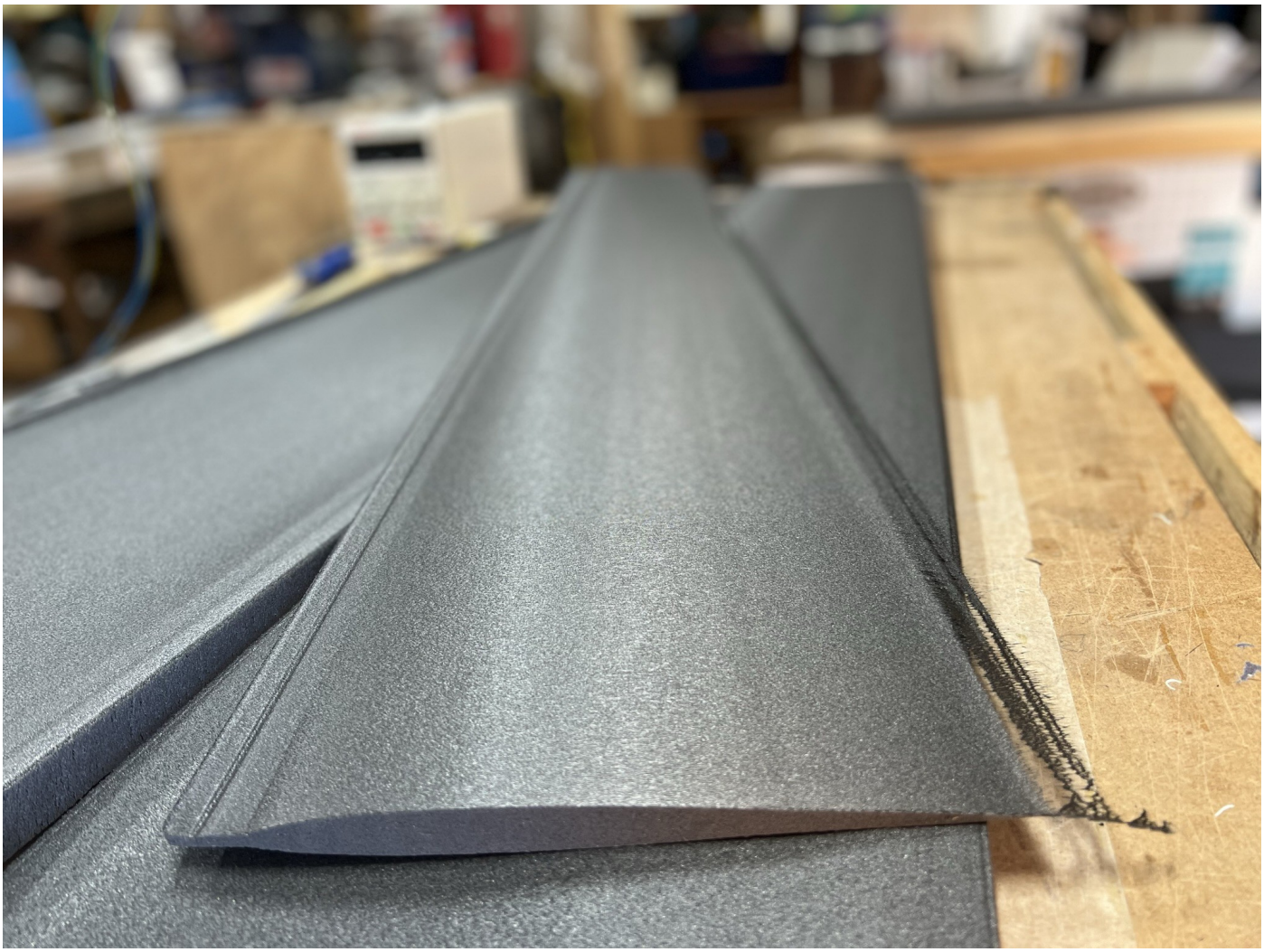


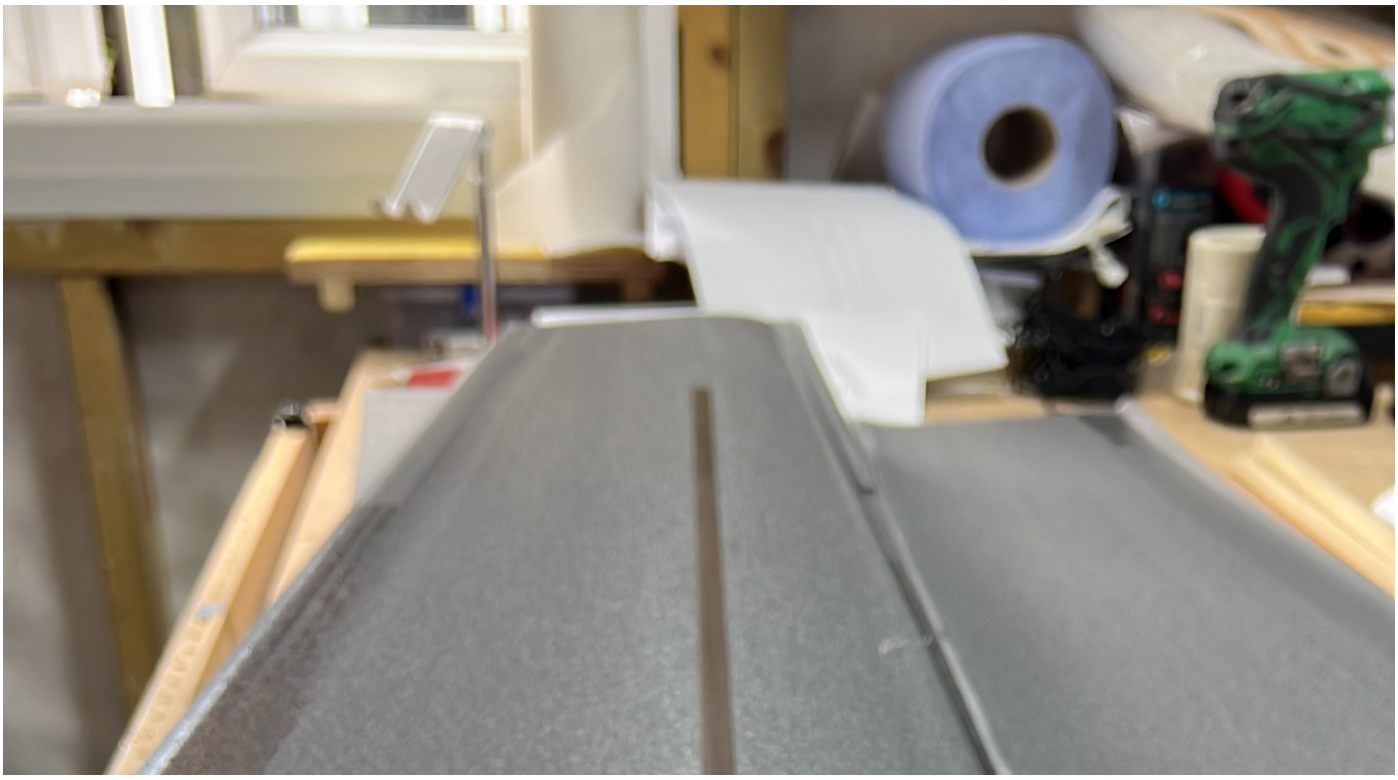


Templates for the hot wire made from aluminium sheet.

Foam Selection

My initial attempts at cutting cores for the *Orcrist* were made using some EPS polystyrene that I had in the workshop. Alas, it was poor quality and the resulting core was very flexible and very low density. A few Google searches later and I located a supplier of grey XPS foam offered as a replacement for the blue and pink foams many of us have used for years. (N.B. You cannot get blue and pink foam in the UK any more.)





A test core hints at good things to come, testing locations for spars.

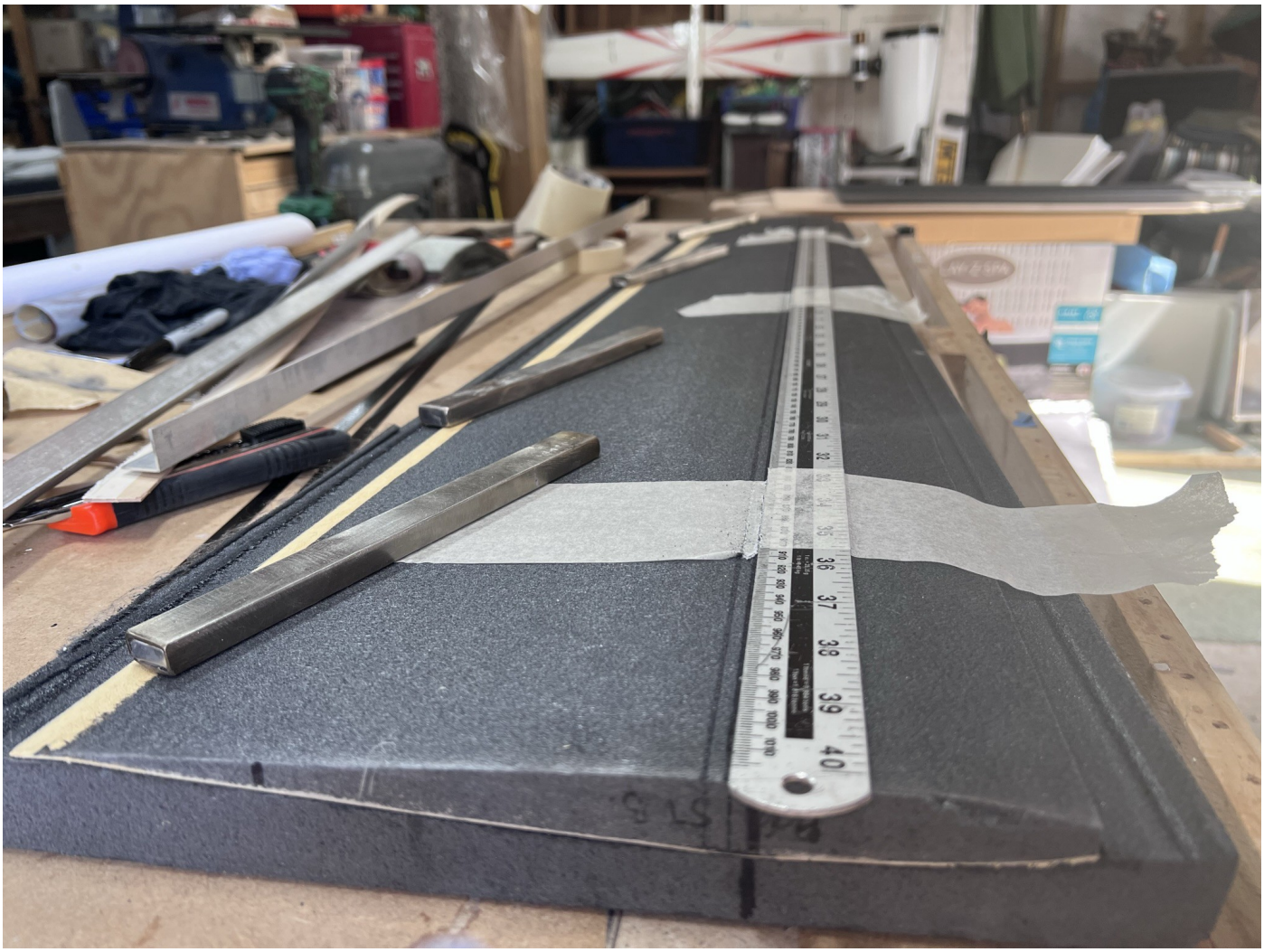
First Skin

A pair of cores were cut, remembering to make two *different* cores, **not** two *the same* (yes, I have been there, done that in the past!). The first order of business then was to add a lower skin. This helps with keeping the delicate trailing edge intact and provides a reference surface when cutting spar and joiner channels in the foam later.

The skins are a one piece wood veneer similar to Obechi. They are coated with epoxy, a 10mm x 0.8mm carbon strip, a 25g/m² glass layer (wetted with the epoxy) and a 100g/m² rectangle around where the joiner will go. This lower skin is then sandwiched between the core's outer carcass, the core and the top carcass, all weighted down with what ever I could find while the epoxy cured overnight.

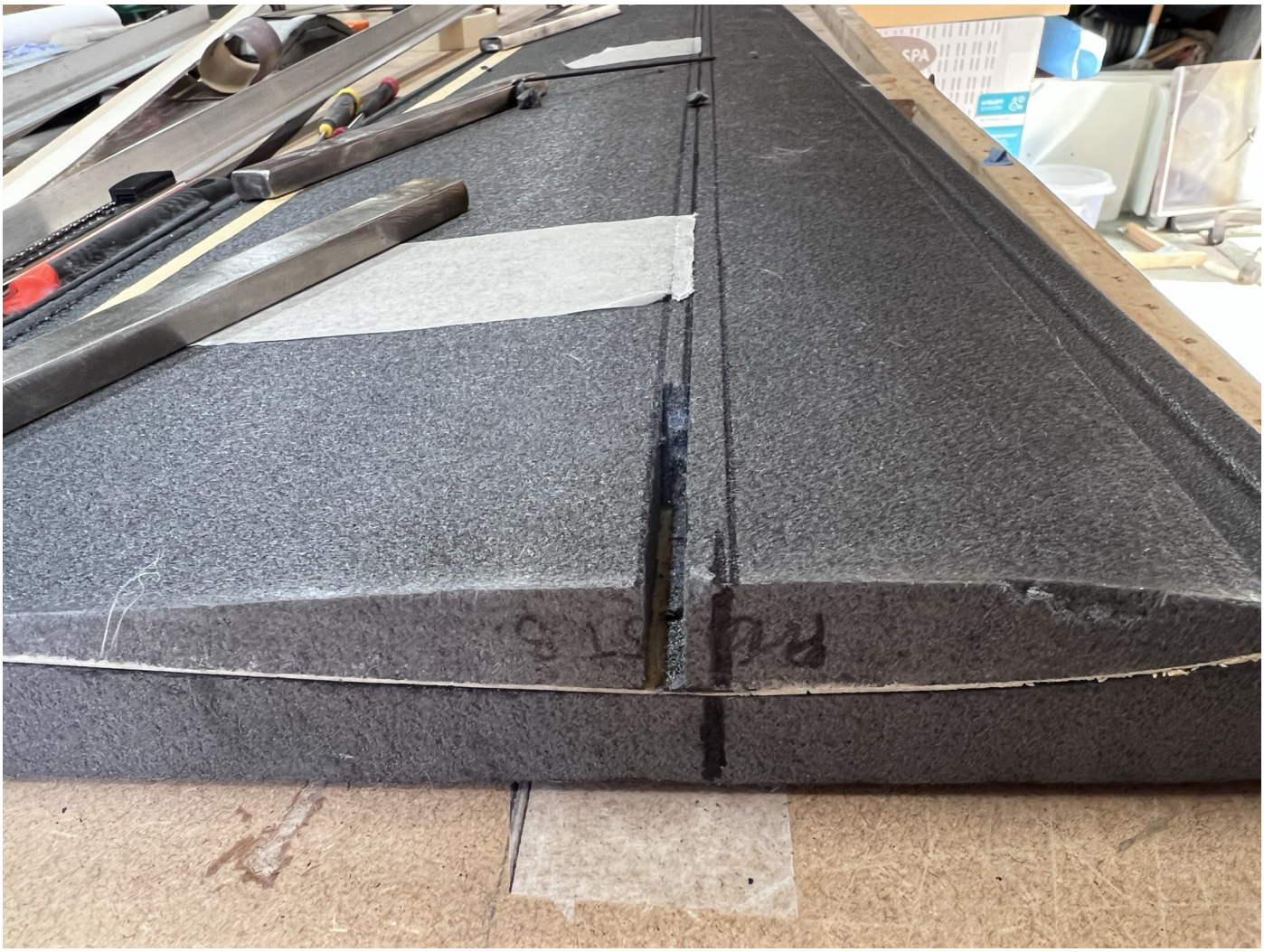
Spars

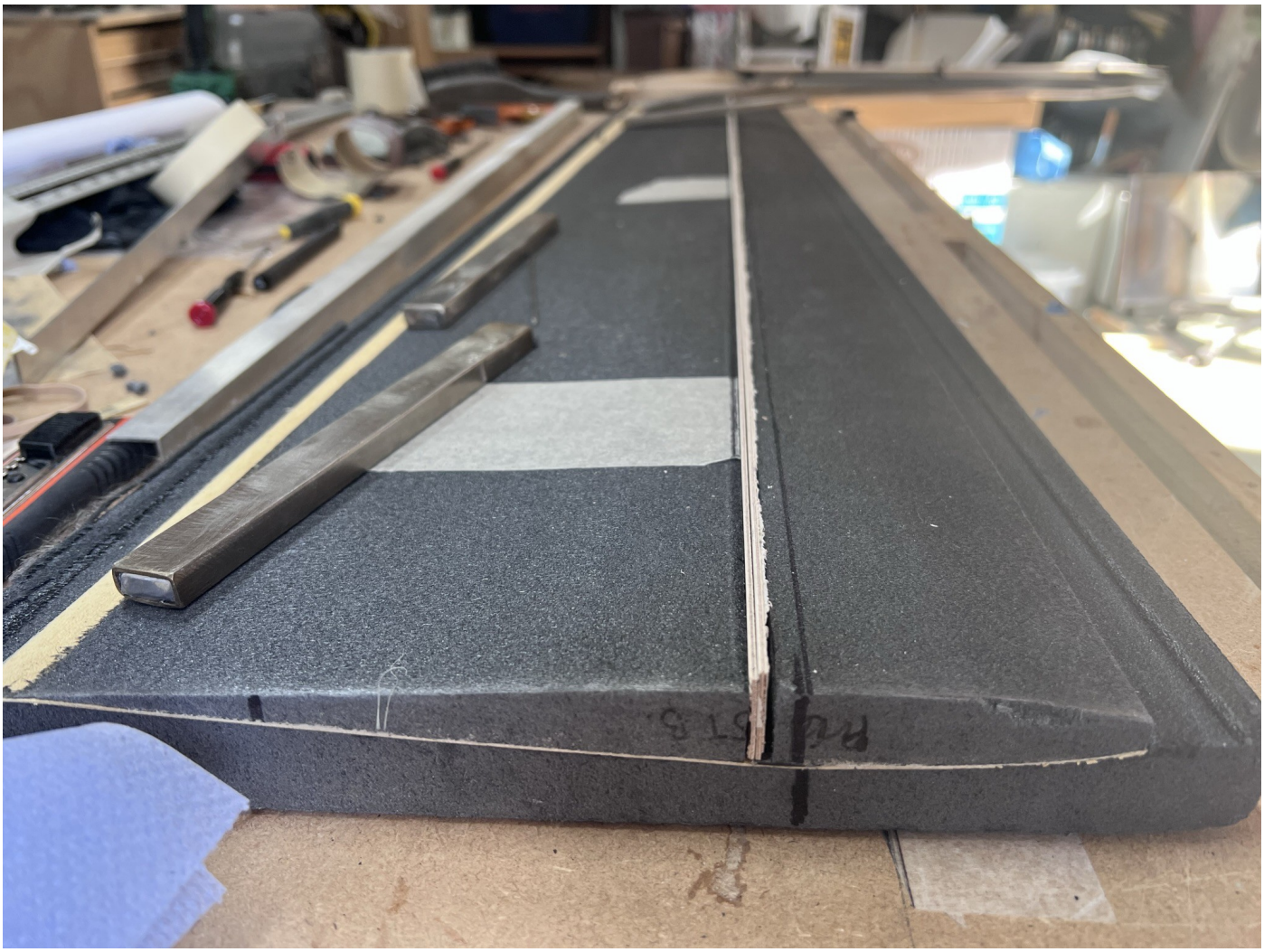
With the cores skinned on one side I began the process of laying out the spars referencing the plans, drawing out with sharpie and a long ruler. Once happy with the layout, I used a combination of craft knife and razor saw to carefully score the foam to make a channel twice the width of the spar. The foam cuts easily, but I used several passes, rather than trying to make a single cut to full depth. I needed to be careful **NOT** to cut through the lower skin. With luck (skill? ha!) I found the carbon strip at the bottom…perfect!


36
37
38
39
40

Carefully cut vertically through the foam, but NOT through the lower skin.

The next step was to remove the material between the two scored lines. If you have made any foamboard aircraft (looking at you, FliteTest), you will recognise the process of removing foam here! I found a small flat bladed screw driver worked well to eat away at 3–5mm sections and left a nice neat rebate ready for the ply spar.





Slowly excavate the foam all the way down to the skin/carbon spar cap. Fit your spar and ensure its secured with a good epoxy joint.

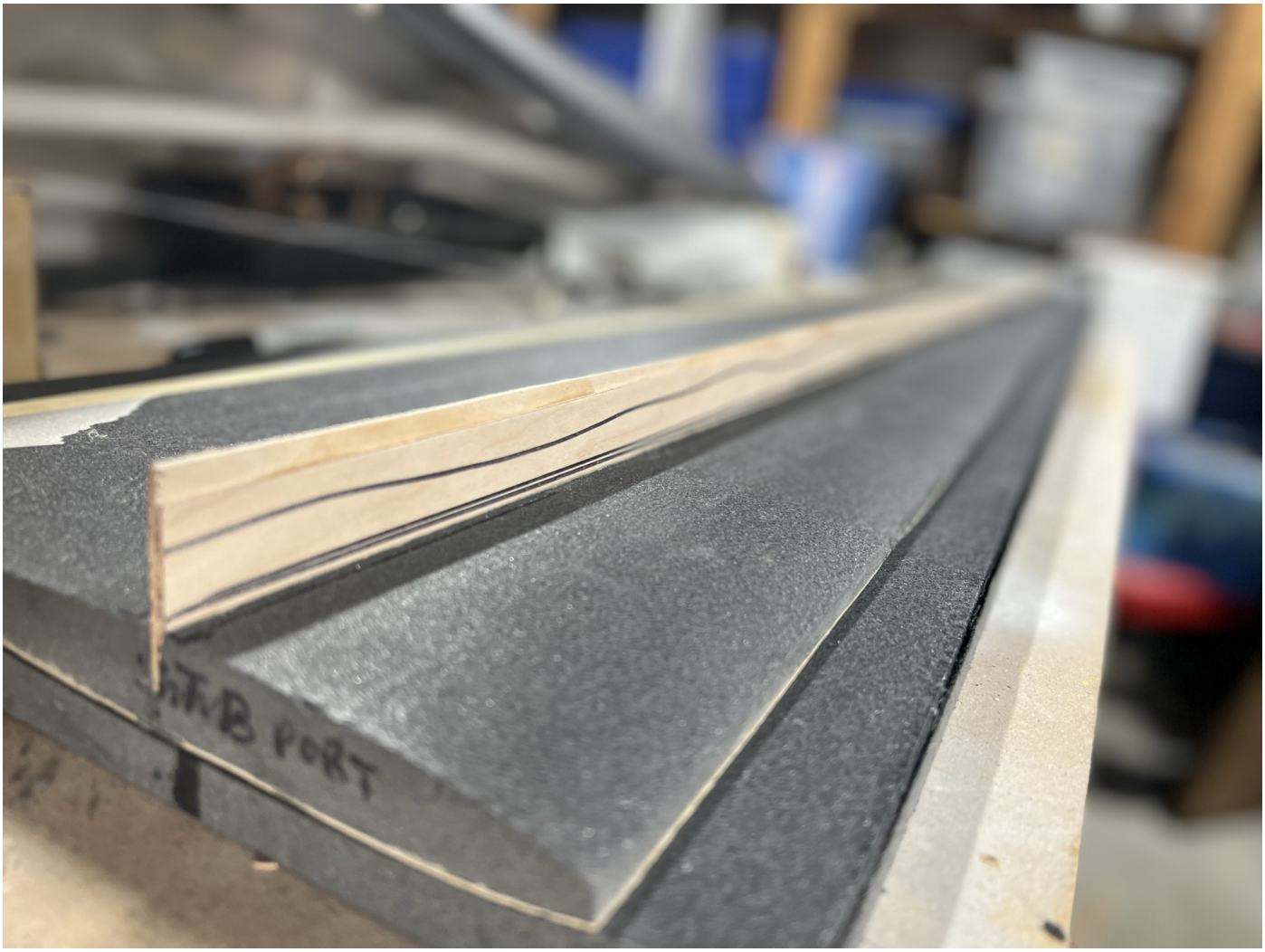
The spar was made by laminating two strips of 1/16" ply and then gluing in the channel with slow epoxy. The lower skin provides a firm base when weighting the spar , ensuring a good bond line to the carbon strip that becomes a lower spar cap. By using play for the spar the vertically aligned grain of the centre ply layer acts a a shear web too.

Once cured (again, an overnight wait!), the top surface of the spar was trimmed flush to the core’s surface with a block plane. (I find a good, sharp block plane is a very therapeutic thing to use!) The plane made light work of the spar and once again, I used packing tape to mask the delicate foam as I

got close to the surface. You can hear when you're approaching the last few skims: the sound gets a little 'crunchy' as you start to plane through some of the epoxy that's escaped when the spar was slotted in.

A light sand with some 80 grit paper gives a slightly roughened spar top and a slight rebate either side for the carbon strip that's the top spar cap.

This is where adding the lower skin first helps keep things true: if the gap you cut was slightly too wide or not quite wide enough, you may end up altering the curve of the lower wing section. The veneer helps avoid this, especially when combined with the carcass and weights during the cure stage.



Slot the spar in and wait for the epoxy to cure. Weight down to keep it all tight against the carcass.

Trim back to flush with a sharp block plane — ‘wafer-thin’, just like Mr. Creosote likes.

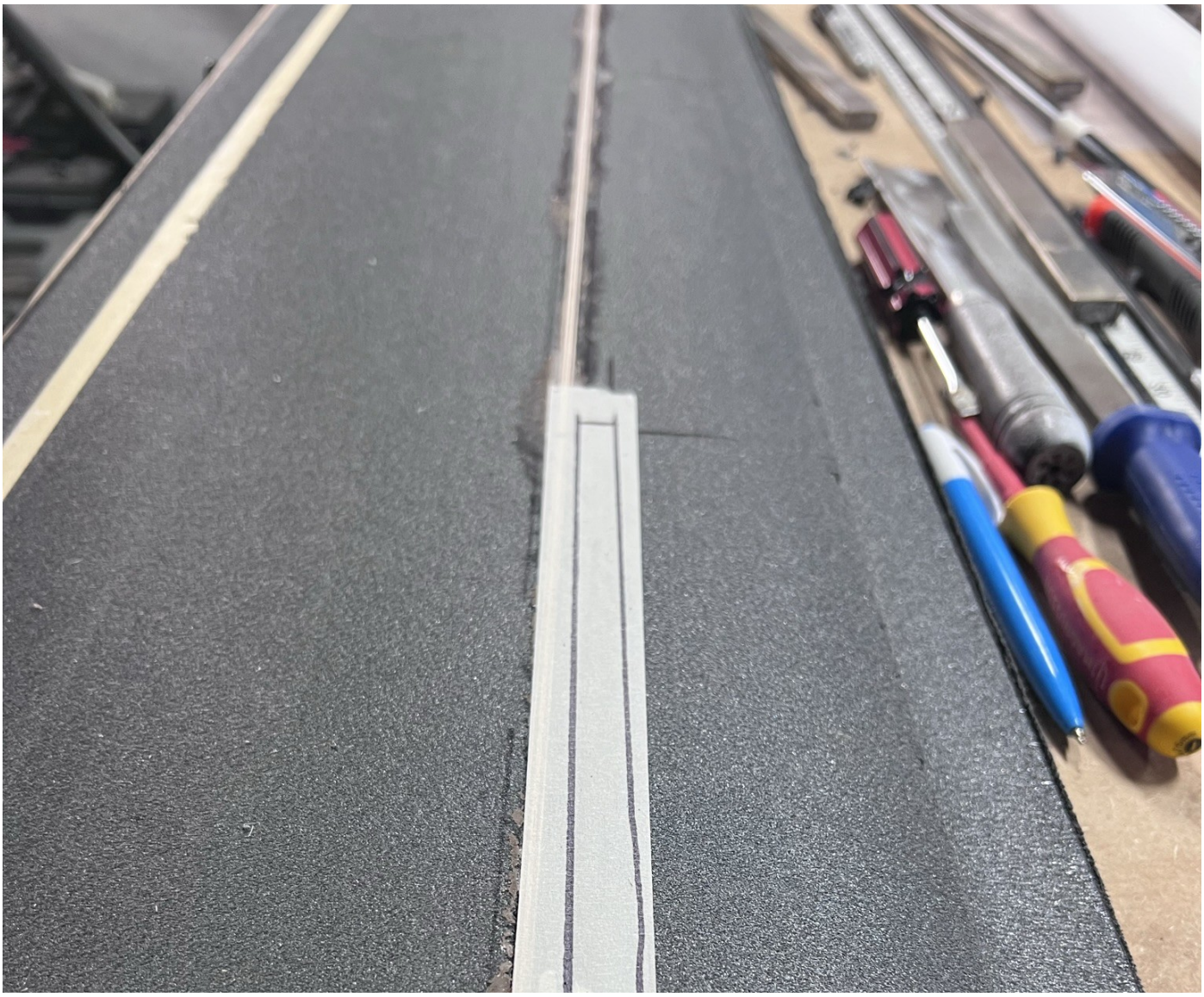
Joiner and Pockets

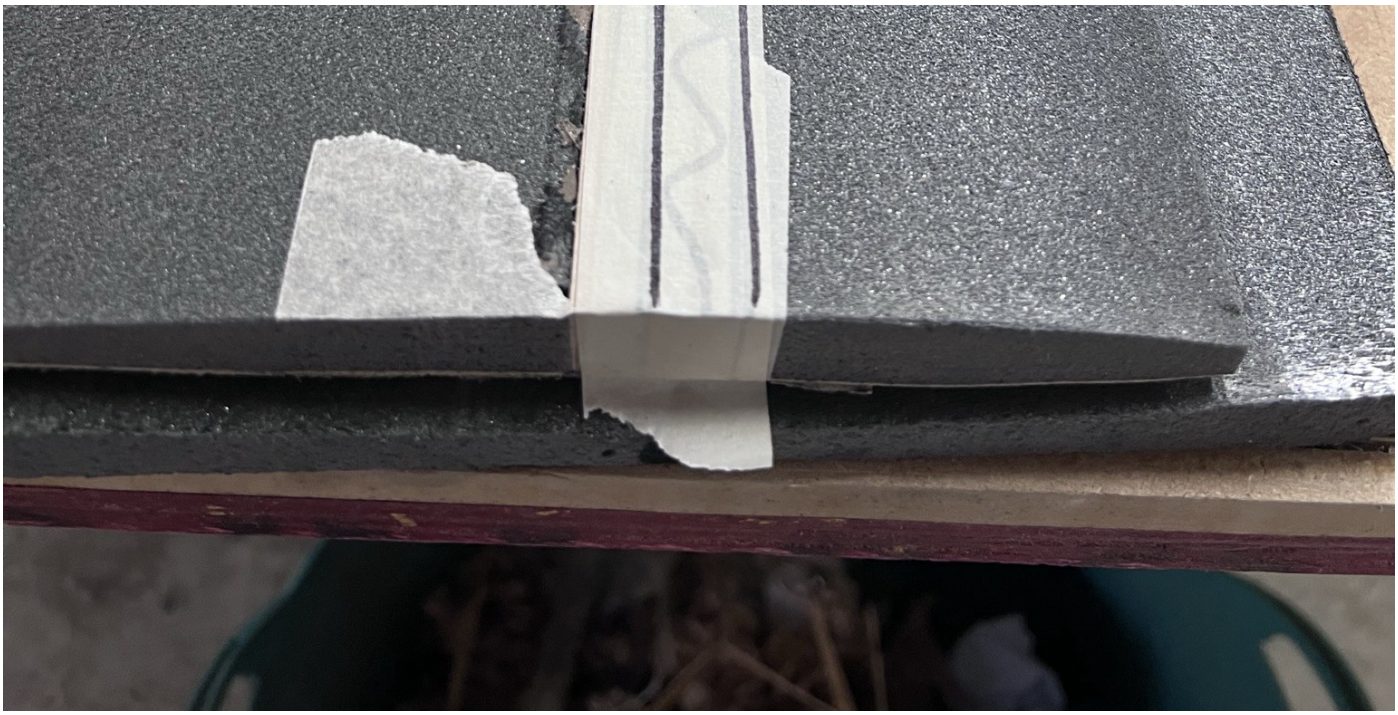
The plans show a 10mm joiner but on a recent local hobby shop visit, all I could find was an 8mm solid carbon rod and a 10mm carbon tube, with a ~1.6mm wall thickness. The fit is good, but I may still run a line of CA along the rod near the end of the build.

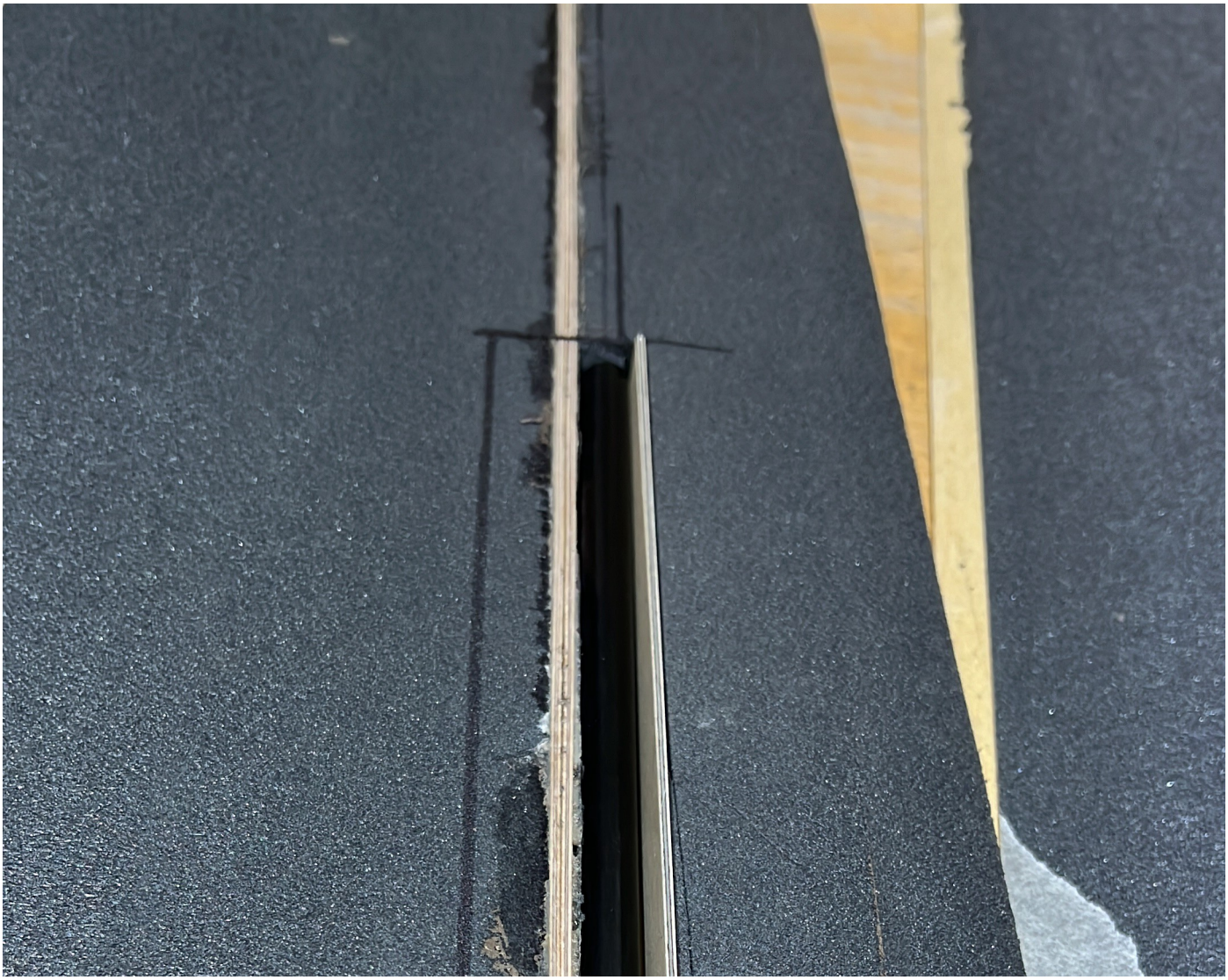
With my joiner and tube at hand, I set about marking up the joiner sockets in the wing cores. They sit snug to the spar and have a ‘false spar’ (not sure of the engineering term — it’s a second spar) to form a box for the joiner socket. The area of foam is cut and excavated out in the same way as the

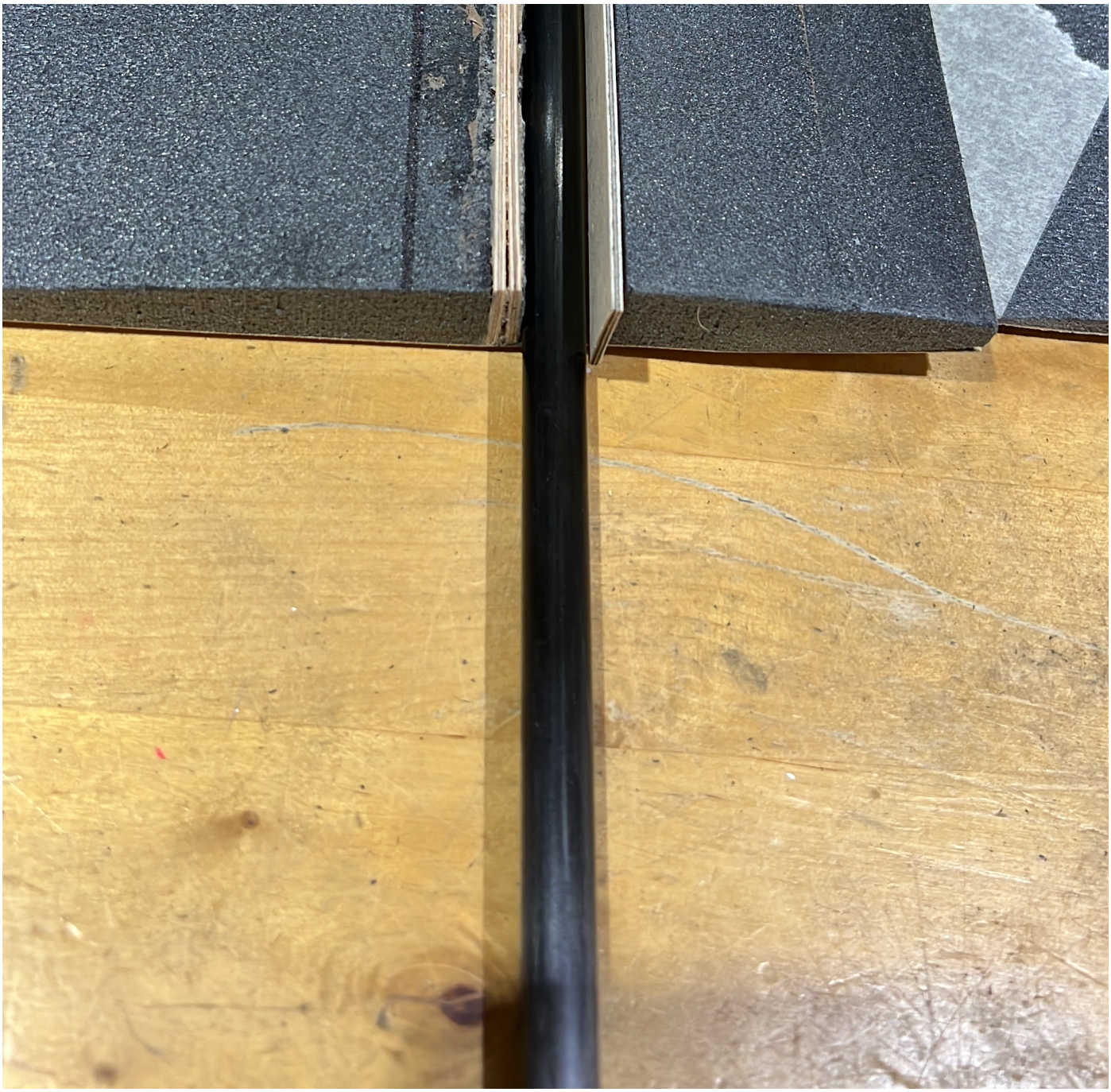
spar rebate, leaving the lower skin quite exposed and delicate. Once done on both wings, I used the extending dining table in the house to lay out the full wingspan (wing upside down to allow a ***very slight*** dihedral) end-to-end, so as to be able to confirm the joiner's alignment and the correct wing sweep of 25mm measured at the tips.

The more observant of you will note that one wing is covered on top, the other underneath — yes, I did get it wrong and cover the top of one core — doh! Luckily its no biggy. The construction is the same except for the servo pocket reinforcement (see *Second Skin* section below) so I'll just put it down to distraction!









Mark the joiner rebates, excavate and rough fit the joiner tube. Walls fitted the same way as the spars.

With the joiner and wings aligned, a couple of small foam offcuts and a dab of Clear Gorilla Glue held the rod in place while I poured slow epoxy with 10% carbon millings added into the trench with the tube in it. Once cured, the whole thing was flipped over and the process repeated for the newly exposed trench in the other wing (did I mention I skinned the wrong surface

of a wing!?)

End-to-end line up, check wing sweep and then align and hold in place for 8+ hours

Once cured, the rod can be cut and the roots trimmed back to flush with the rest of the core. The surface of the new joiner pockets can be planed back flush (if proud) or scuffed ready for the skin bonding (if recessed).

Can you see Han Solo in there?

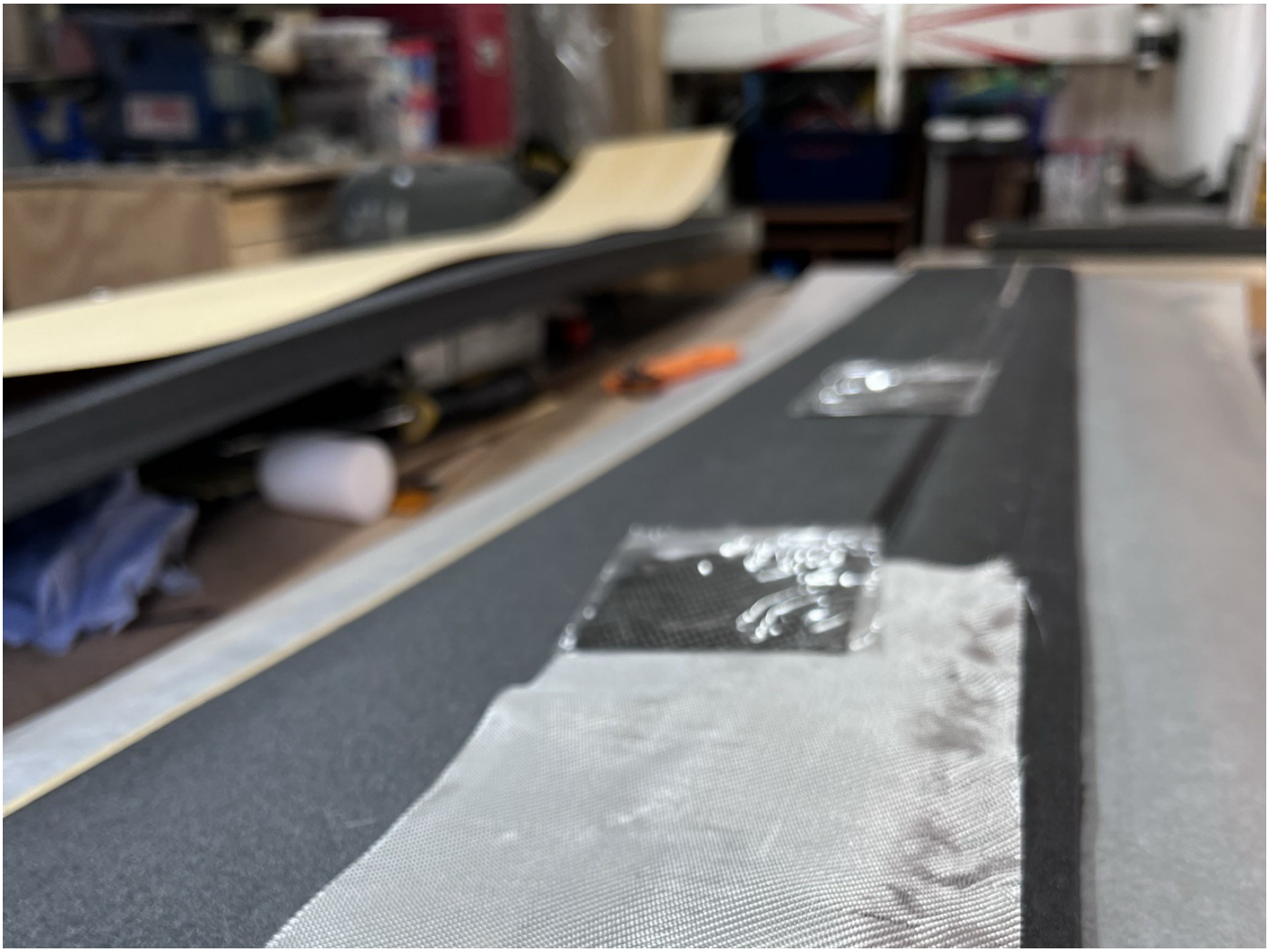
Second Skin

Time to add the second veneer, to the top sides of the cores (or the bottom if you messed up the first time like me!)

The order of the sandwich is (with additional 100g (3oz) glass over the joiner/spar area top and bottom):

Schematic drawing for illustrative purposes only — not to scale!

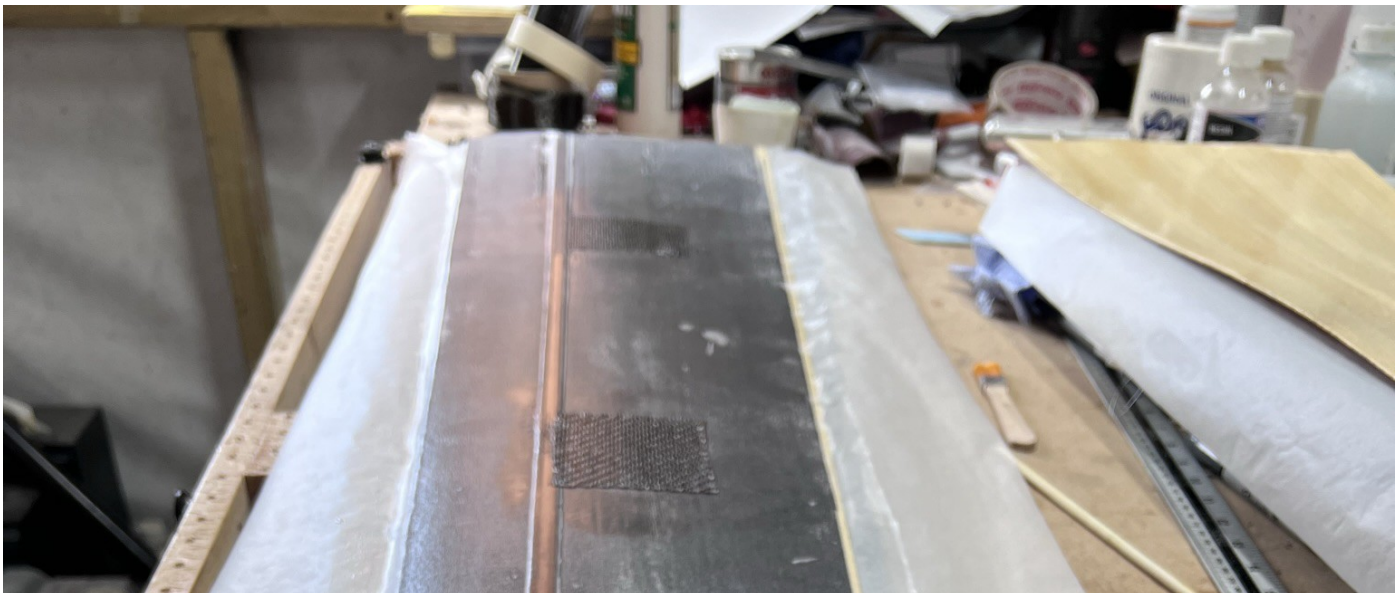
Getting all the layers ready before hand helps to avoid forgetting a layer and given potentially short pot life of some epoxy, it makes sense to be organised. below you can see the dry mock-up, with everything cut to size and ready to go, in order.

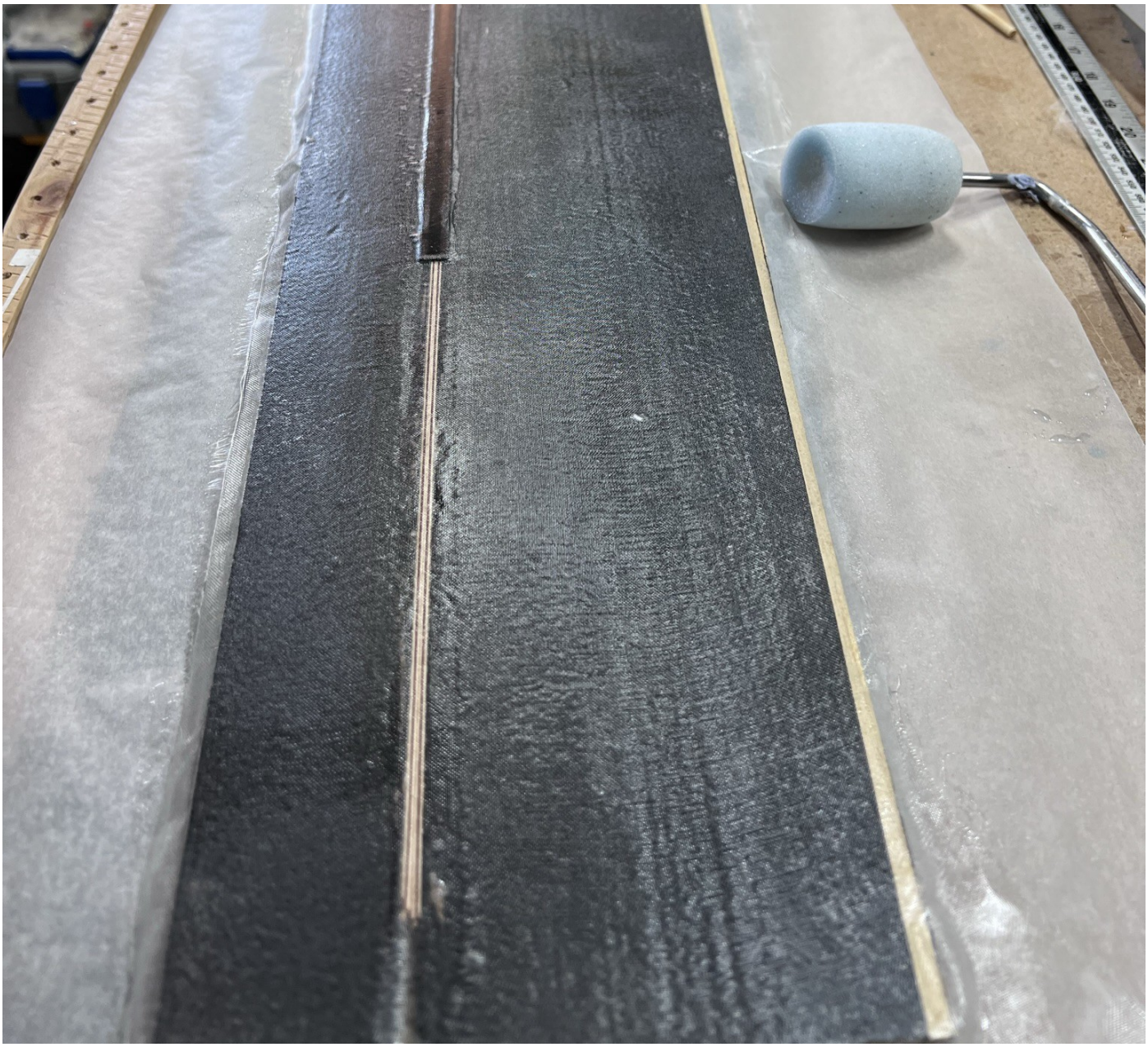


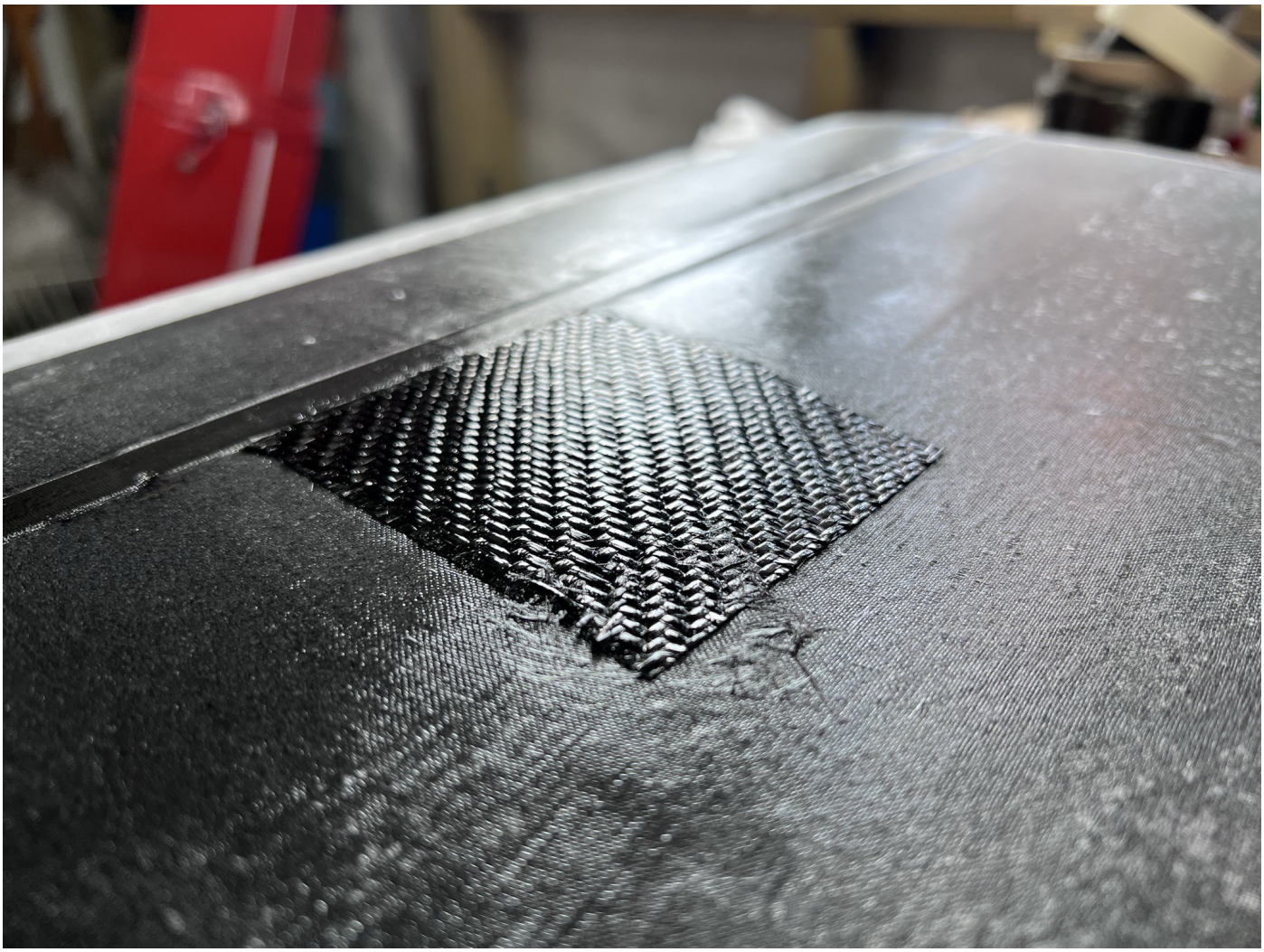

Formula 50
EPOXY RESIN

Dry mock-up, veneers and glass cut to size.

With the epoxy mixed, time to wet out and make the sandwich. As before, I wetted the veneer first, followed by the foam core's layup, which was followed by another wetting of both halves, before the last step of adding the veneer and clamping under the core carcass.







Well wetted, carbon strip visible, carbon reinforcements where the servos will be.

Weight

The target all up weight (AUW) weight is in the region of 1700g — 2000g (60oz —70oz). So far as photographed below, its at 1680g. That excludes the receiver battery, four wing servos, any balance weight that's needed and coverings of course. I think I should still *just* creep in under the upper target!

N.B. There's also around 5–10cm (~4") of wing span to shorten to fit the plans, that should shave a little too.

Joiner to Fuselage

We've got this far… a fuselage, tail plane, a pair of wings with a joiner… would be a shame not to have a quick table fly wouldn't it?! Just one problem! there's nowhere for the joiner to go in the fuselage. 10 mins with some **very** careful measuring and drilling — the joiner fits both the fuselage and also makes a nice 'pop' sound when removed from the wing pockets.

So, without further ado, here's the table fly!

See you next month for the next instalment of my *Orcrist* project. And by all means, if you have any questions, please do not hesitate to leave your questions in the *Response* section below and I'll do my best to answer them.

Resources

- ***Orcrist | A 2.5m VTPR Glider*** — Part I: Picking the design, making plans and getting the build underway.
- ***What a Tool! Servo Templates for Dremel Rotary Tools*** — My previous RCSD article where I explain the finer points of routing with Dremel tools.

- ***Dark Grey Styrofoam*** — The foam is listed as 'styrofoam' with a density of 33kg/m³ (~2 lbs/ft³). They do other colours, but not in the 'large size' sheets — however, it's all the same density.
- ***Koto Wood Veneer*** — This veneer is very similar to Obechi.
- ***25g/m² Ultra Lightweight Close Weave Glass Cloth, 950mm Wide*** — I've had both glass and epoxy from this supplier — friendly and quick service. Their epoxy hardener has a slight blue tint which is helpful when mixing which isn't noticeable once cured.
- ***EL2 Epoxy Laminating Resin*** — I'm using this laminating resin with the 'fast' hardener, pot life 15–20 minutes in my shed at 15C. Cured in ~10 hours (ie. overnight). The cloth samples are handy for odd jobs and repairs where you don't need a meter of material, such as the servo pocket reinforcements.
- ***My LHS: Addlestone Model Centre*** — A proper model shop with materials, kits, and parts. Don't forget to support *your* LHS (local hobby shop)!
- ***Orcrist 2.5m on RCGroups*** — The RCGroups thread that proved to be the source of so much valuable information.

*All images by the 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**. A PDF version of this article, or the entire issue, is available **upon request**.*

Published in The New RC Soaring Digest

Chris Williams Follow
Apr 28 · 3 min read · Listen

Wringing out the new, 1/4-scale Red Petrel above the verdant fields of Wiltshire, in southern England.

Red Petrel Redux

Part I: Variations on a Theme

I have been a victim of *Petrel* fascination for more years than I can possibly remember — see *Resources* below for my previous article on the subject. When I was a strapping, virile young stud, I used to make 'em to a fairly large size, but time and gravity are taking their toll, and the *Petrels* coming out of my workshop are now more OAP-friendly in their

Left: View of the Red Petrel's conventional tail feathers. | **Right**: The all-moving-tale of the White Petrel which has now been restored to varnished wood in the US. Click on any picture in this article for a high resolution version.

Sometime during its existence, this full-size example had its all-moving tailplane removed, and a conventional type fitted instead. This, then, was the main task in re-drawing the existing plan, plus the decision to make the ailerons knuckle-hinged instead of top-hinged in order to keep the Scale Police at bay.

Close up details of the new Red Petrel.

Other than that, the construction was identical to that of the previous version, so it was with a sense of familiarity that I whizzed through the building process.

Left: The before maiden photo. | **Right**: Author gives scale to the Petrel.

The flying surfaces are covered with Hobbyking film: matte clear in the translucent areas, and red trim for the rest. The fuselage is covered with some of my dwindling supply of Solartex, and 2K primers and paints.

Left: The Petrel above the Central Model Flying Club (CMFC) patch in Wiltshire, Southern England. **Middle, Right**: In action at the recent White Sheet Radio Flying Club (WSRFC) scale fly-in.

It's early days yet, but so far she seems to have all the desirable flying qualities of her predecessor, and I look forward to us becoming more acquainted. I'll keep you posted.

Resources

- ***Petrels I Have Known and Loved*** — The author's photographic review of examples of the iconic Slingsby Type 13 Petrel which appeared in the August 2021 issue.
- ***White Sheet Radio Flying Club*** — From the website: "White Sheet Radio Flying Club (WSRFC) operates from the White Sheet Down National Trust property located in

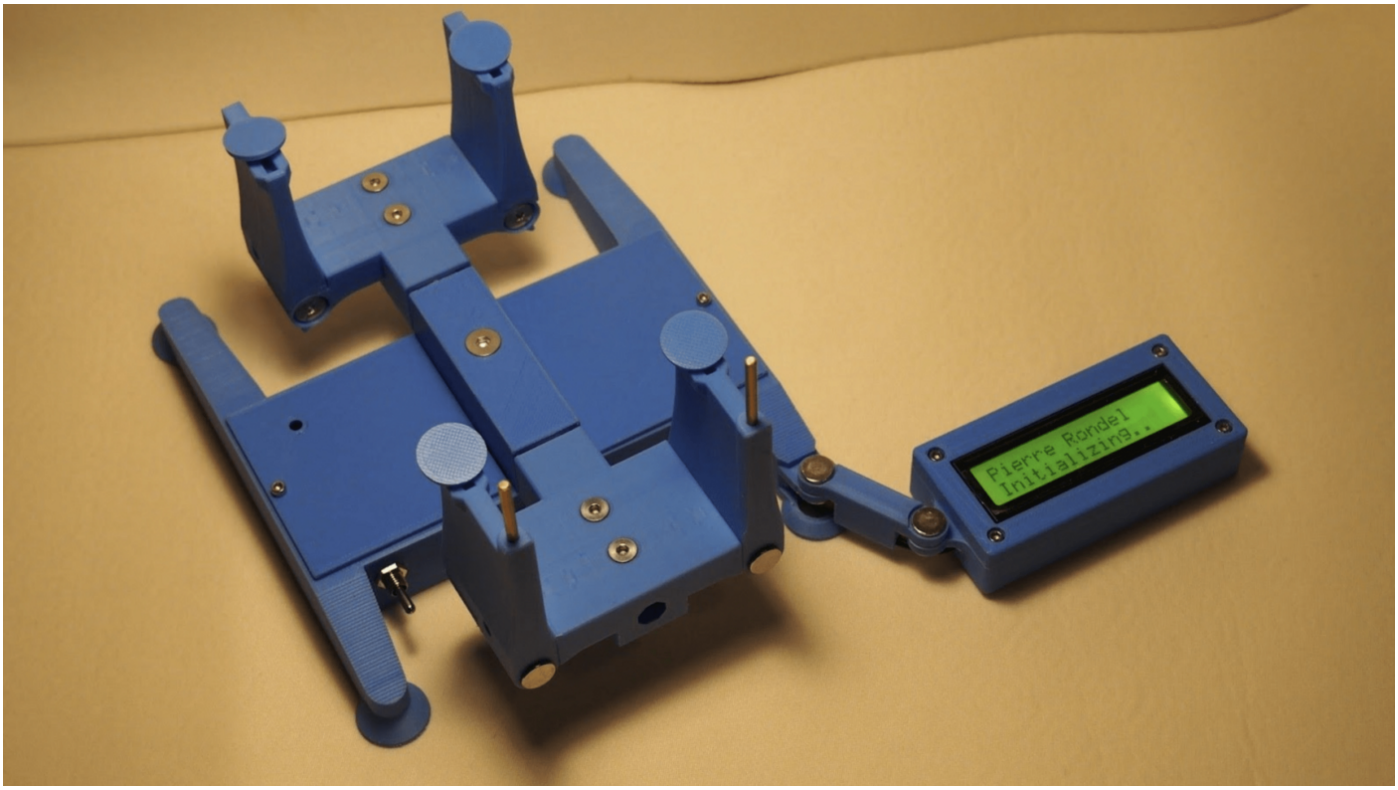
- ***Central Model Flying Club*** — From the website: “The CMFC welcomes all pilots of fixed wing, glider, and electric models…the club field is situated in rural Shropshire, near to the Severn Valley Country Park…”

*All images by the author. Read the **next article** in this issue, return to the **previous article** in this issue or go to the **table of contents**. A PDF version of this article, or the entire issue, is available **upon request**.*

Trimming Model Aircraft

A short primer for beginners.

Peter Scott



“A good F3F competition plane deserves a good CG setting, which requires the appropriate tool.” While not absolutely required to determine your aircraft’s centre of gravity, anything which makes it easier and more accurate is an asset. See Resources, below for a link to Pierre Rondel’s Digital CG Balancer article. (image/quote: Pierre Rondel)

We wouldn’t drive a car that drifted across the centre of the road. We wouldn’t ride a bike at speed that had a warped wheel. We shouldn’t fly our models that are not trimmed correctly.

For the Newcomer

What does trimming mean? It means adjusting various settings on a model until it flies straight-and-level (SL) under cruise throttle or level gliding flight.

For some, but not all, models it means you can take your fingers off the sticks and the model will fly SL.

What Can We Adjust?

- Centre of gravity (CG)
- The neutral positions of the control surfaces
- The throws on the control surfaces
- How much small stick movements move the control surfaces (sensitivity)
- Lateral balance
- The thrust line of the motor or engine
- The angle of attack of the wings and tailplane (incidence)
- The dihedral

What Do We Check?

- The flying surfaces for warp or misalignment
- The control surfaces to make sure they are solidly and freely hinged

Some of those are part of the design of a model. If you buy a ready-to-fly (RTF) model you should not find warps and the thrust line, angle of attack and dihedral should be correct. If you build a model or, even more, if you design and build, then all of the above are relevant. Even an RTF will need checking after you have crashed and repaired it.

Checking the soundness and freedom of the control surfaces should be part of your pre-flight checks.

Assuming that you have a new RTF model how do you set about trimming? A good start is to RTFM, a computing term meaning ‘Read The Friendly Manual.’ At least I think that’s what the F stands for.

Basic Trimming

Centre of Gravity (CG)

The manual will tell you where the model should balance, in other words where the centre of gravity should be. Often it will give a range. For the maiden flight it is best to set it to the most forward position. You can balance the model on your finger tips or preferably use a stand. Many foam models have the CG stamped into the wing underside. Another tip is to stick on the reinforcing rings used when filing sheets of paper where the CG should be. You can buy transparent ones to avoid spoiling your model. You can feel the holes with your fingertips. Move the batteries and radio equipment around till the CG is correct. If that does not work, add self-adhesive steel weights, or even lead, to the extreme nose or tail to balance. You will need a lot less in the tail than the nose.

Neutral Positions

The ailerons, elevator and rudder should be **exactly** in line with the flying surfaces, not ‘near enough’. Full size aircraft have small trim tabs. On our models the whole control surface must be moved for trimming so exactitude is crucial. The best way to adjust the position is to disconnect the servo linkage from the control horn and the turn the clevis until all is correct. Don’t forget to return the locking ring to the clevis. You can also adjust the position using the servo offset or bias if your transmitter (Tx) allows it. That will mean having the ailerons on separate channels. Yes, you can use the trim buttons on your Tx but it is far better to start correct.

Throw

This also called ‘weight’ or ‘rate’. If you have RTFM you will have found data about how far the control surfaces should move. There will usually be a

maximum and minimum. It is normally given in millimetres but sometimes, less helpfully, in degrees. Set the throws to the minimum value for first flights. If your Tx allows you can add the higher value as well. You use a two-way switch as a rate switch and set the minimum as the 'low rate' and the maximum as 'high rate'. If you set the throws higher than given in the manual the model might be beyond your ability to control.

Sensitivity

Most transmitters allow you to vary the effect of stick movement. Movements close to the neutral point move the control surface less than the same movement farther away from the centre. This is called 'expo', and makes it easier to give gentler control when the model is close to stable. You would normally set expo to around 30 for low rate and to zero for high rate.

Lateral Balance

This will probably only apply if you are using an engine set at an angle. Upright or inverted engines usually balance. Hold the model at the front of the propellor spinner or the nose and at the centre of the extreme tail. The model should not noticeably tip over. A small amount won't matter but you might need to add a small weight to one wing tip to balance. Even an electric model is worth checking.

The Maiden Flight

We all feel a bit nervous at this point, but it's only money (and pride). You could of course ask someone else to do the maiden flight but really it is best to do it yourself unless you are very nervous or the model is a big step up. Get the model into the air and find the throttle setting that gives level flight. Ideally have someone standing with you to observe and to move the trim buttons if you feel you can't. Here's what to look for:

Does the Model Turn with Neutral Sticks?

- It does but the wings stay level — adjust with rudder trim.
- The model banks — adjust with aileron trim.

Once correct land and adjust the servo linkages.

Does the Model Fly Nose Down When the Stick Is Neutral?

Try up elevator trim. Even if this fixes it you might need to move the CG back a little and try again.

Does the Model Fly Nose up or Porpoise?

Porpoising is when a model's nose goes up then down then up and so on, like a dolphin. It is usually the result of the CG being too far back. The big danger is that the model is close to a stall and might become difficult to control. Or perhaps the model flies steadily but looks nose up. Note that some models always fly nose up. Land and move the CG forward.

Does the Model Respond Sluggishly?

Try the model at full throttle. It might be acceptably responsive then. It could be that it is sluggish by design, perhaps as a trainer model. More likely the CG is too far forward or the throws are too small. Land and adjust the throws and try again. If that doesn't help move the CG back a little. Don't do both at once.

And Now the Advanced Stuff — Aerobatic Aircraft

If you do all of the above you should now have a stable model that responds well to your control. If you are moving to a truly aerobatic model there are further things to think about. The model needs to be more neutral than for

sport flying to reduce the corrections you need to make. The higher speeds make the control surfaces bite better too.

Thrust Line

Most models will be designed with some right and down thrust. To evaluate: 1) Fly SL at half throttle, 2) increase throttle to full. If:

- Model climbs — increase down thrust
- Model dives — reduce down thrust
- Model turns left — increase right thrust
- Model turns right — decrease right thrust

Centre of Gravity

To evaluate: 1) Fly SL at full throttle, 2) start a 45 degree climb, 3) roll inverted and see if the model holds 45 degrees. If:

- Down elevator needed — move CG back
- Model climbs — move CG forward

Incidence

From a good height, zero the throttle and dive in a straight line. If:

- Model's nose goes up — reduce wing incidence or increase tailplane incidence
- Model's nose goes down — increase wing incidence or reduce tailplane incidence

Lateral Balance

To evaluate: 1) Fly directly towards you or away from you, 2) pull a tight loop and a tight bunt. If:

- One wing drops on exit — add weight to high wing

then 3) half roll to inverted at half throttle:

- One wing drops on exit — add weight to high wing

Aileron Differential

This where the aileron moves up more than down. It can be twice as much. 1) Fly towards yourself, 2) go into a vertical climb, 3) half roll. If:

- Model turns in same direction as roll — increase differential
- Model turns in opposite direction as roll — decrease differential

Dihedral

This is the least likely to be needed as an aerobatic model is unlikely to have dihedral. Roll to knife edge with top rudder to fly level. If:

- Model rolls to inverted — increase dihedral
- Model rolls to upright — decrease dihedral

Gliders

These are different in two main ways:

First, having no motor they always glide downhill. Only if the air they glide through is moving upwards do they climb or maintain height.

Secondly they can fly in different modes at different times. When circling in a thermal they fly slowly close to a stall. When travelling across country they fly faster and in this mode they achieve their best glide angles. This is the distance they move forward in still air for a certain distance down. It can be as high as 40:1.

To achieve these modes a glider's wing aerofoil can often be varied. The under camber can be increased using a small amount of down flap and aileron for slow thermalling flight or moved slightly up for fast flight. This makes trimming more difficult, so the best approach is to trim for normal gliding flight using the basic trimming above. You will find that the recommended CG position is further back than on a powered aircraft. This can be at half chord or even further back. To get the very best out of your model use Brian Agnew's method below. Some text is omitted from Brian's article and and my comments are in square brackets:

> ***Centre of Gravity (CG)***
>
> *Charge your sailplane and get to bed early because we're getting up early enough to be out at the field 1/2 hour before dawn. If we're going to test our sailplane, we need the deadest air Mother Nature can provide. By the time you set up your winch and plane, there should be just enough light to launch. It is imperative to get consistent launches, but if you can't zoom consistently, don't, just let the line fall. [For electric gliders use your vario to start gliding at an identical height each time.]*
>
> *Time every flight. Each flight should be as hands off as possible and in straight lines to the limits of your vision. Go straight out and straight back 'til touchdown. [On a smaller field turn at the same points on each circuit.] Record your times.*
>
> *After each flight, change your elevator trim to max[imise] your time.*
>
> *Once the optimum elevator setting (longest flight) is found, remove 1/8th oz [3 g exactly but use 5 g weights.] of nose weight and start over, again. [If there is none in the nose use 1 g weights on the tail.] Every flight should be flown as close to minimum sink as possible. This is closer to a stall than you probably realize. It usually takes 3–4 flights to find the best*

> *elevator trim after removing weight. If the air is dead and you are launching consistently, your flights are going to get longer and longer as you remove weight from the nose and you are going to think, 'There is no end to this process,' until all of a sudden, your timer peak will start to suffer.*
>
> *What happens is simply that as the performance of your sailplane increases, your sailplane's stability decreases. This is the trade-off. You don't get something for nothing as they say. You will notice that as you remove weight from the nose, the performance (dead air times) increases, but at the same time you are having to put in more control input to keep the sailplane flying straight and at minimum sink. Eventually, the airplane requires so much input that the drag from the constantly moving control surfaces brings your Thermal Wonder 1500 down to Earth sooner. Put weight back into the nose until you reach your maximum dead air flight time and call it good. You will never have to wonder about your CG, again, only your elevator trim.*

The rich are not useful for much. However one thing they have done is to answer Plato's question, 'How should men live?' The day should begin at 10 am. Before that the streets aren't aired. The bit of Brian's excellent article involving getting up during the night is not for me. However the message I get from it is that we should keep moving the CG back until the instability means that we increase drag by constant corrections. Having started out flying A2/F1A free flight gliders with the CG at mid-chord I always think the CGs specified for gliders are too far forward.

If you have any questions, please leave them in the *Responses* section below and I'll do my best to answer. Thank you for reading and best of luck with your trimming efforts!

Resources

- ***Trimming Your Sailplane for Optimum Performance*** — Brian Agnew's original article from the May, 1993 edition of the legacy RC Soaring Digest. The text was revised in **October, 1997**.
- ***Great Britain R/C Aerobatic Association*** — From the website: "The GBRCAA is the specialist body appointed by the BMFA, to organise precision aerobatic competitions (F3A & F3P) to the international rules of the FAI."
- ***Digital CG Balancer*** — The complete article from Pierre Rondel's very popular *Planet-Soaring* website.

*Read the **next article** in this issue, return to the **previous article** in this issue or go to the **table of contents**. A PDF version of this article, or the entire issue, is available **upon request**.*

How to Create Great RC Soaring Videos

Make yours stand out from the crowd.

Raymond Esveldt

Looking over the shoulder of the pilot. Big scale planes are perfect platforms to carry onboard cameras as they are not bothered by a bit of extra drag and weight.

On YouTube there are countless videos that show our hobby. But the majority of those videos are not very interesting to watch. All too often it's just the raw footage that is placed on the internet without any editing. Nice material for those directly involved, for others not really attractive to watch. Yet some of the movies are noticeably better. What is it that makes them stand out? With some effort you too can make movies that are worth watching. That way you can let others enjoy your videos too. In this article I

will show you how I build my videos and what I pay extra attention to during the editing process.

A general remark about my editing style is that I do not try to make an exact registration of one single flight from beginning to end. I want to capture the 'feel' of a model or a meeting, not show everything that happened during one flight or during the whole day. By mixing footage from different flights I am able to show a general impression of a model, rather than just show a particular flight.

Filming

The whole process starts with capturing your footage. It helps if you have a general idea about what kind of video you want to make, but that can also be decided later during editing. Some tips for filming:

Use the Zoom Function Sparingly

Choose a frame and keep that frame for a while. If you need to zoom: zoom as slow as you can and make only one zoom, not zoom-steady-zoom etcetera. Try to make both wide shots and zoomed tele-shots. When you make tele-shots, do not zoom in too much. The model does not need to fill the whole screen. It's better to zoom out a little bit and keep the model in the frame than make really close-up footage where the model bounces all over the screen. Tracking a flying model accurately is very hard and takes practice!

Keep the Arm Holding the Camera Tight against the Side of Your Body

An arm hanging loose in the air will swing, resulting in wobbly footage. Don't breathe too deep, a shallow respiration will also get you more stable footage. For shooting stationary objects a tripod is ideal, but a tripod involves a lot of

'carrying around'. A monopod can be a nice intermediate solution. With a monopod you are much more mobile than with a tripod, but you do create more stable footage than without any support.

Do Not Talk during Filming

Preferably also ask this from the people next to you. It's nice if you can use the original sound during editing, but a talking cameraman or neighbor will be very loud on tape and can be very disturbing or even make a clip unusable. If you want to add spoken commentaries you can do this during the editing process. But removing chatting from a clip while retaining the environmental sound is basically impossible.

Do Not Only Shoot the Airplane

Also film stuff in the surroundings and details that show the environment you're in. Professionals call this 'B-roll' footage. The windsock, a panning shot of the field, bystanders watching, a church on the horizon, a closeup shot of the transmitter or grass weaving in the wind. These are perfect shots to add visual interest in your final video or can be used to 'jump' from one part of a flight to another part without feeling weird. A lot of B-roll footage can easily be shot before or after the main action.

Onboard Footage

Nowadays you can buy a lot of different action cams that are small and light enough to carry on airplane models. By using onboard video you can get a lot of variation in the final video edit. Make several flights with different camera positions, by making a smart video edit you will make it seem like the plane was hung with many cameras. Variation is the trick here!

With a wide angle lens you can get your whole model in the frame when the camera is on the wingtip. Another advantage of a wide angle camera is that the footage is less shaky.

Drones

Another great tool for filming is a camera drone. You can get really nice and potent camera drones for affordable prices nowadays. Sometimes I just position the drone at a strategic location and start the camera, the GPS position hold makes sure that the drone stays in the same position. In the mean time I can operate my normal videocamera or take pictures. If you have friends that are confident with racing drones you can even have a drone chase your plane, thus creating unique footage.

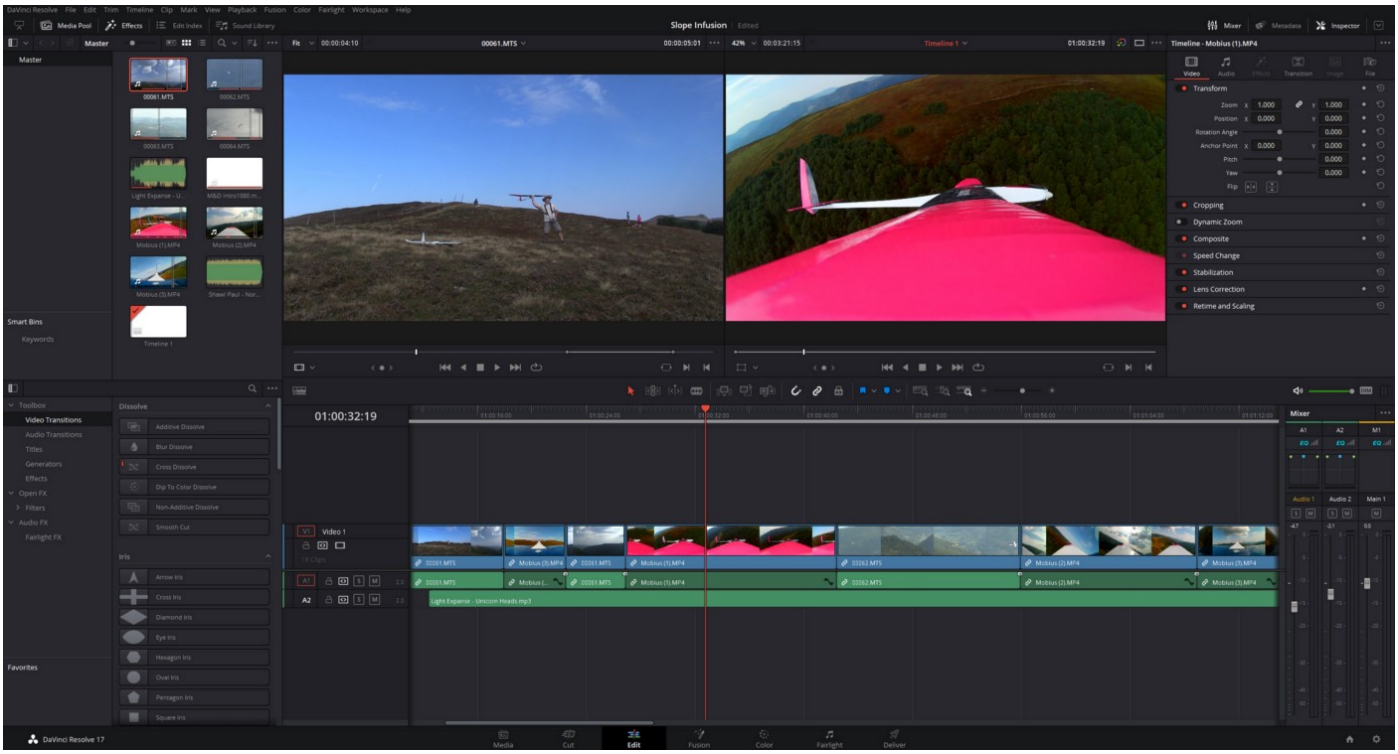
With a camera drone you can get unique viewing angles.

Software

Video editors come in a wide variety, ranging from free programs with limited capabilities, via reasonably priced consumer programs to expensive prescription based professional suites. With freeware you can get okay results, but the options are often limited and the workflow may not be very ergonomic.

A while back I stumbled upon *DaVinci Resolve* (see *Resources*, below) from hardware manufacturer Blackmagic. This is pro-level editing software and to my amazement is completely free to use. The possibilities are endless, but you will have to invest a lot of time and practice to get to know the software and get comfortable with the workflow, especially if you want to get into

special effects and colour grading. For a beginner a stripped down program may be the better option. On YouTube you will undoubtedly find many tutorials for your video editor to get you going.



DaVinci Resolve is a very extensive free video editor with tons of features, but requires a long learning curve.

Viewing All Footage

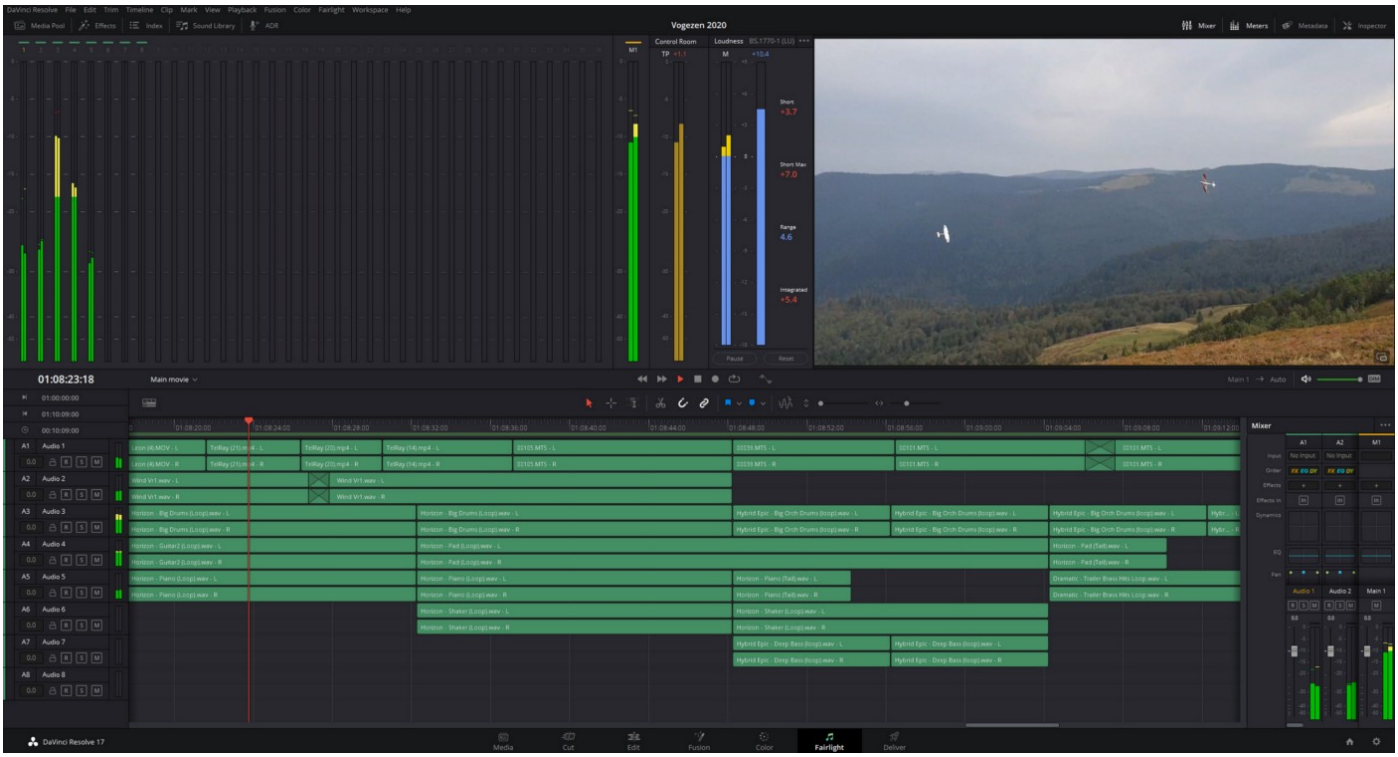
If you have shot more than a few shots, you will need to inventorize your footage. I normally make an Excel file where I write down all file names and the content of the clips. If I find specific interesting moments in the clips I mention them in the prescriptions with a + (nice to use) or ++ (must-use!) and the time stamp. When I get home from five days flying in the mountains I may have up to 300 clips, then it's imperative to have some sort of system where you can quickly find the moments you want to show in the final video.

Music

Before putting one clip on the timeline I first look for suitable music for my

video. Background music is extremely important to set the mood of your video. So take the time to search for the right track. Fast or slow, dreamy or with tension, having the right music is half of the success.

YouTube can be picky about music in a video. You may get messages that the music is copyrighted, or even the video may be muted. Copyright-free music can be a solution. Many websites have royalty-free music for free or for a small fee. Even YouTube offers a royalty-free music library, albeit with slightly cheesy music.



For this project I used a commercial pack of loopable music files to create my own soundtrack. A lot of work, but you can build the music yourself to flow to your wishes.

Logical Sequence

A video should have a logical sequence in all the footage. It’s probably an open door, but start with the model assembly, then the takeoff, flight and landing. For a viewer it’s weird if he sees a second takeoff without having seen a landing first, or if the video starts with a landing. This does not mean

that all clips should always be in placed in chronological order. You can mix footage of multiple flights where in the video it seems to be one flight.

Successive clips should also have the correct 'connection'. If one clip ends with a left turn, the next clip should not start with the model in a right turn, or inverted. Onboard footage at high altitude should not be followed by a low flyby. If the clips do not have a logical sequence the viewer has to think about the new situation with every clip. You want to present the viewer with a 'story' that is easy to follow. If you want to make a 'jump' between moments that do not naturally follow each other you can use a B-roll clip in between.

Short Clips

A good video editor uses only a small amount of the total footage he shot. On a flying day you should film as much as possible, giving you enough choices during the editing process.

In the edit use very short clips. More than half of the clips in the video should have a maximum duration of eight seconds (and three seconds is often even better than eight seconds!). This creates variety, keeping the viewer fascinated. Off course you can sometimes use a longer clip, but if all clips are more than 30 seconds the viewer will quickly be very bored. When starting with video editing you will probably want to show way too much. Narrow it down to the absolute top moments and cut away the rest. It will benefit the end result.

Not only the clips, but also the total video length should be kept to a minimum. Five minutes is normally enough to show the best of the best. Limit yourself to using only the very best material or your movie will be tedious.

Sound

Not just the video, but also the sound deserves some attention. Often the sound part of video editing is neglected by amateur editors.

The balance between the original sound and the music has to be right. Sometimes the original sound does not add anything but distraction, then the original sound can be put at a very low volume or even be muted. But many times you do want to have the original sound. Even if you don't hear the model or people talking it will add background sound that adds to the atmosphere. If original sound becomes very important (conversation, model sound) the music volume can be (temporarily) turned down a bit. If two successive clips have very different sound volumes the volumes should be matched or a smooth transition should be used.

Wind can cause annoying noise, a fluffy microphone cover can reduce wind sounds considerably.

Transitions

With video editing software you can create all sorts of exotic video transitions between clips. Do not be tempted to use this trickery box to the max. Every once in a while you can use a fancy transition, but an overload of digital tricks will get annoying for the viewers. By far the most used transition is the simple 'hard cut', basically without any effect. Crossfades (where one clip slowly fades into another) can be used regularly, but keep the exotic transitions to a minimum.

The first flights of the amazing Fokker FG-2 model featured in RCSD (see Resources below). A camera drone was used for additional footage.

Practise Makes Perfect

Making interesting videos takes practice. Video editing is always very time

consuming, but especially during your first few projects you will need to put in a considerable time effort. But hey, it's a hobby! Count on at least one hour of editing time for a minute of video, probably more.

With the tips in this article you should be able to make a good start with making videos that are not just fun to watch for the directly involved friends, but are also worthwhile to watch for others. The list of options I mentioned in this article is far from complete. Once you master the basics you can advance to slowmotion, stabilization, color grading, time remapping, visual effects et cetera. But that's for later. First try to film more consciously en edit your videos using short clips and plenty variation. You will see that you'll progress very quickly. When friends or even strangers start to make nice comments on your videos it's very rewarding.

Good luck editing!

This video was made during a flying trip with friend in the French Vosges mountains. With 10 minutes the duration is kinda long. You may recognize the key image from last month's issue of RCSD!

Resources

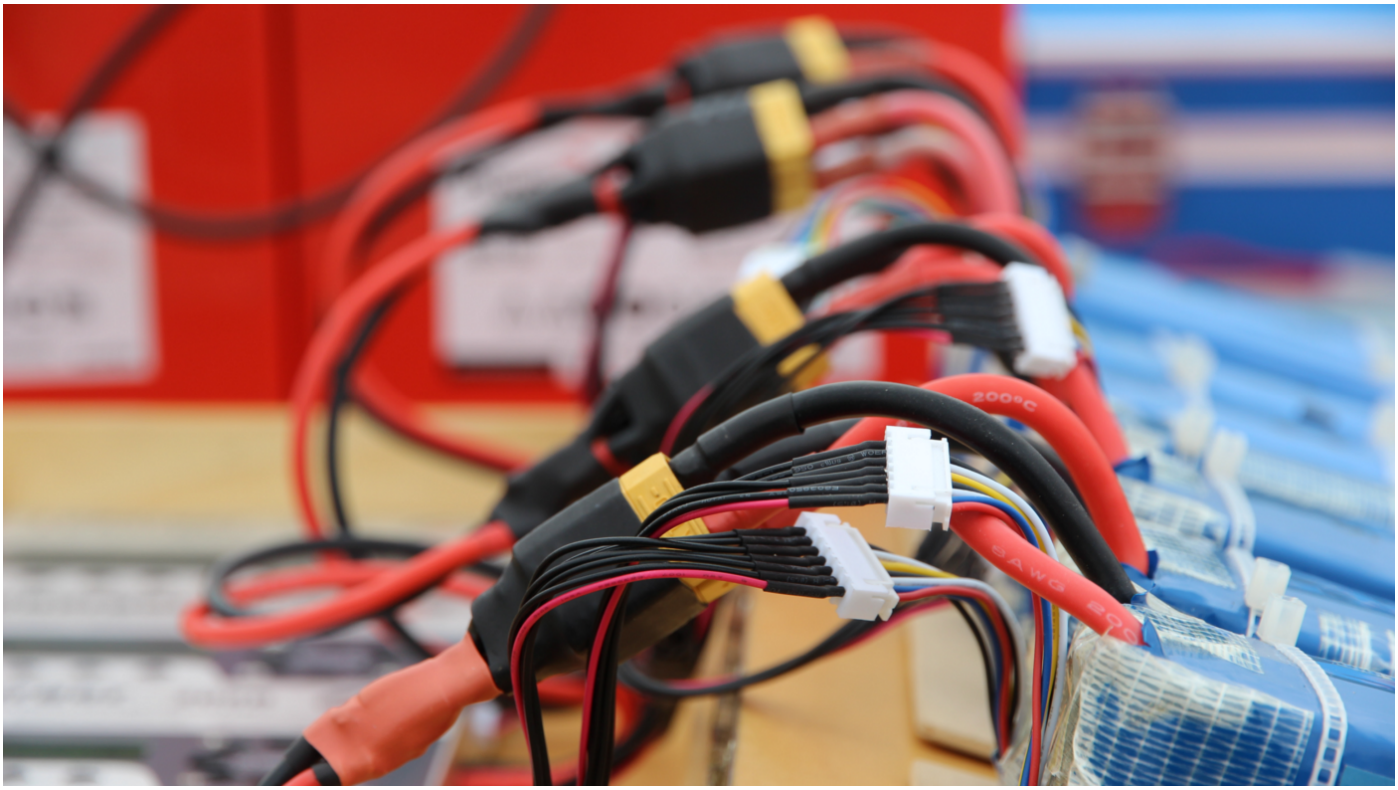
- ***DaVinci Resolve*** — from the website: "DaVinci Resolve is the world's only solution that combines editing, color correction, visual effects, motion graphics and audio post production all in one software tool! Its elegant, modern interface is fast to learn and easy for new user..."
- ***The Fokker FG-2*** — Vincent de Bode's magnificent recreation of this classic vintage aircraft, as described in the February, 2021 issue of the New RC Soaring Digest.
- ***How to Create Spectacular Multishot Photos*** — my previous article on this interesting photographic effect.

*All images and video by the author. Read the **next article** in this issue, return to the **previous article** in this issue or go to the **table of contents**. A PDF version of this article, or the entire issue, is available **upon request**.*

Electricity for Model Flyers

Part VI: The Care and Feeding of LiPo and NiMH Batteries

Peter Scott



“Taken during an aerotow event. A lot of towplanes fly electric nowadays. The towplanes have high-power setups, so if you want to fly more or less continuously you need a collection of battery packs and charging the batteries takes some management.” (image/caption: Raymond Esveldt)

Lithium-Polymer (LiPo) Batteries

Lithium-polymer batteries are impressive. Unless you are planning to boil a kettle, shorting them when changing connectors is a bad idea as I discovered. Luckily a window was nearby. That, and avoiding a full discharge, are the only vices. Otherwise they pack a decent amount of

energy into a compact package.

I am careful not to discharge LiPos too low so I set telemetry to tell me when I have used a certain amount of mAh or energy. For example with a 2200mAh it tells me when I have used 1500mAh.

It is a bad idea to store LiPos fully charged or below about 20% charged, as it reduces their lives. Ideally they should be discharged to a middle 'storage voltage'. More of that later. I left a battery in a glider with the receiver switched on. When I realised it, the battery was down to 0%. I was tempted just to throw it away but it was an expensive graphene and I decided immediately to try a recharge. To my surprise it charged without complaint and appears to be back to normal performance. On the other hand I have just had to recycle a 6S 4.5Ah that I left connected overnight to an ESC that I had been testing. That was gone beyond recovery so it might be that graphene handles full discharge better.

The energy cost is low — about 0.8 pence (1 cent) to charge a 3S 2.2Ah at 50% efficiency, but there is one major drawback with electric flying. With IC flying you use the same fuel in all of your models. Apart from the 2.2Ah 3S size which is used for many small and medium sized models, you have to buy a whole range of different sizes of battery. It gets expensive. On a long flying day you will need to recharge at the field. I am lucky to have mains electricity at my club but I take a 12V 120Ah leisure battery to the field anyway.

It pays to buy well-known brands of LiPo. When they were out of stock everywhere in 2021 I bought some that were unknown to me but from a well-known model shop. I always check and record the internal resistances (Part II of this series) of the cells in new batteries. I was horrified to see after three charge/discharge cycles that these were all around 30 milliohms rather than

the 1 to 5 that you should expect. They went back for a refund.

I use the self-adhesive indicators shown in Picture 1 on my batteries. As I remove a battery after a flight I slide it to red. When fully charged I move it to green. When discharged to storage voltage I move it half-way. HobbyKing sells them but I prefer the EV-Peak ones in the picture. I got mine from Tomtop at $US3.67 for ten. They are much more robust and the backing paper comes off more easily. You also get sheets to stick on your batteries to record when each charge was done. No, I don't bother with those.

Picture 1: Self-adhesive charge status indicators. Green means ready to go, red means the battery needs

recharging. (image: EV-Peak)

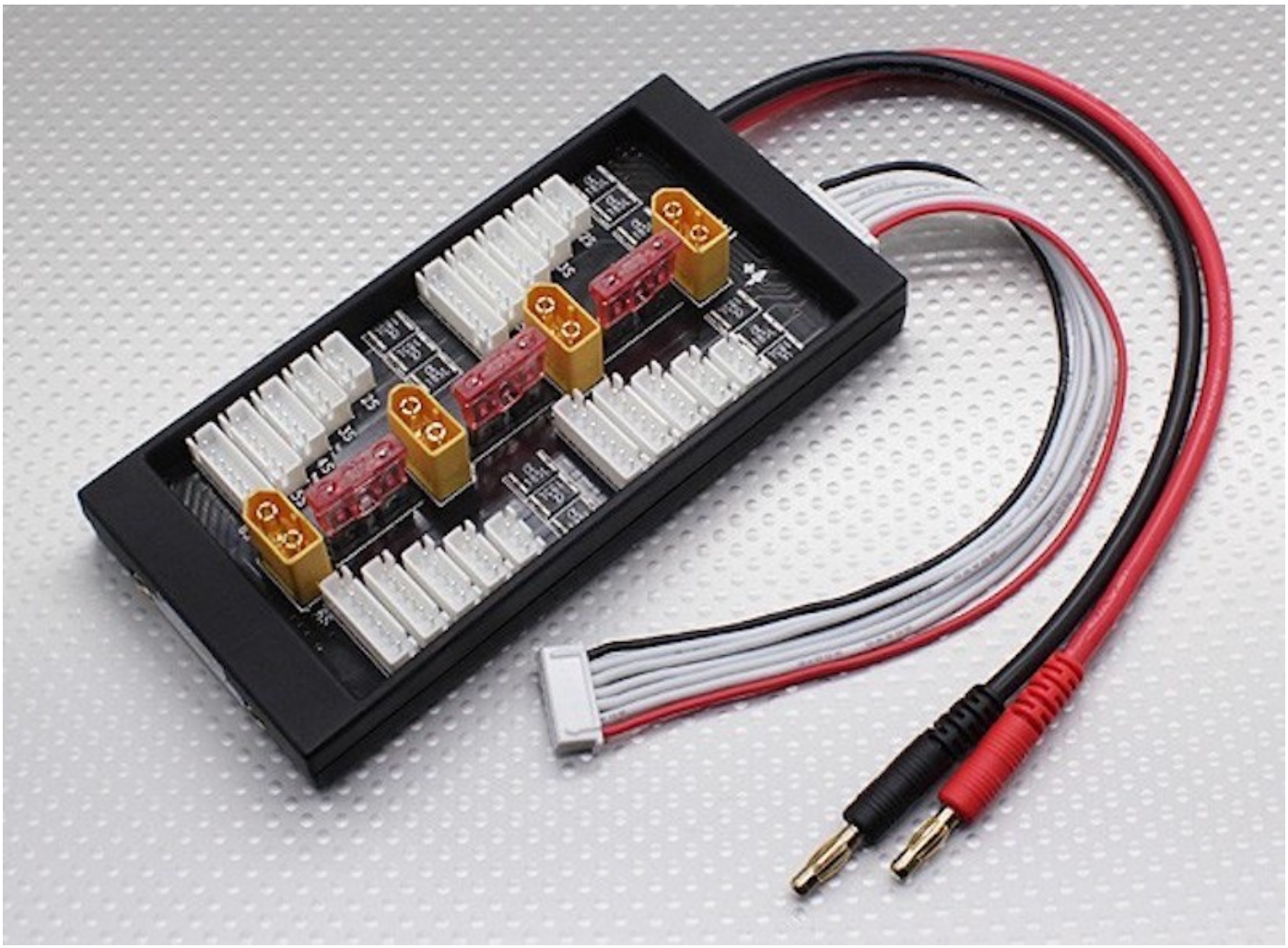
LiPo Storage Voltages

Being an optimistic cove I always assume that the next flying session will not be too long coming so I usually don't discharge my often-used batteries to storage voltage. However I expect that reduces the battery's life. Your charger will have a storage setting, but just in case you want to check without hooking up here are rough storage voltages. A bit either way won't matter.

Per Cell	3.8V
3S	11.4V
4S	15.2V
6S	22.8V

Parallel Charging and Balance Boards

These made no sense to me at all. How can several batteries be charged and balanced off one lead? Surely each must be charged and balanced to its own voltages? But people assured me that a board like this from HobbyKing actually works (Picture 2). So I decided to see if I could figure it out.



Picture 2: HobbyKing parallel charge board. (image: HobbyKing)

Charging

Let's say we have four 3S batteries. When connected each will have different overall voltages, say 11.00, 11.32, 11.20 and 12.01. Plug them all in and what happens? Two effects. First the charger will start to pump charge into all of them. Secondly the higher voltage batteries will discharge into the lower voltage ones. That makes sense. Eventually all will settle to the same voltage.

Balancing

Is the same thing going on at balance level? Can we extend the above

argument to the four sets of three cells. I suppose the higher voltage cells will discharge into the lower until they are the same.

How Long Does It Take?

So I can now see how it can happen. However logic tells me that this is all going to take a long time as the balancing currents produced by small voltage differences will be small. Is there an optimum number of cells? Maybe with two batteries it would be quicker to charge them separately. Maybe not for three. Does anyone know? I'm not asking for a scientific study but practical experience.

Charging LiPos Safely

We are always advised not to go away from LiPos when charging or to use a fire-resistant bag or box (Picture 3). I recently found out the wisdom of that.

I was testing out the motor of a new electric glider using a nearly new lipo. The voltage on the telemetry was fine, but dropped rapidly under high throttle. The ESC shut down, which should have made me suspicious even though the battery was new. I just assumed the battery needed charging.

I started charging it and put it in a fire resistant bag. As I was working nearby I heard a loud hiss coming from the bag. I unplugged the LiPo and chucked it out of the window still in the bag. It didn't catch fire but swelled to double the size and it might have gone up if I hadn't disconnected it.

Picture 3: Fire resistant bag. (image: RobotShop)

Stay Out of the Sun

No, not you, your LiPos. I charged a battery at the field not realising that the sun would hit it after a while. It was intense that day and I found that the battery had swollen badly. Tests proved that it was not worth risking it so

another one bit the dust.

What lessons did I learn? If a LiPo behaves strangely check its cell voltages and internal resistances. The latter is covered in an earlier article in this series. If in doubt discharge it and recycle it. It is cheaper than redecorating, quicker than a house rebuild and less painful than skin grafts. Oh and only charge in the shade.

Comparing Energy Stored in Different LiPo Batteries

It is energy that mostly decides powered flight times. However no battery label shows us how much energy it holds when fully charged, only amp-hours and the number of cells. Comparing the energies in different batteries can be troublesome.

Though they are improving, LiPo batteries still fall a bit short of what we would like. What I will do here is give two simple ways to compare the energy stored in different combinations of number of cells and capacity.

- The formula is energy = voltage x current x time (volts x amps x seconds)
- A fully charged LiPo has about 4.2 V per cell.
- Current x time is shown on the battery as capacity.
- However it is shown as amp-hours (or milliamp-hours which we divide by 1000).
- In the formula we need amp-seconds so we multiply the result by 3600.
- If **N** is the number of cells in series e.g. 3S gives N = 3
- And **C** is the capacity in Ah (mAh divided by 1000), the final formula is:

> **Energy = N x 4.2 x C x 3600**

For example a common 3S 2.2 Ah battery has: 3 x 4.2 x 2.2 x 3600 which is about 100,000 joules of energy; a 6S 5Ah has 6 x 4.2 x 5 x 3600 which is about 450,000J.

By the way a kWh ‘unit’ of mains electricity is 3,600,000J.

Of course batteries waste energy internally due to their resistance, which is why they get warm. And they lose capacity as they age, but using the above method will give you the chance to compare. As shown in a previous article, using more cells, giving higher voltage, reduces current which reduces heating and wasted energy, so will use the energy more efficiently.

An Even Easier Way

This method won’t give you the energy in joules but it will allow you to compare energy content and so powered flight times. Simply multiply the number of cells by the capacity.

For example which has the highest energy, a 3S 6Ah, a 4S 4Ah or an 8S series combo with 2.5Ah?

3S	6Ah	3 x 6	= 18
4S	4Ah	4 x 4	= 16
8S	2.5Ah	8 x 2.5	= 20

So the 8S wins and could well be even better as the lower current will waste much less energy. I feel entitled to give a name to the measure. Let’s call it ‘esscap’. S x C.

Nickel Metal Hydride Batteries (NiMH)

Charging

NiMHs are probably the most tricky batteries to look after. Charging is complicated and slow and they lose charge when not being used, at up to about 4% a day. Why do we use them then? The four and five cell receiver packs give 4.8V and 6V which is exactly right for many receivers, retracts and servos. They are compact for their capacity and do not risk high voltages ruining equipment as can be the case with a 2S LiPo with voltage at up to 8.4V.

Why Are They Tricky?

I had just bought some Eneloop 4.8V packs. The label says to charge at 200mA for 16 hours. How long? As I wanted two in the model because of the powerful coreless servos this meant using two chargers or charging for up to 32 hours. And this has to be done just before a flying session to avoid charge losses. I thought I would find out more.

NiMHs must be charged carefully. It turns out that there are two safe modes of charging, at C/10 and 1C where C is the capacity in Ah. That is ‘safe’ in the sense of getting long life out of the batteries. They don’t catch fire like LiPos. Alternatively if you are really organised you could do it all manually by fully discharging then doing a timed charge at a certain current.

Mode 1: Low Current

This can be done, with care, using a general-purpose charger in NiMH setting. You charge at C/10. For my 2Ah this gives the 200mA on the label. There is a potential problem. If you do not disconnect the battery at full

charge, oxygen is generated in the cells. There is a catalyst in the cell that destroys this but it generates heat. So you have to be around to disconnect when the battery gets warm. For up to sixteen hours?

Mode 2: Minus DeltaV

When a NiMH cell gets near to full charge its voltage drops by about 10 mV, called ‘minus DeltaV’ (-deltaV). It is safe to charge at much higher rates if the charger is designed for NiMHs and its specification includes words like ‘peak’, ‘delta’, ΔV or ‘-deltaV’. This means that its software can detect the voltage drop and switch to a low current to do the remaining charging. It then switches off.

I bought a mains-powered Radient Recoil charger similar to that shown in Picture 4 for the surprisingly low price of £13 ($16). This charges at 2A, which for my batteries is 1C. This current means that it is probably not suitable for NiMHs with a capacity lower than 1Ah. There is an LED indicator to show the various charge stages: `Stand by`, `Charging`, `DV mode`, `Charged`, `Error`. DV is the -deltaV final charging stage. As you see it has, for no obvious reason, a Deans connector so I had to make an adaptor for the JR connectors on the batteries.

Picture 4: Radient Record NiCd/NiMH peak detection charger. (image: HobbyTown)

It is likely that your general-purpose charger also has DV detection in its NiMH settings, but you will need to check in the manual or on the menu. At least you now know what to look for. My iSDT, GT Power and other chargers have the option when you select NiMHs.

That's it for this month, see you next time for Part VII where I'll be talking about how **not** to burn your expensive brushless motors out!

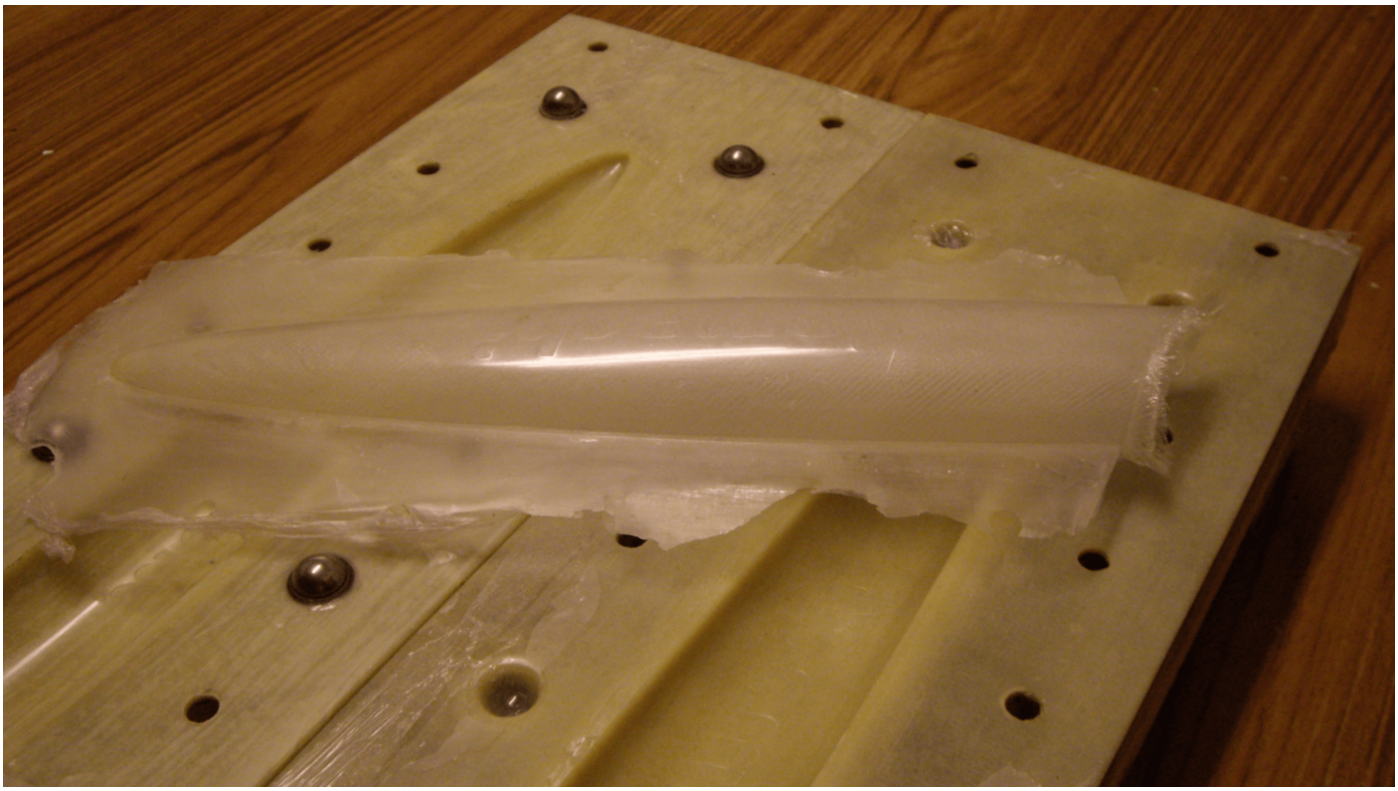
All images and video by the author. Read the [next article](#) in this issue,

*return to the **previous article** in this issue or go to the **table of contents**. A PDF version of this article, or the entire issue, is available **upon request**.*

Shinobi | A Home-Grown Moulded Fuselage

Part VI: Here's Where We Become Pin/Ball Wizards

James Hammond



A finished Shinobi nose cone fresh out of the completed nose cone mould.

*Readers who have not already done so may want to read the **previous parts** of this series before continuing with the article below. — JH*

First, a Bit of Joining Information

Before we get into alignment I will say one thing about joining the laid-up parts in your new moulds because it has a direct effect on the end results: I do it wet with the layups still soft, or at least green and preferably

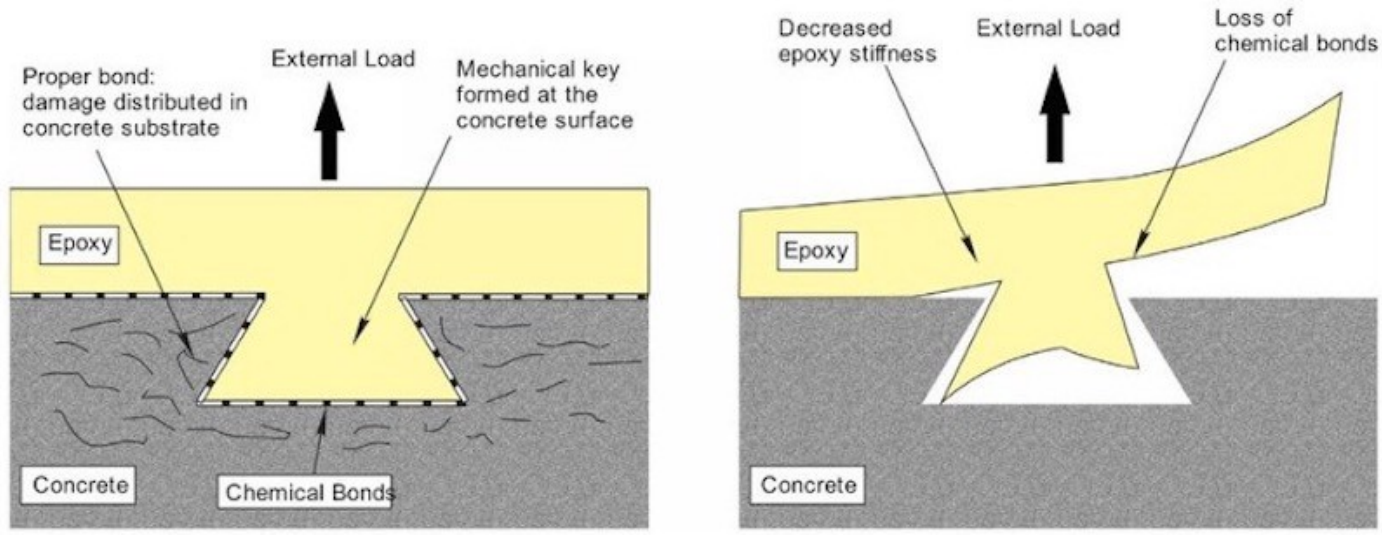
immediately after finishing glassing the two halves. I have never tried to do this operation dry, on cured mouldings — mainly as I know a chemically receptive join will give a far superior result. A wet join has the added benefit of an overlap where the layers of glass form a reinforced ridge along the seam. Wet joins are therefore mechanically and chemically far stronger than dry joined parts. Also, there can be difficulties and possible damage to the mould that comes from trying to trim ragged, hardened glass edges back to the seams by cutting or grinding. Some people do this regularly and swear by it, but I don't.

Notes for Techies Only

Here, I'll explain just a little more about the physics of epoxy binding for those who are curious. If not — skip this part!

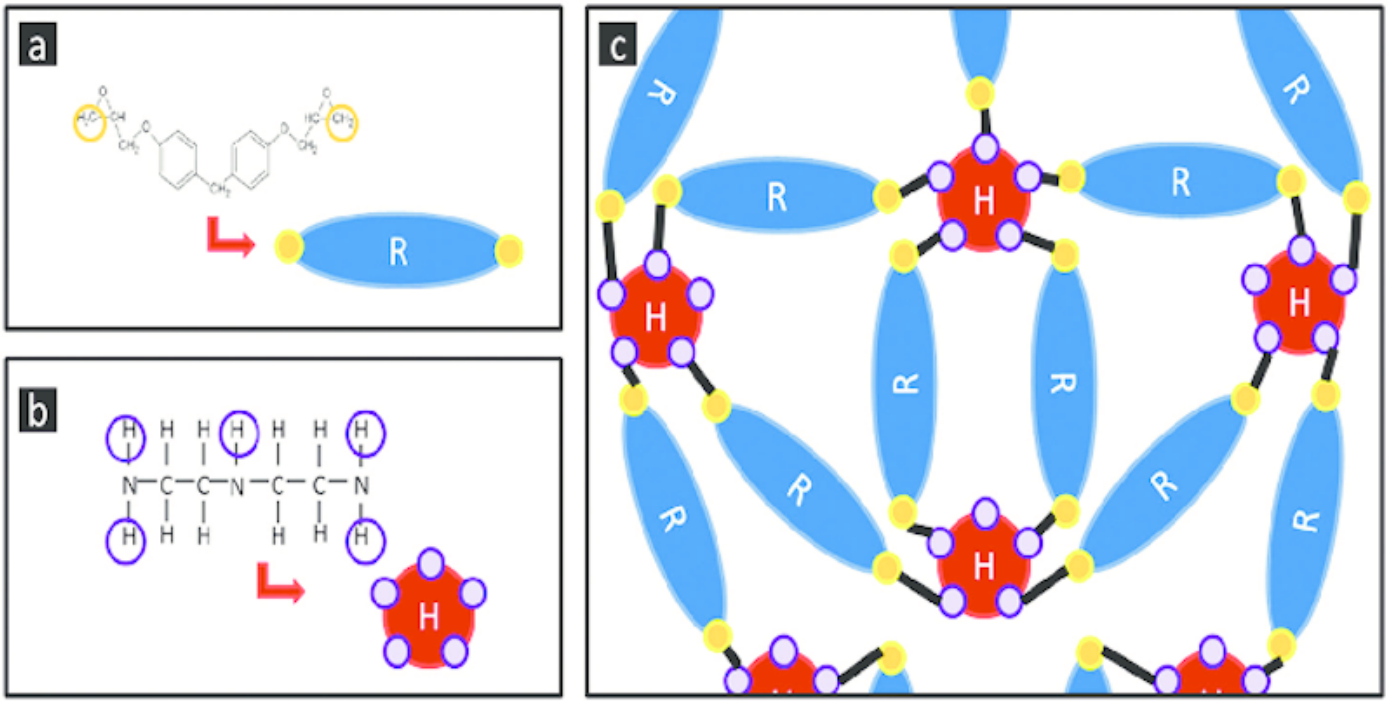
The ability for epoxy resins to chemically (ionically) link diminishes as the epoxy cures and then the joint becomes a **secondary** [1] or mechanical bond. Whereas, epoxy applied to or over partially cured epoxy will chemically link with it and is a **primary bond**.[2]

[1]***Secondary*** *bonding relies on the mechanical linking of the epoxy/glass to a different material or to a cured epoxy surface.*



Here is a simple adhesion diagram in this case joining epoxy to concrete but in fact it does not matter too much what the substrates are the effects are the same. (image: Jovan Tatar et al)

[2]***Primary bonds*** *involve sharing or donating electrons between atoms to form a more stable electron configuration. Primary bonding occurs when electrons are lost or gained so that the outer shell is filled.*



Here is a diagram of the crosslinking that occurs when epoxy substrates are chemically joined for a primary bond. (image: Jinjun Zhang et al)

Meanwhile, Back at The Ranch

Having separated the first half of the nose cone from the parting board, we now need to decide how to make sure that the two halves of the finished mould will actually locate in exactly the same place each time so that we get those lovely wispy thin seams.

There are two main choices: pins and balls. Each has its merits, plus there is also the case for a ‘hybrid’ pins/ball alignment method which should work well although I have never tried it.

A Shinobi nose cone fresh out of the mould — note the crisp seams.

The Case for Ball Alignment

I use ball bearings, 12 to 15mm in diameter embedded and epoxied into the mould lands for alignment. The spherical bearings will provide alignment that, if not as crisp as Pins, is nevertheless pretty darn good. But in fact, the

reason I use this is that it literally gives a little 'wiggle room'. Sometimes in order to get the glass overlap to align nicely with its mating area on the other mould half, it's nice to be able to skew the moulds a little bit sideways as they are being joined. With smaller moulds or odd shapes, this can be a distinct advantage.

The Case for Pin Alignment

Vertically orientated 6mm to 12mm pins arranged around the outside lands of the mould are a good way to align the mould halves. After a layup, with the wet glass as yet not bedded down, the two halves of the mould can be loosely positioned and the pins can then be pushed through the pre-drilled holes to accurately locate the mould halves. After inspection to make sure none of the glass is trapped in the seam, the joint can then be bedded down with a roller or similar, then the mould halves clamped for curing.

> ***Advice:*** *Hardness: Make sure that the pins you will use are hard — at least steel or stainless steel and preferably hardened carbon steel. The reason for this is that if by some chance a pin becomes stuck in the mould, it can be gripped tightly to twist it out.*
>
> ***Advice:*** *Pin length: make sure that the pins are long enough to go completely through both sides of the mould and then some so that they can be gripped to remove them if needed.*

The Case for Hybrid: Balls + Pins

I have never tried a combination of pins **and** balls but on thinking about it, this could be a very good way to go. This new method would comprise of aligning the mould halves using the balls to allow a bit of skew, then when all is aligned and the seams bedded down push the Pins into place. I have never

tried this approach but I think I will on my next mould as it would likely provide the best of all worlds.

Here the alignment balls have been inserted into the holes and the surrounding gaps are filled with epoxy.

Selecting Ball Alignment for Shinobi

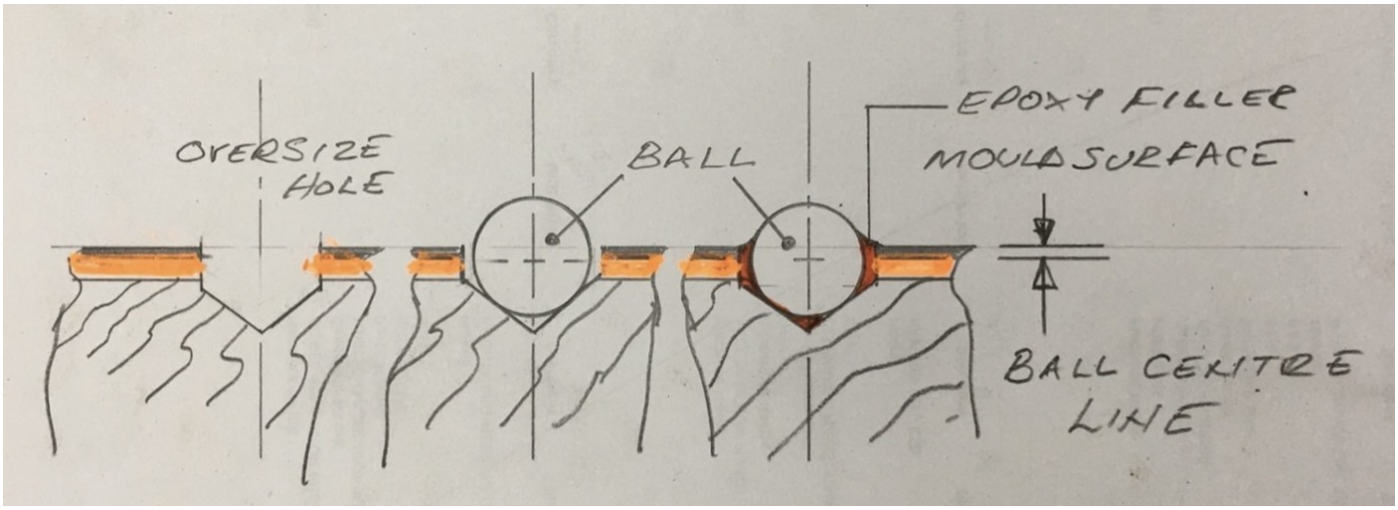
I like to space my alignment aids (pins or balls) at a distance that will allow them to do their jobs well but not be so numerous as to be a chore to clean at the end of a moulding job — but even for a small part, I would still use at least four. 8″ (200mm) to 9″ (230mm) spacing is about right and try to make the distances as even as you can — but remember they don't have to be exactly spaced the same.

First, we need to mark the positions of the balls or pins on the mould lands, and then drill the appropriately sized holes. Here we need to make sure that the pins positions will allow the pins to go clear through the mould, and not interfere with any cross bracing. In the case of pins, it's a good idea to use a

drill press to bore the holes if humanly possible so as to get a ninety-degree vertical alignment. Also, it's best to trial drill a couple of holes first in a spare piece of timber to make sure that the pins are not too loose. If necessary buy a new drill bit but if the hole sizes do turn out to be a bit too large, and the Pins are loose, then don't despair- we have a fix to cure that problem later.

For ball alignment, the holes are purposely drilled a little larger than the ball bearing diameter and are only drilled to just over the ball centre depth, but it's a good idea to test drill a couple of holes in a piece of scrap wood first to get the depth correct. I simply use a piece of tape wrapped around the drill bit to set the depth by hand, but a drill press with a depth setting feature is always preferable. Thus:

I simply use a piece of tape wrapped around the drill bit to set



Shallow holes are drilled into the mould surface to allow the balls to settle just below the centre line. Then epoxy is applied to secure them.

Setting the Locators into the Mould Half

For the ball method, the next step is to set the balls into the mould half. First, check that the holes are drilled to the correct depth by dropping them one by one into the holes. Check each one individually. They should all sit with

the centers at a depth of just over 1/16″ to 3/32″ (1mm~2mm) below the lands and no more. If they are a little shallow then tickle them a bit deeper. If too deep then insert small scraps of wood to raise the ball up a little. That done, and when you are satisfied with the ball height mix a small amount of epoxy and using a thin piece of wood (I use chopsticks — a valuable tool in any workshop) drop some epoxy into the hole — not too much as you will almost certainly have to add more later — and then drop in the ball.

Repeat this process with all of the balls, adding a little more epoxy to any that do not have a nice meniscus, and wiping the epoxy away from any that spill over. When the epoxy has begun to harden then leave the assembly for at least 12 hours to allow the epoxy to cure.

> ***Advice**: Check the epoxy levels around the balls: leave the balls for 10 or 20 minutes and then check again — you'll probably have to add a little more epoxy here and there as the wood reinforcement absorbs some of the resin.*
>
> ***Advice**: Waxing: for the pins method, first wax all the pins with mould release wax following the instructions in wax drying times and process — do this a few times. If the pins are a good fit in the land holes, then push them all down into the mould half with half of the pins protruding.*
>
> ***Advice**: Loose pins: if the pins are a little loose then wrap a little thin tape around them where they go into the bottom of the first mould half to secure them in the holes. If this fix has to be used, try to get the pins as vertical as possible.*
>
> ***Advice**: Balls: if you intend to use clamping bolts through the mould then mark the positions of the pins or balls on the outside of the mould reinforcements so that you have a reference when both halves of the mould are completed. It's not good to drill the bolt holes into the balls. In*

> *the case of pins, the positions can easily be seen.*

The first trial finished Shiniobi nose cone. All is looking good.

Making the Second Nose Cone Mould Half

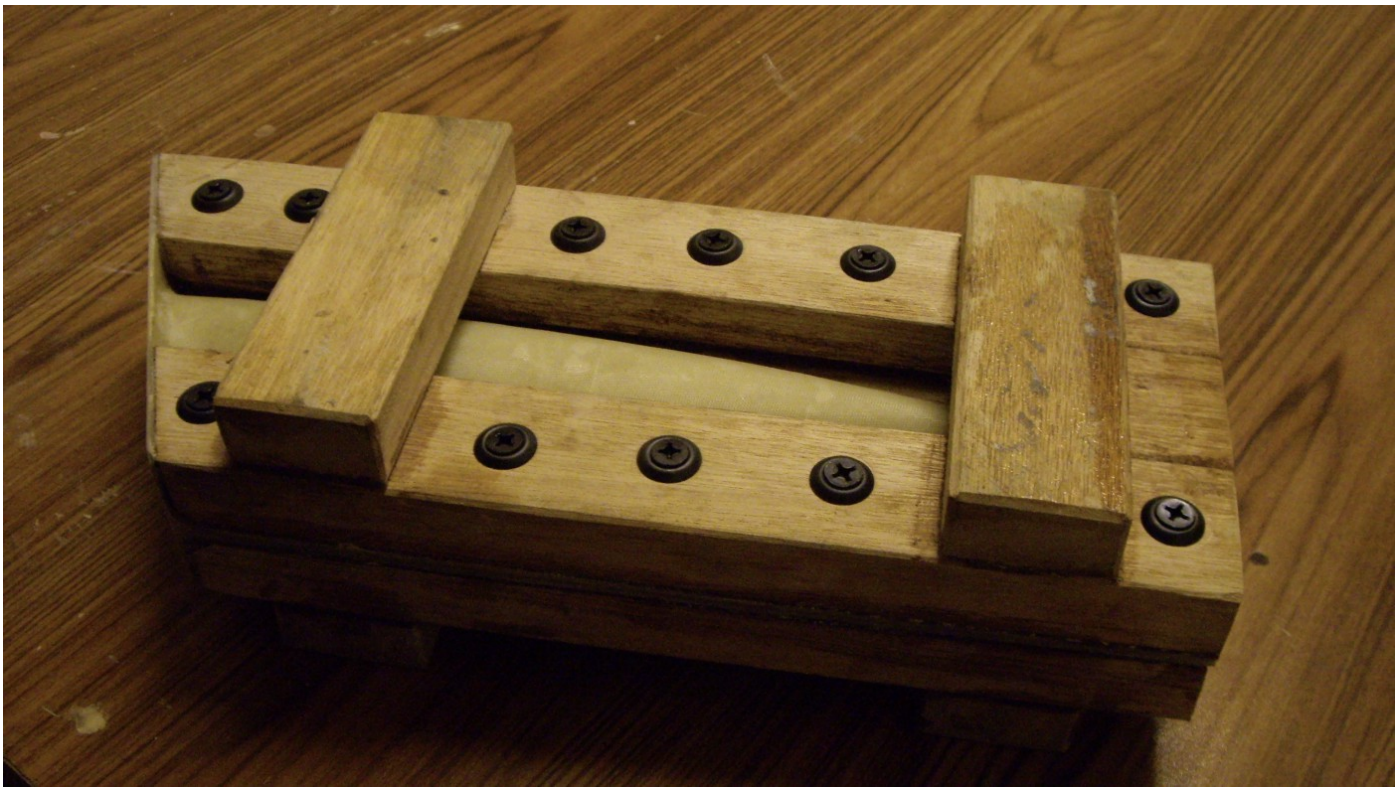
Preparation By now we have done quite a lot of work so the first mould half has had quite a lot of handling. So unless you did it in an operating theatre and used surgical gloves throughout, then there may be microscopic traces of dirt, oil or grease. It's a good idea to clean the mould lands and the exposed part of the plug thoroughly with alcohol. After that, apply release wax according to the instructions — several times. I like to use at least four applications and preferably more — always waiting between coats to allow the wax to harden in the air.

Wow…the nose cone mould is complete now and separated from the plug.

PVA Release Agent Here, I'll reiterate what I have mentioned before: you might like to think about an insurance policy in the form of a layer of PVA release agent. A light layer of PVA will almost certainly guarantee that the plug will release nicely from the mould when that exciting time comes.

> ***Advice:*** *Loose pins: If your pins are loose, then it's best to take them out and wax them separately before putting them back again, secured with tape prior to applying the second mould half gelcoat layer.*

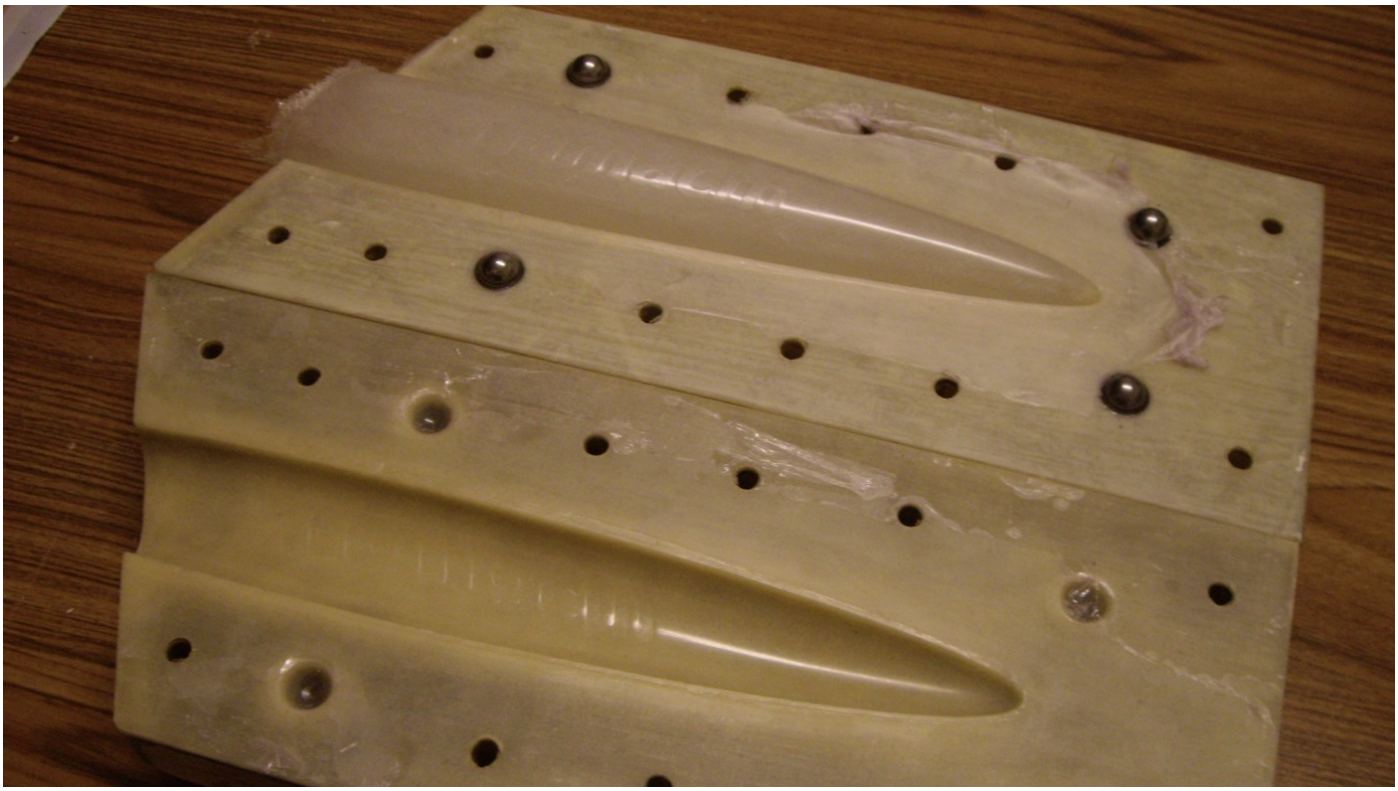
OK, let's clear the decks first. Ready to roll? Then mix and apply the gelcoat epoxy to the waxed mould/plug surface and as usual, leave it severely alone until its begun to set. The waiting time can be used to prepare the light and heavier glass strips to be used for the glassing over the gelcoat. Just to remind you, in a good green state, the gelcoat should be easily marked by a fingernail but not sticky. After that, it's on with the glassing and then the wood reinforcements just as we have done before.



Here the outside ragged glass edges have been trimmed and rounded and the clamping crews inserted.

For the next part, since I have no reason to reiterate what I have already written, you can use the same methods we have used on the first half to make the other side of the nose cone mould.

In the next part of this series, we separate the nose cone mould halves, start to clean and polish them and then begin preparation for making the first fuselage half shell.



Here the moulds have just been separated from the plug. Note the PVA release agent residue around the edges.

Between now and then, if you have any questions please don't hesitate to post them to the *Responses* section below and I will do my best to answer them. Putting them here also means others will benefit from both your question and my answer.

Thanks for reading and good luck with your project!

Resources

- ***Durability Evaluation of Florida's FRP Composite Reinforcement for Concrete Structures*** by Jovan Tatar, Mark Lisek, Natassia Brenkus and H. R. Hamilton.
- ***An optimized cross-linked network model to simulate the linear elastic material response of a smart polymer*** by Jinjun Zhang,

Bonsung Koo, Nithya Subramanian and Yingtao Liu

*All images by the 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**. A PDF version of this article, or the entire issue, is available **upon request**.*

The Tip of the Ed-Berg

The Immaculate Ejection

Bob Dodgson

"Several Dodgson gliders in this photo shot at 60 Acres Park early 1990s." (image/caption: Waid Reynolds)

This story originally appeared in the 89–2 edition of Second Wind, *Dodgson Designs in-house newsletter. — Ed.*

Gary Brokaw, perpetrator of the famous AFART (Automatic Flap Aileron Reflex Trim), the Automatic AFART etc. staged a real attention grabber, as he was getting boringly high in the standings at the 1989 AMA Nationals in Pasco, WA.

Gary, always the consummate showman and special effects wizard, rigged his Camano's radio system so that at the apex of his well calculated zoom

top-off, the receiver and batteries would eject from the glider and forever vanish into the atmosphere. All went as orchestrated by Gary — a perfect launch to great altitude, a powerful zoom and the perfect top-out. Then came the pay-off. The plane started doing the minuet in the air, gracefully swooping, looping and doing wingovers. Gary's planning was perfect — right down to a perfect greased- in belly landing.

Needless to say, Gary's careful work in allowing for windage etc. was rewarded with an outburst of spontaneous applause from the entire soaring assembly. With a knowing and defiant smile, the cool FX man took his bows and was last seen trying to rematerialize his vanished receiver and battery pack. One of his droll flying buddies was overheard saying "that's what happens when you fly with AFART"!

Soon after Gary's masterful performance and the much deserved recognition that he received, a lesser man tried to capture some of the glory. I am sad to say, this man was me. Thinking that Gary had gone a bit overboard, playing to the crowd, with receiver ejection etc, I thought that a more subtle approach was in order.

I set the stage by turning in a couple of perfect flights with perfect times. Now for my moment in the sun. I did a great zoom off of launch — and surprise, no control. I was trying to play the crowd now like the FX man had done so well before me, but alas, they all assumed that I just could not control my glider.

As I went off running down the field, after a rapidly disappearing and stalling glider, all I could hear ringing in my ears was "well, there he goes again". Fortunately Bill Hanson found my plane for me. It was about half a mile away, lodged in an embankment, slightly damaged but still flyable.

Go figure. Here, I had succeeded beyond my wildest dreams — yes the

receiver battery had come unplugged at the top of the launch and all had gone perfectly except that the crowd was not sophisticated enough for my subtle performance. They had all assumed that I had just screwed up again! I did learn one thing though, never follow Gary (he FX man) Brokaw when you are playing to an audience that has been standing out in the hot sun for several days!

Off the field, in an effort to mend my shattered ego, I thought that I would win back the crowd on an individual basis — using my wit and charm. That evening I went for a cooling dip in the pool at the Clover Island Inn. While I was the only one in the pool, at the time, I noticed that an animated group of about four people were bemusing themselves in the hot tub. After achieving my usual state of cool- down in the pool (Tom Brightbill just calls me 'Numbnuts') I sauntered over to the hot tub to get thawed out and to start my campaign to contain the damage done to my reputation by the unfortunate misinterpretation of my afternoons performance at the glider field.

I carefully sized up the group — a dark haired young man of about 30, and three fellows who looked to be of varying stages of pre- and early puberty. "Ah", I said to myself, "easy prey!" In my most condescending and sincere sounding voice, I smoothly stuttered out: "I could not help but overhear you fellows talking about gliders". I was putting out the bait so once I got them to bite, I would reveal who I am and they would naturally think how fine a fellow I am to talk to regular flyers, like themselves, and thus, they would become mine. "Are you guys sailplane flyers?" I went on. To this, the boys started tittering among themselves.

"I must have embarrassed them" I thought. "They probably do not fly very well and so do not know what to say". In an attempt to ease their insecurities, I gave them a reprieve by asking "Where are you fellas from?" The reply was

“California” and more tittering. For the first time, I was beginning to think that I might be losing them — and then to my horror, the man quietly and patiently said, “you know who I am, you just don’t recognize me — but that is all right, I didn’t recognize you either until I saw your plane pirouetting off into the sunset today.”

Then it hit me and I died right there; this semi submerged man before me was non other than Don Edberg and his sons (without the sun glasses, without the special hat and neck protector combo and without the ever present, telltale camera pouch at his side). This man had just won the F3B event and who has been famous in the world of soaring since his late teens!

Now you see one more reason why for me personally, the 1989 AMA Nationals became known as ‘The Port of Pasco Fiasco!’

©1989

“Here is a picture of Dave Banks holding the Dodgson Designs Pixy with which he won the 2M class at the 1989

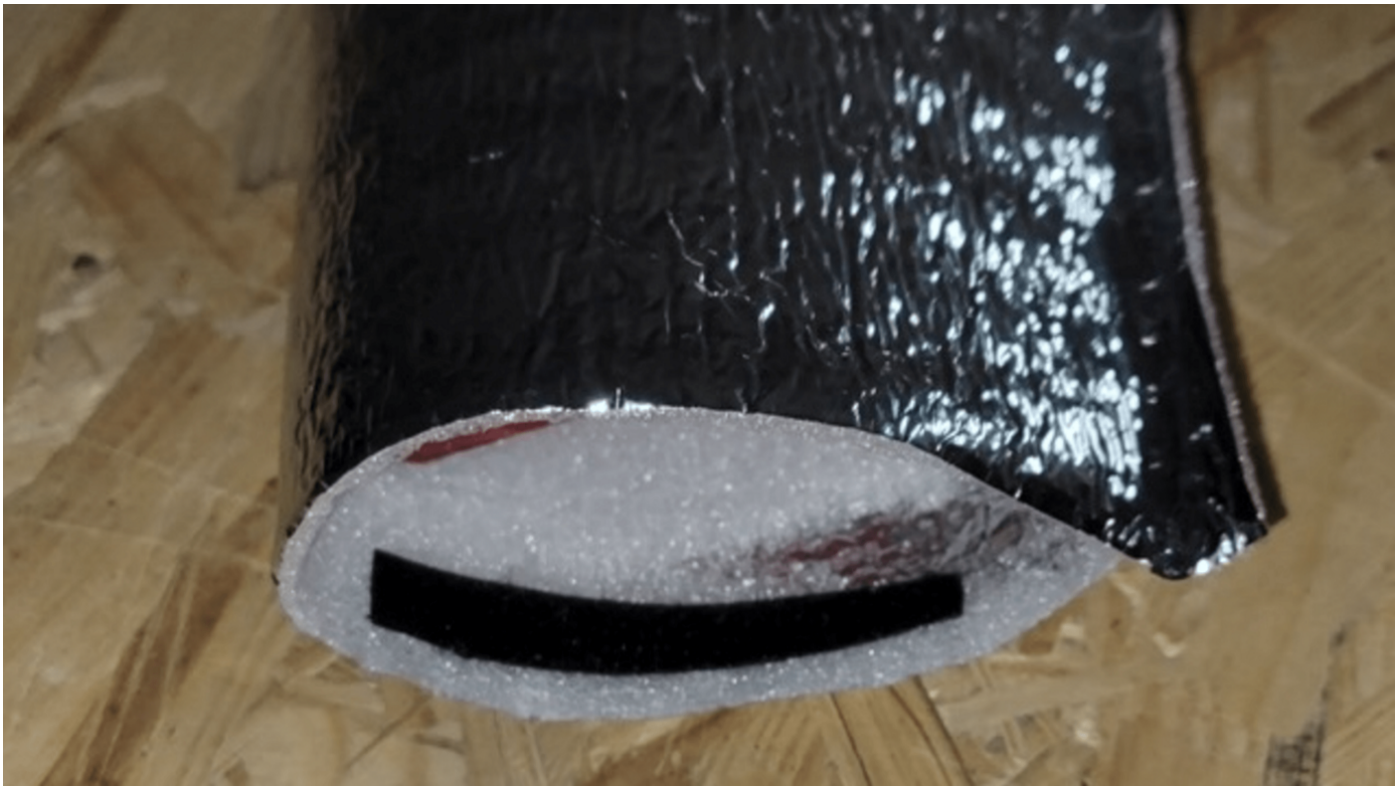
Nationals at Pasco. He and his Pixy also got the highest score of any glider class at the 1989 Nationals — so it wasn't as bad for Dodgson Designs as it was for my personal adventures." (image/caption: Bob Dodgson)

Read the collected works of Bob Dodgson in the New RCSD: see **The Dodgson Anthology**. *Also, are you a fan of the retro* ***Dodgson Designs logo****? Otherwise, now read the* ***next article*** *in this issue, return to the* ***previous article*** *in this issue or go to the* ***table of contents***. *A PDF version of this article, or the entire issue, is available* ***upon request***.

Quick Covers (Revisited)

I guess we can blame the catch-all ‘supply chain problems’, right?

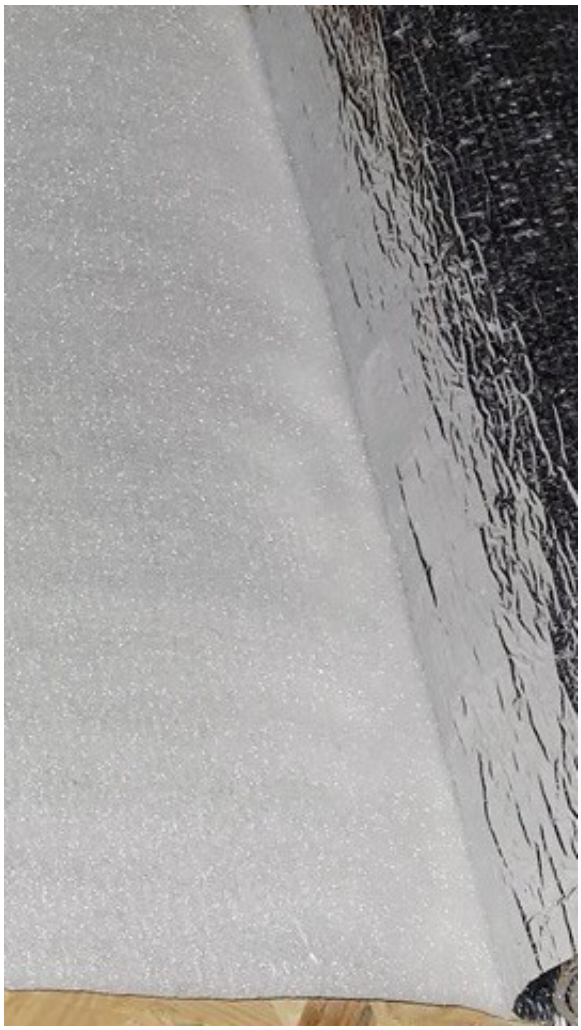
Tom Broeski



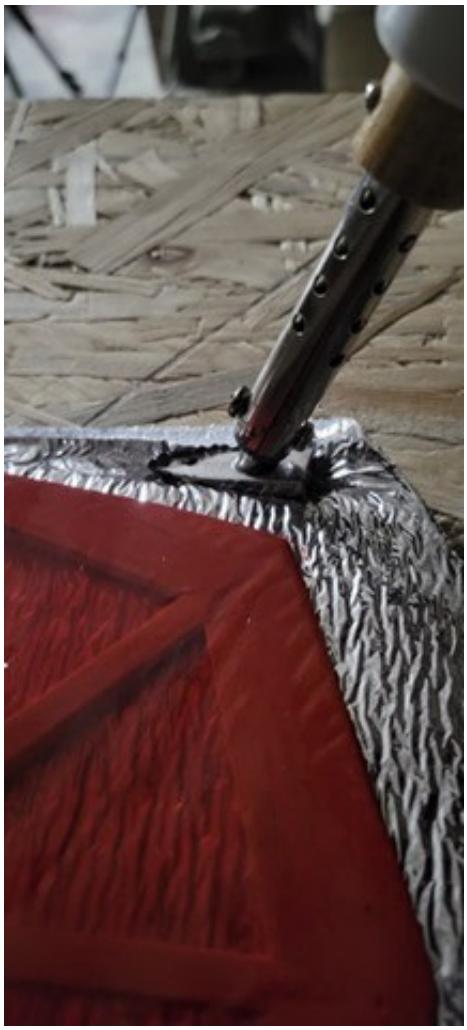
The hook-and-loop method used to seal up the enclosure when the part is inside.

As is sometimes the case, product specs don’t age well, and that was the situation with the previous article of mine on this subject (see *Resources*, below). A number of readers had trouble finding the product mentioned therein. So I went on a hunt for an alternative which I could test and see if it met the spec. Success!


ENERGY CONSERVATION
FOR THE NEXT GENERATION
SmartSHIELD
RADIANT BARRIER + INSUL +VAPOR BARRIER
ALL IN ONE



The material is labelled *SmartSHIELD, 3mm, 24in x 25ft Reflective Foam Core Insulation roll, Radiant Barrier, Commercial Grade, Pure Aluminum* (see *Resources*, below, for link) The one side you don’t need — the ‘inner’ side, next to the part the bag encloses — can easily be peeled off. This was easier to do than with the previous product I tested.



Given that there is no substantial difference in the technique, simply follow the instructions found in the previous article (again see *Resources*, below).

It's best to size the particular bag you're making by using the actual part as a guide, as shown in the pictures above.

Once again have at it, let me know if you have any questions. Thanks for reading.

Resources

- ***SmartSHIELD -3mm 24"x25Ft Reflective Foam Core Insulation roll,***

Radiant Barrier, Commercial Grade — Pure Aluminum — Sadly, it's currently showing as out of stock again, but least you have an exact spec to guide your search. Google is your friend.

- ***Quick Covers*** — the original article which should be used as a guide to employ this new material described in this article.

All images are by the author. Check out all of **Tom's Tips** *here in the* New RC Soaring Digest. *Read the* ***next article*** *in this issue, return to the* ***previous article*** *in this issue or go to the* ***table of contents****. A PDF version of this article, or the entire issue, is available* ***upon request****.*

The Trailing Edge

Momentum

The NEW RC Soaring Digest Staff

Merriam-Webster dryly defines it as a "*strength or force gained by motion or by a series of events*". Yuck. We like iconic Scottish singer-songwriter Annie Lennox's take on the subject much better:

> "When you're…successful, things have a momentum, and at a certain point you can't really tell whether you have created the momentum, or it's creating you."

And so it is with the New RCSD these days. It's hard to believe that just a little over a year ago we were sitting around and wondering "so how are we going to do this exactly?" while staring at a blank whiteboard. While its

indisputable that we were standing on the shoulders of 34 years worth of RCSD back numbers, we were still attempting to create something entirely new with respect to production, format, distribution, marketing and business development while not losing sight of from whence we came.

Fast forward to the production of this, our 17th issue, and while we are light years away from having the operation running itself — actually, that day will never come — at the very least there's now a defined process which results in a predictable and something-approaching-sane production schedule which also optimises for all the values that our readers appreciate. We have systems in place to measure how well we do each month and use these to continually tweak the article mix and other variables to ensure that we continue to grow our audience.

We hesitate to say that we have gained a certain amount of momentum — as per Lennox — but it's beginning to feel that way. We're *still* working like slaves creating it, but at least every once in a while we can now take our hand off the flywheel crank momentarily and, as if by magic, it keeps spinning. For a short while, at least.

Our Feature Photo

It was our good friend and multi-article RCSD contributor Iain Medley-Rose who triggered our thinking about momentum in the first place. Unsolicited and right out of the blue, he touched based with us mid-month and passed along his wonderful picture for this edition of *The Trailing Edge*. Whether it was his intention or not — let's say it was! — Iain gave us the gift of many hours back in the long days leading up to a new issue coming out. Finding just the right picture for our bookend articles can easily spin out of control and cost us a ton of time poring over unsuitable also-rans.

So, thank you Iain. The first round is on us as soon as we get a chance to get together. We'll turn it over to you, to tell us about this great minimalist image:

"It was a cold but spectacular day at a very picturesque site at Roundway Down, Iron Age Hillfort near Calne, Wiltshire, UK in the late afternoon of February 10, 2022. This photo was taken from a different viewpoint — sometimes we forget how lucky we are to visit beautiful places at stunning times of the year when the light, the landscape and our passion coincide to create something special. The plane in the photo is an Avatar *by Jiří Tůma of JiToma (see* Resources, *below) and was flown by Mark Passingham."*

Thanks again, Iain, for the opportunity to feature your beautiful work in the past, present and (hopefully) well on into the future.

New Publication Deadline

This was mentioned in Terence's *In The Air* editorial, but it's such good news from our perspective we wanted to share it with you, too. The new deadline for RCSD submissions is the **end-of-day on the 15th** of the month preceding the month in which the story runs. We can't begin to tell you how much we appreciate this! Of course, we'll happily accept your article after the 15th for the issue *after* the next issue.

New in the RCSD Shop

This great new heavyweight t-shirt just hit the shelves in The RCSD Shop. Available in black or white in a wide variety of sizes. We manufacture worldwide and ship worldwide.

Here's a great way to cheekily comment on all the regulations coming down the pipe which will undoubtedly impact this thing we love to do. The slogan worked for skateboarding, so why not RC soaring, right? Actually this fun new item in *The RCSD Shop* reflects the subtitle and subject of this month's *In The Air* editorial: Managing Editor Terence C. Gannon's journey from aeronautical scofflaw to law-abiding citizen, eventually. **Order one today**, and be the first kid on the slope or at the field to have one!

Make Sure You Don't Miss the New Issue

What with all the talk of momentum, you don't want to miss the June issue of RCSD when it's out. Make sure you connect with us on **Facebook**, **Instagram**, **Twitter** or **LinkedIn** or subscribe to our **Groups.io mailing list**. Please share RCSD with your friends — we would love to have them as readers, too.

That's it for this month...now get out there and fly!

Resources

- ***JiTom*** — "The company was founded in 1992 with the goal to manufacture models for the F3x categories..."
- ***In The Air: RC soaring is not a crime*****.**— "I sometimes wonder, as the airliners working Calgary International Airport's runways 17/35 pass in the distance, whether I am running afoul of the to-the-surface Class C airspace..."

Read the ***previous article*** *or go to the* ***table of contents****. A PDF version of this article, or the entire issue, is available* ***upon request****.*