
Radio Controlled
Soaring Digest
January 2022
Vol. 37, No. 1

The New RC Soaring Digest

January, 2022
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In The Air

Time flies like an arrow.

Terence C. Gannon

What better backdrop for a flight than the iconic profile of Mount Fuji in Japan as captured here by Masanori Ichikawa.

One of the great joys of editing this publication are the personal relationships I have established with the many people who contribute to the success of each issue. Of the many discussions which occur over the course of the month, one of the ones I enjoy the most is with Norimichi Kawakami, the author of *Mita 3 Production Notes*, the tenth part of which appears in this issue. I find I often remark to him that 'time flies' between our conversations, which typically occur about the middle of the month. Incidental to the most recent conversation, Kawakami referenced an ancient Japanese proverb:

光陰矢の如し

The essence of the proverb, when translated into English, is that ‘time flies like an arrow’. I love that metaphor. I instantly see in my mind’s eye the arrow cast into flight by the long, graceful bow of a kyūdōka (弓道家). But as a metaphor, I think it might mean more than just the notion of an arrow whizzing by — which times does, of course. It might also impart the notion of the arrow in flight both when viewed from the archer’s position and the position of the target. In either case, the arrow might seem almost motionless. The long, graceful arc of an arrow is distilled down to a quick dip or curve. While less aesthetically pleasing, perhaps, it’s actually better in communicating what’s actually going on as the arrow courses from the bow’s string to the bullseye.

And so it is as the calendar turns from one year to the next. It’s a great time both to look back — toward the archer, if you will—to see how things turned out, and to look forward — toward the target — to see how we would *like* things to turn out in the year ahead.

For my part, I’m happy to look back on 2021 and say that 12 issues of the *New RC Soaring Digest* came out and were enjoyed by readers around the globe — in 94 countries the last time we counted. As I have said previously, while I am supremely unqualified for the work, I *have* learned a lot on the job. To that end, I’m not so modest to not say I think each issue has been a little better than the one before it. That would make this the best one yet. And next month’s even better.

Of course, none of this would have been possible without a gaggle of very talented and dedicated contributors. So 12 successful issues is **our**

accomplishment, not **my** accomplishment. So let me simply say 'well done!' to all of us.

Looking forward to 2022 the goal, of course, is to produce another 12 issues of RCSD, with the additional goal of making each one a little better than the one that proceeds it. My intention is to continue to refine the processes by which the journal is produced so that more content can be delivered in more formats with the same effort. A further goal is to make sure that no matter how diverse the audience, that everybody will find at least one article which really grabs their attention and provides some inspiration for a new project or activity.

Speaking of audience, without putting too fine a point on it, we have a very narrowly defined demographic. That's not the result of anything specific in the environment — it's just the way it is and the seemingly the way it has always been. That said, I don't believe it's the way it has to be. So one of my personal goals for 2022 is to consciously reach out, with your help, to audiences with which we are not currently in touch. We all have an interest in our community being as large and diverse a mosaic as can reasonably be achieved.

Finally, there's the goal of making RCSD financially sustainable over the long term. We continue to court the *Friends of RCSD* to provide long-term, stable financial support in exchange for a platform which helps high quality brands articulate their narrative, and to do so in a way which does not impinge on a pristine reading experience. We also continue to develop the *RCSD Shop*, which is committed to great, unique products at a reasonable price while supporting the ongoing operation of RCSD. If you're in a position to help with either and/or both, by all means let us know!

So as we look both backwards and forwards at this temporal crossroads, I

both thank you for your support over the past year and thank you, in advance, for your enthusiasm, contributions and readership in the year ahead.

I have a feeling that 2022 is going to be a *really* great year.

Patricia Gannon (née Conroy)

I hope RCSD readers will forgive me if I take a bit of this platform to share some personal thoughts. Time going by as quickly as it does is truly both a blessing and a curse.

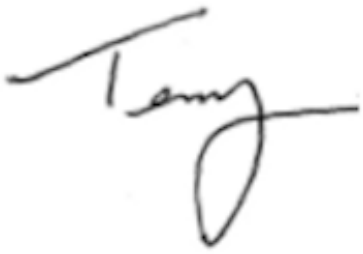
While the family dynamic of our hobby is most often 'father and son', I want to take a moment to acknowledge the vital role my mother played in my lifelong interest in RC. It's true, Dad was the parent who most often accompanied me to the flying field. However, it was my mother who never — not once — complained about us heading out after dinner for a practice session after wolfing down the dinner she had lovingly prepared and afterwards cleared away after we had bolted. Our Mum was very proudly stay-at-home at least until the last of her three kids — that is, me — were all in secondary school. She deserves much credit, along with my father, with churning out fairly decent offspring while keeping a perfect, happy household.

But most importantly, Mum provided the gift of absolutely granite solid support for whatever her kids chose to do. She always encouraged us to be our best, even though she innately believed we were *already* the best of whatever we undertook in our lives. She was there both for the good times and, vitally, also there to console the inconsolable when my latest RC creation came home in matchstick-sized pieces. She would let me cry it out and then kindly but firmly **not** accept "*I quit!*" In Mum's book, there was no

such thing. Her belief in her kids taught us to believe in ourselves, and that priceless gift is the one I take with me for the rest of my life.

Mum passed away quietly and comfortably on December 12th, 2021 in Delta, British Columbia at the age of 88. I imagine by now she is with my Dad as they undertake their next adventure, together, in the great beyond. If you would like to honour her in my sorrow of her leaving us, all I ask is that you take a moment to honour your own mother's contribution to your hobby undertakings and, of course, the rest of your life.

From the bottom of my heart, thank you Mum. I hope I made you proud. I miss you terribly and I'll love you always.



Cover photo*: This month's outstanding cover photo is by Kevin Newton who captured Ewan Maxwell launching a Pitbull above the clouds at East Lomond in Scotland on December 18, 2021. Kevin commented: "What a surreal day. Thanks to Peter Gunning for motivating me to set the alarm [for that] morning."*

Here's where you can find the ***first article*** *in the January, 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****.*

The 30-Year Saga of the Ventus C

And what happens when you entrust the flight testing program to a beloved Disney character.

Waid Reynolds

Long ago and far away in the dim reaches of the late eighties and early nineties of a previous century, a German company named Graupner manufactured a 1:4.5 scale model kit of the Schempp-Hirth *Ventus C* high performance, all-composite sailplane. Years later — the late nineties — while perusing the many interesting booths at the big Puyallup Model Show near Seattle, I stumbled across a "new-in-the-box" Graupner *Ventus C* kit for sale by a private party for what I'm certain must have been a "can't pass it up" price, now long forgotten (and probably not shared with the wife!) Apparently, the original purchaser finally admitted to themselves that they

were never going to do anything with the kit. So, they dumped it on the first sucker who happened along…me. It did seem like a good idea at the time, though. Not long after that I kind of burned out on RC soaring and stopped participating for several years, although I hung onto all the gear, just in case.

The Ventus C's home for something like 20 years.

During this period of dormancy, RC-wise, the *Ventus* was allowed to properly age undisturbed in its classic cardboard box.

In early 2008 I said goodbye and thanks to my job at Boeing. My wife Cheri

and I retired in St. George, a small city situated in the beautiful red rock country of southwestern Utah. With plenty of free time on my hands, my interest in RC flying began to rekindle. I eventually stumbled across a couple of like-minded glider guiders — Terry Sires and Ron Wittman — hanging out at a local turf farm — a great spot for flying RC gliders. Through the wonder of acres of green grass combined with the comradery of other pilots the fire was set fully alight once more.

After flying my rebuilt vintage Laser 3M TD ship (below — white with red wingtips) and a used Snipe DLG for a while, the big box containing the *Ventus* kit drew my attention. Freeing the well-aged components from their dusty cardboard restraints, I slowly began delving into its construction.

Ron Wittman and Terry Sires at Turner's Turf Farm near St. George, Utah.

The kit consisted of a shapely white gel-coated fiberglass fuselage with clear plastic canopy and plastic cockpit tray, balsa-sheeted foam core wings, a retractable landing gear, realistic metal spoilers, balsa, light ply, and various fittings, along with plans and instructions (in German), and decals. Assembly required actual construction of the stabilizer and elevator, the rudder, and the wingtip extensions out of sheet balsa. Remember those medieval times when large scale models required building skills? Time consuming work, but a type of model construction that, being an old-timer, I was very familiar with.

While living in St. George for a decade and dabbling in various RC pursuits — DLG, TD, electric aerobatics, even off-road trucks — I squeezed in some *Ventus*-work between higher priority projects, and finished those built-up balsa assemblies, installed the retract and its servo, sealed the balsa-sheeted wings with polyurethane, installed wing rod tubes in the fuse, and got the rudder hinged to the vertical fin. Lots of people build entire home-built aircraft in less time, and the *Ventus* still wasn't nearing completion. But, at least by late 2016 I could assemble the ship and see that she looked like a rather beautiful sailplane even if she was still a long way from achieving actual flight. Unfortunately, work came to a standstill at that point as other activities took precedence.

First assembly to get a feel for the glider's appearance.

In mid-2018 my wife and I relocated our household to Green Valley, Arizona — south of Tucson. After getting settled into the new digs I continued doing occasional work sessions on the *Ventus*, which had survived the move

unscathed.

In the days of yore when this kit was designed, control surfaces were typically operated by pushrods emanating from servos mounted in the fuselage. After pondering my pitiful level of manual dexterity and the potentially severe difficulties that I would undoubtedly encounter in connecting barely accessible pushrods to nearly unreachable servos when assembling the glider, I decided to modernize the control scheme by embedding servos in the wings to actuate the ailerons and spoilers. Whenever you modify a design, the time required to complete the project increases exponentially, and it did here. But that was just the beginning. I also chose to embed the elevator servo in the vertical fin to forego the inevitable slop that a long, curved cable would have introduced into the system — more extra time, mostly spent in head-scratching, of course.

After investigating the RC flying fields and the types of RC activity in the Tucson area, the realization dawned on me that I was not going to find a suitable flying venue, or anyone with a winch or a tow plane to launch the *Ventus*. Further, there were no slopes suited to flying anything other than an indestructible foamy. Virtually every hill is covered with rocks and cactus. In sad point of fact there was very little RC glider activity of any kind in the region south of Phoenix. Thus, it made good sense to give the *Ventus* self-launching capability — yet more time expended designing (head-scratching) and building a motor/ESC/battery system. I researched the motor sizing thoroughly, then took a wild-ass guess and bought what “looked about right” and would fit. Oh man, does it hurt to have to saw off the nose of a sleek glass fuselage — so wrong! Anyway, many hours of work and several months later all systems were finally completed.

I wanted the glider's finish to look at least somewhat realistic — no problem for the glass fuse. But, the wings and tail were another issue. Covering balsa with white plastic film was the obvious thing to do, but I thought the grain of the wood might show through. After countless hours of priming, wet sanding, and finally spray-painting with rattle cans, the wings, horizontal tail, tip extensions, and rudder looked pretty gel-coaty, at least from a distance. I probably should have just gone the Ultracote route.

Disney kindly allowed me (truthfully, I didn't ask) to enlist their well-known character, Goofy, as the glider's pilot. After completing basic flight training, and skipping ground school, he was installed snugly in the cockpit of the glider.

A few ounces of lead sinkers glued inside the fuse near the motor brought the center of gravity forward to the recommended location. I sensibly (for a change) decided not to put any more effort into beautifying the glider with trim until it had been flown successfully.

Finally, after a mere twenty years under my ownership, the *Ventus C* was ready for flight! Unfortunately, the lack of a good local field at which to fly a large glider, combined with some serious family health problems, relegated the ship to hangar queen status after completion. Goofy sat on the shelf for over a year until our situation improved sufficiently to enable my wife and I to travel to a flying venue that I felt was suitable for the maiden voyage.

Goofy in his new home.

In late 2018 I had flown in the Blue Skies of Arizona F3K (DLG) contest at a field near Eloy, which is about 80 or 90 miles north of us near Casa Grande. I wanted a flat field with plenty of elbow room for the maiden voyage of the big (to me, anyway) glider. The field at Eloy fits that bill to a tee — a vast expanse of nothing but dirt, and a fairly smooth, firm and flat surface for takeoff and landing. Flat-Earthers would like this place! One problem this glider has is limited prop to ground clearance. I found that a grass surface does not work, as the wheel sinks in and the prop becomes a very effective lawn mower! Firm dirt or pavement is a necessity for takeoffs. And 'firm' this dirt is.

Upon arrival at the immense field, I was disappointed to see that it was covered in small two-to-four inch dried-up weeds. They didn't look like a major problem, though — just kind of crunchy underfoot, and maybe a few would get weed-whipped by the glider's prop. Surprisingly, these innocuous little beggars almost proved to be Goofy's undoing. We parked our pickup truck out in the middle of nowhere and set up shop. There was no other human activity within sight across the emptiness— a bit weird.

Assembling the bits and pieces of the *Ventus* under Goofy's critical eye took a while, but the 152-inches and 7.5-pounds of graceful bird was finally ready to go with all the movable parts seeming to flap or retract or spin in the right directions and amounts. The electric motor with 10X7 folding prop was pulling strongly, powered by a 3300 mah 4S LiPo battery. Hopefully, it would be sufficient muscle to get the glider airborne. Everything seemed to be ready.

Goofy, the erstwhile pilot, gave thumbs up. So, I nosed the *Ventus* into the steady 10 mph breeze, held onto the tail, leveled the wings, cranked up the throttle, and let 'er rip. The sudden rapid acceleration took Goofy completely

by surprise. The *Ventus* leaped into the air so suddenly that he overcorrected with too much down elevator and slammed the glider back into the ground, with the left wing tip touching down in those damnable little weeds and causing the glider to spin 180 degrees into a ground loop with a pretty hard strike on the nose and prop. Oomph! What a terrible start! All those months of hangar-queening had apparently been very detrimental to Goofy's piloting skills.

To my relief, the only damage was the lead ballast in the nose coming loose. The sinkers were easily glued back into place. I had words with the pilot, encouraging him in the strongest possible terms not to repeat that performance! At least we now knew that lack of power was not going to be a problem.

A foolish mistake I made in setting up the controls was about to bite us — the old dogs/new tricks thing. For decades I've always controlled a powered model airplane's throttle with the left-hand stick, the same one that controls the rudder — up and down for throttle, left and right for rudder. In my somewhat-less-than-infinite wisdom I decided to put the spoilers for this glider on the throttle-rudder stick and control the throttle by the potentiometer lever on the left side of the transmitter. The reasoning seemed sound at the time — for unpowered gliders I've always controlled the flaps using the throttle stick. So, it seemed natural to put spoilers there, too, as they carry out the same function — glidepath control. I failed to take into account that old habits die hard, especially under stress, and that this model is powered and therefore would tap into Goofy's powered plane reflexes.

With the ballast again properly stowed, our intrepid pilot signaled his readiness for Attempt Number 2. This 'flight', although it never actually left the ground, was even more exciting than the first. After quickly gaining significant velocity, Goofy let the left wingtip drop slightly, just enough to

catch in those nasty little weeds and spin the glider 180 degrees with the tail flipping up and the nose with rapidly spinning prop(!!!) slamming down. Goofy immediately chopped the throttle, but the mad thing wouldn't quit! It came screaming full bore back towards where Cheri was relaxing and enjoying a perfect view of what had now turned into a shit show. Before Goofy finally realized that he was automatically using the wrong input(!!!) — the spoilers — to throttle down, the glider whacked into the leg of Cheri's chair right next to her, bounced off and proceeded to come back at her in an attempt to bite her ankles! Goofy must have been shitting his pants by the time he finally got it together and closed the throttle! Cheri said his eyes were as big as flying saucers.

Amazingly and thankfully, Cheri's delicate ankles were unscathed! The only damage to the glider was a small ding in one wing leading edge and the usual ballast weights broken loose. There was also, of course, a problem with Goofy's underwear. The most surprising thing to me was the survival of the CAM folding prop after being used as a 20,000 rpm dirt augur and metal cutter! Of course, if I hadn't brought along spares, the blades would undoubtedly have disintegrated out of sheer spite. Given Goofy's problem with habitually using the throttle stick to control the throttle I reconfigured the transmitter to switch the throttle function to the traditional left stick. Lesson learned.

OK, so third time's the charm…right? At this point the intrepid Goofy — having changed into fresh underwear — was pretty dubious. He may even have been displaying a bit of uncharacteristic trepidation, as was I. I called into question Goofy's skills, but he assured me that wind and weeds were the problem, not his well-honed pilotage. Further, if I would quit trying to make him rise off grojnd (ROG) through these grabby little weeds, there would be no hassle — "Just throw the damn thing, fool!"

The last time I attempted to heft this glider to fling it for a test glide I was surprised that I couldn't lift it above shoulder height with my right arm. That ended the first attempt — I was not about to use my "throws like a girl" left arm. Fortunately, after months of weight training I had since regained some of the strength that I had lost as a result of rotator cuff surgery. Not one to ignore the advice of a cartoon dog/wannabe glider pilot, I decided to throw Goofy and glider into the blue in lieu of another ROG fiasco. At least the potentially disastrous results — since the idea was his — would be on Goofy, not me. I hoisted the *Ventus* up into the wind, Goofy opened the throttle until I could feel a strong pull. After running a few steps, I reared back and chucked the whole assemblage into the blue void. To my astonishment…and immense relief, the *Ventus* moved upwind smoothly in a slight descent with wings level. Goofy added power and angled the glider up into a rapid climb. No problem! Almost too easy! Too bad I didn't think of this before Goofy did — embarrassing indeed!

Graupner Ventus C at Eloy, Arizona.

After the insanity of the first two 'flights' this was a welcome lark. The *Ventus*

C looked shapely against the clear blue sky, and flew beautifully, needing just a bit of up elevator trim to maintain straight and level flight. Control response was excellent. The power system luckily proved to be just about optimal with climbs to thermal hunting altitude accomplished expeditiously. This heavy glider flies fast compared to the composite TD ships I'm used to. Even so, it climbed very well in thermals with the motor off. Goofy found to his consternation that considerable care must be taken to maintain adequate airspeed while circling in lift, as the stall break out of a tight turn is rather sudden — a true thrill ride! Without any warning, the inside wing suddenly falls to near vertical, then the nose points straight down as the glider instantly cranks into a spin. At least 50 feet of altitude is lost before level flight can be resumed. There will be no low-altitude thermalling with this baby! Straight ahead stalls, on the other hand, were quite benign… fortunately for Goofy's old/slow reactions.

Sadly, our time was up and we needed to hit the road for home with only one actual flight under our belts. Goofy glumly lowered the retractable wheel, raised the spoilers, and brought the glider in for a smooth landing, ending appropriately in a slow-motion ground loop, which was, of course, entirely Goofy's fault. Even so, good old Goofy was stoked about twenty minutes of sublime soaring in his new ride, and is looking forward to really wringing out the Ventus in the future. Just this single successful flight felt like a great reward for all the effort and years that have gone into completing the glider! Persistence pays off again, albeit very, very slowly in this case.

Cheri and I celebrated the successful maiden flight with fast-food burgers in Casa Grande. Not Goofy, though. He was on his way back to advanced glider flight school to learn how to take off and land properly. I plan to have words with his original flight instructor, too!

Now that I know the *Ventus* flies well and that Goofy's skills will be upgraded,

I'll be gussying up the old bird with proper scale numbers and markings, and other bits of visual adornment to make it look even more like the real thing. It only took a bit shy of three decades for this model airplane kit to reach this point!

How time flies…and model airplanes…sometimes. Thermals!

*All images are 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**.*

The Gull

Part II: Wrapping up construction and first flights.

Thomas Martino

The Gull, ready for its maiden flight, at Kitty Hawk, North Carolina in September of 2020. My scratch-built DLG is peeking out from the bottom of the frame.

In Part I of this two part series, I chronicled the inspiration, design, and construction of my four meter gull wing glider which I affectionately refer to as simply *The Gull*. In this installment I will cover the rest of the build and the exciting journey of the first flights.

As most of the framing work was complete, I started covering the model in early May. I chose to cover the model with *Oratex*. I selected the natural white color for its silky translucent qualities. After covering the rudder I realized that the slight charring from the laser cutter showed through the

fabric, so I removed the covering, carefully sanded all the ribs, and re-covered it.

Next, I covered the horizontal stabilizer and elevators. They looked nice, but I worried that the elevators were not stiff enough and could potentially flutter. Having lost a nice model to flutter before, I chose not to take any chances so I found myself removing covering once again. With the *Oratex* removed, I added 1/32 inch thick balsa sheeting to the top of the elevators. I installed the sheeting at an angle to increase torsional stiffness.

After re-covering the rudder I decided the elevators needed to be stiffened and re-covered.

Diagonal sheeting on the top side of the elevators significantly increased their stiffness and gave me peace of mind.

I couldn’t move forward on covering the fuselage without first making a canopy. Since my attempts at making a clear plastic canopy were a dismal failure, I chose to manufacture the canopy out of fiberglass instead. I protected the fuselage with plastic cling film and laid up five layers of fiberglass that had been precut to approximate the canopy’s outline.

Canopy layup in progress.

Once the canopy had cured I removed it and did a final sanding of the fuselage. I glassed the forward half of the fuselage with two layers of two ounce fiberglass.

The front half of the fuselage was glassed while the rear half was left natural and would be covered with Oratex.

Next I coated the fuselage with *Duratec* to fill in any imperfections. Then the fuselage underwent several rounds of sanding, filling, and priming until I deemed the surface quality acceptable.

To open the cockpit area, I created a vinyl template and cut around it with a rotary tool. The abrasive cutting wheels from *Perma-Grit* are wonderful for tasks like this. I then trimmed the fiberglass canopy to fit.

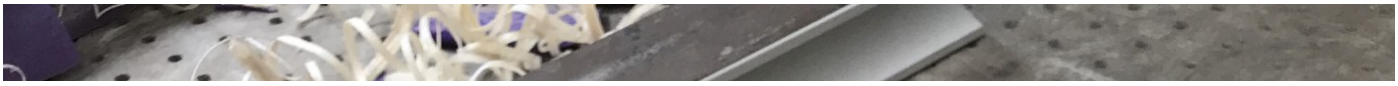
On May 20 the fuselage was ready for installation of the tail surfaces. The vertical stabilizer was notched to accept the horizontal stabilizer and both were glued to the fuselage with epoxy thickened with flocked cotton. The wings were installed for this process and everything was laboriously measured to ensure perfect alignment. This process was anything but simple! Actually it was fairly humorous. The large, wacky shaped gull wings made it challenging to align other components. I used everything from precision ground 1–2–3 blocks to paper towel rolls to jig the wings and fuselage in position while installing the tail feathers. The plane is a bit too big for my shop, so I had to get creative while positioning it. After a lot of carefully stepping over the wings and tip-toeing around trying not to knock anything over, I finally decided everything was perfect and left the glue to

cure.

With the tail surfaces installed, it was time to get to work on the control hardware. The elevator push rods and rudder pull-pull cables were installed through the laser-cut holes in the fuselage formers. The elevator and rudder servos were also installed at this time. The aft portion of the fuselage was finally ready to be covered with *Oratex*.

Aligning the tail surfaces was quite a task. The “Hold on, I’ve got to overthink it” sign had never been so relevant.

The ailerons were cut free from the wings. Balsa sheeting was installed on their top surfaces to stiffen them.




Perma-Grit Tools

Wing tip shaping in progress. 1/32'' plywood is sandwiched in between the balsa so the trailing edge can be tapered without risk of damage.

I also installed additional sheeting at the root section of the wing. Small triangular gussets were installed where each rib meets the trailing edge. The spoilers were made out of 1/8 inch thick balsa sheet. The wing tips are made out of 1/32 inch thick birch plywood template with 3/16 in thick soft balsa glued on top and bottom then sanded to shape. The aileron and spoiler servos were installed at this time. The wings were then covered. The ailerons were attached with CA hinges. The spoilers are hinged with *Oratex*. The right wing weighed 12.8 ounces before covering and 20.6 ounces after.

Nearly done covering. Another giant scale project sits in the background awaiting covering.

Now that everything was covered, it was time to begin painting. The entire fuselage was painted white with the exception of my AMA number which I had masked off so that the light would shine through it.

The paint went on beautifully but unfortunately began to wrinkle and crack as it dried. I suspect because I had taken it outside to paint and it was an exceptionally hot and humid Georgia day. Cracked paint continued to plague the project. Some parts of the fuselage had to be sanded down and repainted up to four times. Eventually I gave up and painted the fuselage inside my shop with the AC on and had no more problems. I love the translucent look of the covering so I masked off all the open sections of the wings and only painted the sheeted areas. The rudder was decorated with yellow scallops, which I plan on adding to the wings after flight testing is completed.

The plane sat around for a few weeks after painting. Things picked up at work and I had no way to tow the plane so I was in no rush to finish it. In September I had the opportunity to visit the Kill Devil Hills in North Carolina. I loved the idea of slope soaring near where the Wright Brothers took their first flight. With renewed enthusiasm I got back to work on *The Gull*. Final details like wing struts, tow release, and canopy screws were taken care of. The model was tail heavy, so about 12 ounces of nose weight was added. The finished all up weight was seven pounds and six ounces. For a big plane it sure is light!

Just when I thought I was ready, my radio died. I tried everything I could to troubleshoot the problem but it was to no avail. I decided it was time to upgrade anyway. I ordered a Graupner *mz-16* and a couple of suitable receivers. Control Hobbies was kind enough to expedite my order to ensure I had it in time for my trip. The radio arrived just in time for me to pack up and hit the road. I read the manual while my dad drove. After ten long hours of

driving we arrived in Kill Devil Hills to be met by cold and rainy weather. Thankfully we would be in town for a couple days and the weather was supposed to clear up. I installed the receiver and programmed the model in my hotel room. After a thorough airframe inspection and preflight check *The Gull* was finally ready to take to the skies.

The next day brought more rain, so we visited the Wright Brothers National Memorial. This was a fantastic experience that I highly recommend to any aviation enthusiast. The rain subsided later in the day, but was replaced by ferocious wind. Perhaps this would be exciting for a more seasoned slope flier, but I'm a slope soaring novice at best so the idea of doing a maiden flight in such strong conditions did not appeal to me. We visited Jockey's Ridge to scope out the flying site. I always get a bit nervous before a first flight, but now I was starting to get really concerned. I was far from home, with an unfamiliar radio, at an unfamiliar flying site, with an untested aircraft. My dad and I agreed this was not the day to attempt a flight.

The next day the wind raged on even stronger and we were occupied at a family event. That day gave me an opportunity to assess the pros and cons of the situation. I knew I would be taking a big risk if I attempted to fly the plane. I have very little slope soaring experience and the 20 knot conditions were not dying down. On the other hand, test flying near where the Wright Brothers did their test flights really appealed to me. Also, this would likely be my only opportunity to fly *The Gull* for many weeks, since there are no slopes back home and I don't know any tow pilots.

I decided to go for it. I wanted to take advantage of this once in a lifetime opportunity.

September 24 was the big day. We waited as long as possible, but the wind maintained 20 knots with powerful gusts. At least my GoPro would be

onboard to provide a bit of ballast. I assembled the plane in the parking lot. A handful of onlookers came by to check it out and wish me luck. A security guard noticed the crowd and came by to investigate. He was very friendly and had no problem with my giant model once he determined it didn't have a prop. He said any kind of unpowered flying is welcome on the dunes, but nothing with a motor. I had another glider with me that I planned to use to practice sloping, but the motor up front didn't fly with security. I knew my DLG didn't stand a chance in such strong wind, but I took it anyway as a last resort.

Ready for the maiden flight. Now you can properly see my scratch-built DLG is in the background.

With the plane assembled, my dad and I did a final preflight inspection before beginning our hike out to the dunes. I carried *The Gull* and my dad followed with my transmitter case and DLG. We chose a hill that looked promising and climbed to the top. I could barely hold on to *The Gull* as the

wind tried to pull it out of my hands. We ended up walking around the dunes for nearly an hour searching for the best spot. Some locals were out flying kites and having a great time, but I couldn't find a place where the wind seemed to be blowing directly up the hill. Eventually I decided to launch my DLG to see what would happen. The wind easily overpowered it and it ungracefully landed at my feet. We wandered around a bit more searching for a spot with suitable topography and a favorable wind direction. Around 6:00 PM we settled on a low, shallow, hill. It seemed like a good place for some test tosses to see how *The Gull* would glide.

The first flight was pretty smooth, besides a strong pitch down tendency. This was my fault. I had dialed in a lot of down trim earlier because when I

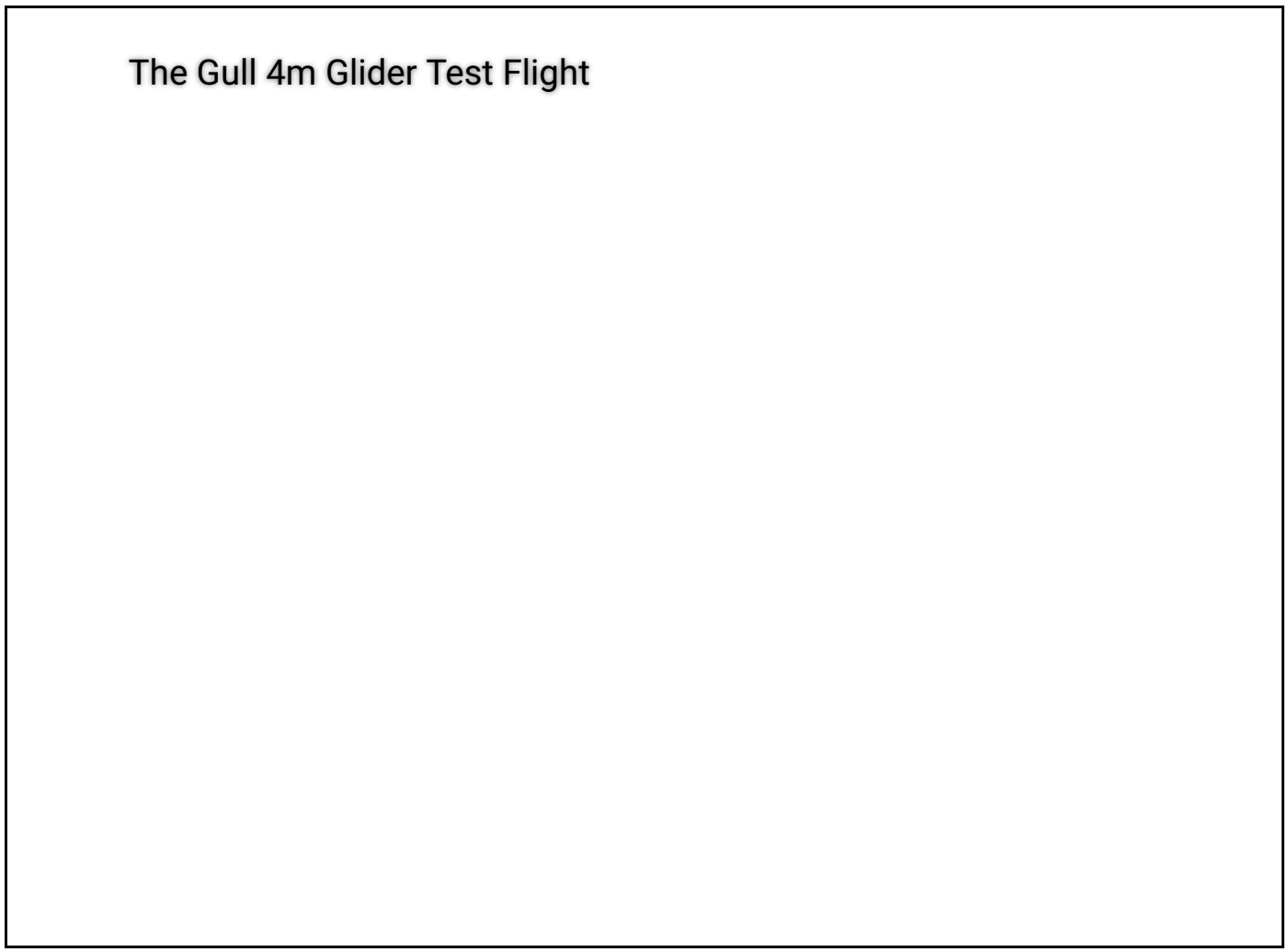
held the plane in the wind it seemed to pitch up. Turns out that wasn't a CG or trim issue, it just wanted to fly away. I corrected in flight by pulling back on the elevator and letting the plane follow its natural glide path. I didn't attempt to turn except for a strong rudder kick near the end to straighten up for landing. I was headed towards the one bit of shrubbery in the entire area, so I deployed full spoilers and set the plane down smoothly, albeit a bit fast.

I was shocked by how slippery the plane felt in the air. The unnecessary down trim made it much faster than I expected. We carried it back up the small hill for another test glide, this time with a neutral pitch trim setting. The second flight was very short, but it offered me much more insight into how the plane behaves. My dad threw the plane straight and level. I pulled up slightly then started a left hand turn to feel out the controls. *The Gull* flew slower this time and felt more floaty. Pitch authority was excellent and the rudder seemed to respond well, but the ailerons felt a bit sluggish. The air was very turbulent and the plane was bobbing around quite a bit. I hoped I could find some lift, but either the hill was too shallow or I don't know how to read the air when sloping because I quickly started to lose altitude. I attempted to make a right turn back into the wind and once again felt like the aileron response was a bit slow. The rudder yawed the plane very well but now I was slipping and losing altitude fast. The landing had quite a lateral component but the plane was fine and I was happy for it to be back on the ground safely. The entire flight was only about 15 seconds but it felt much longer.

I carried the plane back for a third flight. As we were preparing to launch, a strong gust picked up the left wing and caused the right wingtip to jam into the ground. It made a bad sound. We inspected the airframe thoroughly. The only damage was some broken ribs near the root of the right wing. The spar seemed fine. I foolishly decided to carry on with the third test flight. Right as my dad launched it, the right wing twisted and the plane aggressively

banked to the right. I attempted to counter this with left aileron input, but there was no stopping the inevitable. The right wingtip jammed into the sand once again, this time cracking the main spar and crunching some more ribs in the process.

Unfortunately the flights were poorly documented. We hoped to get three camera angles. I had a RunCam on my hat, a GoPro on the plane, and my dad planned to film with his phone after launching the plane. The RunCam died before the first launch, and the flights were all short so my dad didn't have time to start filming after throwing the plane. At least we have the onboard camera footage. I included a video of the short but exciting second flight below.



The short but exciting second test glide.

We collected our things and hiked back to the parking lot where I could unscrew the struts and remove the wings, one of them which was now floppy. It had been a whirlwind of an evening. Obviously it was a bummer that I damaged the wing, but I knew since I built it I could fix it. I was excited that I finally got to see the plane in the air after waiting so long. The experience was fun and memorable. I got to experience a bit of what the Wright Brothers felt. Success and adversity often go hand in hand. I have repaired the wing and look forward to flying *The Gull* again in the spring.

Resources

- The Gull Part I

*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**.*

Contest Performance Improvement Process

Ten steps for moving steadily up the leader board.

Ryan Woebkenberg

My 100 point landing at 2020 USA F3RES Nationals.

Throughout my quarter century journey competing in RC soaring contests, I have continuously worked to improve my contest flying performance. This probably wasn't always obvious to most people that flew contests with me because for many years I finished at the bottom of the score sheet. Over the past decade or so I have tried to get more analytical and systematic in evaluating my contest flying. I have decided to write a series of articles as a way to put the methods I have used to improve my placing into a more formal multi-stepped system. Although I have done all of these exercises several

times, this is the first time I have made an effort to put all of the items into a more formal process which I will demonstrate over the next several articles.

Step 1: Determine Your Contest Goals

The first step is to honestly state what your goals are from a contest performance perspective. You don't have to publicize these goals. However, I have heard it said that publicizing your goals has a certain effect of making you live up to what you have announced to the world. Whatever your goals are, those goals you set are perfectly appropriate for you. I'm not here to crush anyone's dreams. That said, one thing I have heard a really good contest pilot say — and I am paraphrasing here — is "*you work hard to improve your flying and then when you improve your flying your scores improve and when your scores improve you start to win contests*". To that end, I have recently set my goals as more of a 'placing range'. Since you the reader are taking the time to read this article I will put it out into cyberspace that my contest performance goal is twofold: to place in the top 25% of half of the contests I attend and to someday win a contest with at least 20 pilots.

Step 2: How Do You Compare to These Goals?

Once you have taken some time to think through your goals and state them, this step is fairly straightforward. I record all of my flights and all of my contests in a spreadsheet so I can evaluate how far I am from my goals. I suggest pilots that want to make a structured effort at improving their scores do similarly.

The following is presented as an exercise in demonstrating the evaluation of how far a pilot is from their goals. The second part of my goal is easiest to evaluate. I have never won a contest with at least 20 pilots. I have been close a few times finishing 2nd in a contest with 32 pilots in 2003, finishing first in

a contest with 18 pilots also in 2003, 2nd in a contest with 23 pilots in 2014, and 2nd in a contest with 19 pilots in 2021. For evaluating the first part of my goal I do a season ending analysis on my contest results. My 2021 contest placings are as follows:

My 2021 contest results.

In 2021 I placed in the top 25% in exactly half of the contests I attended.

Step 3: Evaluate The Contest Scores of Your Target Group

For this step you can evaluate the scores of the contests you attended or evaluate scores of contests you would like to attend — your Target Contest(s). My suggestion would be to evaluate at least the scores of contests you have attended because you will need to do that in Step 4 anyway (covered in the next article in this series).

For demonstration purposes I will evaluate the scores of the top 25% of the *Southwest Classic* (see *Resources*, below). A few things should be understood about this contest, however, before proceeding with this evaluation. This is an F5J contest and as such each pilot is entitled to drop their worst score. In the spreadsheet below that dropped score is identified by an asterisk in front of the score. Also F5J is flown in flight groups and normalized. The pilot with the best raw score of the flight group gets 1,000 points and all other pilots in the flight group are scored as pilots score divided by the winners score multiplied by 1000. Finally F5J's raw scores are a maximum of 599 seconds of flight score. F5J is flown in a 10 minute window where the maximum possible duration score is 9:59 due to the time stopping at the end of the window and the time not being able to be started until the beginning of the window. The maximum possible landing points is 50. Landing points are scored in five point increments with 50 points being

the best possible, 45 points the second best and so on. There is also a start altitude penalty of half a point per meter up to 200 meters and three points per meter for every meter over 200 meters. These penalty points are subtracted from the duration and landing bonus score.

The top 25% finishers at the 2021 Southwest Classic.

Breaking into the top 25% of at that contest would have required scoring an average of 906 points each round that counted. Remember, since the contest is F5J that means that one round could be really bad and been dropped. Looking at the raw scores of the 8th place pilot (the threshold of my top 25% goal) a few things can be observed: the average flight time of the nine rounds that counted (Round 6 is a drop score) was 9:18. This meant this pilot dropped 369 seconds over the nine rounds from a maximum theoretical best possible flight time. This pilot's landings over the nine rounds that counted were excellent: scoring 50s in all rounds but two where the pilot scored 45s. This pilot's average launch height was 136 meters.

At this contest a pilot could have broken into the top 25% by consistently getting within 30 seconds of the target flight time, consistently landing within two meters of the landing spot (landing within two meters is a 45 point landing in F5J), and launching to a relatively conservative ~130 meters on average. The drop round allows you to have one really bad round but otherwise I would have needed to average within 40 seconds of the flight target from a reasonable start height and score a solid landing to make it into the top 25% of that contest, which as we will see in the subsequent article's analysis I didn't manage to do.

Analysis of the 8th place finisher's contest performance.

This exercise can be repeated for each contest you attend or you can also do this analysis on contests you have not yet been able to attend. If your

goal is to place in the top five at a contest with 50+ pilots, for example, and you have not yet been able to travel to contests that large you can use the contest results at *GliderScore* (see *Resources*, below) to evaluate the type of scores that would be required to break into that group.

That covers the first three steps of my process. Over the next few issues I will continue this journey of contest performance self improvement. If you have any questions, please don't hesitate to leave them in the *Responses* section below and I will do my best to answer them.

Resources

- *GliderScore* "*Automates the running of your competition: DigitalTimer automates calling pilots to fly and timing of flight groups; eScoring… automates score collection and updating; produces draw reports, scoring sheets and score cards…*" and a number of other useful features.
- *My Southwest Classic F5J 2021 Experience* The author's account of the F5J contest mentioned in the article abovce.

All images and data tables are 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****.*

Scheibe-Loravia Topaze 1:4.2-Scale

Part II: Completing the Build and Flying

Chris Williams

Launching at this size is a simple matter, even for an OAP!

For readers who have not yet done so, you may want to take a look at Part I of this two part series before proceeding.

My wing construction methods have changed in recent years. These are incorporated into the Topaze build, such as 5mm square spruce spars are used for the initial construction in the normal fashion, with ply web plates glued to the front of the spars. Then, slots are retro-cut (a five minute job) and a 5mm square sub spar added in front of the web plates for about two-thirds of the wing's span. This results in a very strong but light wing and goes a fair way towards keeping the wing loading down. Once the lower D-

box sheeting has been added, the wing is set up on its support jigs, weighed down, and the top sheeting added, thus locking it in its final shape.

The flying surfaces are covered with HobbyKing film, with the open structures covered in their recently added matt clear. The fuselage is covered with Solartex, the joints brushed with 2K primer and flatted, and then the whole fuselage sprayed with white 2K primer before finishing off with 2K top coats.

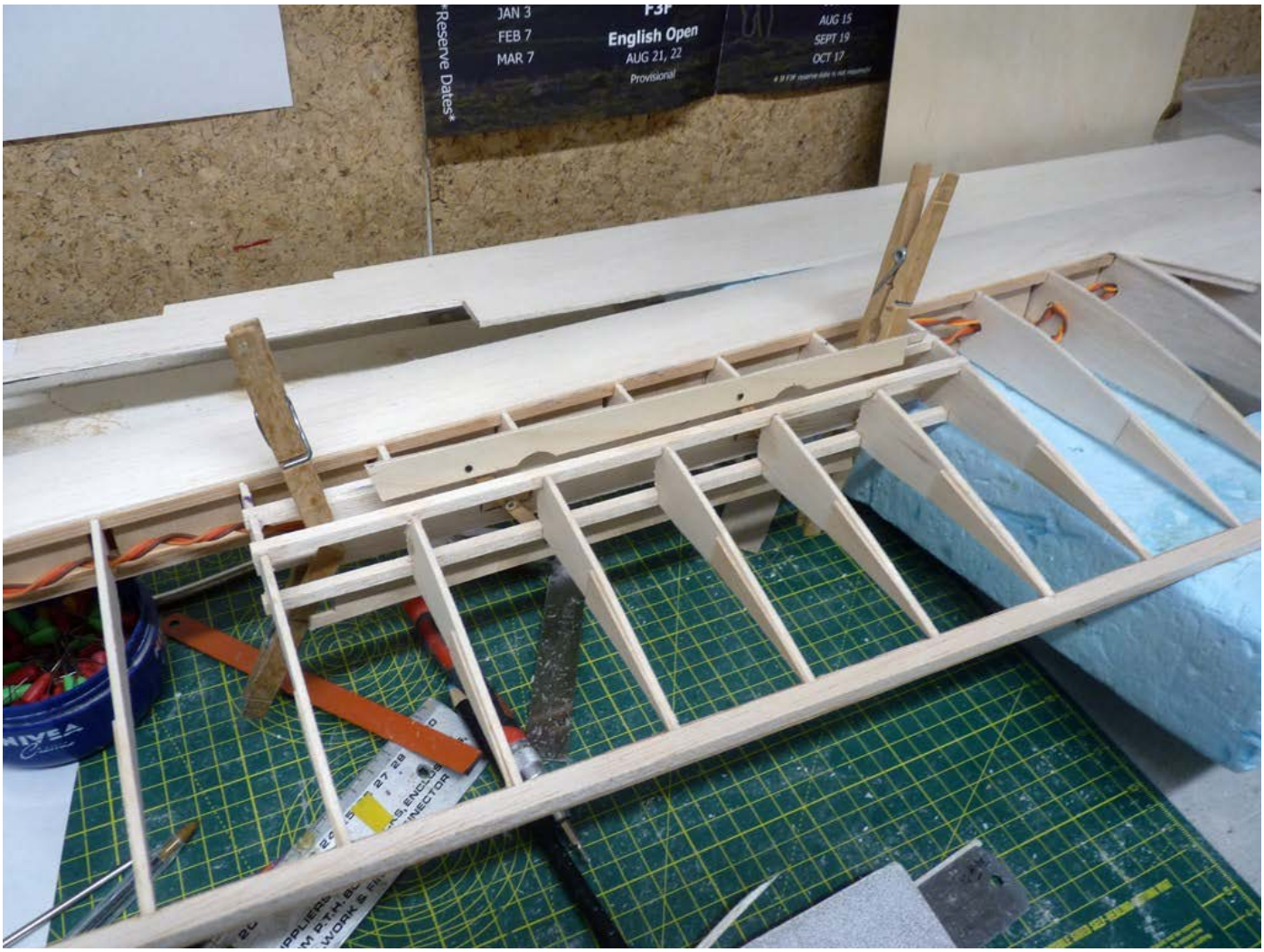
In flight, the Topaze is entirely predictable and vice-free. With up-going ailerons mixed with the airbrakes, industrial quantities of drag become available, allowing spot landings in the most challenging of slope environments.

The drawings in PDF format are available from the *Resources* section, as are a link to more detailed build photos.

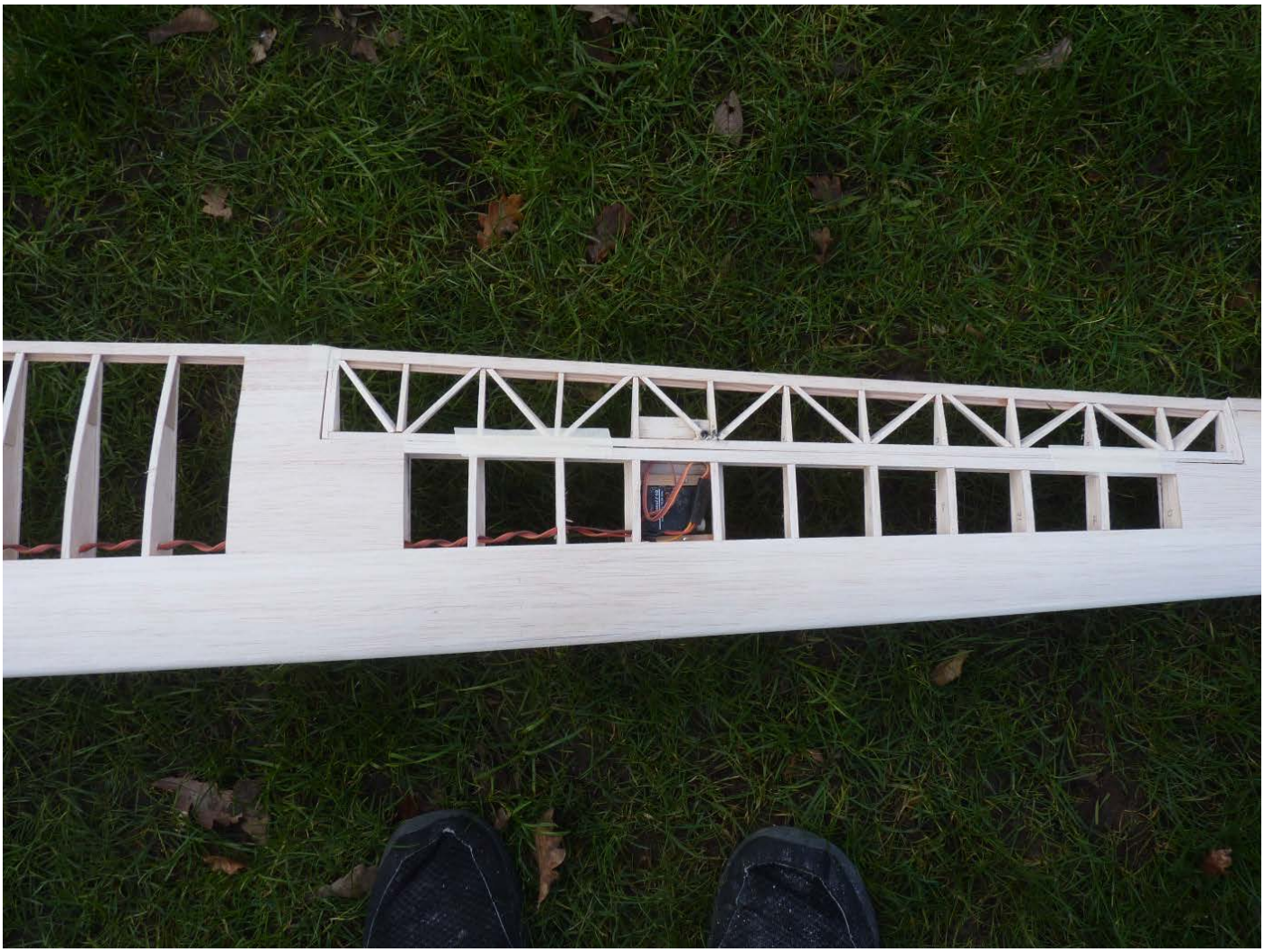
01: With the slots cut out, the sub spar is ready to glue in place.

02: With the 0.8mm ply plates sandwiched between the spars, a string I-beam is produced.

03: Scary bit—the aperture is cut for the airbrake assembly. The TE is supported by the rear airbrake stringer, which also is rendered rigid with balsa web plates.



04: The airbrake assembly is jigged to make the blades equally central before glueing in place.



05: View of aileron servo placement.

06: The wings are retained with old-fashioned No 63 rubber bands.

07: The instrument console is retained with magnets, as is the canopy.

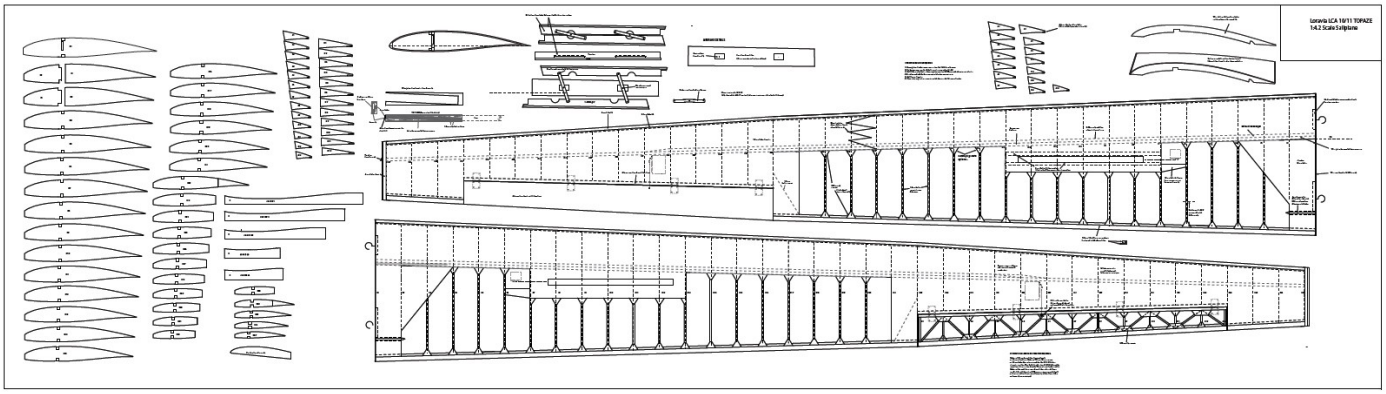
08: View of the tailwheel fitment.

09: View of the mainwheel and fuselage underside.

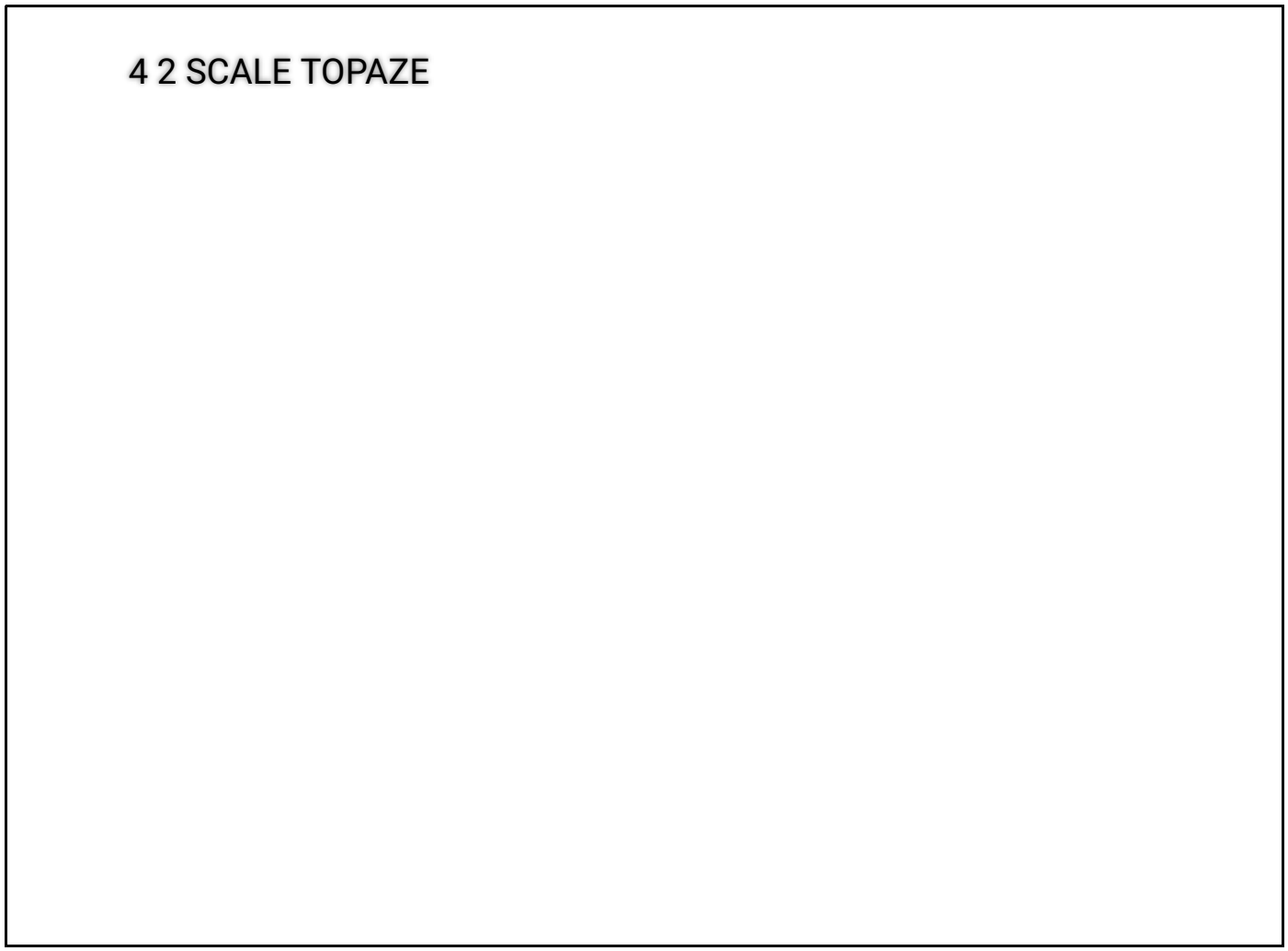
09: View of the mainwheel and fuselage underside

14: The model is perfectly happy with mild aerobatics. **15**: 15: The Topaze at White Sheet Hill.

16: The Topaze at Win Green Hill



17: Wing plan.



18: You've read the articles, now watch the video!

f you have any questions about this or the previous article, please feel free to leave them in the *Responses* section, below, and I'll do my best to answer as many as I can.

Resources

Finished Aircraft Specifications:

- Scale: 1:4.2
- Span: 3.57M

- Weight: 4.5kg (10lbs)
- Wing Section: HQ3514–12

1:4.2-Scale Topaze Free Plan (three PDFs):

- Fuselage
- Wing
- Tailplane

Detailed Build Photo Gallery

- Coming shortly…watch this space!

*All images and drawings 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**.*

Volantex RC ASW28 V2 2.6m

Building notes and some tips for improving this popular ARTF.

Peter Scott

Without the red wing tips, absence of garish decals and an added white spinner, the model approaches the elegance of the full-size aircraft.

I bought this Volantex model from HobbyKing for £142. The parts were well packed in a solid cardboard box. The mouldings are of good quality with little damage to the foam parts. There is a pilot mounted on a black moulding and a clear canopy. All servo leads were in place, though I replaced the aileron ones as they were on a Y-lead as I like to put aileron servos on separate channels. In addition to the latter, here is the summary of the proactive changes I made:

- Swapped the included ESC for a FrSky *Neuron* 40S
- Removed the red paint from the wing tips
- Painted the spinner white
- Replaced the battery strap
- Left off the garish decals
- Changed the way the canopy fitted on
- Increased the size of the servo lead holes

Fuselage

You remove the battery plate by unscrewing four tiny self-tap screws in the fuselage sides. This picture shows the motor wiring with the FrSky 40S *Neuron* ESC that I used to replace the supplied ESC. This gives me all the telemetry I need except the vario, labelled 20 in the photo. I shortened the ESC leads and fixed the wires for the motor and ESC firmly to the bottom of the fuselage with duct tape so they lie flat and don't touch the motor. On another model I have had insulation worn through by a motor with unhappy results.

Here is the same view with the battery plate fitted. I replaced the supplied battery strap with a strip of velcro with hooks on one side and loops on the

other. It can be slid along to suits the battery.

The manual says that the battery should be a 3S , and definitely not 4S. It doesn't say why. Perhaps the motor and/or ESC aren't capable of taking a 4S voltage though that seems unlikely. I think it probably is the prop. A change to 4S would mean having to use a propellor at least 25mm smaller. If it runs slower than the kV rating times volts, the motor will probably overheat. The kV is 850 so connected to a 4S RPM would need to be up to 14,000. However the blades are easy to remove and have the standard size 8mm fitting so the change could be made. All of this is irrelevant if the model is used only for slope soaring.

Wings

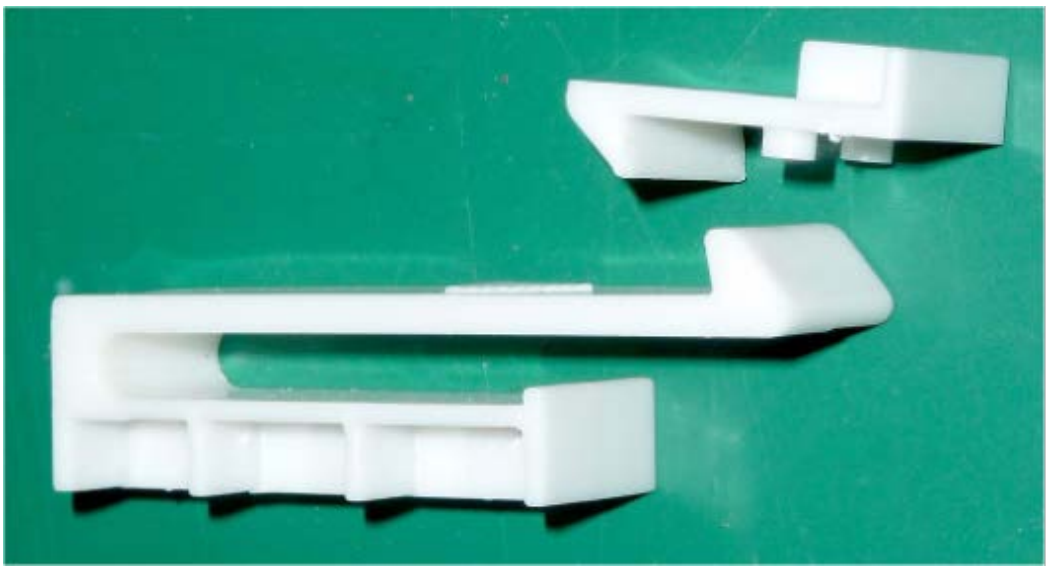
The full-size ASW28 is a 'standard class' glider. That means that it has no flaps, only an upper surface airbrake. The model has flaps but they are top hinged so they are partly concealed. This is a neat and useful compromise. A floaty model like this is likely to travel a long way when landing. Flaps or crow brakes are essential, especially on a slope.

The wings are held on with the same type of clip used on the Volantex *Phoenix* series of gliders. It is a light and neat method but the clips sometimes snap. It is worth buying a few spares. Buy replacement props and

spinners at the same time. Oh, and maybe a spare fuselage just in case. Volantex glider fuselages are prone to motor mount failure with a nose down arrival. The spares can be bought from HobbyKing and Banggood.

> ***Hint:*** *Do test fittings of the wings into the fuselage before fitting the fin and tailplane. The tail feathers are easily damaged when you manoeuvre the fuselage. On my model the wings would not fit easily into their fuselage housings when slid in with the the rods in place. I had to slice a millimetre or so off the front underside of the root fairings.*

The first two or three times you will find it difficult to push the wings in so the clips lock and go click. Push the mated aileron and flap connectors into the fuselage as they can stop the wing going in. Pushing the clips in to unlock and remove the wings is even more difficult and, again for the first few times, I pushed with a large flat blade screwdriver. It gets easier. However one side remained especially difficult so I sliced about 0.5 mm off the mating part of the wing clip.



Wing clip set.

One of the clevises supplied for the wings was poorly made without a hole for the peg to plug into. Fortunately I had some spares.

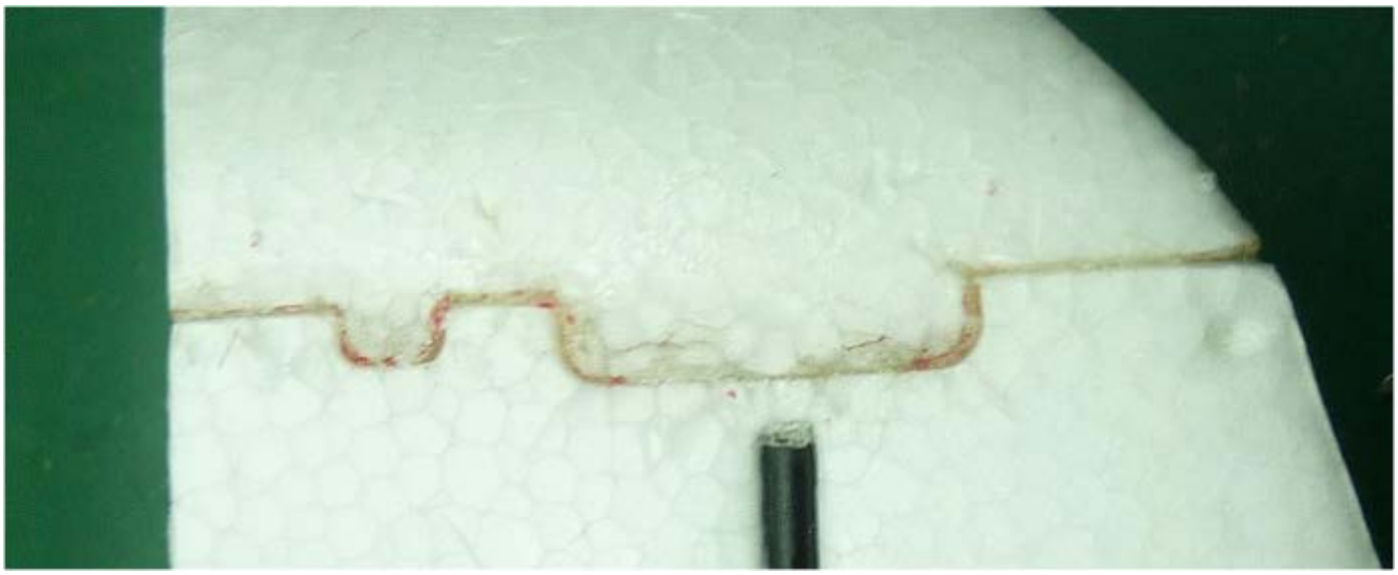
The wing mouldings are good with one exception and have the centre of gravity (CG) markers moulded in. I will probably fly with the CG further back, especially as the leading edge tapers but not the trailing edge. Some of the control surfaces are quite thick so long screws were supplied to fit the horns. All were the same length. An extra pad was added to thicken the the aileron horn area but still these screws were too long. In the end the poor appearance and likelihood of scratching holes in my hands moved me to fit shorter ones. In my box labelled ‘small screws’ I found some 2 x 9mm self-tappers that did the job perfectly.

Clip installed in wing.

The rising wing tips are supplied unattached, and have to be glued on. Their leading and trailing edges were poorly finished with flashing sticking out, so I

trimmed them with a scalpel and then gently sanded them. The wing leading and trailing edges needed a small trim to line up with the tips. I pulled off the naff red paint with sellotape. Even then, further fettling with knife and sandpaper was needed to remove the last of the paint. After gluing and pinning the tips on with epoxy I filled in the joins with white filler made from *Eze-Kote* and micro-balloons. After a very gentle sand I spotted the joins with white acrylic paint to conceal them.

This is what one tip looked like before the filling and painting.



And after filling, sanding and painting — far from perfect but better.

One annoyance was that, with the tips in place, the wings didn't fit into the box they came in. I like to take foam wings to the field in the supplied boxes to avoid damage. The tips make it more difficult to make padded wing bags too. I had a strong cardboard box that came with a 2.4m Phoenix. There was enough cross sectional room in it to hold both the Phoenix and ASW wings. I extended the box with scrap thick card and lots of duct tape so it could take both.

Fin and Tailplane

The fin and tailplane screw into place. That is better than gluing when the time comes for repairs. On the model I received, the rudder and elevator servos were of different types. The elevator had a metal final shaft that made fitting the horn easier. The rudder one was plastic and involved squeezing the arm on by pushing with a rod — in my case a large allen key. The screw was very awkward to fit as there was no direct access only a sloping groove. The supplied screwdriver was badly made and didn't turn the screws. It would have been better for the maker not to glue the servos allowing me to make an easier job of screwing on the arms.

I originally thought that the servos were held temporarily in place by white tape so I took it off. In fact they were glued in and the tape was to conceal them. I had to buy some white tape to conceal them again.

> ***Hint:*** *Fit the tailplane pushrod before you screw the tailplane on to the fin. You can't do it after. The push rod runs up at a weird angle but seems to work OK. The elevator movement is asymmetric but that can be corrected in the transmitter programming.*

The plastic T-tail tailplane mount came loose after a while. I think the workers in the factories in China are paid a glue bonus if they use as little of

the stuff as they can. I normally avoid thin CA glue as it runs to all kinds of unwanted places. I once glued the wheels of a model to my bench. However in this case a few drops carefully applied to the edges of the mount quickly got drawn in by capillary action and cured the problem.

Electrics

The servo leads were already in place and labelled with channel numbers: for example `CH5`. I replaced the aileron Y-lead with two leads, one in Channel 2 and the other in 5. This enabled me to set up crow brakes and variable camber. The connectors on the leads from the aileron servos needed to be trimmed slightly on the corners to fit into the extension leads.

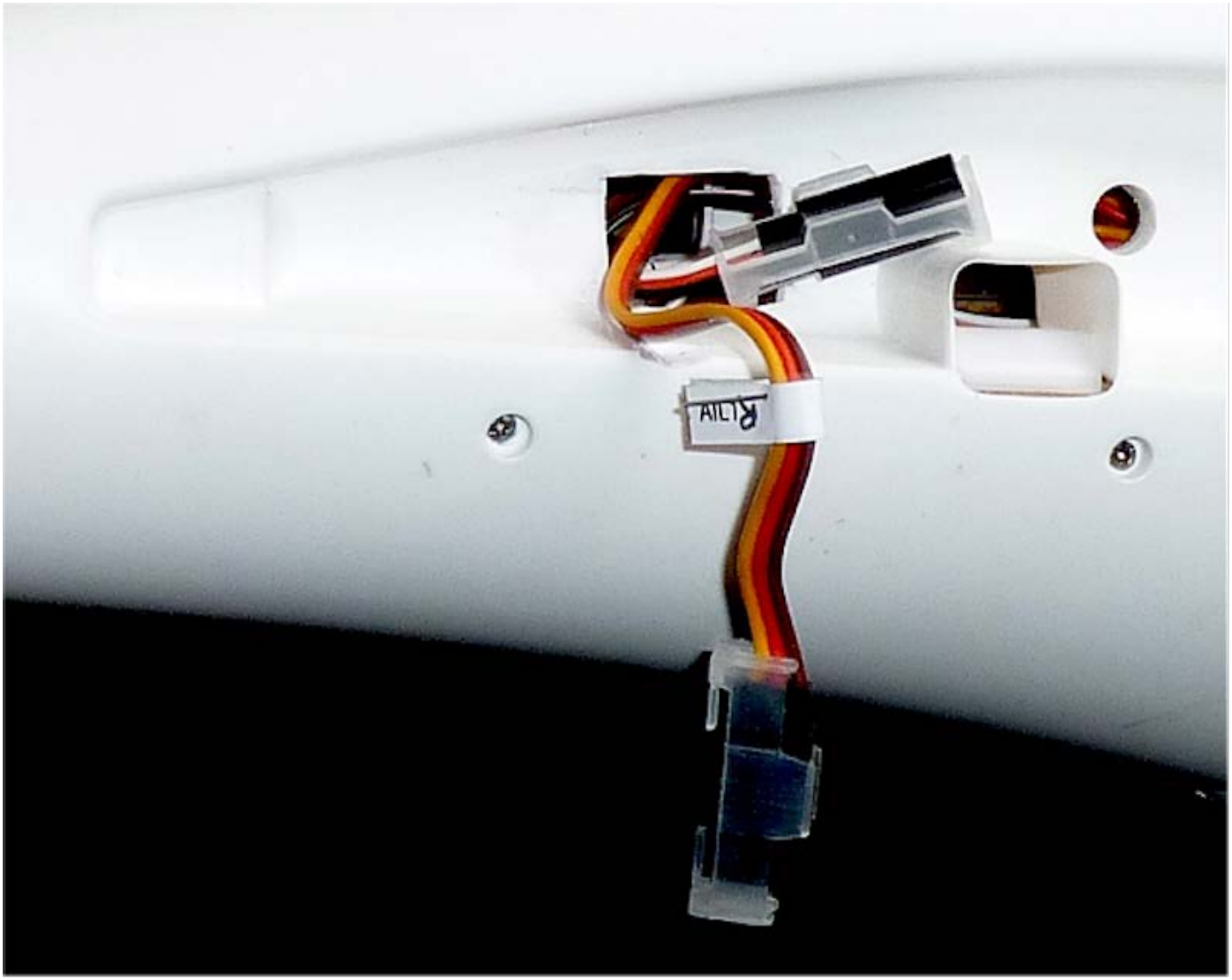
Because it was impossible to get a screwdriver in to tighten the arm screws on the wings, I cut V-shaped slots as shown in this picture. They will be covered with white tape.

> ***Hint:*** *To avoid them dropping into the fuselage during transport and storage poke the wing servo leads into the clip holes.*

The holes into which you push the wires when fitting the wings are too small. I couldn't get the wires through with servo connector locks on. They are probably not needed but I like always to use them anyway and it helps when pulling the wires back out to remove the wings. So it was out with the Dremel and scalpel to making the holes rectangular and a bit larger.

The metal ruler is there to avoid the Dremel grinder going in too far to damage the wires. Picture is before the holes were tidied up with a scalpel.

A finished hole with wires refitted with clips. More than enough room now. The new larger holes will not weaken the fuselage. The walls are quite thick where they are.



The servo arms were well prepared. The thickish pushrods fitted the horns perfectly but were too thick for the servo arms. A single hole in these had been opened up to fit.

The Canopy

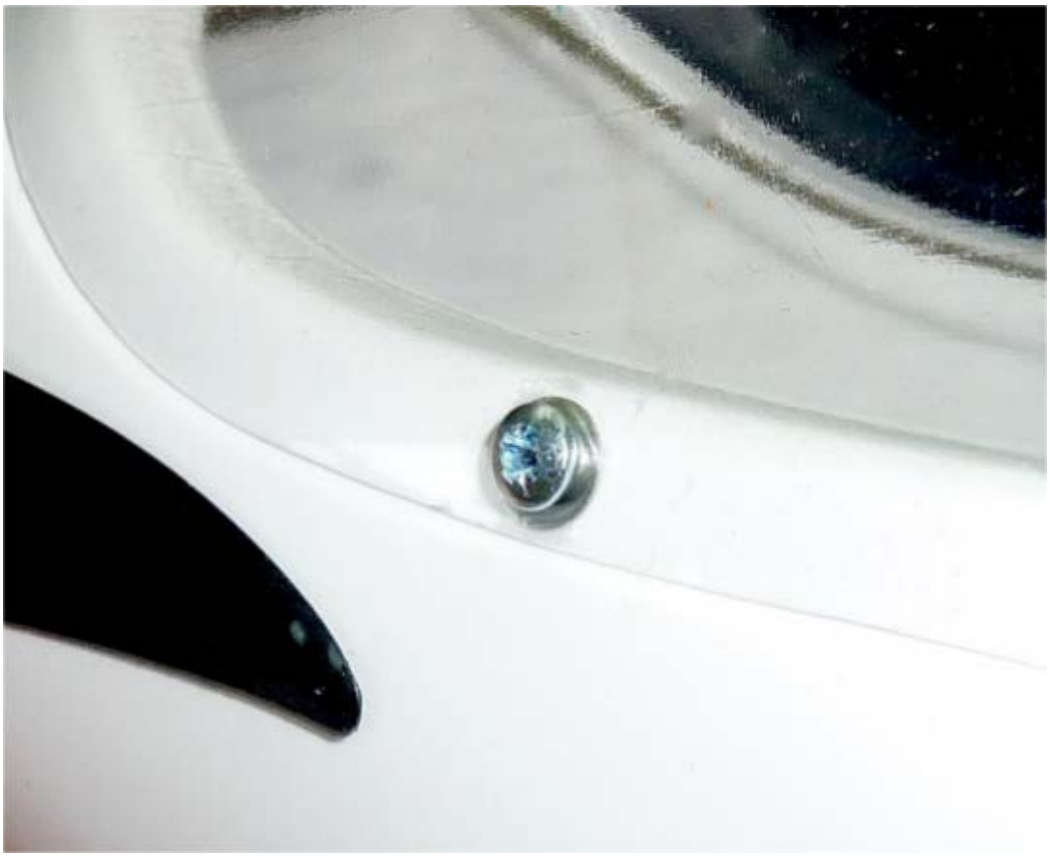
This has all the hallmarks of something that will fly off the model when in the air, never to be seen again. It is very flexible and is held by four plastic studs

that should pop into four holes in the fuselage. The simple fact is that the canopy doesn't fit. I smoothed the mating parts of the fuselage that projected a bit, but it still didn't fit. Any attempt to get all four studs to pop into place at the same time failed miserably. One last attempt at brute force resulted in a cracking sound from one stud.

The only solution was to use screws. They should hold the canopy down better with the bonus of reducing the drag from gaps. To do this I needed something to screw into. To start I epoxied some pieces of spruce inside the fuselage, one each side and one each front and back. I also planned to reinforce the edges of the canopy where the new screws would go.

Then it struck me. Why not remove the studs and screw into the holes in the fuselage into which the studs should pop? I raided my boxes of small screws and found some 4 x 12mm self tappers that fitted perfectly and held well. I used M3 washers to spread the load. I cut around the studs and twisted them with some pliers until they came out. The glue deposits are concealed by the washers.

And here is one of the screws. It's another example of Occam's Razor or KISS (Keep It Simple Stupid) principle. The only downside is that four screws have to be removed to change the battery.



I had wasted money on a bottle of canopy glue — Zap 560 (PT56). I was going to use it to glue on strengthening strips of acetate. The results of the tests I carried out hopefully will be useful at some point in time. Use the tiniest drop of glue and spread it thinly by moving and pressing the two surfaces. It takes the glue three hours to set and 24 hours to harden fully and go clear. I did two pairs of test strips. I cleaned the surfaces for one test with methylated spirit. The adhesion after 24 hours was quite good, though I was able to separate the test strips. The meths made no difference. The glue had become almost transparent.

Pilot and Instrument Panel

Model pilots are usually the wrong size — sometimes absurdly so. The supplied pilot has a shoulder width of 80mm. That translates to a scale of about 1:8. The span of the model is 2.5m so the full-size should be 20m. Being a standard class glider the full-size aircraft was 15m wingspan, or 18m

if it was the ASW28–18 version. So that makes the pilot pretty much the right size if a little big. The pilot is fitted into a plastic mount that fills the canopy opening. From now on I'll call the whole thing 'the pilot'.

This is a picture of the ASW28 instrument panel. You can print and laminate this picture to cut out and stick on to the cockpit moulding. You will need to change the percentage size to suit your printer. Copy the image and paste it into your image software, or printscreen and paste into *Paint* or similar.

Above right shows it in place. It's a bit small but the effect is good. It will just be for show and will not be fitted when flying.

Balancing

I had hoped to use a 3Ah battery. With that as far back as it would go the model was very nose heavy. The same was true of a 2.2Ah so I was forced to try a 1.3Ah. Even with that I needed to put 25g on the tailplane to balance. In all of these cases I had the pilot in place.

The pilot weighs 75g. That is a lot of useless weight to add. I would rather it went into the battery. I tried a rebalance with the pilot missing. The results were:

Battery Capacity	Battery Weight	Brand Name	Weight Need on Tail
1.3Ah	127g	Graphene	Zero
2.2Ah	174g	Turnigy	15g
3.0Ah	214g	Turnigy	25g (didn't balance)

My final decision was to have no pilot and to use a 2.2 Ah. I buried 25 g of weights in the fin — which is quite thick — then fixed them with CA glue and filled with my own EzeKote filler. I covered them with white tape as used for the servos. I can move the 2.2 Ah battery forward a little if I need to.

After extended flight testing I will possibly add more rear weight to move the CG further back.

Flying Trim Data

All Up Weight	145g	Including radio & 3S Turnigy battery but not pilot
Wing Area	33.4dm^2	Not specified in manual so measured; full-size at scale 6:1 gives 29m^2 but maybe the model is of the 18m (7.2:1) span glider.
Area Loading	43g/dm^2	
Aspect Ratio	20:01	Calculated from model so only best estimate (full-size was given as 21.4:1)

Throws

As I said above these were not specified in the manual. I set them up by eye and intuition with lots of expo just in case.

Both the aileron and elevator throws were assymetric, with more down than up. The elevator is the result of the strange angle of the pushrod. I could see no reason for the ailerons. In both cases I moved the position of the clevises in the control horns, then turned them to reset the zeroes and reduced the down throws in the transmitter. I also moved the rudder clevis to increase the throw.

The settings, with channel numbers, then were:

Control	Channel	Throw	Clevis Position	Weight
Ailerons	2 and 5	12mm	Down one hole	100 up / 70 down
Elevator	3	10mm	Down one hole	100 up / 80 down
Rudder	4	35mm	Down two holes	
Flaps	6		Down two holes	

Flying

Allegedly model ASWs are tricky to master. The design has a very small tailplane and elevator. However I did a maiden flight on December 15th and it flew beautifully. The CofG was at the places marked but was too far forward. The model was too stable and I had to hold in up elevator to keep the nose up even after full trim. I'll try it 10 mm further back on the next flying session. I did attempt a gliding loop but it would not pull up enough. The wings flex a lot just like the real thing but I guess are strong enough for a simple loop and stall turn.

Things I Didn't Like

- Servo access for fitting arms
- Canopy fixing
- Rubbish supplied screwdriver
- Overlong screws for wing servo horns
- Poor weight distribution meaning no pilot for flying
- Poor wing root fairing moulding
- Balance does not allow a decent size battery to be used
- One wing clip very difficult to unclip
- Servo lead holes in the fuselage too small, so made larger and rectangular

Summary

This is a very handsome model with a few minor faults and two bad ones. Don't expect to have this model assembled and ready to fly quickly. There is a fair bit of work to be done to get it ready. You might say, 'Why bother?' At the impressively low price it is well worth a bit of extra work. It looks beautiful in the air. The only ugly part is the rudder but that is the same on the full-size

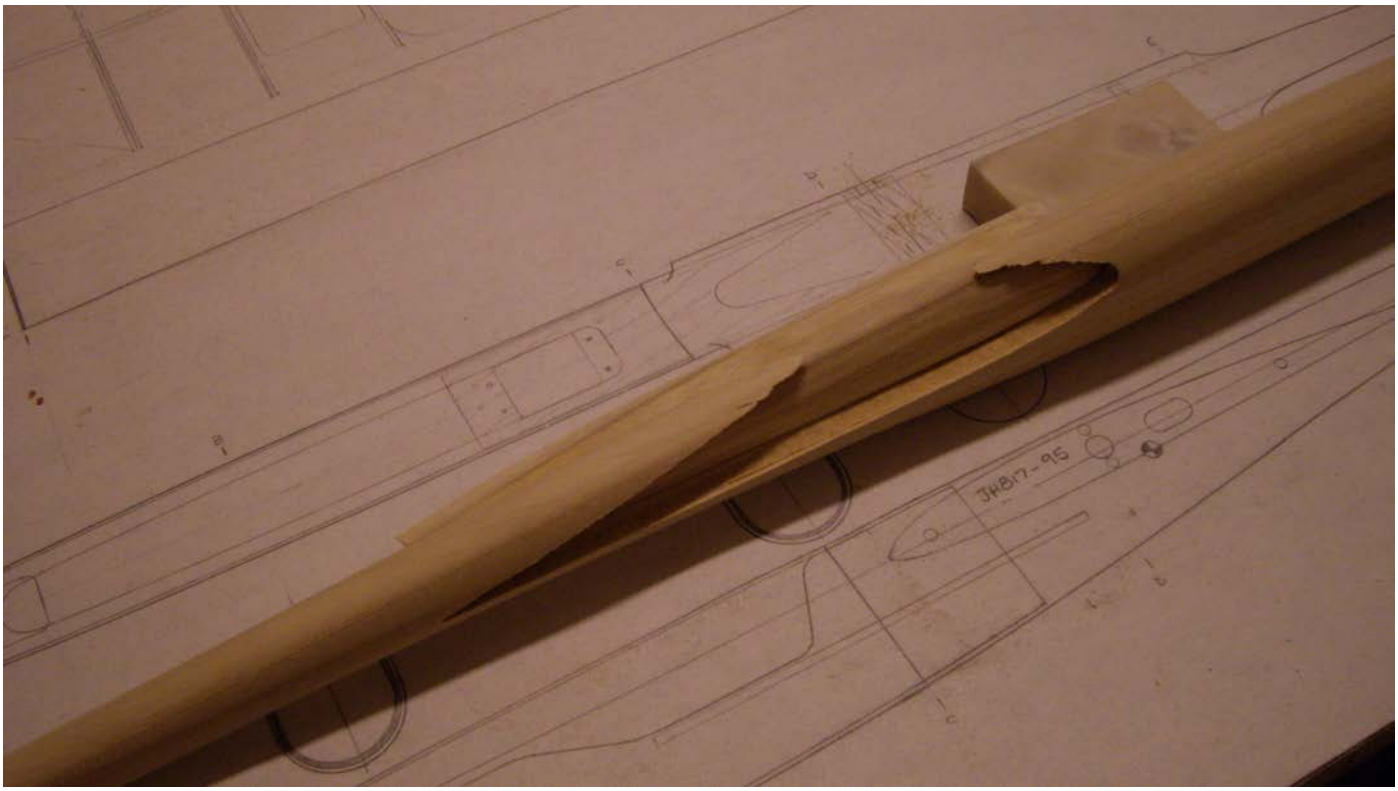
design.

*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**.*

Shinobi | A Home-Grown Moulded Fuselage

Part II: Fairing the Wing Stub Block into the Fuselage

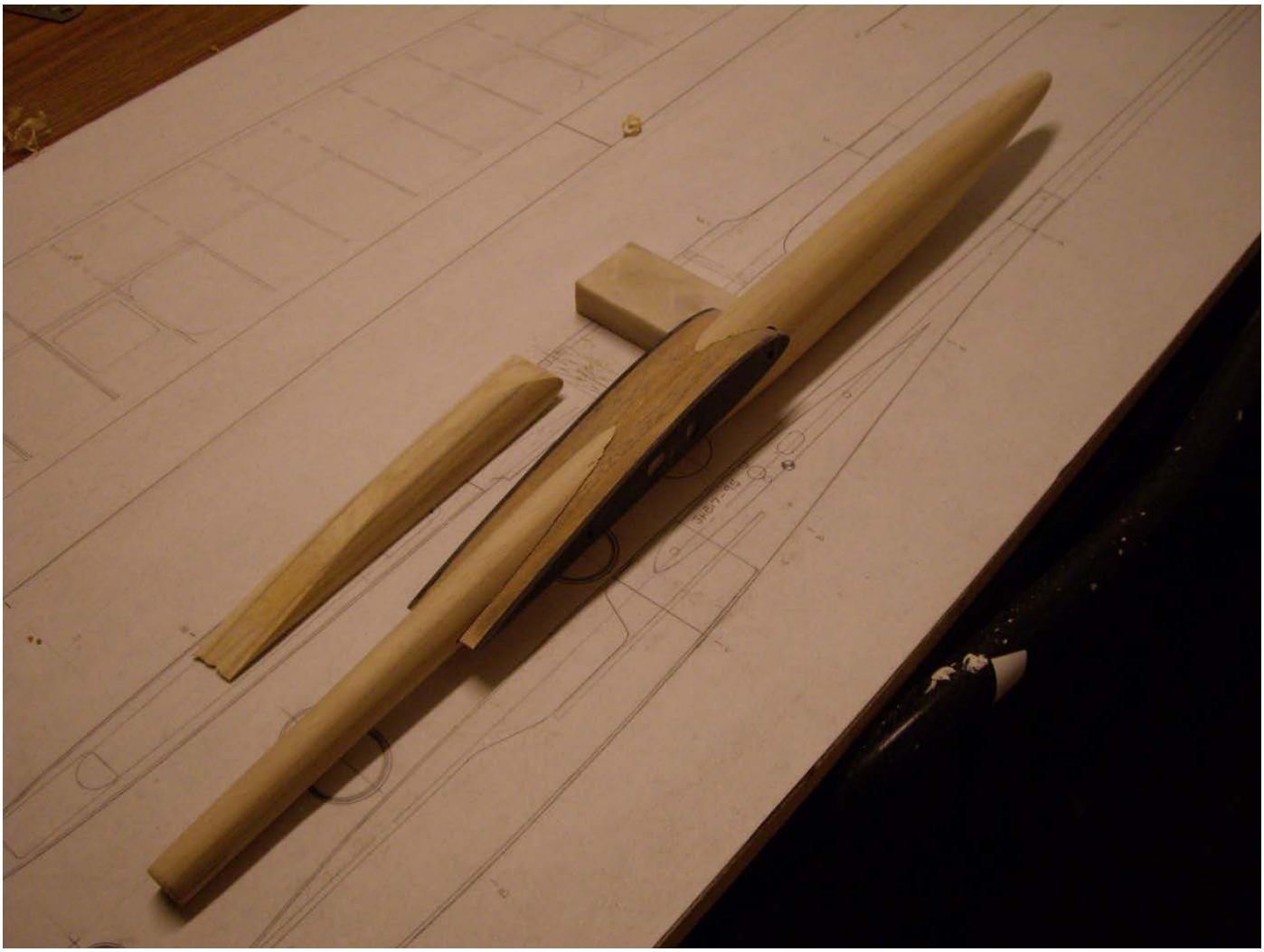
James Hammond



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

If you were following along at home in the first article in this series, you will now have finished sanding your fuselage plug to shape. However, before I continue, may I offer:

> ***Advice**: Check that plug one more time. Is the final shape 100% what you want?*



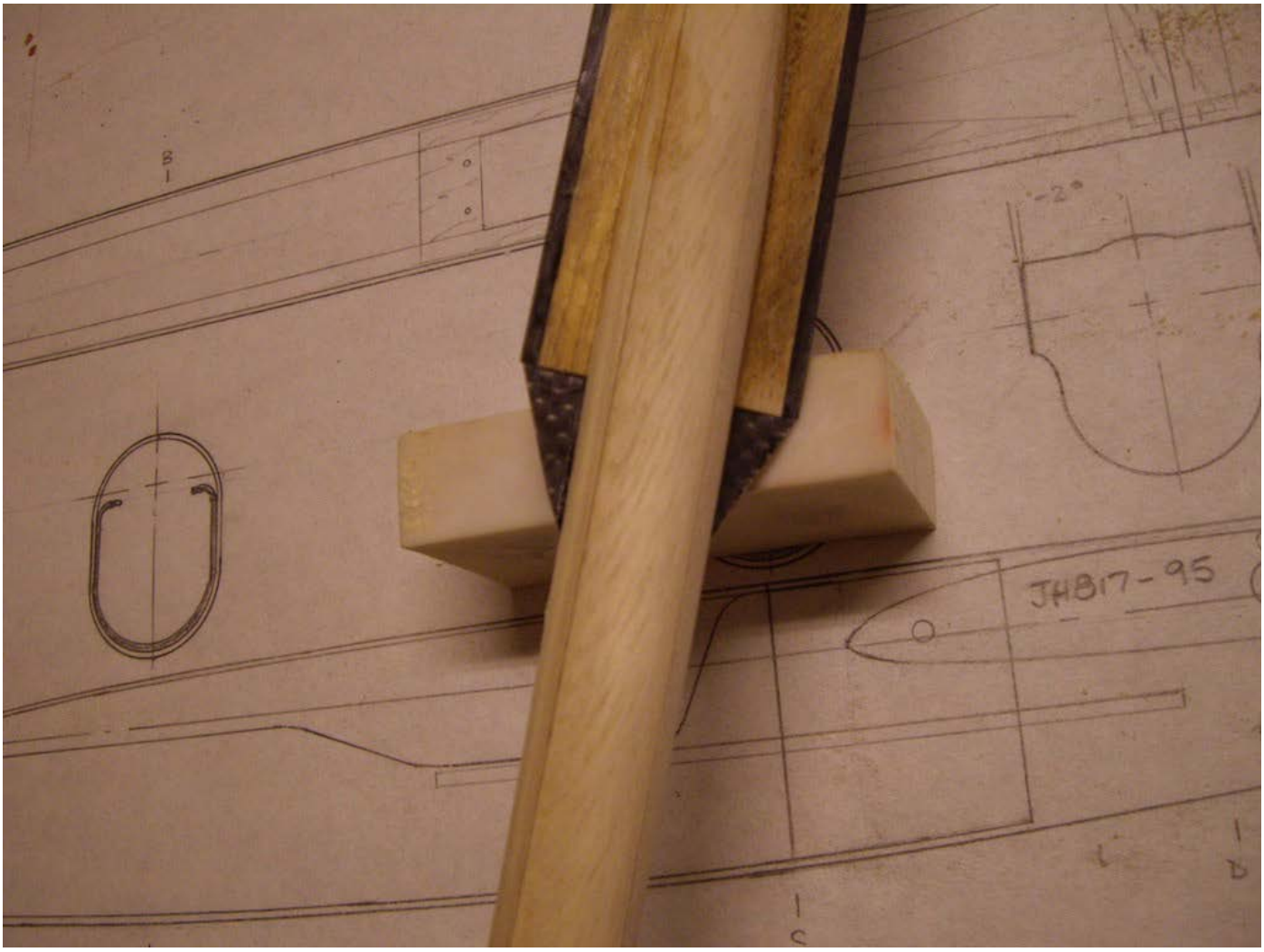
The wing stub cutout has been removed and the final wing stub block inserted, but not yet glued in place.

Satisfied? OK then, carefully ease out the tacked-in temporary wing insert and check the wing stub block alignment in the fuselage plug. If you did a good job carving and sanding it will be a nice fit. So, now the final wing stub block can be glued in, but first check the alignment. Now check it again. Apply just a couple of tack glue spots and check it again. Is it 100% aligned, and the faces parallel with the centre line? If you are happy, then apply more glue to make the insertion permanent.

> ***Advice:*** *Take time aligning the wing stubs. A few extra minutes to check here will result in a perfect wing fit later.*

Time to Think About That Fairing

To kick off the fairing, glue a couple of triangles made from 1mm or 2mm G10 glass or some spare carbon sheet at the trailing edges of the wing stubs, and flush with the fuselage to form the beginnings of the wing fairings. These don't have to be shaped before attachment as it will be easier to do it — and to get both sides the same — after we apply the resin that will make up the fairing curves; but make sure to get them straight with the centres of the wing sections. The same can be done with the front of the fairing at the leading edges. These small triangles when embedded in car body resin, will provide strong, hard points on the plug and prevent the sharp edges of the fairings from breaking.



Two small triangles of carbon have been added to the trailing edges of the wings stubs to form hard points for the fairings later. Note the drawing indicating a 2-degree dihedral to the cross section.

After the reinforcement triangles are hard bonded to the plug, use a piece of dowel and abrasive paper to sand them to the shape you want. Again, take time with this job. The shaping of these fairing edges will have a great effect on the eventual organic look of the fuselage.

> ***Advice:*** *Try to make the radii blend in as much as possible with the lines of the fuselage and the trailing edges of the wing stub block in a smooth curve.*

Now it's time to make the actual wing stub fairings, so the first thing we need is a nice body filler fairing tool, and the very best fairing tool that I have ever used is the good old humble teaspoon. You can take, nick, steal, borrow, re-purpose, or appropriate one from the spouse's silver heirloom family tableware case, but don't tell them I told you. Or, alternatively you can just find an old teaspoon from somewhere. Either way, the compound ovoid shaped curves of a humble teaspoon work fabulously well as a fairing tool.

Shaping the Fairings with Car Body Fillers

I guess everyone who makes models has their own favourite filler. It really depends on the application. For a repair you'd need to use a hard, strong compound like epoxy and a powder fill, maybe Cabosil or loose fibres, but for our fuselage plug, what we need is something that is reasonably hard but easy to sand. My favourite? Car body polyester resin type fillers. There are many brands, and the name *Bondo* springs to mind for those in the USA, while *Plastic Padding* was a popular product in the UK. They all share some common properties: quick setting, easy sanding, good feathering performance and good adhesion. We are not worried about weight so any good car filler resin fits the bill.

This Is a Stick Up

Like always, plan what you want to do, prepare well, and then work slowly and carefully. If you do a lot of filling work you will probably have a special wood or plastic platter — like an artist's palette which you use for mixing and application of fillers. Actually, I have seen some tear-off disposable palettes that look good, but I have never tried them, preferring my own old but familiar square of plywood. Scoop out a tablespoonful or so of resin, and then close the product lid. Put your scoop — normally a short length of thin wood — in a safe place, away from your work area with the product can. Now take the hardener — normally a tube of paste, and squeeze the correct amount onto the resin blob.

> ***Advice:*** *It's better to use too little hardener and have to wait than it is to use too much and have the batch go off too fast.*
>
> ***Advice:*** *ALWAYS keep the resin and hardener separate and never have both open at the same time.*
>
> ***Advice:*** *Aim to do only one part of the fairing at any one time — that means you would normally mix and apply four batches to do an entire fairing.*

Mixing and Applying the Resin

Using a putty knife or something similar (an antique Onyx-handled silver cake knife, stolen from that same spouse's cabinet?) mix the resin quickly but thoroughly until it's a uniform colour, and then using the same tool, apply the resin to the first side of the fairing, working it into the angles as much as possible. Now while the resin is still very soft, take your trusty teaspoon and using the back side, run it along the filled gap from the front to back, removing the excess resin and leaving a nice concave curve. Changing the

angle of the spoon to the resin changes the radius. That is, sharper at the leading edges for a smaller curve, and more oblique at the trailing edges. You should now have a nice radius in there — but don't worry, you should have time for a couple of tries if you are not happy the first time. You can, and probably will almost always apply more resin later. Now repeat the same process on all the corners of the fairing.

A Little General Advice on Resin Use

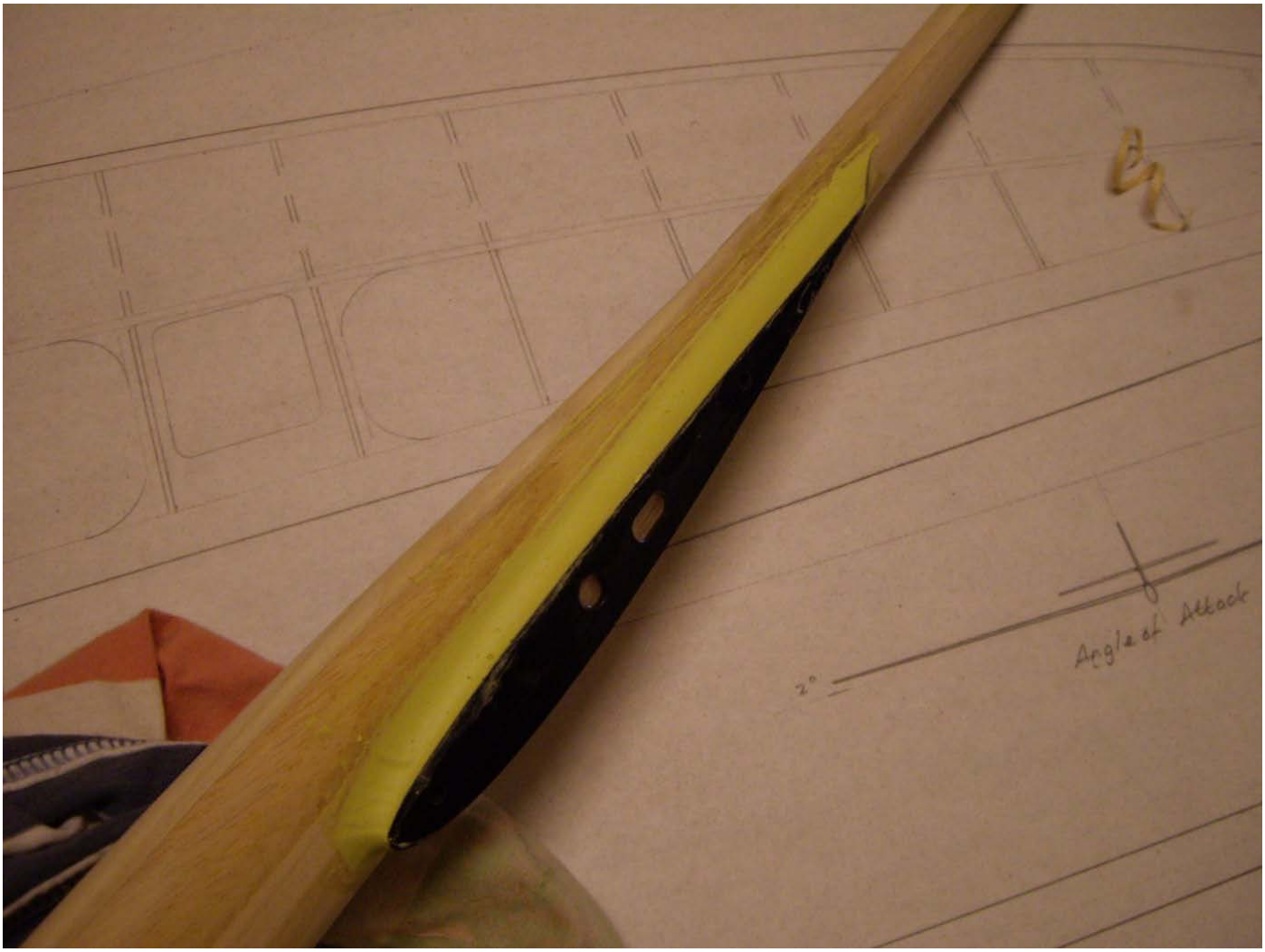
- Don't try to do too much in one shot unless you are really familiar with the process.
- Car body filer is normally a polyester resin compound so don't allow the resin product and the hardener paste to be near each other unless both are firmly closed.
- Use one component at a time and while using it, firmly close and remove the other component from the bench.

Warnings for Polyester (Styrene Monomer) Type Resins

- **Be careful** — Using too much hardener will cause a catalytic reaction where the resin will set too quickly and may get hot. This is an exothermic reaction and can cause enough heat for the mixture to actually ignite.
- **Be careful** — Keep all your mixes under observation until they harden. It's safer and can also let you know more about the mix.
- **Be careful** — The slightest amount of hardener that mistakenly gets into the Resin paste can and will cause the whole contents to harden within 24 hours. Even sanding dust can do this.
- **Be careful** — Don't use an old can of resin that you have had hanging around for years — or your Granddaddy has. It's a recipe for disaster,

and anyway your lovely new plug deserves the best, right?

I did mention that you should **be careful**, right?



One part of the fairing has been filled with car resin and then the excess removed with the back side of a teaspoon. Note the almost perfect radius.

Nicht Fur Gefingerpoken

Don’t be tempted to start poking, stroking, carving or sanding the filled fairing before the resin has cured hard. Leave it at least 12 hours and preferably for a whole 24-hour day. Despite avowals to the contrary and swearing on the last resting places of numerous deceased relatives from the resin manufacturers, it’s still likely to shrink, and unless it sets pretty hard it

can flake off and ruin all your beautiful handiwork if attacked too early.

Sanding, Sanding and More Sanding

When the Resin is hard you can begin to refine the curves. Use tools like a piece of dowel of about the right radius with the abrasive paper wrapped around it. Work slowly and carefully, as usual, taking care not to accidentally round off the sharp edges of the wing stub faces or dig grooves into the rounded fuselage profile. Remember that its highly likely that you'll need at least one or more applications of resin.

> ***Advice:*** *Use different sizes, of sanding aid — it's amazing how many different sizes of round implements and how many implements with round handles, you have in your kitchen drawer.*
>
> ***Advice:*** *Always remember that it's easier to ask forgiveness than it is to seek permission. And that's because you ain't going to get no permission. Whoops I'm going straight to hell for that one…*
>
> ***Advice:*** *If you are worried about over sanding or accidentally sanding the wrong parts, you can put some tape on the edges or surfaces that you do not want sanded to protect them.*
>
> ***Advice:*** *Leave the plug to harden thoroughly before attempting to shape the fairings.*
>
> ***Advice:*** *Use sanding aids to attain the correct curves and radii.*
>
> ***Advice:*** *Protect any critical faces or surfaces with tape.*

The wing stub joined, faired, sanded and pictured here after a sealing coat of epoxy resin prior to the final finishing. Note the continuously blended compound curves and the absence of dips or bulges.

Finishing

All that remains at this stage is to finish the plug. I use a couple of coats of clear epoxy, thickened with a dash of colloidal silica (Cabosil) to give it some thixotropic properties so its doesn't just all run off. The reason I use clear coating is because I want to see the centre lamination line which will be really useful when lining up the plug on the parting board later. Colour paints can be used but it's a good idea to keep track of the nice centre line. Whatever you do please don't use any kind of cellulose type paint, because let me tell unto you that if you do, your plug will stick in the mould —

whatever you do. Rub the coating down to a smooth finish, but note that it doesn't have to be mirror finish. About 400 grit will be good. This will provide a good 'key' for your parting wax to get a good hold on the plug surfaces. The finished mould will be polished later.

The wing stub Fairing sanded and pre-finished with a sealing coat of epoxy.

> ***Advice:*** *Never, never, never use a cellulose based paint to coat to finish your plug — whatever you do, it will eliminate your release agent's effect and the plug will stick in the mould.*
>
> ***Advice:*** *Break the surface of the plug by rubbing the surfaces down to about 400–600 grit — this will provide a key for the wax to thoroughly*

> *coat and infuse the surfaces thus providing a good release.*
>
> ***Advice:*** *Use a little soap or dish washing liquid to provide a lubricant and keep the abrasive paper clean if done wet.*

Next time: What about that nice slip-on nosecone? Until 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.

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****.*

Friday Moment of Zen

A more-or-less weekly video dose of why you started RC soaring in the first place.

The NEW RC Soaring Digest Staff

It doesn't get much more Zen than this. Check out the other inhabitants of the field, off in the distance. (image: Iain Medley-Rose)

There is a massive amount of video being uploaded to the internet every minute of every day. Purely in fulfilment of our (*ahem!*) professional responsibilities we watch a lot of RC soaring videos. As one might expect, they do vary in quality quite a bit. But every once in a while one really catches our eye.

A while back we worked with the creator of one of these more amazing videos to put a clip on our Twitter feed. When we chatted about how to

frame that exactly, somebody suggested "oh, it's like that *Moment of Zen* thing that John Stewart started on *The Daily Show*". And it was a Friday. Thus was born our new Twitter-only feature entitled, predictably, the *Friday Moment of Zen* (*FMoZ*). Not a lot of science there, we have to admit.

The concept is pretty simple: take a few seconds — maybe a minute — of the full video and put it on the RCSD Twitter feed. Then provide a link to the full video and also where you can find more *FMoZ*. That's it. Seriously, that's *really* it. Here are some recent examples (click title in caption for full video):

Slope Soaring Trip Italy 2021 by Speedamigo-Modellflugfilm.

Sorry

Because of its privacy settings, this video cannot be played here.

4.2:1 Scale Topaze by Chris Williams

Sorry

Because of its privacy settings, this video cannot be played here.

Elvira by Iain Medley-Rose

So where do you find all this curated goodness? We have a filter of the RCSD Twitter feed setup so you **get just our FMoZ tweets**. You'll want to bookmark that. You don't even need to sign up for Twitter to do that.

However, what if you don't want to miss a single *FMoZ* in the future?

That's easy: just follow us on Twitter by clicking just over there on the left (or just below) and it will take you right there. Then click the *Follow* button. That's all there is to it.

We should also say that *FMoZ* isn't the only reason you'll want to add our Twitter feed to your regular intake of RC Soaring Digest. We feature lots of stuff over there which is only available on our Twitter. So unless you're untroubled by FOMO (fear of missing out), getting to know our feed is something you'll definitely want to do. And, of course, like all the other great RC Soaring Digest distribution channels, *FMoZ* and/or following us on Twitter is absolutely free.

We look forward to seeing you there!

The NEW RC Soaring Digest Staff

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Soaring's Dream

Innovation keeps the best of the RC soaring dream alive and forever young.

Bob Dodgson

Craig Aho has been widely recognized as one of the leading, modern builders of Bob Dodgson's designs. Pictured in this montage is Craig's latest project: a updated rendition of the Anthem. Can you spot some modern innovations to Bob's original design? Craig's Anthem will be flown for the first time in Spring of 2022. (images: Craig Aho)

What is it that binds together the weird hodgepodge of humanity who make up the diverse RC soaring community? The only thing I have found that we share in common is the dream of and wonder at powerless flight! We are the ones, who as kids, stood in awe watching the birds fly overhead while our peers were more interested in shooting at them with BB guns. We never cease to be amazed when we see a thistledown parachute or a maple seed helicopter rising magically skyward soon floating out of sight. As a result of

our infatuation with defying gravity, we have been trying to make things fly all of our lives, from dime-store gliders to sleek, multichannel high performance soarers to our priority plagued marriages. We are people who have refined our building skills, through continuing practice, research and determination, to the point where we can now construct our own gliders that seem to want to leave the building board and leap skyward.

Model soaring is a wonderful and fulfilling learning process that revitalizes our enthusiasm with each success along the way. Every model that we construct is a mystical sculpture of boundless possibilities. Even if it is our third model of the same kit, there are so many 'construction improvements', weight saving techniques and wing leading edge shaping variables that we can always have the hope that this new model will be the best performing model yet. Nor is this a totally vain hope. All of us have seen exceptional gliders, built from a kit, exuding performance that seems to transcend the kits design limitations by flying much better than other models from the same kit. Often, it is not the immaculately constructed glider or the model with the show finish that is the standout performer. Sometimes the best flying model looks downright offensive to the accomplished craftsman. Yet, it is the possibility of that next (even if imperfect) glider being the occasional breakthrough glider and outperforming the pack, that is the dream from which we draw our sustenance.

For example, one local flyer built a *Camano* that flew and performed like an absolute dream. After its untimely demise, he built a succession of *Camanos* and even a *Lovesong*. None of these planes could match his *Camano Dream*. This flyer now has a *Pixy* which comes about as close to his *Camano Dream* as a 2- meter ship can and he has a good flying *Lovesong* but oh that one *Camano*. This dream flyer may never have another glider that he likes as well. For some reason, that one model did everything right and no one knows exactly what it was that made that one plane so special.

I know another flyer, who has one of the local *Anthems*. There are better looking *Anthems* around and there are definitely better flyers around but this particular *Anthem* in his hands is a wonder to behold. It outperforms nearly everything else at the field. When asked why his particular *Anthem* flew so well, the creative and opportunistic flyer replied, I modified the airfoil a little. Upon hearing this explanation, the questioner, adroitly responded "*oh, you mean that you were too lazy to use the leading edge templates when you were shaping the wing leading edge?*" With this brilliant insight, the inquisitor had his answer. There would never be another Anthem that had quite the exact same airfoil as this one particular *Anthem*.

With recent test results from the Selig/Donovan Princeton wind tunnel tests, as published in *Soartech 8* from Herk Stokely, we designers have considerably more information at our disposal than ever before. New airfoils were even designed from the new data while the tests were in progress. Using the Sailplane Design computer program by David Fraser (now available through Herk Stokely), one can easily try many different airfoils and model configurations in the lab without having to even construct the prototype gliders. This new capability is a wonderful tool and it can be used to achieve excellent results in a short period of time.

While we now have this great body of data on model glider airfoils and performance, due to the practical limitations of time and resources it is important to realize that of the infinite number of aerodynamic possibilities only a small and finite number of possibilities have been tested. It is obvious that every possible airfoil shape could not be tested. Even every possible airfoil-trip location could not be tried for one airfoil, let alone for every airfoil. As amazing as is the amount of data to which we now have access, it is still a drop in the bucket compared to the potential knowledge that is still beyond our reach. The vast knowledge that we do not yet have is like a black hole that can suck in even the most careful of designers. Happily for me, it is this

presence of the vast unknown that still makes glider design a creative and artistic experience. Coming from an architectural background, I drive the button-down engineers crazy. They like to work with absolutes, even if the available information is not conclusive. This 'blinders on' reliance on partial data and imperfect technology can lead to false assumptions and erroneous design concepts when the artistic side, common sense and design intuition are factored out of the equation.

I am reminded of the World Soaring Championships that were held in Sacramento, California in about 1980. This was truly a battleground of art verses technology. The epitome of technology was the Swiss team's stable of magnificent all molded glass, hollow-winged *Spartacus* gliders. The technology and workmanship rivals the best that can be seen today. Since these ships were all from the same molds, they were basically identical to each other. Any team member could fly any of the 12 *Spartacus* gliders at any time and achieve equal results. Everything was great except for the fact that a major design parameter, based purely on scientific rationale, proved to be a false premise rendering the pilots and gliders embarrassingly ineffectual. The major premise error was that instead of using ballast, the *Spartacus* would use a remote controlled CG-shifting mechanism. There was one person with the team whose sole job was to go out with each team flyer to calculate exactly where the CG should be for that particular flight, event type, humidity, wind speed and direction. Even if the scientific basis of the idea were sound, the artist-designer should have known that constantly shifting a gliders CG is a bad idea even if it offers theoretical scientific advantages. You see, changing the CG changes a planes handling and flight characteristics to such an extent that flying the *Spartacus* must have been like flying a different glider every time a pilot went to the flight line. In spite of a spectacularly poor showing in competition, these gliders received endless praise from a mindless US press.

The praise that was thrust upon this ill-conceived technology reminded me of a saying that I heard from an old professor: "*it is not what you do, it is how you do it*" that matters. In glider design, it also matters that your design premise is sound.

The plane that actually won the World Championships was designed and flown by Dwight Holley. This former *Maestro* flyer admitted to me after his win that his F3B World Championship glider was much like a smaller, beefed-up *Maestro*, utilizing the same control configuration. This glider did not sport the hollow-core fiberglass construction techniques used on the *Spartacus* but it was a much more consistent and reliable performer.

Another possible technological leap of faith is the unquestioning acceptance of the Schumann planform as being the ultimate wing planform. This in spite of the fact that many Schumann-winged model gliders have tip-stall and other problems and as far as I have seen, there appears to be no field experience that would show it offers a performance advantage on thermal competition gliders. In fact, the basic 1982 designed straight winged *Windsong/Lovesong* is still beating the new designs on a regular basis.

Now our hobby is inundated with numerous similar *Spartacus* technology gliders among which a modeler can choose. These coexist along with the more traditional foam, wood and fiberglass kits as well as the all wood kits. Unlike with traditional kits, theoretically all of the plastic gliders made from the same set of molds should fly exactly the same. This is good, right? The down side of all this sameness is that it robs the pilot/builder of one of soaring's most exciting and creative aspects. No more can his mind wonder unrestrained, as he is inhaling an airborne elixir of balsa dust and CA fumes, while he is imagining a finished bird that will fly like his dream, the dream that this one glider will be that special glider with performance on loan from God.

With the advent of the off-the-shelf glider the mystery, the wonder and the dream of this artistic sport will have been reduced to a common formula that may even stifle future breakthrough development. In the past, designers and would-be designers were free to try anything. Sometimes a glider would defy the odds and perform above normal expectations. This success would aid advances in design by providing tangible performance improvement for evaluation and further testing. With the investment of time and money required to make molds for plastic gliders, no one is going to go out on a limb to try something that is not already tried and true. As a result, we are getting a herd of fair to good performing look-alike gliders but we miss that occasional standout glider that seems to defy the accepted wisdom of the day and thus provide a building block for the future. In a molded world, there are no freaks no anomalies and no happy accidents. Think about that while you are joyously spending weeks (in some cases months or if you are like Sal, even years), building your *Saber* or *Anthem* while your good buddy is out at the flying field terrifying bystanders with the plastic wonder that he received only last week!

Oh sure, for F3B where high-speed and great strength at-any-cost are important, some of the exotic plastic gliders appear to offer the advantage. However, in the multitask requirements of serious thermal competition, the plastic ships are still playing catch-up. Many times they are either heavy or they are fragile and vulnerable and cannot withstand the rigors of the sustained competition environment.

Lest you think that I have lost it altogether and am simply bashing the hi-tech approach to soaring, fear not. Great strides are being made in this facet of the hobby to make good performance more accessible to more people. I just do not want to see the world of instant gratification totally overshadow the spirit and the dreams of the individual builder/flyer who has always been the backbone of this remarkable sport. Fortunately, in a plastic world there is

still room for individual craftsmanship and innovation.

From a performance standpoint, many factors come into play that are not anticipated by the computer polars particularly at thermaling and searching speeds. As a result, happy accidents do happen. Excitingly, no one knows exactly what unpredictable air-flow patterns are being generated by the hand-sanded flying surfaces on your individualized glider. The blending of art and technology along with a generous infusion of the hand-crafted dream is still the heart and soul of RC soaring and this dream, along with the wonder and anticipation are still alive and well. Just consider that each new hand-crafted and hand-sanded glider you complete and proudly carry onto the flying field may be the one offering the unexplainable breakthrough performance that will make you a champion and local hero. No one else can ever have a plane that flies exactly like yours! At best, a molded wing can only faithfully reproduce a known airfoil along with its known limitations.

In a cookie cutter, disposable sacrificial parts plastic world, may we never lose sight of the hand craftsmanship and the individual innovation that keeps the best of the RC soaring dream alive and forever young.

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Save Money on Sanding Disks

Why buy new when you can refurbish what you have and pocket the difference.

Tom Broeski

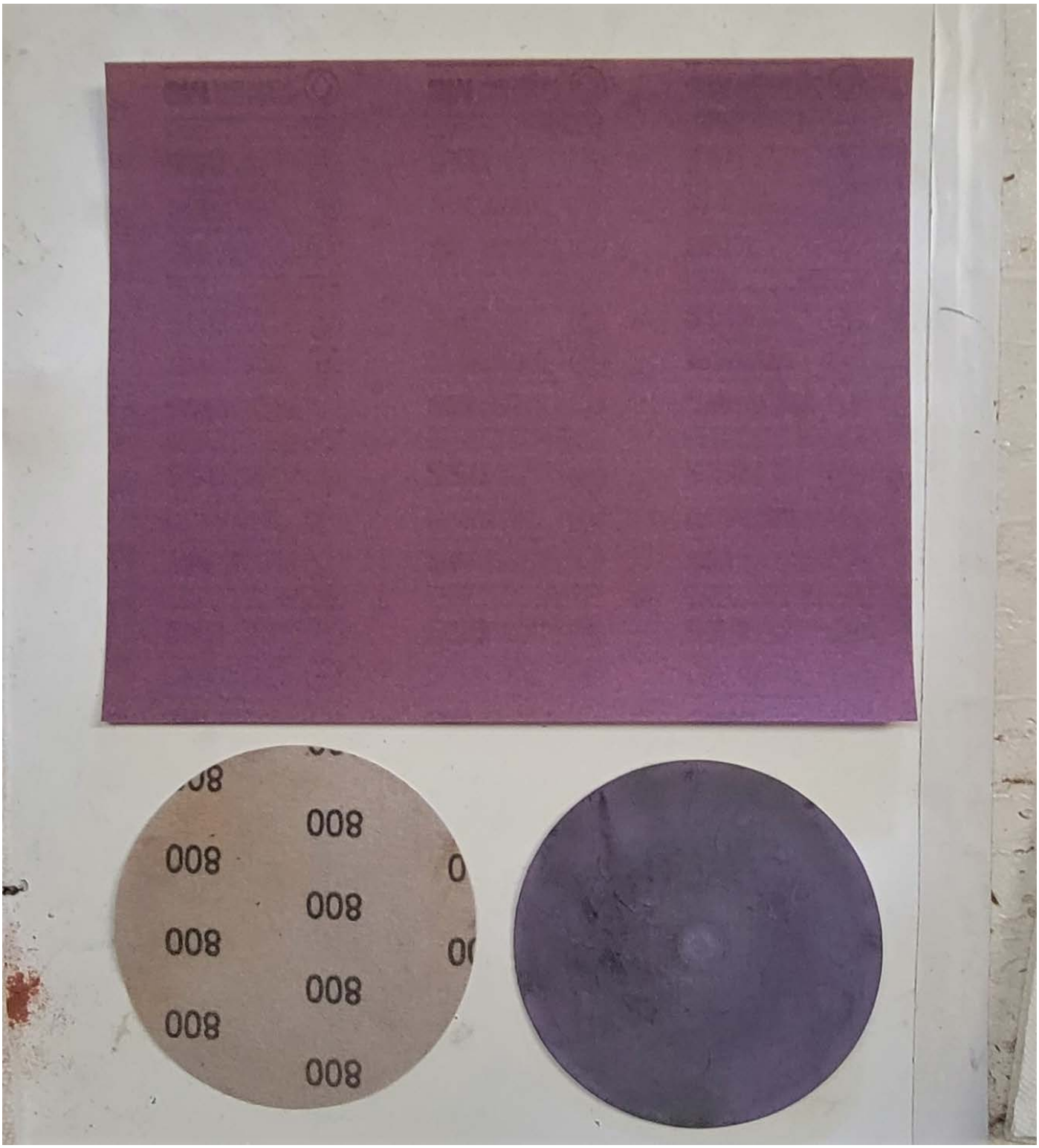
The tops of the boxes torn off and put in a drawer for easy access to my inventory of refurbished sanding disks.

I go through hundreds of sanding disks in a year. However, I find some worn-out loop disks that won't recover from cleaning with the abrasive stick (below) can be used as backing for new sandpaper.

I pay up to $0.80 each in quantity for good disks. I started recovering the worn-out ones using sheet paper that cost around $0.49 per 8″x10″ sheet.

Trying to clean the disk with an abrasive stick.

I find a sheet of the grit I need. In this case, it is 220 grit. I use some spray glue on the face of the disks. Normally I use a Camie product, but spray glue of any type should work. I grabbed some 3M *90 Spray Adhesive* here.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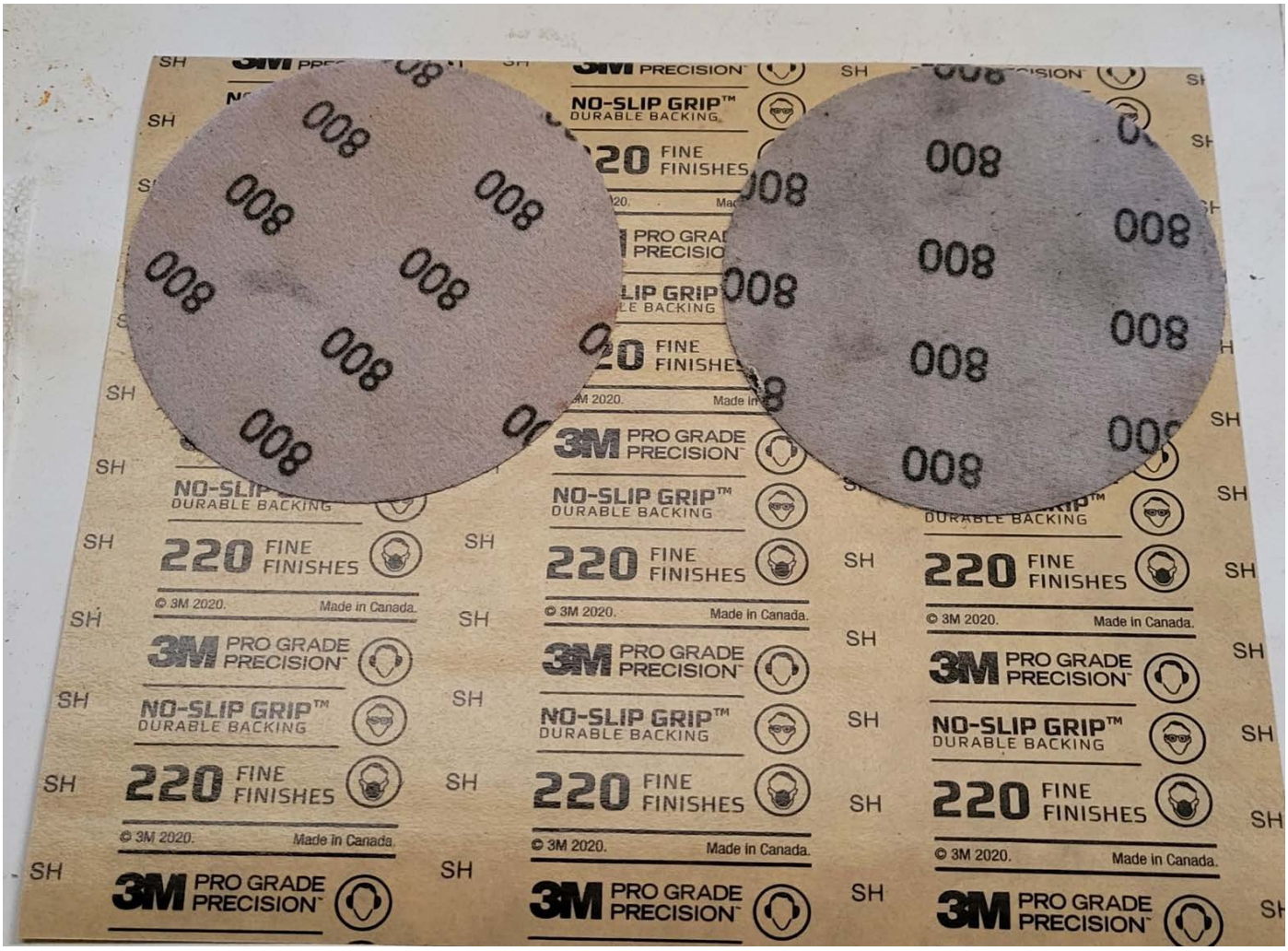
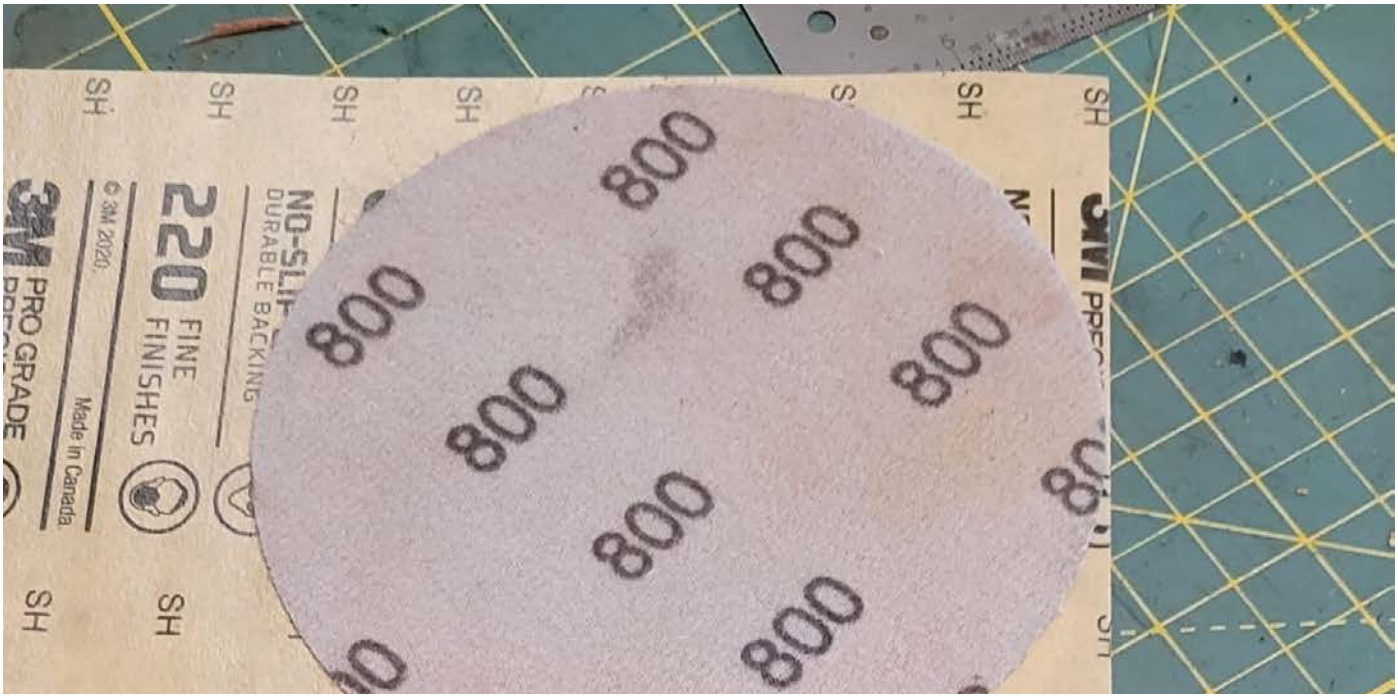
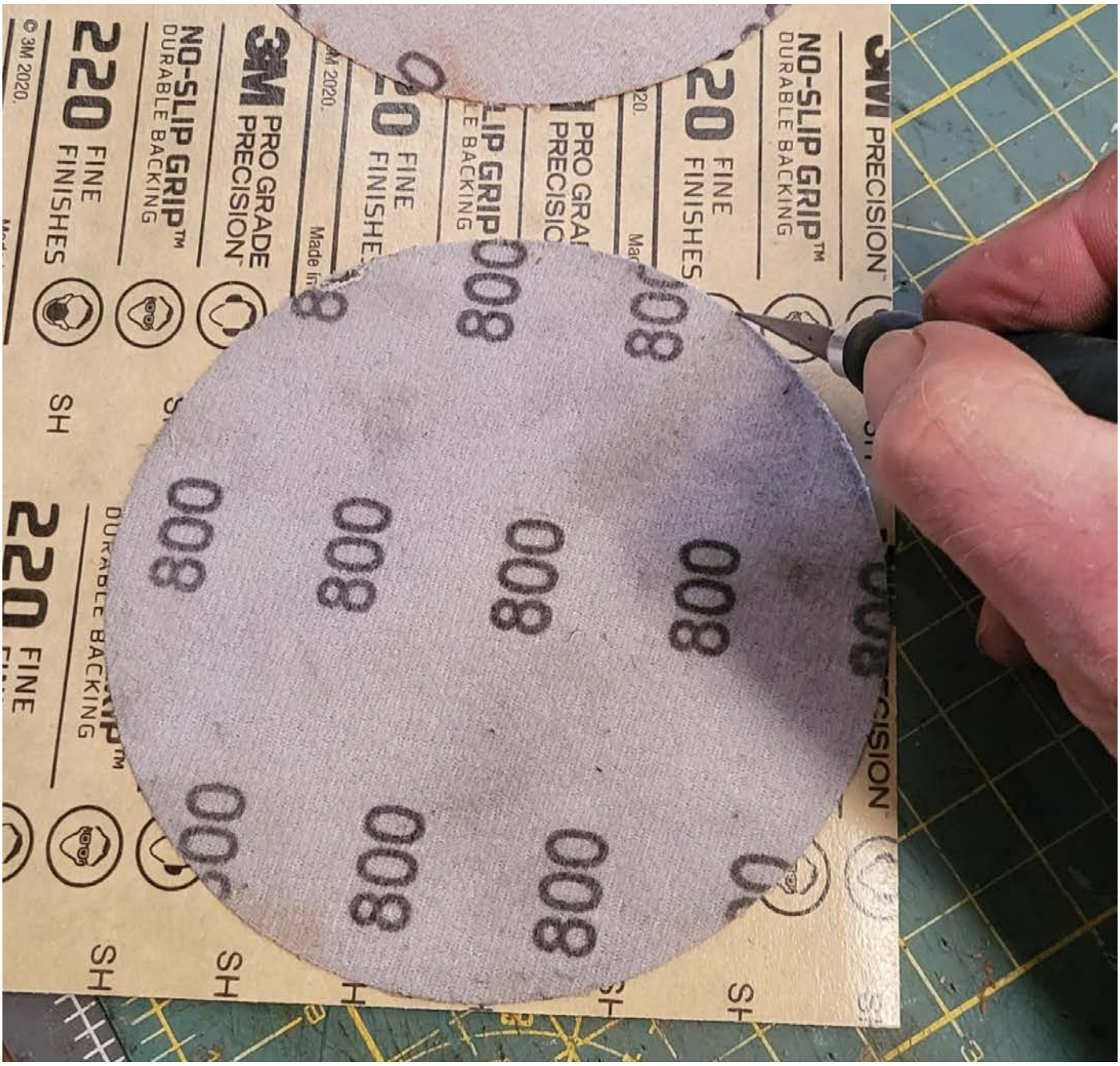
3M
Hi-Strength
90
Spray Adhesive
Spray Adhesivo
Bonds laminates, kick plates, polyethylene, polypropylene, plastic lettering.
Pega laminados, placas metálicas, polietileno, polipropileno y rotulaciones plásticas
NET WT. 17.6 oz / 500 g

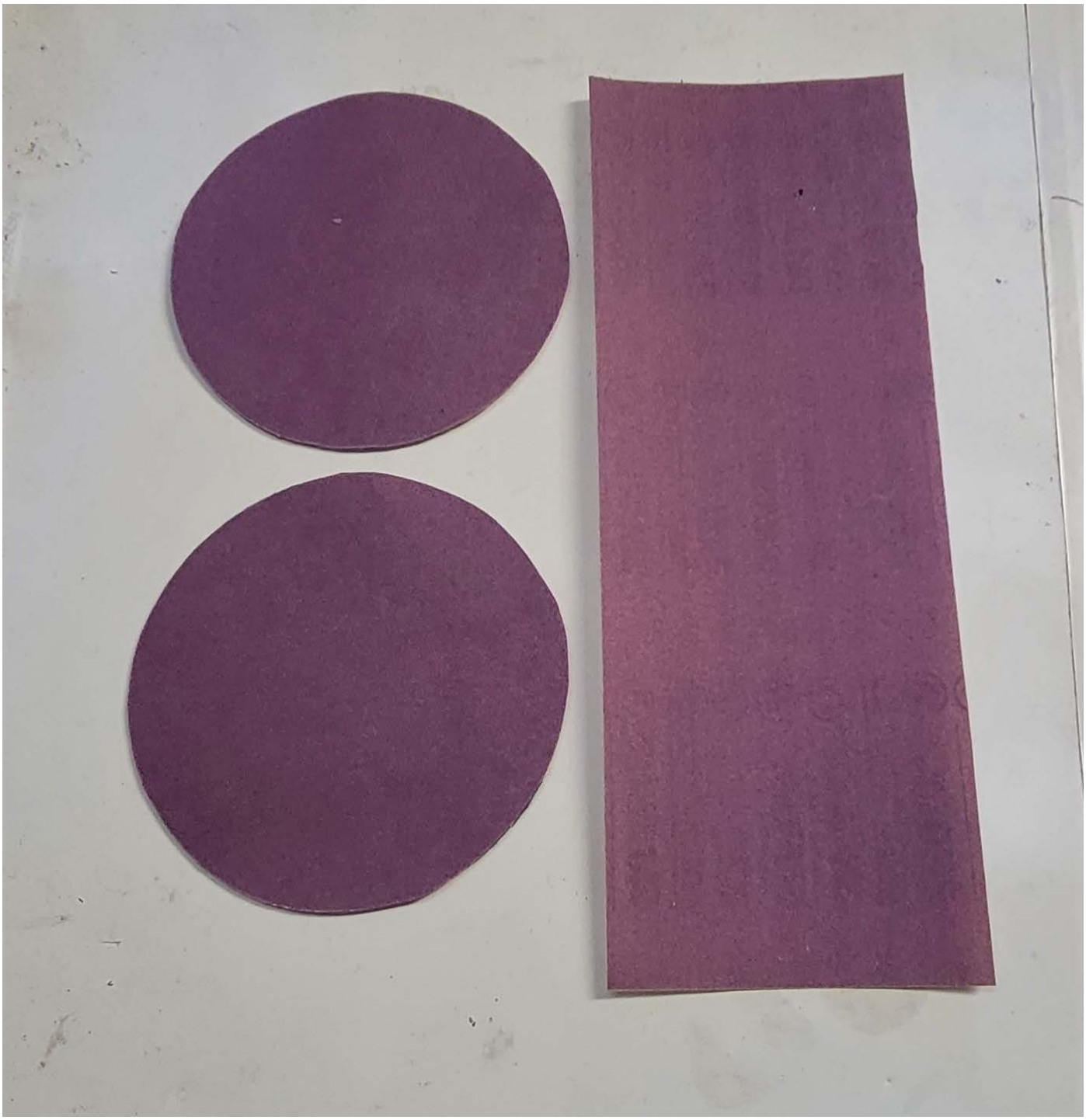
I then stick the disks to the back of the sheet and cut them out.







Since my disks are 5″, I end up with two disks and a partial sheet left. This works out great since I rarely use a full sheet for anything. The leftover fits my long sanding block perfectly.



I tear off the tops of the boxes and put them in a drawer for easy access as shown in the photo at the top of this article, above the title.

If you have any questions, please use the *Responses* section below and I will do my best to answer them.

'Til next month!

*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 II: Internal Resistance and Why It's Important

Peter Scott

The e-Genius electric-powered motorglider over the Alps in 2015. (image: Wikimedia under CC-BY-SA-4.0)

This is the second part of a nine part series which goes through a comprehensive explanation of everything an RC modeller needs to know on the subject. Readers who have not already done so may want to read Part I before proceeding with this article. — Ed.

Resistance

Everything in the world has electrical resistance. Resistance is what determines how much current flows from a particular energy source or voltage. Some materials have very high resistance and are called insulators.

Some, mostly metals, have very low resistance and are called conductors. A few have resistance somewhere in between and are called semi-conductors. This is a bit of an odd choice for a name as they are much more like conductors than insulators. They are definitely not materials that only conduct in one direction as the name might suggest. Those are called diodes.

Only one group of materials has zero resistance. They are called super-conductors, but only behave like that when made very cold, currently usually below 20 kelvin (-253°C), or more recently at higher temperature but very high pressure. That's why the coils in medical scanners that use high magnetic fields, for example MRI machines, have to be cooled with liquid helium to reduce the wasted energy from the high currents. Its also why we shouldn't waste the limited supply of helium on balloons and squeaky voices.

Because of the limbo in which they live, semiconductors behave oddly. It only takes a small temperature change to change their resistance. Higher temperature means their resistance goes down, which is opposite to metals. When I started playing with transistors there were only germanium ones — yes that long ago. If you passed even a little too much current through them they got warmer, the resistance went down, the current increased, they got even hotter and then failed. That was called thermal runaway, and resulted in one week's pocket money gone. You can make a glass rod conduct from mains type voltages if you heat it to near its melting point.

Adding impurities to semiconductors (doping) alters their properties dramatically. It is that fact that allowed the whole semiconductor industry to develop the minute circuits for the marvellous devices we all now use. They dope tiny areas with different elements to make circuits on wafers of silicon. It is why some of the alloys have such great names, like the gallium-arsenide-phosphide that is used in light emitting diodes. All of the electronic

devices that we use in models, the car in which we travel to the field or slope and the phone that we use to say that we will be late back, rely on semiconductor ‘chips’.

Silicon (glass) is the most commonly used semiconductor because it is plentiful, cheap, robust and withstands high temperatures. Though not exactly a semiconductor, graphene — a layer of carbon one atom thick — behaves like one in some ways and might well replace silicon in some applications.

Georg Simon Ohm discovered the electrical properties of conductors. That’s why the unit of resistance, the ohm (Ω — omega), is named after him. He devised the equation that we call Ohm’s Law:

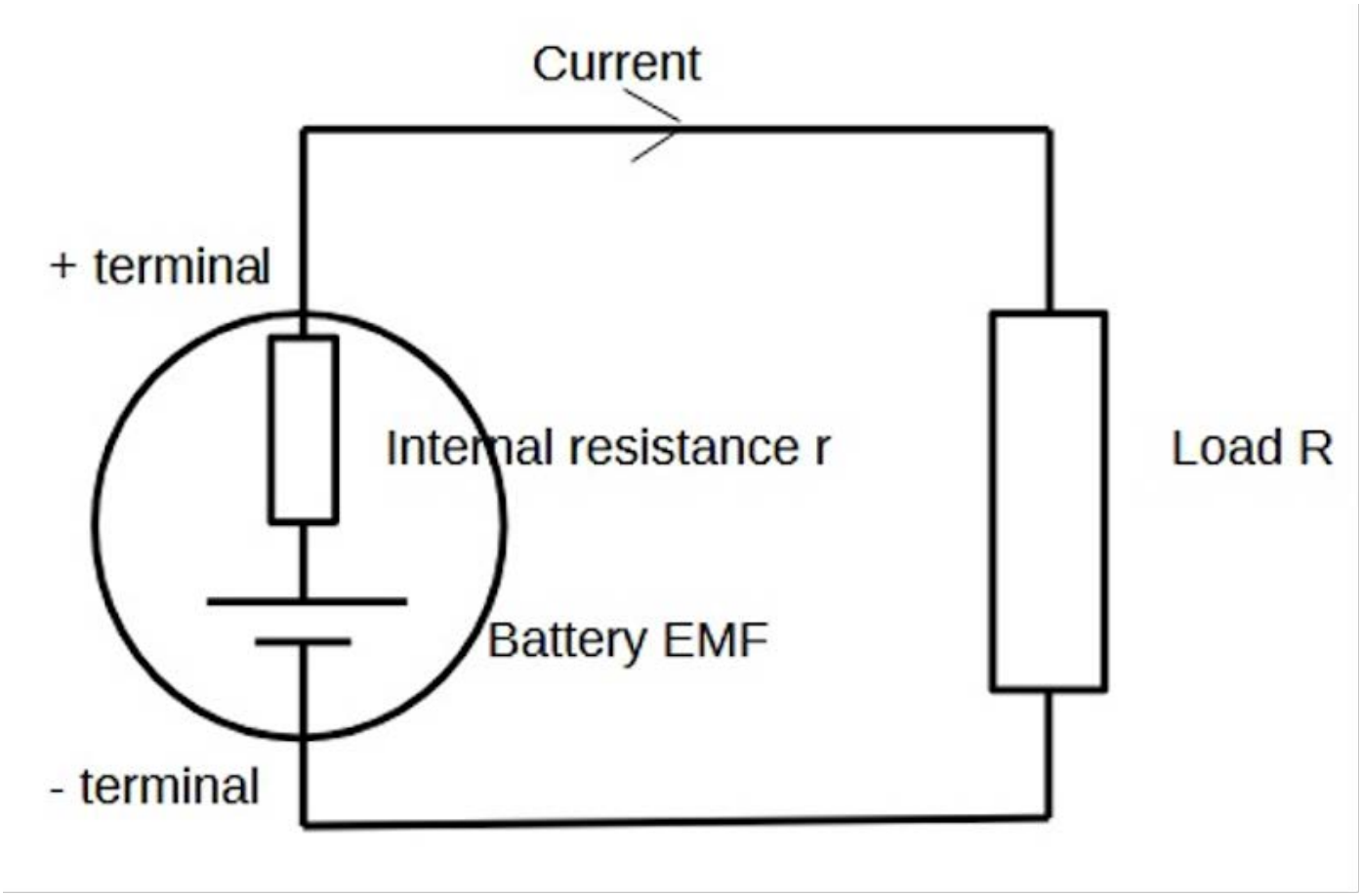
Resistance = Voltage / Current	R = V / I
Voltage = Current x Resistance	V = I x R

So What Is Internal Resistance?

Try an experiment. Take a battery, a light bulb and a digital voltmeter. Connect the voltmeter leads to the battery terminals and note the voltmeter reading without the bulb connected. Then connect the bulb. You will see the voltage drop. But why?

The stuff that the battery is made from has resistance, called ‘internal resistance’. The current the battery produces flows through this stuff and some of the voltage is ‘lost’. Voltage is energy. The lost energy warms the stuff in the battery. The lost voltage reduces the voltage at the battery terminals. The higher the current the greater the drop in voltage. And of

course the higher the internal resistance the more voltage is lost.



Consider the diagram above: the electromotive force — EMF or voltage V — causes a current I to flow. I flows through both resistors r and R. Each has a voltage (energy) drop across it. The voltage drop across internal resistance r means that the voltage between the + and — terminals is that much less. Connected to a high resistance load the difference will be small. Connected to a low resistance load that takes a lot of current, like one of our ESCs or motors, it could be high. This is also why if you want to get an accurate battery voltage reading, or a component in a circuit, you should use a high resistance voltmeter.

A Practical Example

We have a 3S lipo battery that reads 12.6V when fully charged. Each of the

three cells has an internal resistance of four milliohms (mΩ). We run a motor that takes 30A.

The voltage lost in the battery = current x internal resistance = 30 x (3 x 4 / 1000) = 0.36V.

The battery will now show a voltage of 12.24V.

If you have telemetry you can see how the battery voltage drops as you move to full throttle current and goes back up as you throttle back.

As a battery ages its internal resistance rises. Up to 10 mΩ is alright. In fact this was the standard for new lipos until a couple of years ago, now down to around 4 mΩ on average. Once it gets much above 10 you start to get a vicious circle, the speed of which is unpredictable. The wasted energy heats and degrades the stuff inside even more and the gases that are generated cause the battery to swell irreversibly. The message is that when a battery starts to swell it is a good idea to measure the internal resistance to see if it's time to recycle it. Most newish chargers will measure it. It might still be fine, but I put an amber sticker on suspect ones to warn me to check regularly.

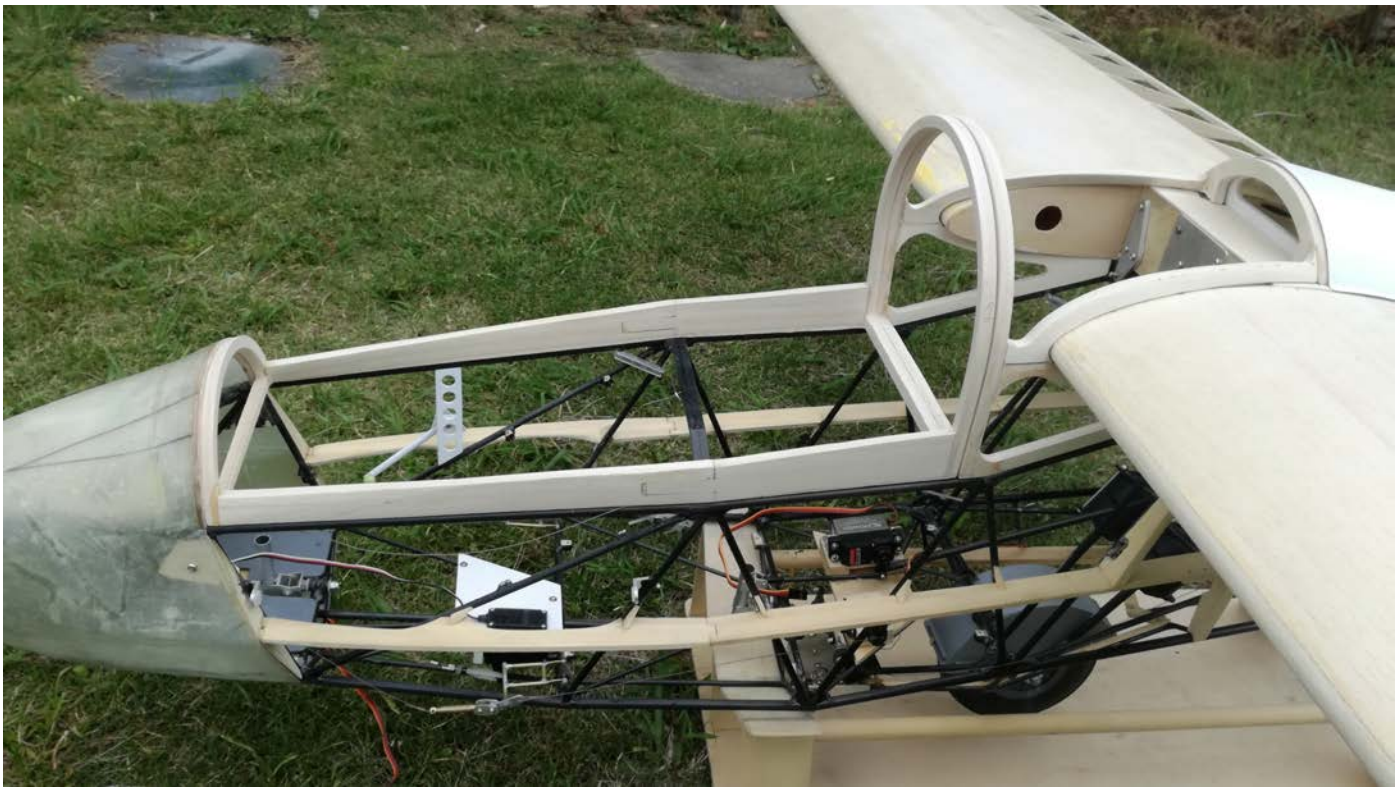
Next month I will be covering exactly how brushless motors work. Until then, if you have any questions, please feel free to add them in the Responses section below and I will do my best to answer as many as I can. Thanks very much for reading.

*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**.*

1/3rd Scale Mita Type 3 Production Notes

The tenth part of a twelve part series.

Norimichi Kawakami



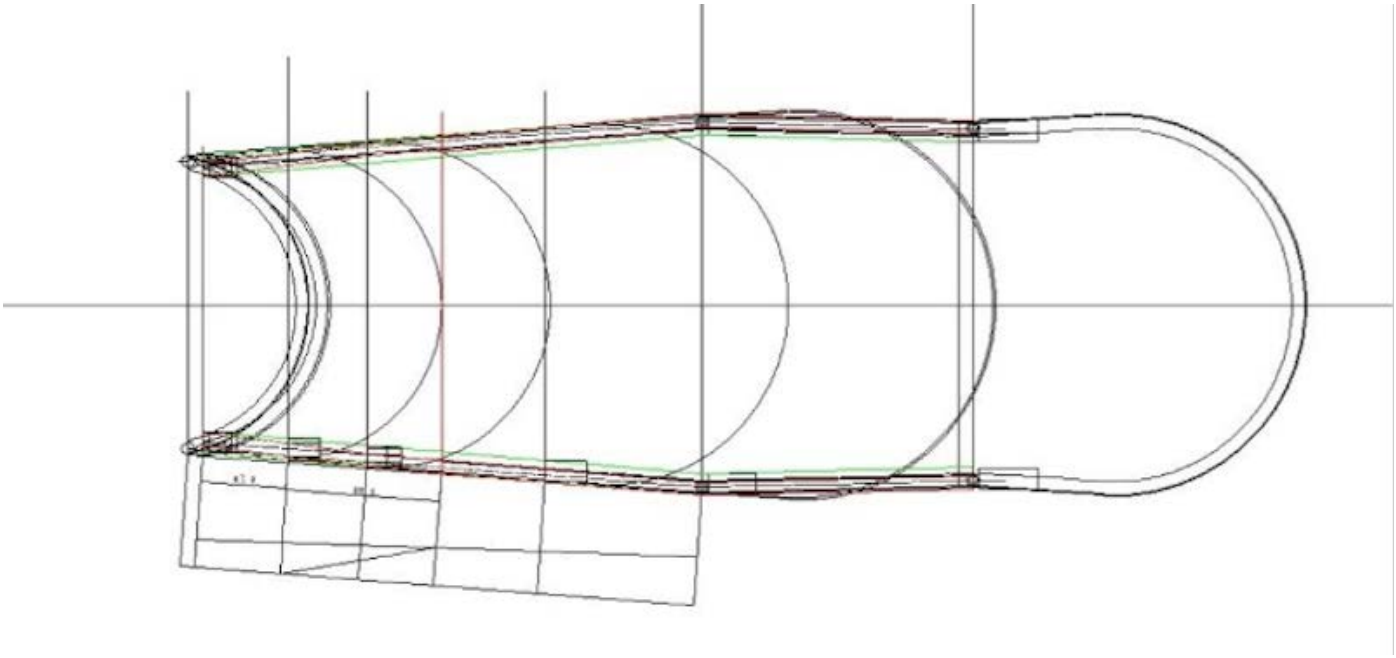
*You may want to read **the ninth part of this series** before proceeding to this article. Also if you prefer, you can read this article in its **original Japanese**.*

Fabrication Part 45: Canopy Frame

Canopy Frame of Mita Type 3 Revision 1

Drawing 55 showed the canopy of this plane. The frame of the forward canopy is made up of two circular frames, one touching the nose cowling

and the other touching the rear canopy, connected at the bottom by two longitudinal timbers running back and forth. The front frame is perpendicular to the bottom, while the rear one is slightly inclined to the rear. The bottom side bars are not straight, but kinked about 2/3 of the way from the front.



Drawing 58: Front canopy frame

The bottom side bars are 15 mm high at the front and about 30 mm at the rear. The cross-sectional shape of the canopy is semicircular at the front, but the lower part at the rear is flat. The position of this change is shown in drawing 58.

The rear canopy frame also has the shape of two frames connected by two longitudinal rails, but the big feature is that the longitudinal rails hold the main wing (See drawing 55). As a result, it has an extremely complicated shape. In particular, the longitudinal material in contact with the upper surface of the main wing has a complicated shape, with a wing shape when viewed from the side and a tapered shape that narrows at the rear when viewed from above, and a cross section that matches the semicircle shape of the canopy.

Fabrication of the Frames

The first step was to make the frames. Since they are thin, I was concerned that they might break. I prepared two pieces of 4 mm thick plywood, pasted them together with the grain orthogonal to each other, and cut it out with the actual size by pasting the drawing on it.

Photo 222: Canopy frames cut out

The parts running horizontally at the bottom of the frames are temporally left to prevent the frames from being broken by unintentional force during the fabrication process. They are cut out after the transparent part is attached. I learned this tip in the process of making 1/5 models.

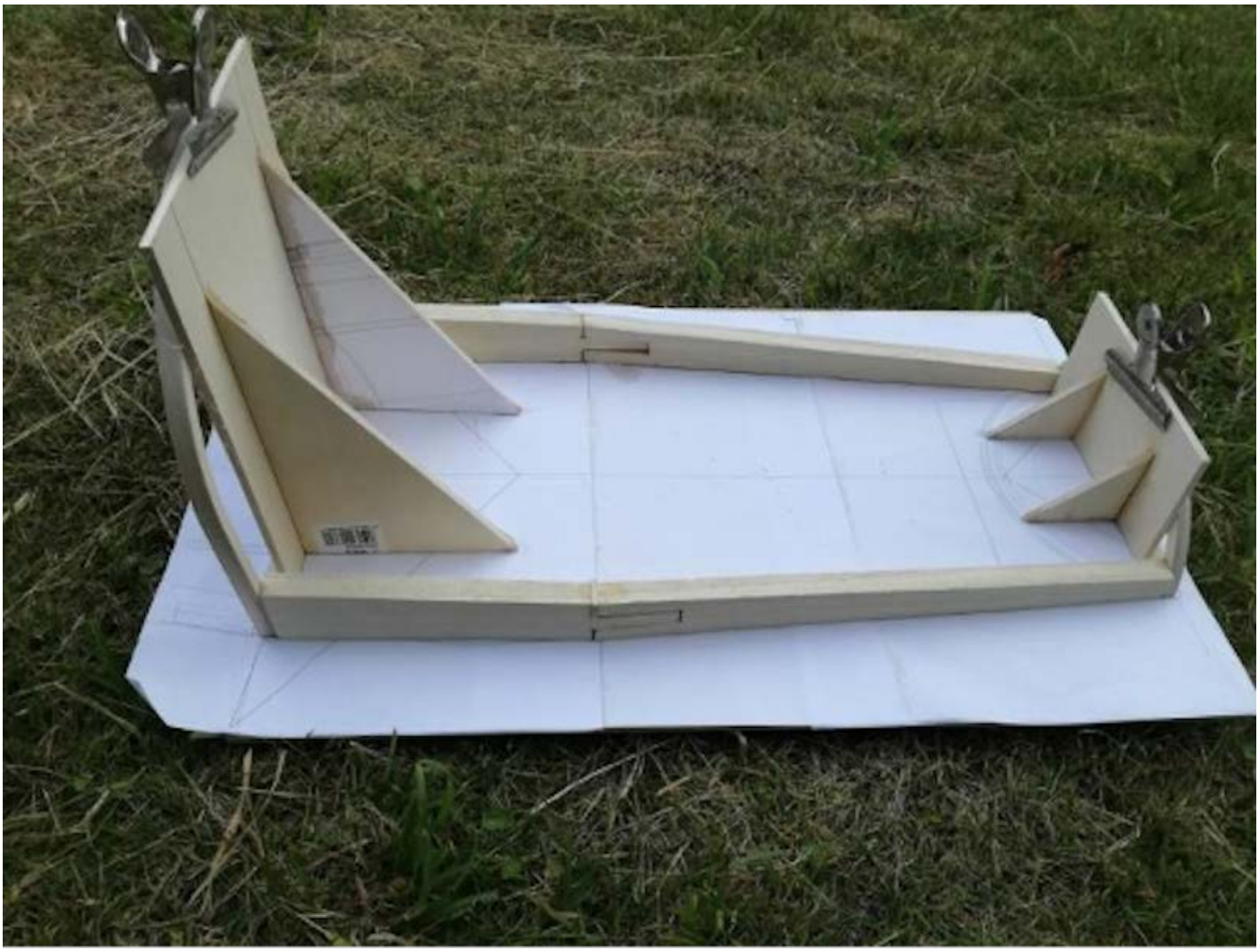
The center two pieces are the front and rear frames, and have nearly the same shape. I put them together so that the contact parts are flush with each other and prepared the outline.

Photo 223: Face alignment of central frames

Since the cross-sectional shape changes slightly due to the thickness of the circular frames, I pasted actual size drawings at three locations: front, center, and rear, and shaped them.

Assembly of the Front Frame

The front frame bases are made of laminated paulownia wood, which is easy to work and has adequate rigidity. Two pieces of wood on each side were combined because of the kink in the middle. In order to assemble the frame, an assembly jig is necessary to attach the vertical frames at an accurate angle to the non-parallel base. I made the jig shown in the Photo 224 and assembled the front frame.



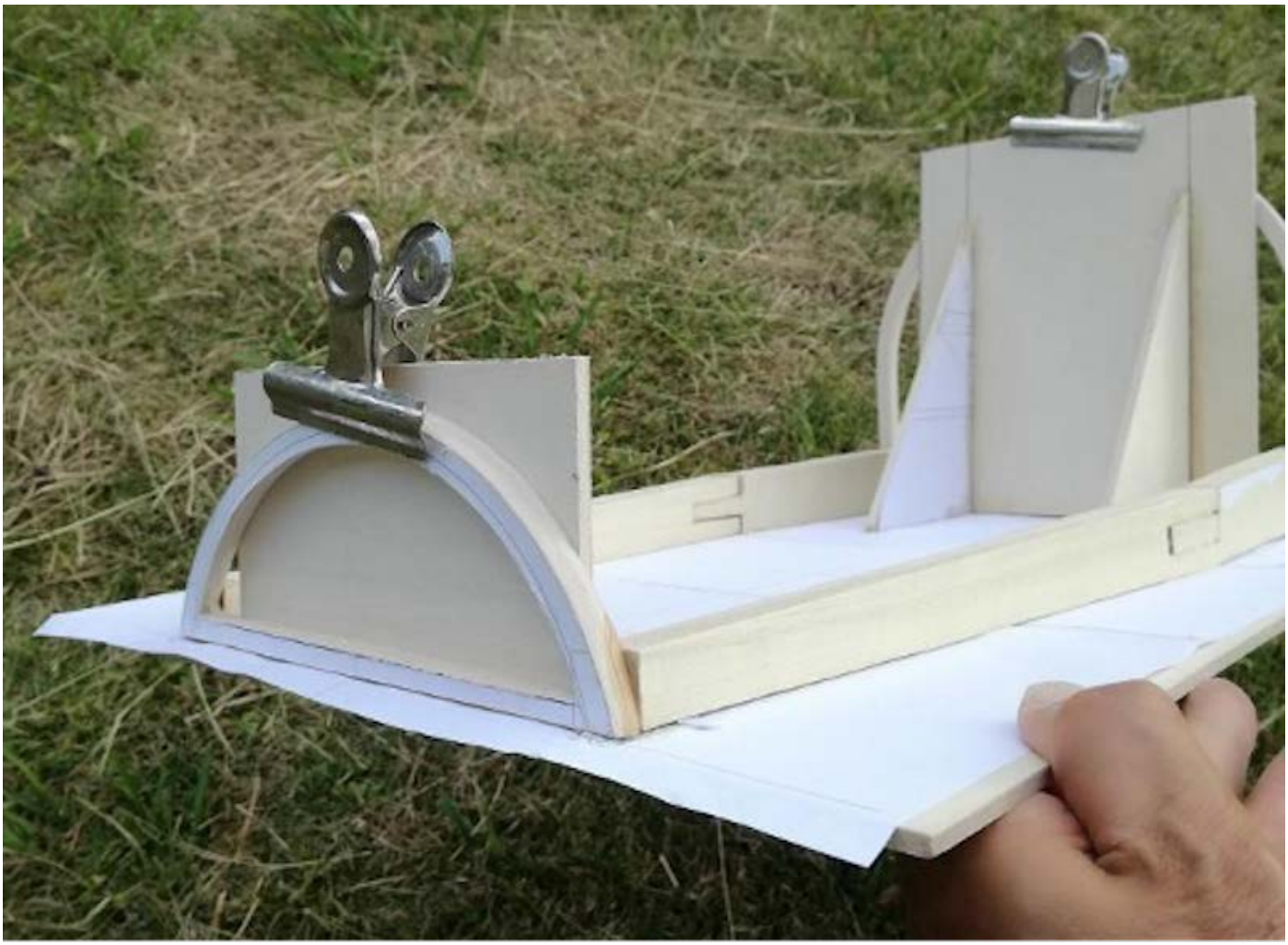
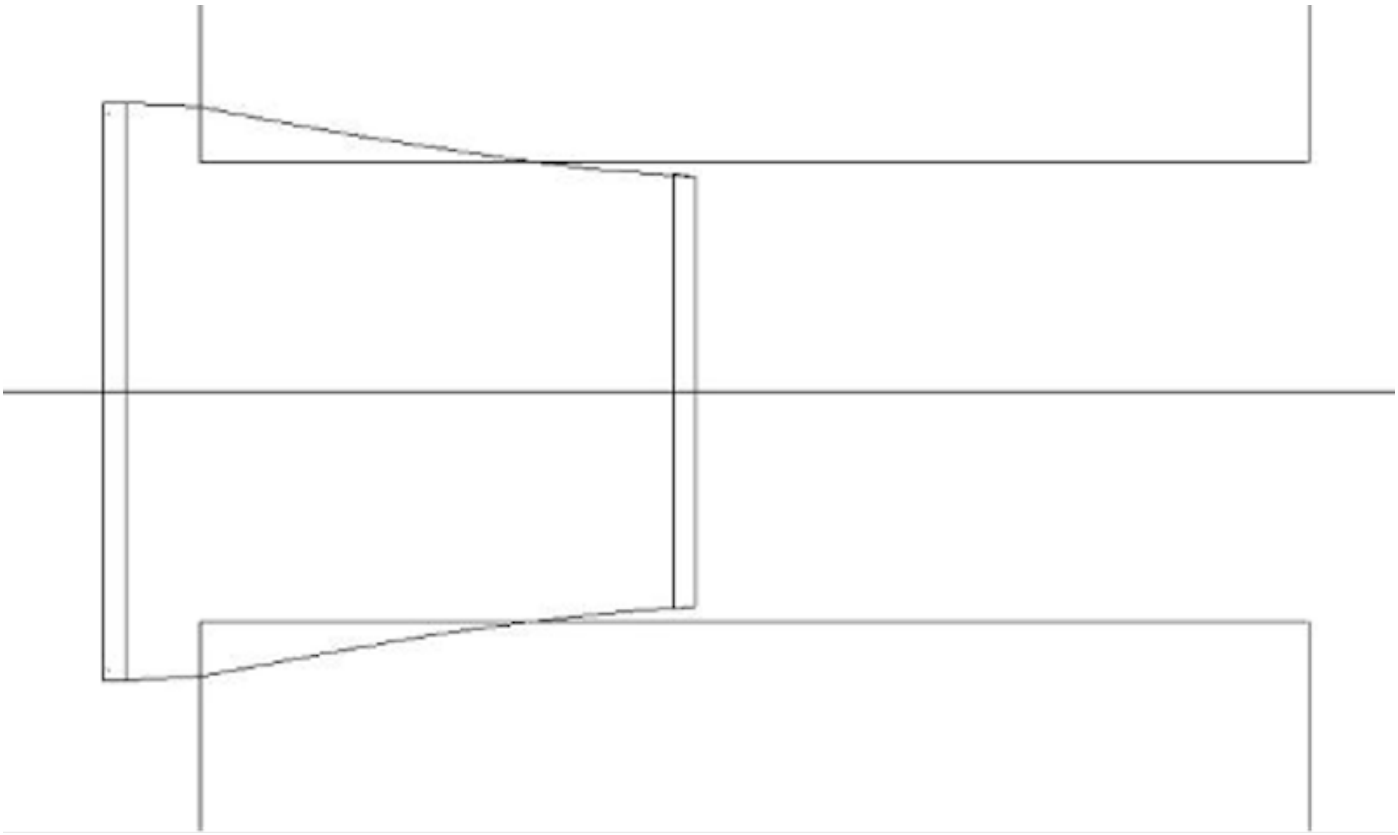


Photo 224: Assembly of the front frame

Rear Canopy Frame Assembly

As the longitudinal members of the rear frame located under the main wing is a flat shape, I cut it out from two pieces of 4mm thick plywood and attached it.

The problem is the longitudinal members located on the upper surface of the main wing. It was difficult to find the exact shape. First, I drew the intersection line with the main wing.



Drawing 59: Intersection line between rear canopy and upper surface of main wing

I cut out the approximate shape from 12mm thick laminated paulownia wood, make a cut to match the contour of the upper surface of the main wing, place it on the main wing, and shape it along the intersection line as shown above. This will determine the shape of the lower outer part of the longitudinal members. After making two of these, I attached the frames to the front and rear.

Next, a jig with the outer contour of the longitudinal members is made and placed on the assembled frame to shape the contour of the members.


⑤
④
②
①
①

Photo 225: Jig for shaping the longitudinal members of the rear frame

Now the contour of the longitudinal members are set. The rest of the work was done by cutting and shaping along the contour, leaving the height and thickness of the members.

Completed Canopy Frame

Photo 226 is the completed canopy frame. It is quite large.

Photo 226: Completed canopy frame

I put it on the fuselage.

Photo 227: Putting the frame on the fuselage

The rear canopy is positioned in front of the center wing fairing with two pins. There are two holes visible in the center of the front fittings of the center wing fairing (Photo 228).

Photo 228: Positioning holes for rear canopy

Problems Encountered

I managed to build the canopy frame with a lot of effort, but I encountered some defects along the way, and it took me a while to fix them.

Defect #1: Gap between Forward Frame and the Nose Cowling

There was about a 2 mm gap between the nose cowling and the top of the canopy frame. The frame of the forward canopy frame was precisely aligned with the design angle using the assembly jig, but the nose cowling was installed without a jig. I think the cowling was installed with the nose slightly lowered because of this.

I put a piece of wood between the gap and attached it to the wooden frame of the cowling.

Defect #2: Gap between the Bases of the Front Frame and Fuselage Structure

When the front frame was placed on the fuselage, a gap of about 1.5 mm was found between the rear of the longitudinal bases of the frame and the fuselage structure. The frame was assembled on the assembly jig in such a way that the bottom surface is exactly flat. However, for the corresponding part of the fuselage, it was necessary to assemble two carbon pipes bent in a shallow “V” shape, about 200mm apart, in a flat manner, but I could not find an appropriate way to ensure the flatness, so I assembled the frame in a rather rough manner.

I put a piece of wood on the bottom of the longitudinal bases of the frame to fill the gap.

Defect #3: Gap between the Rear Frame and the Center Wing Fairing

A slight gap was found between the rear frame and the right front side of the center wing fairing. It turned out that the center wing fairing was attached with a slight deflection to the right. On its own, the fairing deflection is unnoticeable. This was due to the fact that the aluminum channel supporting the rear of the fairing was not exactly perpendicular to the aircraft axis because the fuselage structure of the truss assembly has no discernible centerline, making it very difficult to install at a right angle.

I removed and reattached the channel.

Defect #4: Gap between the Rear Canopy and the Center Wing

The front part of the center wing that covers the fuselage is cut to form a cabin. On the other hand, the rear of the canopy is tapered and is narrower than the front. Because of this, the cutted width of the center wing is wider

than the width of the rear part of the canopy frame, and there is a little gap when viewed from above (See Drawing 59). I designed the cutting width of the center wing by looking at the fuselage structure, but I didn't realize that the canopy width was narrower than that. When I looked at the drawing of the actual aircraft again, I found that the cutting of the center wing was not parallel as in my drawing but tapered to fit the canopy.

I will cover this part later by pasting the filler wood on the center wing side.

Most of the problems were caused by working without jigs. I should have used more jigs.

Hinges and locking mechanisms still need to be fabricated before the frame is completed.

Production Part 46: Painting of Fuselage Truss Structure

Paint Color of the Structure of the Mita Type 3

The steel pipe truss structure of the actual aircraft is painted with zinc chloride to prevent corrosion, which is the original color. However, the JA2103 on display at the Shizuoka Aviation Museum is white. This is because Mr. Kimura, the original owner, painted it white while it was in his storage.

Since the 1/3 model that I am making is based on this JA2103, the seat pillars and other parts that have already been made are painted white. So I decided to paint the carbon pipe fuselage truss structure in matte white.

Painted Fuselage Structure

Photo 229 shows the fuselage structure after painting. Three spray cans were needed.

Photo 229: White painted fuselage structure

The white color makes the fuselage look smaller than the black color of carbon.

The weight of the fuselage was measured to be 1,542g. All legs and servos are removed.

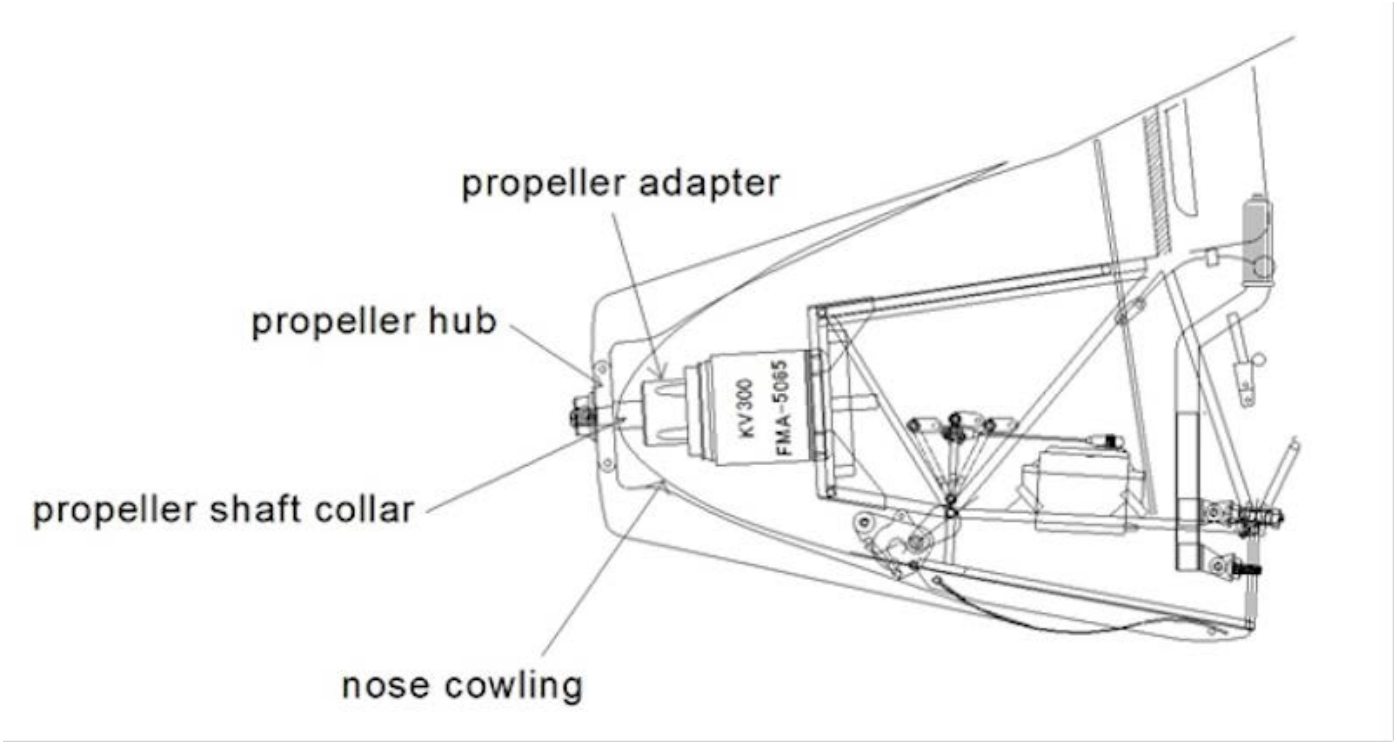
Mr. Takamura Provided Me Metal Cutting Parts

I asked a fellow club member, Mr. Takamura, who is good at metal processing, cut some metal parts for me. He has a mini lathe, so I often ask him to cut some parts that I can not make without the lathe.

1) Motor Shaft Collar

The FUTABA FMA-5065 motor is designed to drive an airplane propeller, and the included propeller adapter has a Φ8 shaft on a Φ29 base. The propeller is pressed against the base and tightened with a Φ8 nut.

If I was to install the folded propeller using this adapter as is, the base of the Φ29 propeller adapter would have to pop out of the nose cowling. This would be too awkward, and the short distance between the motor and the base would cause the motor to hit the tapered cowling. So, I decided to put a collar of appropriate thickness in front of the base and make that part stick out from the cowling to attach the propeller. This is the drawing.



Drawing 60: Motor shaft collar

For this reason, a propeller shaft collar was needed, and it was machined from aluminum. Photo 230 is a magnified view of the collar installed on the motor. This will allow me to install the folded propeller neatly.

Photo 230: The installed shaft collar.

2) Instrument Case

All instruments of the Mita Type 3 are round. The size of the instruments on the actual machine are two types, Φ72 and Φ53. In order to make instruments that mimic these, round cases are needed, so I had them

machined out of aluminum. There are four large ones and two small ones for the front seat, and two large ones for the rear seat.

The ones for the front seat are made very thin to save weight, since the back of the instrument panel will not be visible, but the ones for the rear seat are mounted naked near the center of the cockpit, so the entire instrument can be seen. For this reason, I had it cut down to a suitable length. Each case is made of two parts, the main body and the top cover, and they are fitted together. When opened, it looks like Photo 231.

Photo 231: Instrument cases

The left sides are the main bodies and the right sides are the top lids. The top lids have a flange on the top. The body is lightly machined and the printed scale will be attached there. There is a small gap between the flange of the top lid and the body. I plan to put a transparent plate between them for the appearance of a glass. Once finished, they will be painted in matte black

and attached to the instrument panel with fine screws of 1.4mm diameter.

3) Turnbuckle

The turnbuckle that I asked him to make this time is the one that is placed between the tow rope release mechanism and the servo that operates it. The turnbuckle is made from a thin brass rod with a diameter of 3mm. The turnbuckle is small, but when disassembled, it consists of three parts as shown here.

Photo 232: 3mm turnbuckle

One side is threaded right-hand and the other side is threaded left-hand, and turning the middle part will extend and retract the left and right rods.

The turnbuckles made from a larger brass rod with a diameter of 5 mm have already been installed in the rudder and elevator control system. Now I have all the metal parts I was worried about.

Fabrication Part 47: Canopy Accessories

Canopy Accessories

The canopy has the following four accessories:

1. Hinge: This is the fulcrum for opening and closing the canopy. It is located on the right side of the canopy frame.
2. Locking Mechanism: A locking mechanism to prevent the canopy from being opened accidentally. It is located on the left side of the frame.
3. Canopy Opening Holding Mechanism: This mechanism holds the canopy from falling too far to the opposite side when it is opened.
4. Rear Canopy Fixing Mechanism: This is a mechanism to fix the fixed rear canopy.

These parts were made and attached to the canopy frame and fuselage structure.

Installation View of the Accessories

This is a picture showing the overall installation of the completed canopy accessories.

Photo 233: Canopy frame with accessories installed

1) Hinges

Hinges are mounted in two locations on the right side of the frame, front and rear.

Photo 234: Canopy Hinges: rear (left), front (right)

The hinges are a brass stay attached to the fuselage frame, with a 2 mm diameter piano wire soldered to it. On the other hand, the canopy side has an L-shaped brass stay attached to the outer side of the frame, and a 2mm inner diameter brass pipe at the end of the stay. Attach the canopy from the rear by inserting the piano wire through the brass pipe.

2) Lock Mechanism

Photo 235 shows the locking mechanism. It is attached to the inside of the left frame and slides back and forth.

Photo 235: Canopy locking mechanism

When the spheres attached to both ends of the mechanism are pushed forward with the front or rear seats, the mechanism slides and locks into place. To unlock, pull the spheres backward. The center of the sliding mechanism is as shown in photo 236.

Photo 236: Detail of the slide mechanism

The tip of the piano wire goes in and out between the conduit attached to the fuselage side. The photo shows a locked state, and the white part is the conduit. The fuselage side conduit is attached to the left side longitudinal material as shown in photo 237.

Photo 237: The conduit for the lock mechanism attached to the fuselage side

Up to this point, the mechanism is the same as that of the actual aircraft, but this lever, which is not found in the actual aircraft, is installed.

Photo 238: Lever for opening and closing the canopy

This is a thin plate lever connected to the sliding mechanism, and it appears on the left-outside of the fuselage. This is for operating the mechanism from outside the aircraft. In the real aircraft, the sliding mechanism is operated by opening a small window of the canopy and inserting your hand into the cabin. This mechanism was installed because the model does not allow access to the sliding mechanism through the small window.

3) Holding Mechanism When the Canopy Is Open

When the canopy is opened, the weight of the canopy causes it to open too far and collide with the side of the aircraft. This is why there is a retaining mechanism to prevent this from happening. The retaining mechanism is a simple wire connection between the three parts of the canopy and the

fuselage. This is the situation when the canopy is opened and held.

Photo 239: Holding mechanism when the canopy is open

The pipe structure is not only for attaching the wire, but it is presumably also for opening and closing the canopy. In this photo, you can also see the lever to operate the lock from outside the aircraft.

4) Rear Canopy Attachment Mechanism

The rear canopy, which does not open or close, has its trailing edge inserted into the hole in the center wing fairing with a pin, while the forward part is screwed to the fuselage structure with hardware attached to the bottom of the frame. Currently, there is a dummy bar running across the bottom of the

frame, so the fittings will be installed only after the canopy is completed. However, I have prepared the fuselage side to receive the fittings by attaching 3mm nut receivers.

Photo 240: Rear canopy mounting mechanism

Now all the canopy accessories are ready.

Tail Fairing Made by the Vacuum Process

I had been wondering what to do about the tail wing fairing since I failed to make its plaster mold. But when I consulted with Mr. Toyama, who is a

master of the vacuum manufacturing method and is now making the canopy transparent for me, he agreed to try the vacuum manufacturing method if I send him the wood mold.

Tail Wing Fairing Made by Vacuum Process

The wooden mold I made was for plaster mold making and was made of balsa. Therefore, I was worried about whether it would be able to withstand the vacuum process, which applies quite a lot of pressure, but Mr. Toyama reinforced it. This is the tail wing fairing made by the vacuum process using the wooden mold.

Photo 241: The tail wing fairing made by the vacuum process

The 0.5 mm thick PVC I had assumed was not rigid enough, so he also made 0.7 mm and 1 mm thick ones. The part extending to the lower part at the rear seemed to have a hard time to extend properly, so he took a measure to

increase the slope of the boundary between the vertical and horizontal tail wings. This seems to be the know-how of many years of experience in vacuum manufacturing.

Fit Check

The fairing will cover this part of the vertical/horizontal tailplane intersection (Photo 242). It should fit on both tail fins.

Photo 242: Area covered by the tail wing fairing

I immediately cut out the required shape and did a fit check. First is the horizontal tail fin.

Photo 243: Fit check with the horizontal tail fin

It fits perfectly. Next is the vertical tail fin.

Photo 244: Checking the fit with the vertical tail fin

There is a gap on the right side due to the spring back. However, this is not a problem because it can be fixed by the way the fairing is installed.

Installation

In the end, I found that 1mm thickness was good enough to ensure sufficient rigidity. I painted it and installed it immediately. The paint is matte white, the same as the fuselage.

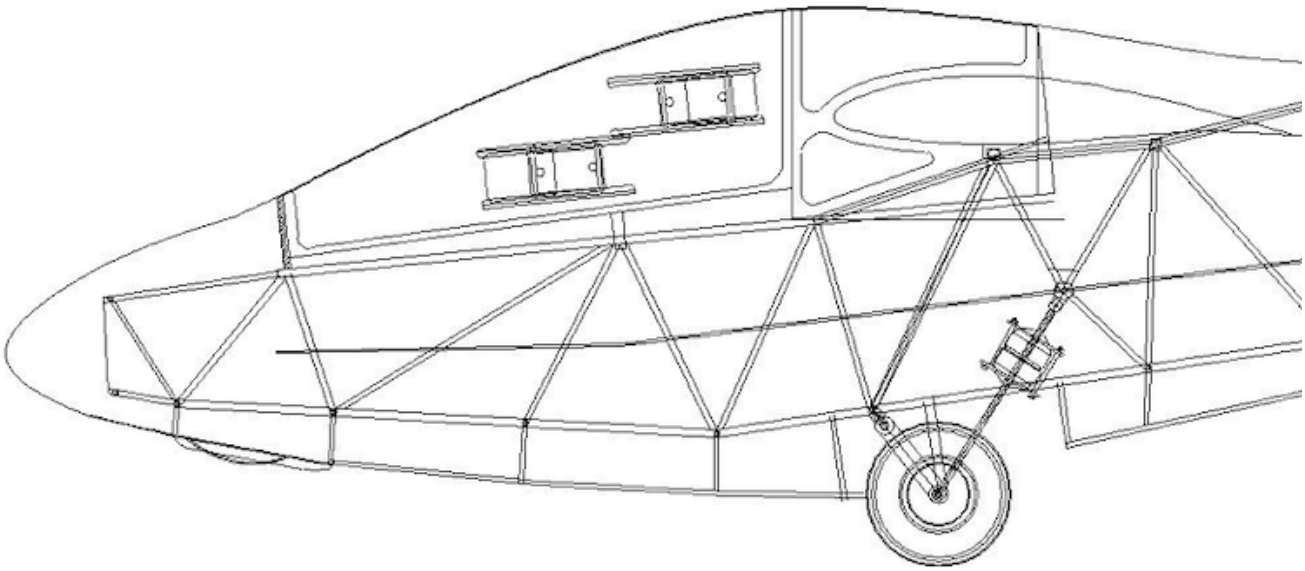
Now the tail wing fairing, which I was wondering what to do after the plaster mold was broken, is completed.

Photo 245: Installation of the tail wing fairing

Model Checking of the Small Canopy Windows

Small Canopy Windows of the Mita

There are two small windows on the canopy of the Mita Type 3 glider for ventilation. The drawing looks like this.



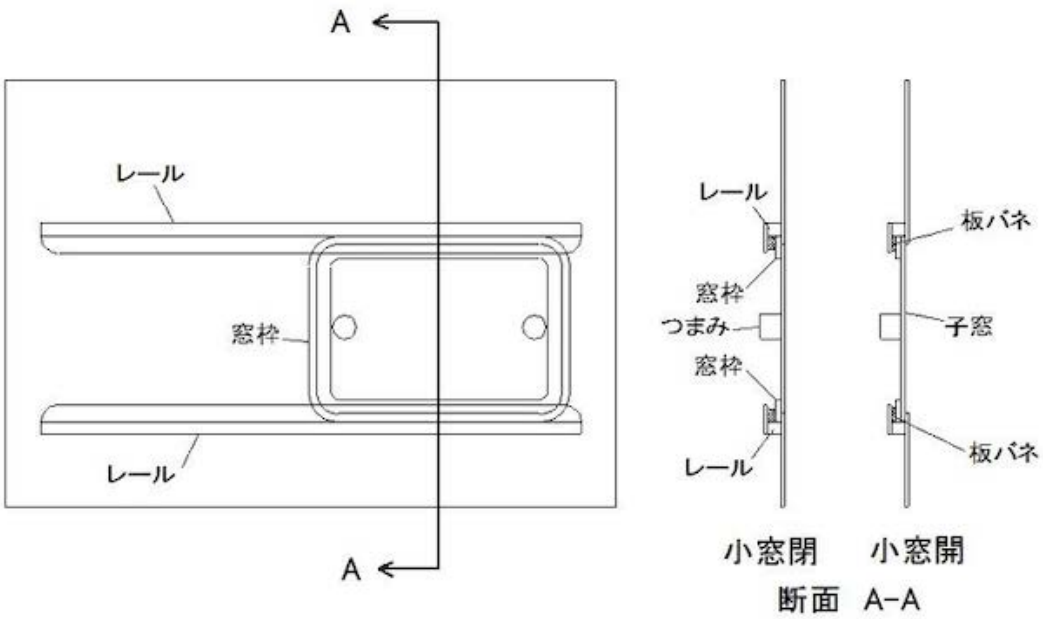
Drawing 61: Small canopy windows

The small windows are sliding type and are installed on the left side of the front seat and the right side of the rear seat. The front seat's small window slides backward, and the one for the rear seat slides forward to open.

In my 1/5 scale model, I put printed stickers on the canopy, but in this 1/3 scale model, I wanted to reproduce this part. However, the small windows must slide inside the canopy when it is opened, and its outer surface must match the outer surface of the canopy when it is closed. I was not sure if it was possible to make such a mechanism with a 1/3 scale model, so I made a model to check.

Confirmation Model

Here is the drawing of the confirmation model.



Drawing 62: Canopy small window confirmation model

This is a model made based on this drawing.

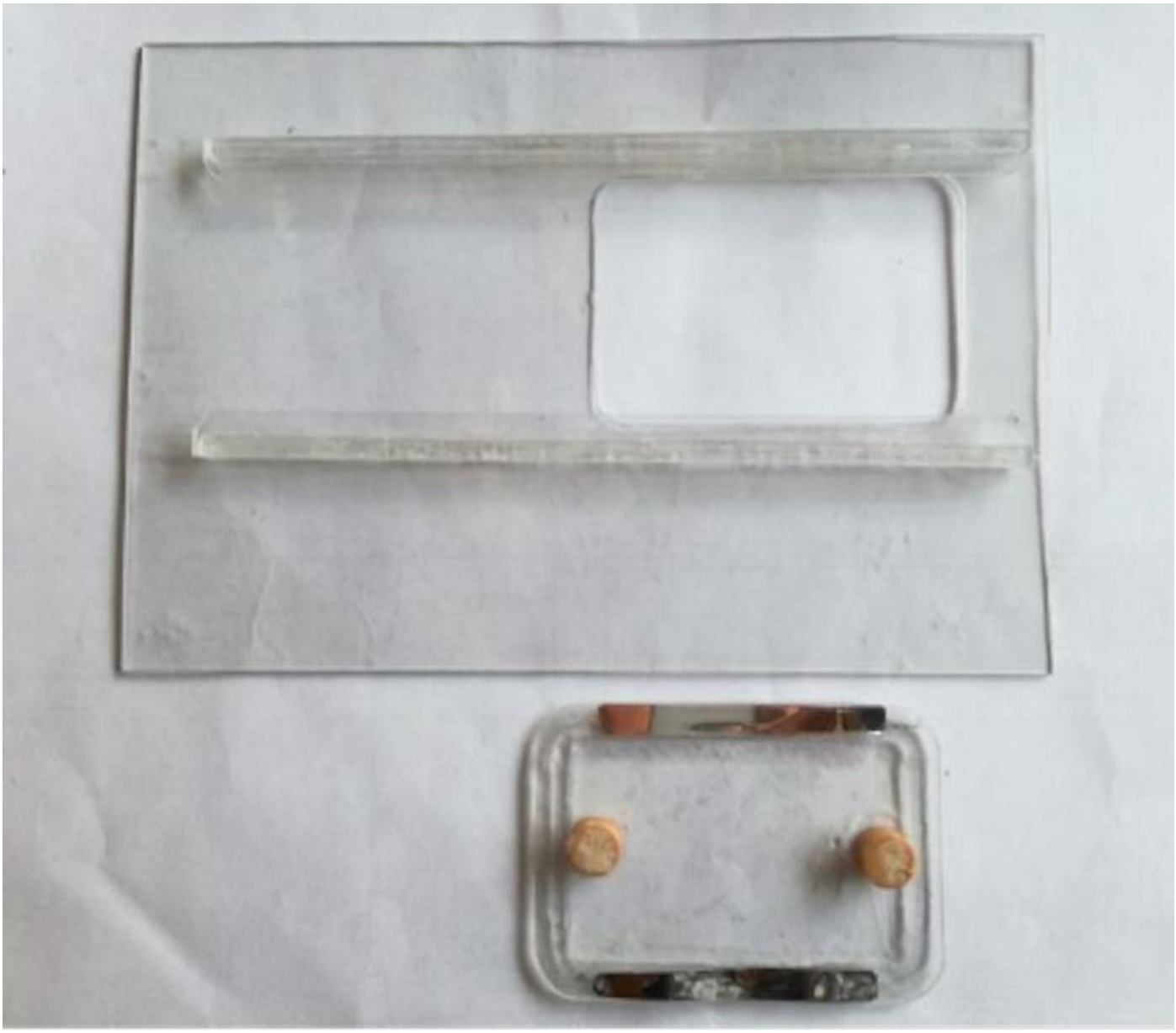


Photo 246: Canopy small window confirmation model

In the 1/3 model, the size of the hole for the small window is 41.6 mm (length) x 60.0 mm (width), so I cut out a 1 mm PVC board as if it were a canopy, and cut it to the size of the small window. Originally, I wanted to make a curved surface like the canopy, but I made it flat this time for ease.

Around the cut window, I attached a window frame made of the same 1 mm thick PVC board. The window frame is 2.1mm larger than the window itself, and this part serves as a sliding part as well as a support to keep the window

from coming off when it is closed. Two knobs made of round bars are attached to the window. Originally, the knobs were made of transparent acrylic round bars, but since I didn't have any suitable ones at hand, I used wooden ones instead.

The rails are made of 3mm x 3mm acrylic square bar and 1mm thick PVC board cut out to 7.2mm width and pasted on. I made two of these and attached them to the top and bottom of the window holes on the board that look like a canopy. Originally, I should have used a special adhesive to attach them neatly, but I used CA adhesive to attach them for the purpose of checking the function, and the adhesive flowed out and made a mess.

Function Check

Slide the small window inward to open the window, and then slide it to the other side to see if the small window pops out and is flush when it matches the window hole in the canopy. This is the point to check. The rail width is 3 mm, the small window is 2 mm thick together with the window frame, and the window frame is 1 mm thick, so it can be opened smoothly if nothing is done, but of course the window will not pop out when it is closed.

So first, I put a sponge gap seal on the outside of the window frame where it meets the rail. The thickness of the seal is about 5mm. After fitting the window into the rail while crushing the sponge, opening and closing the window is a little tight, but somehow possible. Furthermore, when the window is aligned with the window hole, the sponge is released and the window pops out nicely. Thus, I was able to confirm that this method also works. The problem is that the sponge is not beautiful.

Next, I replaced the sponge with a thin sheet of aluminum, curved and attached. Photo 247 shows the condition.

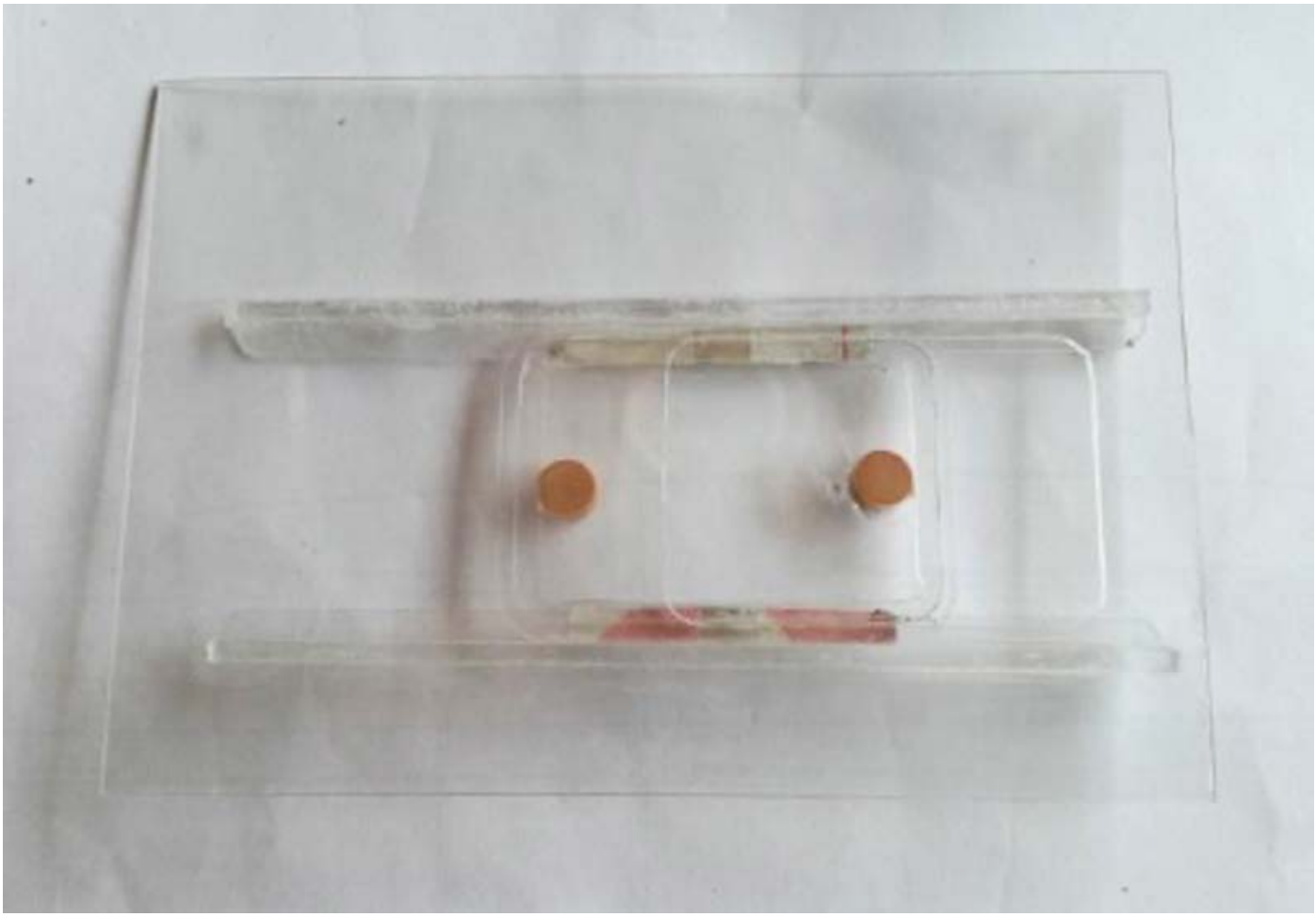


Photo 247: Small window with a thin sheet of aluminum: open (left), closed (right)

I was worried that the thin aluminum sheet would have too little spring effect to work, but the window popped out when the window closed. It looks like I can get away with this method.

Conclusion

There are many possible ways to make the window pop out, but it seems to be possible. However, it seems to be quite difficult to attach the rails to the canopy with the correct rail width. There are many examples of screwed rails. That seems to be a more reliable and neat way to attach the rails.

Fabrication Part 48: Electrical Wiring and Weight and Balance Check

After installing the receiver, servos, motor, amplifier, power supply for the receiver, etc. and wiring the electrical components, attaching the seats and cowling, I checked the weight and the center of gravity.

Electrical Wiring

After installing the motor, I mounted the amplifier and the receiver power supply on the top panel inside the nose cowling as shown in the drawing, but it turned out that the wiring for the 100A amplifier was too thick and the wiring between the motor and the amplifier was unexpectedly long, so there was no space for it. Therefore, I decided to mount the amplifier on the back side of the top panel. Photo 248 shows the mounting situation.

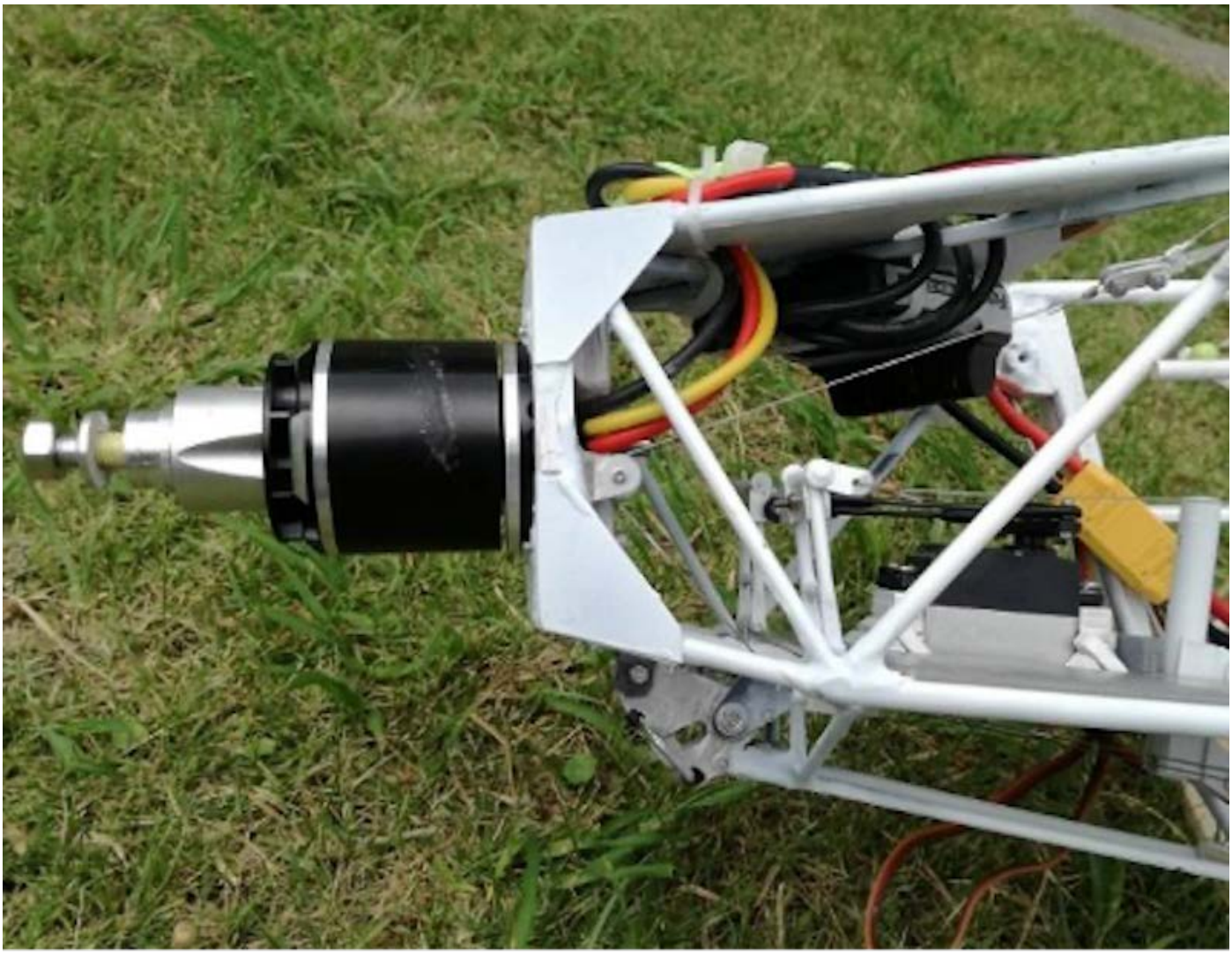


Photo 248: Mounting the power supply for the receiver and the amplifier: power supply (left), amplifier (right)

The long wires between the amplifier and the motor were adjusted by running them over the top panel. The receiver was initially intended to be installed under the front seat, and I had completed its wiring. However, after installing the front seats, I found that the receiver and the seat board were touching. So I changed it to under the rear seat floorboard. The receiver is a FUTABA R3008SB (Photo 249).

The power supply S/W for the receiver and its charging port were unexpectedly troublesome, as the cord attached to the S/W was too long. Initially, the S/W was mounted on the instrument panel same as in the 1/5 model, but the cord extending from the S/W did not fit neatly. So, by

mounting the S/W and charging port on the floorboard of the front seat, I was able to fit it neatly (Photo 250).

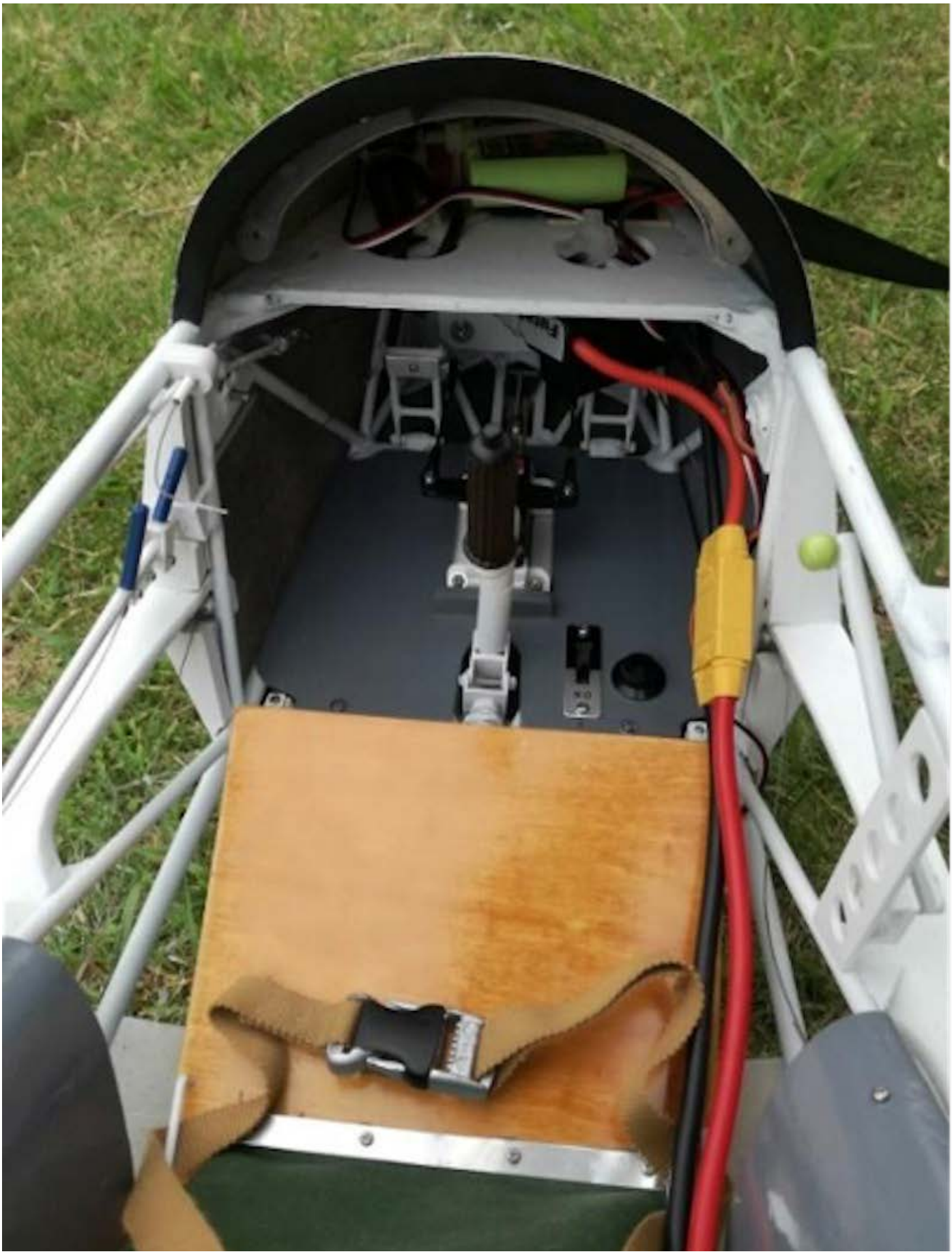


Photo 249: Mounting the receiver (left) — **Photo 250**: Power S/W and charging port (right)

The thick cord and connector beside it is the wiring for the power supply. There is no way to hide this. It may look ugly, but considering the ease of handling, this is how it is done.

Photo 251 is the state where the wiring is finished, and the seats, cowling, etc. are installed.

Photo 251: The fuselage with the electrical wiring completed

I was able to install the wirings to the servos, etc. were almost hidden.

Since the receiver FUTABA R3008SB has 8 channels, I was planning to allocate 2 channels to the left and right ailerons, 2 channels to the elevator and rudder, 2 channels to the left and right spoilers, 1 channel to the motor, and 1 channel to the tow rope release, for a total of 8 channels. However, when I read the instruction manual carefully, I found that I could only use up to 7 channels with ordinary servos that were not S-BUS-specified. So I

decided to use only one channel to move the spoiler left and right. For this purpose, I put a reverser in one of the servos.

The Eighth Examination of Weight and the Center of Gravity

It's been a while since I've examined the weight and balance. The reason for this is that I have been having problems with where to put the LiPo. Initially, I was planning to put the LiPo near the front seat, but after installing the seat, there is no space to put it. The only place where I could place it is between the front and rear seats, which is about 150mm behind the position I had initially assumed. I'm not sure if the center of gravity will match. However, the weight of the motor and amplifier has increased significantly due to the change from the 1200W class motor to the 2000W class. Also, the weight of the LiPo has increased from 5 cells to 8 cells, which is also a big increase. In addition, I have installed tow rope release mechanisms, which were not originally planned, so in a word, the weight and balance has to be re-examined.

So, I mounted all the so far completed items such as the nose cowling, center wing fairing, seats, and tail wing fairing on the fuselage and measured the weight and center of gravity. The result was a weight of 3,580g and a center of gravity of STA660.

The fuselage is expected to have 550g canopy, 60g front instrument panel, 75g rear instrument panel, 75g for covering and 70g for painting. Therefore, the total weight of the fuselage is expected to be 4,410g and the center of gravity is STA663.

The LiPo for power is expected to weigh 1,050g, and its mounting position is only around STA530mm. The eighth calculation of the center of gravity is shown in the table below, adding the weight of the main and tail wings, which is already half completed.

8th Weight & Balance	2019/7/2	Completion Ratio		84.22 %			
	Predicted Weight	STA	Moment	Actual Weight	Estimated Remain Weight	Target Weight	Predicted-Target
Outer Wing Left	973	890	865,970	818	155	700	273
Outer Wing Right	987	890	878,430	833	154	700	287
Center Wing	1,935	890	1,722,150	1,715	220	1,720	215
Fuselage	4,410	663	2,923,830	3,580	830	3,360	1,050
Vertical Tail	222	2,450	543,900	172	50	240	-18
Horizontal Tail	378	2,270	858,060	266	70	400	-22
LiPo	1,050	530	556,500	1,000	50	600	450
Total	**9,955**	**839**	8,348,840	**8,384**	**1,529**	**7,720**	**2,235**
Target CG	same as 1/5model	**846**					
CG range	FWD(30%MAC)	**825**					
	AFT(40%MAC)	**860**					
Weight	50	2,300	115,617				
Normal Flight Condition	**10,005**	846	8,464,457			**7,720**	**2,285**

Table 11: 8th calculation of weight and balance

From this table, the total weight is 9,955g and the center of gravity is STA839, which is slightly ahead of the target position even if no weight is added. The target center of gravity is set at the same position as the 1/5 model.

Actually the center of gravity is not a single point, but has a range. After that, I was able to obtain information on the allowable center of gravity range of the actual model. According to this information, the allowable range is 30% MAC to 40% MAC. This is 104mm-139mm from the leading edge of the main wing, and STA825–860 when measured from the nose. Therefore, it seems that the center of gravity can be accommodated without weights.

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

The Trailing Edge

Some modest goals for 2022.

The NEW RC Soaring Digest Staff

We end where we began, with this amazing shot by Kevin Newton from his trip to East Lomand on December 18, 2021. Kevin caught that perfect moment with "a CCM Vantage glistening in the December sun." Thanks for the opportunity to feature your beautiful work, Kevin, both here on this month's cover.

We have successfully launched Volume 37 of the *New RC Soaring Digest*! We really hope that you have enjoyed what we have put together for you this month and we're also really looking forward to bringing you 11 more numbers in 2022.

In his *In The Air* editorial which kicked off this issue, RCSD Managing Editor Terence C. Gannon made reference to 2022 being the year where "*more content can be delivered in more formats*". For those of you who may be

wondering, this does not herald a return to the beautifully realised PDFs of the Bill and Bunny Kuhlman era, unfortunately. That is something we would actually *love* to do, but it is simply not feasible in this era where we are expected to do (much) more with (much) less. You will, of course, be able to request reasonable facsimiles of any article — or the whole issue — in PDF format. There are links for these which appear at the bottom of each article. A number of readers have regularly taken the opportunity to submit requests and download these PDFs. We will continue to offer this service until there are consistently zero requests over the course of a few months.

One interesting project on which we're working is adapting the RCSD content to additional news distribution services. While for the moment we can't say which ones specifically, it's just possible that your favourite RC soaring magazine might start showing up in places it has never been before. (Rhymes with dapple blues.) If we're successful with this effort — and there are many bridges to cross before we are — we believe we'll be getting to a whole new audience. This is very much consistent with Terence's other stated goal for 2022: "*to consciously reach out…to audiences with which we are not currently in touch*". We believe that these exciting new channels will make a whole bunch of new folks aware that 'RC soaring is a thing', as those audiences are wont to say.

In 2022 we would also like to get some 'real time, contemporaneous events' rolling. Or stated in a much less pompous way, scheduled events where you participate with other participants at one, scheduled block of time. There are *Spaces* on Twitter and en masse Zoom webinars, the latter with which many of you are all too familiar in the work-from-home world. We also have Slack setup and we just know there are a million potential applications for that, particularly in the mass build domain for example.

So please stay tuned in 2022 for all of that and of course, if you have any

specific suggestions along those lines, please let us know. In addition, we're often asked "*what can I do to help?*" and the answer is always two things: first, contribute articles or other kinds of material — that's the lifeblood of a reader-written publication like RCSD. The second is to purchase something from the *RCSD Shop* — all proceeds go to support the rather substantial cost of keeping the *New RC Soaring Digest* an inviting reading experience as opposed to one completely obliterated by pop-ups and banner ads.

New in the RCSD Shop

The launch of our new Designer Series apparel. We're kicking off with the 'Max Out' (left) and the 'Cored In' (right) motifs by Chip Kaye.

OK, this is really (and we mean *really*) exciting. One of our readers and contributors, Chip Kaye, stepped forward and felt that he could add something to our product line in the *RC Shop*. Turns out that Chip is not only a talented writer but also a *very* talented graphic designer and he has come up with these wonderful designs above. We're thrilled to be able to say that

they are **available now** in the *Shop*, as they kick off our ***Designer Series*** collection. Check them out. You will truly be the coolest kid on the slope or at the field — or wherever great apparel is worn. And you can feel good about it, because all proceeds support a pristine, commercial-free *New RC Soaring Digest*.

Make Sure You Don't Miss the New Issue

If you don't want to miss the February issue of the *New RC Soaring Digest* make sure you subscribe to our **Groups.io mailing list** or connect with us on **Facebook**, **Instagram**, **Twitter** or **LinkedIn**. And please share RCSD with your friends — we would love to have them as readers, too.

That's it for this month! Thanks to all of our contributors and above all, thank you, the RCSD reader — without you, we're nothing.

Now get out there and fly!

The NEW RC Soaring Digest Staff

*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**.*