Radio Controlled

Soaring Digest

June 2022

Vol. 37, No. 6

The New RC Soaring Digest

June, 2022
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Click on any row to go directly to that article.

In The Air

Flying fields are as fragile as spring blossoms.

Terence C. Gannon

One of our friend Gary Quiring's memories at Eutawville, albeit in happier times. It's a great shot of him flying over a cotton field back in 2017. The aircraft is a Grafas MAXI 3.5m from Topmodel CZ. (credit: Gary Quiring)

Regular readers of this column will recall last month's missive where I told the story of the emotional rollercoaster I had been on regarding the *Col de Costco*. That's my favourite slope which backs onto — you guessed it — a local mall smack in the middle of an industrial area in southeast Calgary, Alberta (see *Resources* below for a link to that article). Good storytelling dictates that each story should have an arc. That one certainly did, starting with the belief that I had just been thrown off the site through to figuring out the future of this particular location was actually fairly bright.

However, I have been corresponding with a good friend of this publication, Gary Quiring of the *Eutawville Flyers* in South Carolina and the news from there is not so good. I first made contact with Gary when he submitted one of the most beautifully composed pictures I had seen in quite some time. We exchanged further notes where ideas as to how to grow the club were batted back and forth — at that time, there was only a handful of glider guiders in the *Eutawville Flyers* and combined with the pervasive demographic time-bomb which is going off in our hobby, that was not a recipe for continued vibrancy in the future. Then, on April 7th, Gary wrote with this rather ominous news:

> *"I got the bad news today that the new land owner is not willing to sit down and work some sort of deal to keep the flying field going. He's letting the farmer take over the six acres we have. We don't understand it, he gave us no chance to see who we were in the community and it's very upsetting…"*

This was particularly ironic, given the note I had written to Gary which elicited this response was whether he wanted to be in RCSD's *Club in Focus* feature and on our *Clubs* page. So not news I was expecting by any stretch. In an effort to help, I suggested that perhaps we run the *Club in Focus* feature anyway with the footnote of "and by the way, we're looking for a new field!" Gary wrote back:

> *"I think looking for a new field is a lost cause with this club. Its size of 23 members where only four of them are actually active. Most of these guys are approaching 80 years of age and Gene, my best flying buddy is 86. We were still flying at Eutawville until about two weeks ago when we came out and the farmer put down something that killed the grass. So the fat lady has sung. It's over…"*

Fortunately, Gary has found another place to fly — the *Bowman Club* — where he is also a member, but it's a one hour drive from where he lives, and the membership over there is not too glider-oriented. So a less than ideal outcome for him for sure.

If that wasn't bad enough, there was another very similar story at around the same time, involving a flying field a little closer to the New RCSD home office. The following was received from the local Model Aeronautics Association of Canada (MAAC) Zone Director, to say:

> *"Please be advised that LARCS (Leduc Alberta Radio Control Society) have lost their flying field effective midnight last night, April 27, 2022. There is to be no flying at the site effective immediately. Started in August 1993 [29 years! — Ed.] the club has grown from an initial 10 members to 105 members as of today's date. The search for a new flying field is currently underway….the reason for the sale of the land which our flying field…[it] was sold just over a month ago. The new owner had no desire to carry on renting the flying field site…"*

And then there was Chris Williams' *Flying Back in Time* story in the March, 2022 issue of the New RCSD which kicked off with:

> *"The military base of Middle Wallop in Southern England is reputed to be the largest grass aerodrome in Europe. For over a decade the UK scale soaring fraternity enjoyed many, many aerotows on this site, before a change of base priorities sadly bought it all to a close in 2019."*

These are all cautionary tales. However, anecdotally at least, what leaves me with a sinking feeling is all of these clubs, seemingly trying to do all the right things, were still tossed out on their keisters with virtually no notice. What's more, there's a foreboding sense these clubs could not have done anything differently which would have made any difference to the end result.

Here's one thing that doesn't really need to be stated — but I'll state it anyway: we should always have in the back of our collective minds that our ability to pursue this thing we love to do quite often depends on the good graces of others over whom we have virtually no leverage. If there is anything we can do — or perhaps stop doing? — to remain in said good graces, we should never miss an opportunity to do that. We operate almost entirely at their pleasure.

In an admittedly roundabout kind of way, to me it's similar to paving over farmland for a new shopping mall. The original sin of having lost the farmland in the first place is multiplied many times over by the fact that there is virtually no set of circumstances which will result in the shopping mall eventually being torn down and the farmland restored.

Like the spring blossom, once it's gone, it's gone. There's no bringing it back.

New Audio Content: Soaring the Sky Podcast

One of the commitments I made heading into this publishing year was to provide a variety of new and interesting ways of delivering soaring-related content to New RCSD readers. These efforts have borne fruit, and the proof is starting this month, we are featuring selected episodes from the *Soaring the Sky* podcast, hosted by Chuck Fulton.

Before anyone jumps on that and says "hey, wait a sec, that's about full-size gliders, not RC!", let me just say this: **I know**. But I'm also of the belief that there are a ton of episodes in Chuck's vast back catalogue which have a lot of crossover appeal for an RC audience and where the subject matter has not dated.

To wit, the first episode in this month's issue features an extensive interview with Dominic Poppe, a full-size glider pilot and project manager of the

Akaflieg Karlsruhe's *AK-X* flying wing project. What's really interesting is that the decision was made to run this inaugural episode before I learned that the *AK-X* was developed in part through the use of a half-scale, RC prototype. Kismet! It was like it was meant to be.

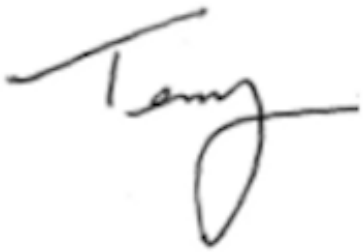
I want to thank Chuck for his enthusiastic embrace of this idea. Our brief and amicable 'negotiations' were underpinned by the notion the most likely and happy outcome was more listeners for him and more readers for RCSD. Everybody wins.

We're going to continue to search for other podcasts which might also fit this brief, along with other types of material in novel formats. The team and I will continue to build the New RCSD into **the** place to go for a rich and varied mix of material related to efficient flight. Please let me know what you think!

And on with the Show!

As usual, I have likely overstayed my welcome with my ramblings, so I'll not delay your diving into the June, 2022 issue any further. Other than to say that I really think there is something for everybody enclosed herein. And to also say that without our contributors, we would have nothing for you to read, and without our readers — well, that's a future simply too bleak to contemplate. So my many thanks and deepest gratitude to both constituencies.

Until next month, fair winds and blue skies.



Resources

- ***Grafas MAXI*** — From the Topmodel CZ website: "Light thermic electric glider for competitions flying F5J. Wingspan 3.52m…"
- ***In The Air: RC soaring is not a crime.*** — Last month's *In The Air*: "There's a Costco big box store not too far from where I live which stands just east of a great slope that runs due north and south for about two or three city blocks…"
- ***In The Air: We belong to a very exclusive club. That is not the good thing we might think it is.*** — You have to see Gary Quiring's photo which headlined this article: it's one of the most beautifully composed that we have seen and yet Gary claims it was an accident. We're sure he's being too modest.
- ***Club in Focus: Southwest Soaring Society*** — The most recent example of this feature: "The home of SWSS is set amongst the hills and desert near Maricopa, Arizona and is newly formed…"
- ***Clubs*** — "This is our just-launched list of clubs featured in our ongoing series of articles which are intended to raise interest in, and awareness of local grassroots RC soaring clubs…"
- ***Flying Back In Time*** — Chris Williams' accidental requiem for Middle Wallop: "I would imagine it to be highly unlikely that 2015 will have gone down in anyone's diary as a premium flying year…"

Cover photo*: The outstanding photo which graces our cover this month is by Raymond Esveldt. You are welcome to download the June cover in a resolution suitable for computer monitor wallpaper (**2560x1440**).*

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

Letters to the Editor

Have the dog days of summer arrived early?

The New RC Soaring Digest Staff

Once again we have to thank Simine Short for providing us with an abundance of stamps to add to our montage. There's another five new ones this month — can you spot them? Simine kicks off her own series of articles in this month's issue entitled 'Stamps That Tell a Story' (see Resources, below).

We kick off with a ripper in response to the challenge that we offered in the latest edition of our *Lift over Drag* newsletter (see *Resources*, below):

A Slope Lift Assessor

All slope soarers will have stood on the edge of a hill pondering over those vital questions such as is there enough lift, do I need ballast, is the wind on the slope? In the absence of the first volunteer to launch a disposable

foamie, birds such as gulls and crows can give some indication. But remember that they are much more efficient than your models and, as a final insult, can just start flapping to get out of trouble, often leaving the poor pilot with the long walk of shame to collect their model. I reckon birds often do it on purpose. So let me introduce to the ultimate slope lift assessment device — a spaniel.

Most spaniels have ridiculously long ears, known, I am reliable informed, as leathers, which appear to have some aerodynamic properties. The device is easy to use: simply encourage them to stand on the edge of the slope and watch the said ears. For safety reasons you must remember that spaniels were last in the queue when brains were handed out, so attaching the assessor to a safety harness is a must to prevent them leaping off if they spot a rabbit at the bottom of the slope.

Reading the ears is easy:

- **Ears hanging down** — lightweight soarers or electric assist only.
- **Ears horizontal** — lovely lift, most models will fly.
- **Ears vertical** — heavyweights or ballast required.
- **One ear up, one down** — wind off the slope, beware.

The drawback to this device is their expensive upkeep — vet bills are ruinous — and the continuous maintenance required in the form of long walks. Unfortunately, you can't just switch them off and chuck in the bottom of your flight box.

Best Regards,
Alan Butterworth

Alan — that is absolutely priceless! A story tailor-made for lovers of both slope soaring and dogs, like me. Thanks so much for sending it along.— Ed.

Transmitter Programming Help Available

Please let Mr. Mandeville from Brockton (from last month's *Letters to the Editor*) know that I'd be happy to help him set up his programming. Or, at least, I can give him an idea of what throws and mixes might be appropriate. I don't have specific experience with that model or radio, but I've set up a number of thermal duration models with ailerons and flaps.

Also, if he's interested in thermals I can give him stick time on something with a more appropriate wing loading. Google Maps says he's 40 minutes or so from my house, and only a few minutes further from CRRC's field. Also, please tell him to limber up and exercise his left thumb.

If he hasn't run across it yet, he may enjoy the Charles River Radio Controllers website (see *Resources*) and its content about gliders.

Please be careful,
Lincoln Ross

Lincoln —we'll make sure that Bob is aware of your offer and he'll be in touch shortly, I'm sure. Thanks for being in touch.— Ed.

Thoughts on Peter Scott's 'Electricity for Model Flyers'

I've just read this series, or, at least, as much of it as has been published yet. Maybe it's coming later, but I haven't seen any discussion of lithium iron phosphate batteries.

Some of them have very good power density, even if their energy density isn't quite on a par with lithium ion.However, I usually size motor batteries so they'll handle the required current, which leaves plenty of capacity to handle the radio for a long time after I shut off the motor. The ones I use can be recharged much faster than lithium ion as well.They're supposed to be safer and more robust. Probably safe enough to charge in the model. I've had good luck so far. I have a heavy 3m model that climbs fast enough for ALES on only two A123 cells. (I don't know what the best brands are now.) I also have two smaller cells in a Supra. Generally, radio gear, even the old stuff, can handle 2S without a power supply or diodes to drop the voltage, because it's hardly any higher than with 5 nicads.

Also, regarding nicads and NiMH, I think they're less complicated to use than lipos. For one thing, they're far less likely to cause fires. For those who think ahead, it's easy enough to plug the tx and the model into a wall wart the night before. For the rest of us, there are innumerable peak chargers that can do the job in an hour or less. I've had excellent luck with nimh and, especially, nicads since I started using pulsed chargers, first the Ace and then the Sirius. Except that one time with the Ace. If you're still using one, check the wiring. Mine developed an intermittent connection.

For some transmitters, it may be necessary to bypass the blocking diode with a tiny wire, but that's easy. You only need one that can handle a couple of amps. For more current, it will act like a fuse, sparing your radio. I admit I

don't know what pulsed chargers are available at the moment.

Best regards,
Lincoln Ross

Lincoln — similarly, we'll alert Peter to your letter and he'll follow up. Thanks so much for this valuable information. — Ed.

Resources

- ***Stamps That Tell a Story*** — Simine Short, who provides many of the stamps featured in our montage, above, kicks off her own series this month: "There are many ways to collect stamps and many kinds to collect. Everybody chooses according to his/her own taste (and pocket-book). I collect postage stamps showing gliders, model gliders…"
- ***Lift over Drag*** — Our more-or-less monthly newsletter which provides advanced email notice about the upcoming issue. *Lift over Drag* is free, but you do have to ***sign-up*** if you want it to arrive in your email inbox each month.
- ***Charles River Radio Controllers*** — From their website: "The Charles River Radio Controllers (CRRC) club was founded in late November 1964 in a basement in Newton. For several months, the original thirteen met in various cellars throughout the area…"
- ***Letters to the Editor*** — Includes the letter from Bob Mandeville to which Lincoln Ross refers.
- ***Electricity for Model Flyers*** — The instalment of Peter Scott's popular series which enumerated and commented on various types of battery technologies.

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

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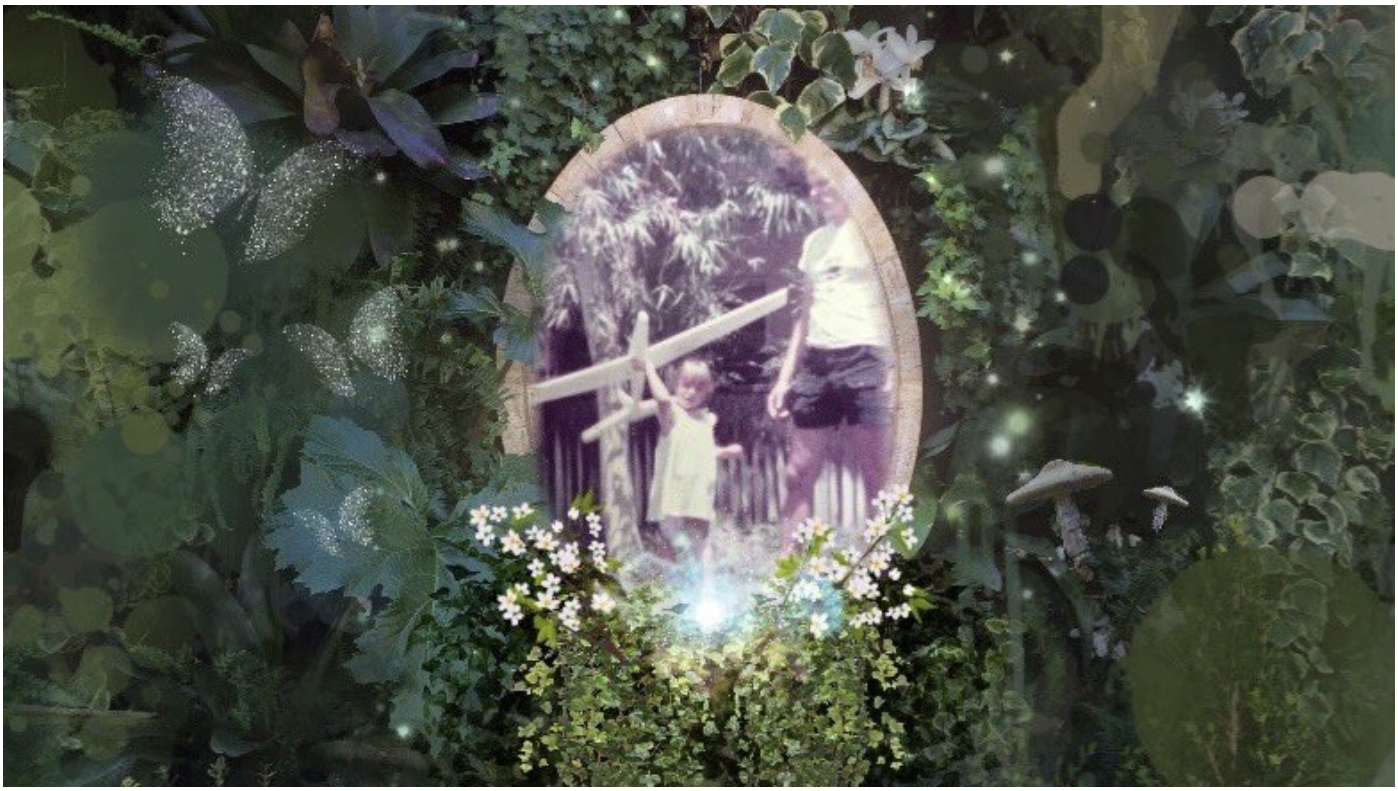
Hangar Queen

Creating one-of-a-kind flying works of art.

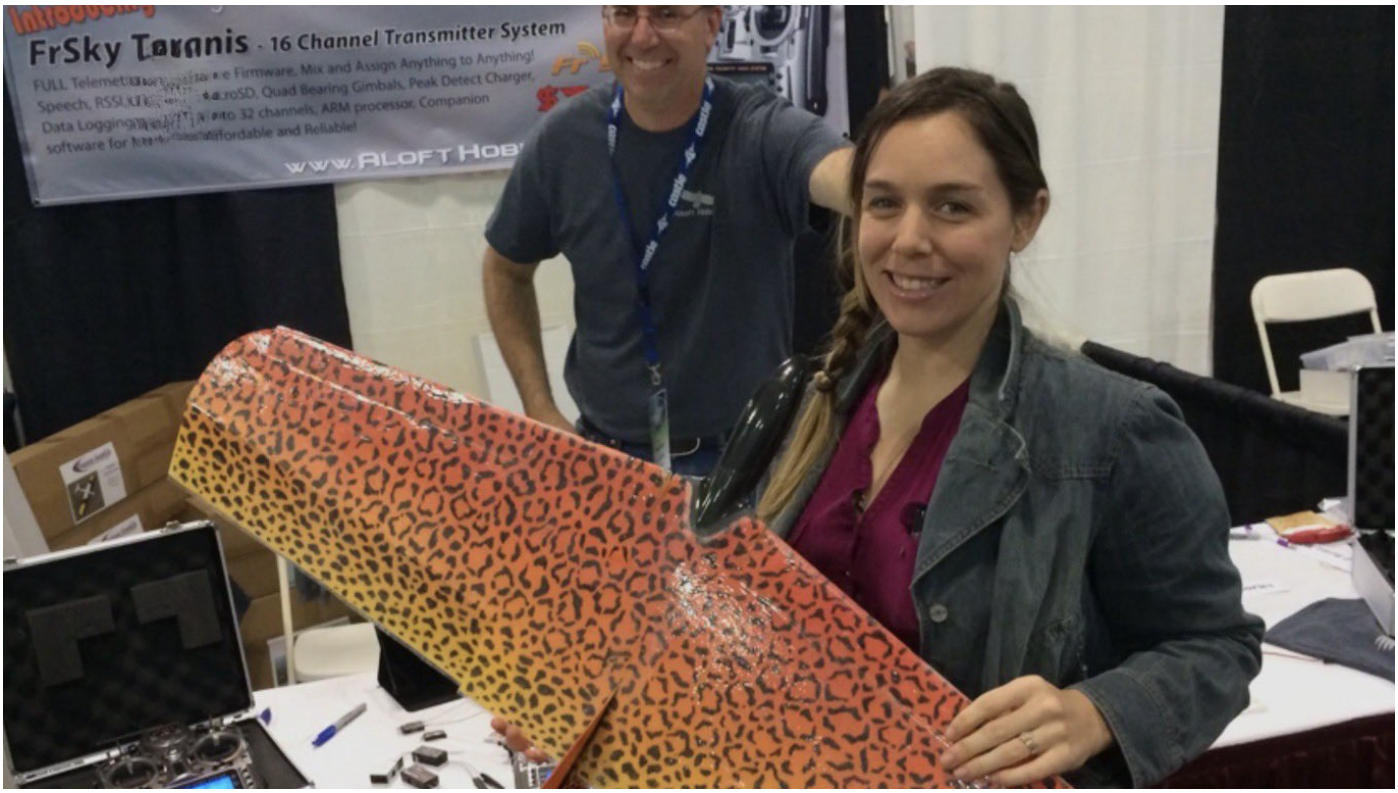
Jenna Quader

Hello, my name is Jenna Quader — AKA the *Hangar Queen* according to my dad. I am an artist who paints, draws and designs digital and photo manipulations into NFT's online. For the past several years my father has been flying slope gliders.



Picture of me and my dad as a little girl. This is what started it all.

When I was a young child he built and constructed gliders back in the 1980's. Just recently he came back to this hobby and asked me to help him make his planes into art pieces.



Me displaying my painted slope glider at the RC show in Orange County, California.

He was concerned that the weight of the acrylic paint I use to decorate his planes may effect the flying characteristics but we have not found any proof it limits their flight. At first we tried using permanent marker over the foam gliders but found it doesn't last and it fades so I strictly use acrylic paint now.

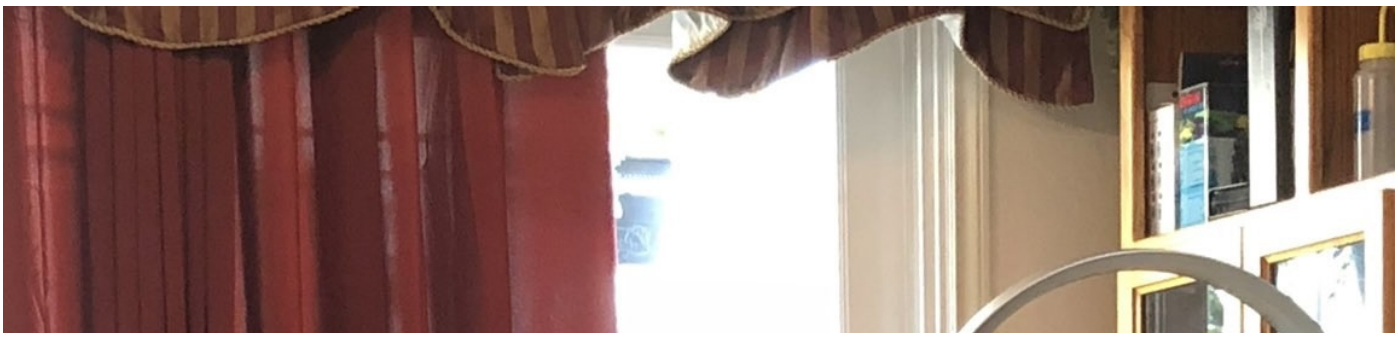
To keep the plane light we don't use a sealer to protect the paint so if it flies and crashes there is no guarantee the art won't get damaged. The good news is when its flying in the air it looks amazing and you can barely tell the damage in the air. Sometimes it's a decision weather to fly it or hang it on the wall as a masterpiece.

Here are some pictures of me working with permanent markers only. In this photo I am wearing gloves so the oils from my hands don't effect the the use of marker ink.

Before I begin painting with acrylics we wipe the foam glider clean lightly

with isopropyl alcohol to insure it is clean so the paint glides on smoothly. You can just use a paper towel to do this.

I use a very light grey acrylic paint and small brush to outline my design so if I make a mistake it is easy to wipe clean with a paper towel or brush. Here in this picture you can see how I outlined my design. I only use water to wipe away mistakes and don't worry too much if the mistake is still visible because I can always paint over it later. I try not to use transparent acrylic colors as the colors are not as bold and don't cover mistakes well. I don't use any expensive acrylic paints either, just colors that cost about 99 cents at your local craft store.



Here is a picture of me painting in my design. As you can see I like to fully paint the whole wing. Sometimes I will paint both sides. Some projects can take about 24 hours or more to finish depending on the size of the glider.

When the glider is in the air it looks pretty rad! See the *Resources* section below for videos of my dad flying some of my art pieces.

So far I have only painted glider foam so I don't know how acrylic would do on other surfaces. I've painted other peoples gliders other than my dad's. If you are interested in a painted design you can message me on any of my social sites linked in the *Resources* section, below. I reside in Orange County, California and have only painted planes locally so far.

Here are a couple of my other designs. The tiger design at the right is

featured in the *SST Tiger* video linked in the *Resources* section.

Thanks for reading and let me know if I can create a one-of-a-kind, flying work of art for you.

Resources

- ***Jasmine Moon Designs*** — This is where you can get ahold of me. For a large painted plane I charge around $200 and for smaller designs $50. A fully painted glider top and bottom around $400. I like to give this range in pricing but that changes depending on the design, how large the glider is and how long it will take.
- ***Alula Trek Maiden Day*** (YouTube) — My dad's Alula Trek painted with with one of my designs. Don't you love how it looks in the air?
- ***SST Tiger*** (YouTube) — SST 'heavy build' emblazoned with the tiger design, flying at Caselman's Hill near San Clemente, California.
- ***NFT*** (Wikipedia) — "A non-fungible token (NFT) is a financial security consisting of digital data stored in a blockchain…[t]he ownership of an NFT is recorded in the blockchain, and can be transferred by the owner…NFTs typically contain references to digital files such as photos, videos, and audio."

*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 2022 International Hand Launch Glider Festival

Sixty-two DLG pilots in Poway, California make for far more than a two day event.

Gary B. Fogel

Ryan Hoellein of Germany gets ready for a quick turn with his Concept CX5. (credit: Gary B. Fogel)

The Torrey Pines Gulls (TPG) in San Diego, California has a long relationship with 1.5m hand launch gliders. In October of 1994 the TPG established the first two-day contest for javelin-launched gliders, including various unique tasks. Over time, while the launch method morphed into discus launch, the FAI established the F3K category including many of the tasks developed by TPG. Thanks to many sponsors and a great collection of dedicated pilots, TPG was able to donate proceeds from the annual event to the USA F3K

team. Everything was going along great until the pandemic precluded hosting the event in 2020 and 2021. However, on April 23 and 24, 2022, the TPG held the 27th edition of the contest with 62 pilots in attendance representing the USA, Germany, Philippines, Canada, China, and South Africa. Additionally, for the first time the IHLGF was also an FAI F3K World Cup event, drawing even greater attention.

A gaggle of DLGs enjoying a thermal at Poway. (credit: Gary B. Fogel)

IHLGF is actually far more than a two day event. The fun begins on the Thursday prior to the IHLGF with an informal meet-up at a local rib joint. On Friday, the field is prepared and used for open flight testing before a taco fiesta hosted by TPG on the field. The contest witnessed eight rounds of flying on Saturday and another four on Sunday morning before a four round flyoff between the top 12 competitors. A silent auction held during the event included KST and MKS servos, a new *Medina* 2m RES aircraft from ArmSoar and a *Concept CX5* from Concept/Stream Team Models. Other sponsors included Spektrum, Horizon Hobby, and SoaringUSA. Kindly, PurpleAir

(operated by Adrian Dybwad of F3KMaster fame) covered the cost of pizza on the field Saturday night and offered matching funds for a portion of the auction proceeds.

TPGer Doug Cronkhite enjoying the competition. (credit: Gary B. Fogel)

The inland location of the flying site in Poway just east of San Diego normally provides dynamic conditions throughout the day. This year, however, the Thermal Gods displayed just about everything Poway has to offer in one contest, sometimes even in one round. This was some of the hardest flying in any IHLGF. The conditions led many top pilots to make off field landings at one time or another. However, one pilot in particular, Walther Bednarz flew consistently well throughout the event, dropping a 958 after the 12 preliminary rounds. The four flyoff rounds were held in windy and turbulent conditions, leaving the top three pilots Walther Bednarz in 1st with Arizonan brothers George and Charlie Morris in 2nd and 3rd respectively:

GER 🇩🇪	Walther Bednarz	15,762.3
USA 🇺🇸	George Morris	14,264.5
USA 🇺🇸	Charlie Morris	14,170.5

See link in the *Resources* section below for full results on F3X Vault.

Adrian's step-son Matthew was another highlight of the event. At age 7, Matthew had a super time flying his 1m *GO Mini* in the contest becoming the youngest IHLGF participant in history. At the end of the contest, Walther Bednarz ensured this young pilot would fly DLG for a lifetime by giving young Matthew a brand new 1m *Deviant* in the true spirit of what the IHLGF means to the community.

Left: Adrian Dybwad and step-son Matthew at the IHLGF. Adrian's company PurpleAir helped sponsor the event. At age 7, Matthew flew superbly with a GO Mini — watch out for him in the future! (credit: Gary B. Fogel) | **Right**: IHLGF 2022 flyoff competitors gather at the end of the event, with Walther Bednarz holding up his 1st place trophy. (credit: Myra Morris)

Congratulations to all of the pilots who participated in this event and helped get IHLGF back on track! It was great to be flying again with friends from around the world. Special thanks goes out to the many TPG members including Event Organizer Mike Smith, Contest Director Mike Seid, and others who helped organize this event and the many sponsors PurpleAir, Concept, ArmSoar, Stream Team Models, Spektrum, Horizon Hobby, SoaringUSA, KST, and MKS (see links to all of these in *Resources*, below).

Be sure to join us for IHLGF 2023!

Enjoying the beautiful SoCal weather. (credit: Myra Morris)

Resources

- ***2022 International Hand Launch Glider Festival Full Results*** — As reported on F3XVault, the "web database of all things F3X Flying…" In addition, the event organizers would like to acknowledge and thank our event sponsors (alphabetical):
- ***ArmSoar***
- ***Concept DLG***
- ***Horizon Hobby***
- ***KST Digital Technology Ltd.***
- ***MKS Servos USA***
- ***PurpleAir***
- ***SoaringUSA***
- ***Spektrum RC***
- ***Stream Team Model***

The participants at IHLGF 2022. (credit: Bob Hirsch)

*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**.*

Tinamou

Revisiting and refreshing an RC Soaring Digest classic from 2008.

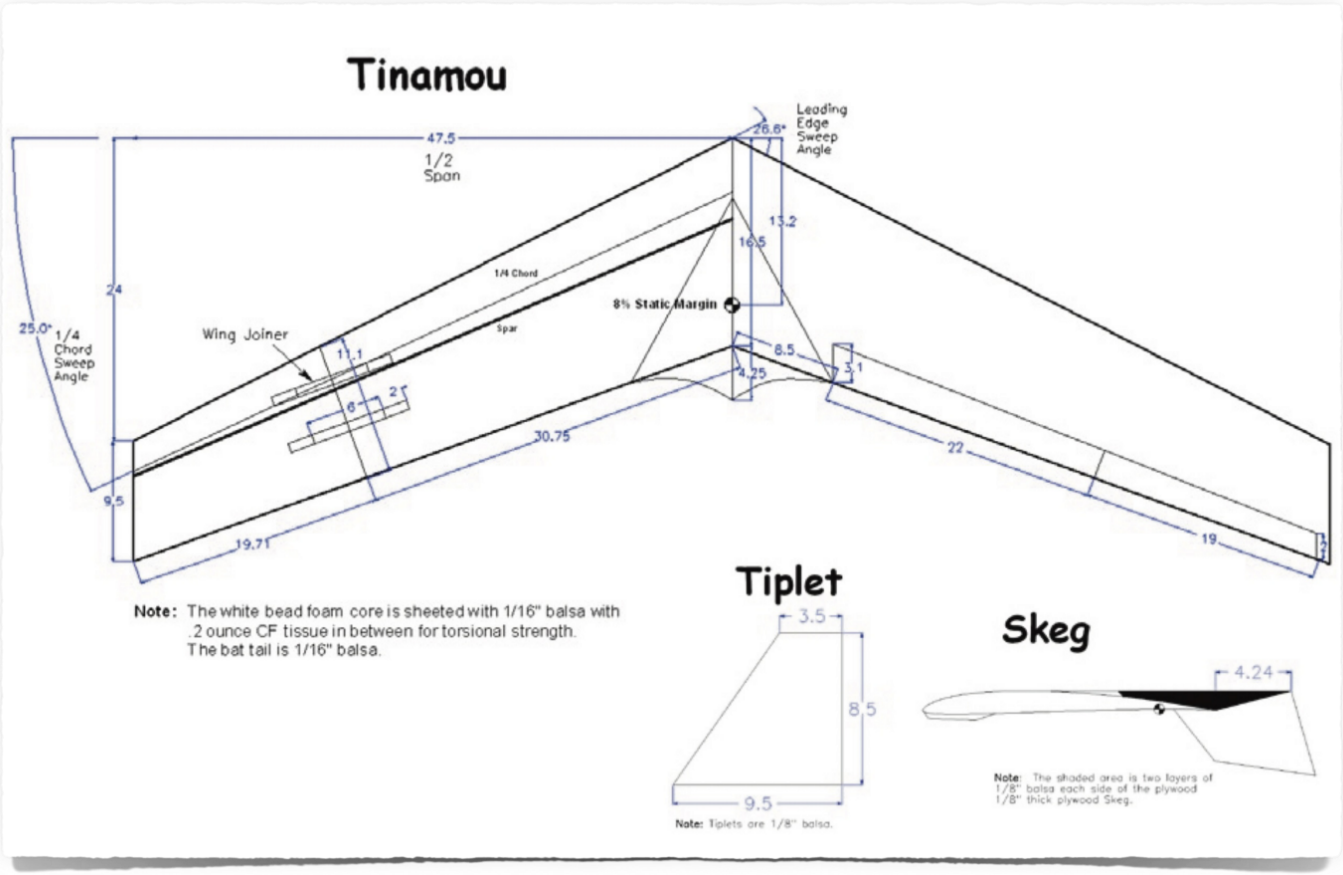
Curtis Suter

Tinamous are strictly neotropical birds— not found outside the tropics, and nowhere but in the Americas. They are large-bodied, almost tailless birds with slender necks and small heads, maybe 30% larger than a bobwhite. They fly but prefer to walk or run, and they're secretive. — Backyard Nature

Well, so much for the name. My *Tinamou* is not secretive, as I have plans free for the asking and it launches, flies and lands very well! I've always been intrigued by flying wings, especially swept flying wings. Six years ago I happened upon an article about a flying wing built and flown by Herk Stokely. See *On The Wing: A Comparison of Two Tailless RC-HLGs* linked in

the *Resources* section at the end of this article.

I wanted a bigger flying wing than Herk's little HLG wing and chose to enlarge his model to 100" wingspan. So I had [the now defunct] CompuFoam cut the wing cores using white bead foam as I intended to use balsa sheeting for the skin. They did a great job cutting the cores, too!



As all this was taking place I got married, bought a house, and was promoted at work. So best laid plans ended up in the rafters of the garage for five years! The end of 2007 I had some free time on my hands and needed a Montana winter project. So I got the foam cores down from the rafters, emailed Herk and started to think about what I needed to do to complete this project.

Originally I wanted to launch her via electric assist and Herk suggested that I

reduce the amount of twist or washout from 8 degrees to 4.5 due to the higher speed of the model.

Well, after five years and just like the weather, I changed my mind about how to launch the model and wanted to use a hi-start and to have a thermal duration model, thus I should have used the original amount of twist. This begged the question, “how do you determine the proper amount of twist”?

This is when I was led to the late Dr. Panknin, who devised a complex but fairly simple formula with the use of a calculator to determine the required twist. I have since taken his work and made a companion spreadsheet to *Sailplane Calc* called *Flying Wing Calc* (again, see *Resources*) that will easily calculate the twist.

The Design

Herk wanted a nice flying thermal HLG flying wing and he was successful. He chose the SD7037 airfoil for the center section of the wing as this airfoil was proven to have good characteristics. The SD8020 was chosen for the outer portion of the wing as it’s a fully symmetrical airfoil and its sole purpose is to act as the tail of the wing.

A flying wing has a tail just like your typical tailed model; it’s just that the tail has a very short moment, that is the distance from the wings quarter chord location to the tails quarter chord location. Remember from your basic aerodynamics class that the horizontal tail is used to counteract the negative pitching moment of the main wing by applying a down force, thus pitching the leading edge of the wing up.

The same thing needs to be accomplished with a flying wing. In a swept wing this is done by twisting the outer portion of the wings trailing edge up in relation to the leading edge, thus this applies a down balancing force to the

lifting section of the wing.

This is different than with a reflexed airfoil that raises the trailing edge of the airfoil across the entire span, creating a very low negative pitching moment. Very little, if any, twist is required if a reflexed airfoil is used.

Some may ask why not use a reflexed airfoil over the entire span. Well, what I've learned during this process is that a reflexed airfoil will suffer in its thermalling or lifting ability. I believe that reflexed airfoils are suited more to slope soaring, electrics, unswept plank type wings or where higher speed is desired. I was looking for a thermal duration model.

Herk then chose a planform, sweepback angle, taper ratio and aspect ratio for his wing. With all of this information he was able place this information into Dr. Panknin's formulas and determine the required twist angle that was required to be built into the wing. It's important to note that Dr. Panknin's formulas require a linear twist. The first 10" of my wing are pure SD7037 with no transition to the SD8020 as I wanted a good lifting section in the center of the wing.

One of the many things I enjoy about aviation is that I am always learning. During this endeavor I learned about airfoil pitching moments, airfoil zero lift

angles, The Middle Effect, the difference between reflexed and non-reflexed airfoils, and how to determine wing twist to longitudinally balance a flying wing. I also learned that a flying wing can have flaps, and very effective ones at that!

Tinamou Specifications

Span	95”
Chord, root	17”, not including bat tail
Airfoil, root	SD7037
Airfoil, tip	SD8020
Sweep angle	25 degrees at 0.25 chord 26.8 degrees at LE
Wing area	1,235 in^2
Twist (washout)	4.5 degrees
CG location	13.2" aft root LE, 8% static margin
Weight	77 ounces
Wing loading	8.98 oz/ft^2
Effective wing loading	11.67 oz/ft^2

Note: Effective wing loading is 30% greater, as part of the wing is acting as a tail.

The Build

The basic building of the wing is quite simple. I took the cores that were professionally cut and chose to use 1/16" balsa wood as the skin with 0.2 ounce carbon fiber in between for torsional strength. The spar is .007 carbon tape top and bottom. I used polyurethane Gorilla glue to attach the balsa to the cores via my home made vacuum bag. I can't take credit for this method as it was done by Terry Brox and an excellent review is on his website (see *Resources*).

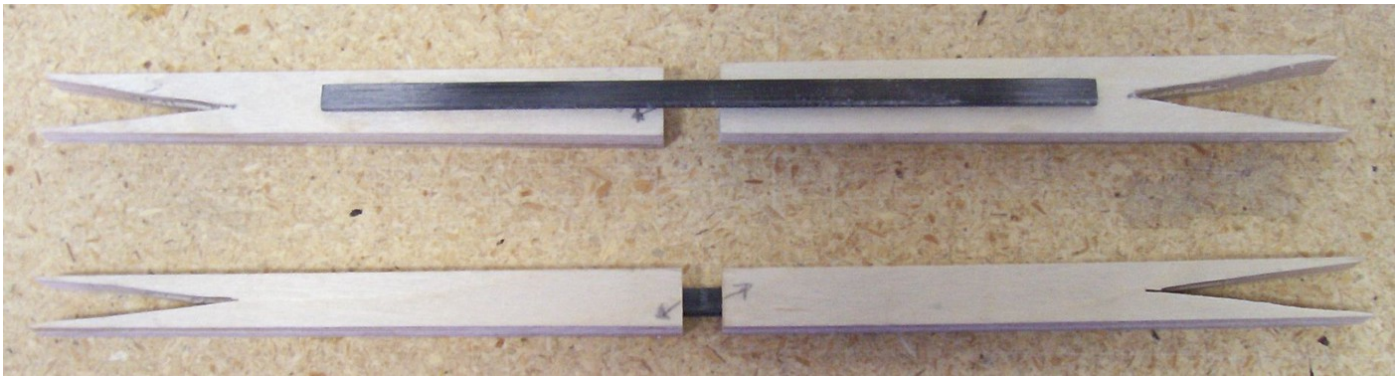
Proof of how strong his wing is can be found by clicking on `Misc. Stuff`. I thought this would be plenty strong for what I needed. The entire center section top and bottom is fiberglassed with three layers of 0.75 ounce cloth starting where the bat tail ends at the trailing edge. Each layer is progressively smaller in span.

The radio gear is mounted in a very simple manner. The battery and receiver

are cut out of the top of the foam near the leading edge. The servos are mounted underneath the wing in pockets cut out of the foam; they are centered on their respective surfaces.

I placed hollow pushrod tubes in the wing prior to applying the sheeting so the servo wires were easy to route to the center of the wing. Here you can also see where the ′chute servo and drogue ′chute are placed. More on the ′chute later.

I couldn’t transport the wing at 100" so I made removable wingtips. I built a basswood box that could receive a rectangular carbon fiber rod and simply tape the panels together prior to flight. It’s worked flawlessly.



Typical wing joiner. Basswood box, the rectangular carbon rod is six inches long.

The carbon rod is six inches long and tapers are cut into the ends of the box to transfer the loads to the wing skins. I chose the length of the outer panel on what I estimated that I needed for elevon size versus the inner section that would be used for flaps.

The photo above, left, shows the completed outer tip. I used 1/8" hard balsa ribs at the root and tip. The tiplets are 1/8" balsa and fiberglassed to the end of this panel. For sizing I use the TLAR method — That Looks About Right. The black line is .007 carbon fiber tape as a spar and the red tube is for the servo wires. This panel is ready to be sheeted.

To the right of that shows an outer wing panel in the vacuum bag. I used a *Space Bag* (storage type bag) and a *MityVac* hand held brake bleed kit to remove the air. I easily obtained 7lbs per square inch of pressure overnight. However, the *Space Bag* won't hold much more with this setup. I've used the *MityVac* system with a different bag and easily held 15 inches overnight.

Herk suggested a skeg in the aft center of the wing to keep the flaps off the ground during landing and something to hold on to during launch. This has also proven to be very effective and simple.

I used a center 1/8" plywood rib to join the wing's halves to and the skeg is cut as one piece with this rib which increases the skeg's strength.

There is something called The Middle Effect. In short this effect is the loss of lift at the center of a swept wing due to the detrimental interaction of vortices at the center of the wing. To counteract this, a so called 'bat tail' helps in compensating for this loss of lift. The bat tail is shown in the photos above. You can see the raised triangular area built up over the center section, that's the bat tail.

You may read more about it the effect at *On The Wing: The Middle Effect* (see *Resources*, below).

There are two tow hooks placed approximately five inches each side of the center of the root. The left photo on the next page shows the hardwood blocks I inserted in the foam core. The block is full depth so the loads are transferred to the main wing sheeting.

I made a bridle that attaches to the main hi-start chute, it has two rings that attach to the wings hooks and another ring that slides on the harness (string) and this ring is attached to the hi-start parachute.

The wings tow hooks are placed 1/2" forward of the balance location which is 4% MAC forward of the balance point. This seems too far forward but any further aft and the launch suffered in height and would periodically pop off during launch. The launches have been a non-event, perfectly straight up the hi- start. The initial launch is what concerned me most prior to the first flight but the lack of sleep was unwarranted.

The 'Chute

This hobby is supposed to be fun so I added a drogue 'chute. I saw this on a friend's Graupner *SB-13* flying wing, so I thought the idea would be great to try on my wing. There was room for a 'chute in the area that made up the bat tail. So I simply made a hatch with a release mechanism. The aft part of the hatch is held in place with two plywood tabs that slip under the top sheeting and the front of the hatch has a small balsa block glued underneath with a hole drilled in it that accepts a plastic pushrod.

At the end of the 'chute I tied a loop of string and inserted it from left-to-right through a hole in the center plywood bulkhead and when the pushrod is inserted this holds the 'chute in place. See the photo above right. The pushrod goes through the loop and extends past the hole in the rib into the balsa block in the hatch, thus holding the hatch in place.

Jeff Vrba launching Tinamou at the Alpine Soaring Adventure Joseph Oregon. Note the wing fences are still in place.

Since the ′chute fits snugly in its compartment when the hatch is closed, it applies a little pressure to the hatch and when released by the servo this allows the front edge to pop up allowing airflow to blow the hatch off the wing. The ′chute is attached to the hatch thus it deploys the ′chute.

The servo has two actuations: 1. During the first half of the movement of the servo the pushrod pulls towards the nose of the wing releasing the hatch, but not far enough to expose the hole cut into the rib, as this would release the ′chute. 2. The second half of the actuation exposes the hole in the rib, releasing the loop of string and allowing the ′chute to be emergency jettisoned.

Also shown in this photo is the root rib and skeg that’s cut as the one piece of 1/8″ plywood.The ′chute is somewhat effective but nowhere close to effective as the flaps. The ′chute is big in the “Wow!” factor, though! A video

demonstration can be found in *Resources*, below.

> Curtis! Why did you name this beautiful model, that flies with the grace and beauty of an Albatross, after a shy semi-flightless jungle bird that probably has the same glide ratio as your transmitter? — Herk Stokely

Tinamou will go straight up the launch with very little correction required. She doesn't seem to zoom off the launch as well as other thermal duration models. She thermals well, but detecting lift will take a lot of practice as the tail moment is short and it's difficult to see changes in pitch.

There is a bit of yawing during flight and turns but it's negligible.

The stall is quite sharp and will catch you by surprise if you crank too much up elevator in a turn. It takes about one-and-a-half turns for the recovery.

I've tried wing fences and at first I thought there was a significant difference in handling, but I've since removed them and haven't noticed a significant

change with or without them except the stall isn't as abrupt with the fences.

At times I wish I had a little more elevator control in order to crank her tighter around a turn without feeling I may stall her. Finesse is key in flying her, more so than with my other thermal duration ships as a light hand on the elevator is required. This may be solved with moving the balance point further aft and adding the flaps to work as elevators. Thus more flight testing is in order.

The model was balanced at 8% static margin for the first few flights and later moved back to 3% which proved to be too far aft during the low speed high angle of attack landing portion of the flight. She really got overly pitch sensitive during landing.

I've since moved the balance point back to 8% as she launches, soars and lands very well.

The landings are easy. She really slows down well with the large flap area and with more practice spot landings are quite possible. F3J type landings have been obtainable from the first flight, however the USA style of precision landings will take more practice.

Changes I'd Make If I Were to Build Another

Since the twist was reduced for an electric model I chose to increase the wing sweep from 22.5 degrees to 25 degrees at the quarter chord point which effectively increased the amount of twist. This reduced the overall wingspan to 95". I'm currently flying with approximately 1/8" of reflex to maintain a nice thermal speed.

So if I were to build another *Tinamou:*

- I'd change the amount of twist from the 4.5 degrees to the 8 degrees

Herk originally used.
- I'd also change where I have the wings joined, making the elevons longer and the flaps shorter, perhaps a 20% increase in elevon span.
- I'd probably leave the 'chute out as it took quite a while to get it rigged properly and the flaps are way more effective.
- I also would like to try different non- reflexed airfoils, such as the excellent Drela airfoils and perhaps a little bit higher aspect ratio.

But these would be the only changes. I'm so very pleased with how easily she built and how well she flies. Herk Stokely and Dr. Panknin really know what they are doing!

Perhaps in the near future I may make a removable fuselage pod that houses an electric motor in the nose. The pod can be held in place by slipping over the nose then attached to the skeg. It'd be a very simple on/off arrangement.

Credits

There are a lot of people I'd like to thank, beginning with Herk Stokely who patiently answered my daily emails for months. Also Jeff Vrba, Jim Cooney, Shawn Keller, Norm Masters and the folks at RCGroups. Photos and videos courtesy of Jim Cooney, Shawn Keller, Jeff Vrba and myself.

Resources

- ***Backyard Nature*** — "Tinamous are strictly neotropical birds — not found outside the tropics, and nowhere but in the Americas…"
- ***On The Wing: A Comparison of Two Tailless RC-HLGs*** **—** by Bill and Bunny Kuhlman, which originally appeared in the March, 1997 issue of RC Soaring Digest.

- ***Flying Wing Calc*** — "Calculate balance point and wing twist using Dr. Panknin's formulas. Now automatically estimates winglet size and calculate a wing with three tapers! June, 2016, version…"
- ***Building a Light set of Wings***— By Terry Brox: "Welcome to my way of wing construction. I would like it to be understood that I am not saying this is the right way…"
- ***On The Wing: The Middle Effect*** — By Bill and Bunny Kuhlman, which originally appeared in the November, 1995 issue of RC Soaring Digest.
- ***Video Demonstration of 'Chute*** — "This is a demonstration of how the Drogue Chute operates on my flying wing…".
- ***RCGroups Forum*** — Lots of additional information and discussion on the *Tinamou*.
- ***Tinamou Video Compilation*** — "Here's a compilation of flight videos of my thermal duration flying wing…"
- ***Tailwind Gliders*** — my personal website.
- ***Tinamou*** — The original PDF of this article as it was published in the RC Soaring Digest in October of 2008.

This article originally appeared in the October, 2008 issue of RC Soaring Digest. *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****.*

The Fine Art of Planking

The time-tested method for moulding strips of wood into an organic, monocoque structure which is both light and strong.

Peter Scott

The Bowlus 1-S-2100 Senior Albatross ‘Falcon’. Although it evokes the planking described in the following article, the fuselage is actually mahogany plywood applied in a series of small panels (click the image for high resolution). However, the basic idea is the same: use small pieces of wood to create a light and strong structure. (credit: Smithsonian National Air and Space Museum)

This article employs ideas described in an article titled Strip-Plank like a Pro *by Henry Holcombe which appeared in the Model Airplane News. See* Resources*, below, for more information on how this article might be obtained.*

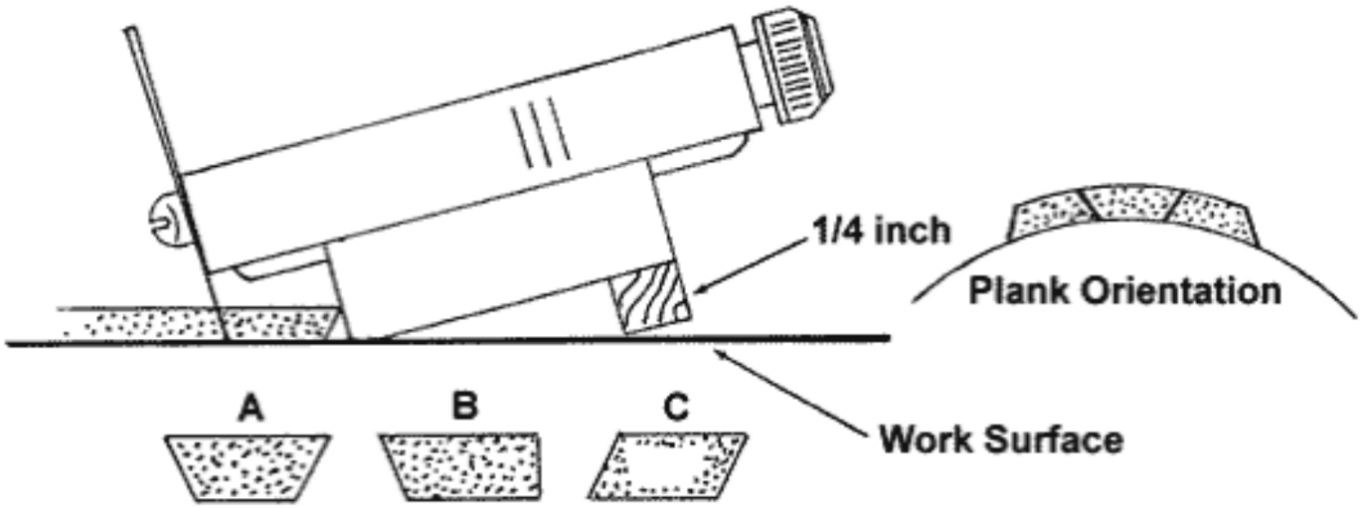
The most elegant shapes with compound curves are usually the most difficult to build. Either you have to make moulds and form them out of glass or carbon fibre or you have to plank. Using Henry Holcombe's techniques planking proved to be much easier than I thought. The pictures show how I planked the fuselages for my 2m electric slope soarer, *Rider*, and 3.5m electric thermal soarer *Sirius*.

Henry's three key suggestions are:

1. Modify a stripper to produce angled edges to the planks.
2. Start from both edges and work towards the middle.
3. To avoid waiting for glue to dry, use small amounts of thin CA glue.

Modify a Stripper and Produce Balsa Strips

For a Master Airscrew Balsa Stripper (see *Resources*), glue a 6mm (¼″) square strip of hardwood along the edge opposite the blade as shown in the drawing. This tilts the blade. I strip balsa with the sheet hanging off the edge of the bench. You can't do that with the modified stripper as the hardwood strip has to prop it up. Place the stripper on a flat hardwood surface and lower the blade until it is a minute distance above the surface. This won't cut right through the sheet but the strips can easily be split off.



(credit: Henry Holcombe)

Choose light and flexible 2.5 or 3mm (3/32″ or 1/8 “) balsa sheet with straight grain. Unless the surface is a major part of the strength quite soft balsa can be used. It is probably best to use 3mm for early efforts as you will probably need to sand out unevennesses. Set the stripping width between 9mm (3/8″) for a large area with a large radius to 6mm (¼″) for small areas of smaller radius.

Cut the first strip. This will have one square edge like section B on the drawing. Reserve it for an edge strip. Turn the sheet 180° — end-over-end, not side-to-side. Cut another strip. This will look like section A. Cut as many strips as you think you will need for the whole job. If you turn the sheet edge-to-edge you get useless strips as in section C.

Plank from the Edges to the Middle

Make sure the formers give a smooth curve by trying a hardwood strip in place. Trim the first square edged strip to length and glue in place. Cut and glue a square edged strip to the other side of the planked area. Pin or clamp the strip. I use balsa cement instead of CA or PVA. It sets quickly, wipes off cleanly and sands well. I found that with balsa cement there was no need to

wait for setting.

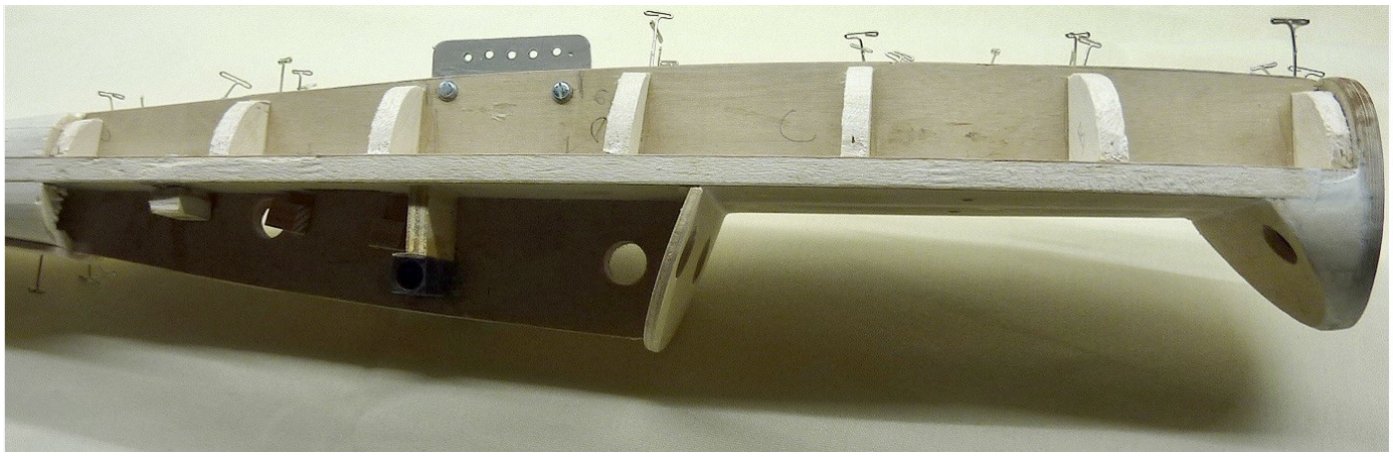
Cut the next strip, which will have two angled edges, to length. Glue and pin into place. The bigger contact area will help fix the strips together. Glue a square-edged strip to the other edge of the area. Continue to add strips, alternating edges, until the far ends touch. You will need to taper the ends of the next strip. Lay it in place unglued and mark the line of the required cut. Check the fit and glue when happy. The last strip must have both the width and the ends trimmed and tapered.

All that you then need to do is filling and sanding. For filling I used Supalite microballoons made into a paste with *Eze-Kote* (see *Resources*) applied with a 0.8mm ply spatula. Holding the piece up to a strong light will show where more sanding is needed.

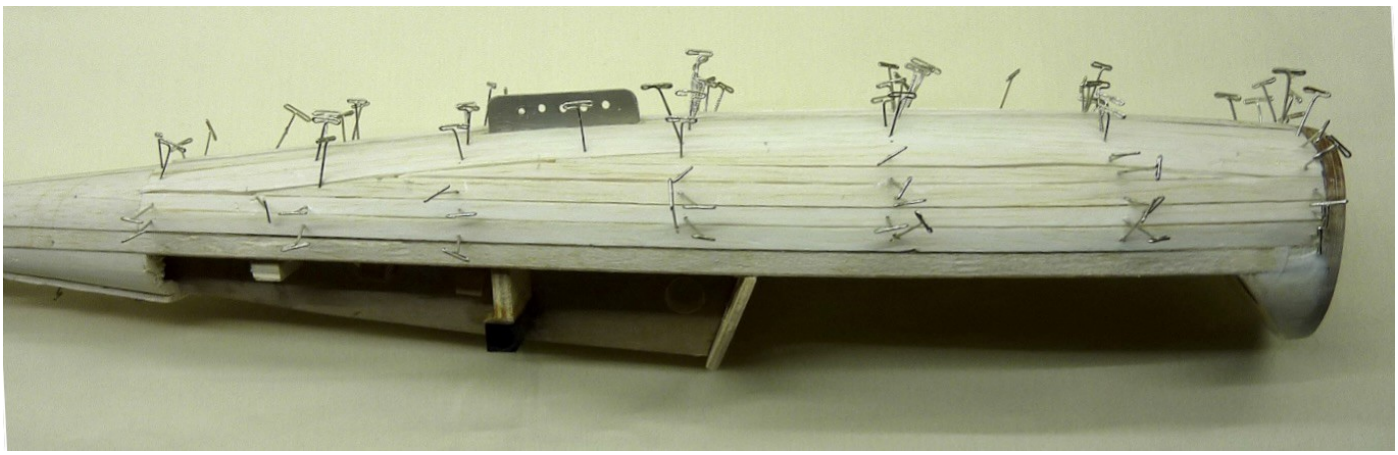
For maximum strength against both bending and denting, with little weight gain, I used 24g/m² (0.6oz) or 48g/m² (1.5oz) glass cloth applied and coated with Eze-Kote. I use glass because carbon fibre on the fuselage could cause radio signals to be screened out. *Eze-Kote* takes acrylic paint and varnish well, ideally air-brushed.

Rider: 2m Slope Soarer and Bungee Launch Glider With Motor

Fuselage front ready to plank:



Planked, unsanded:

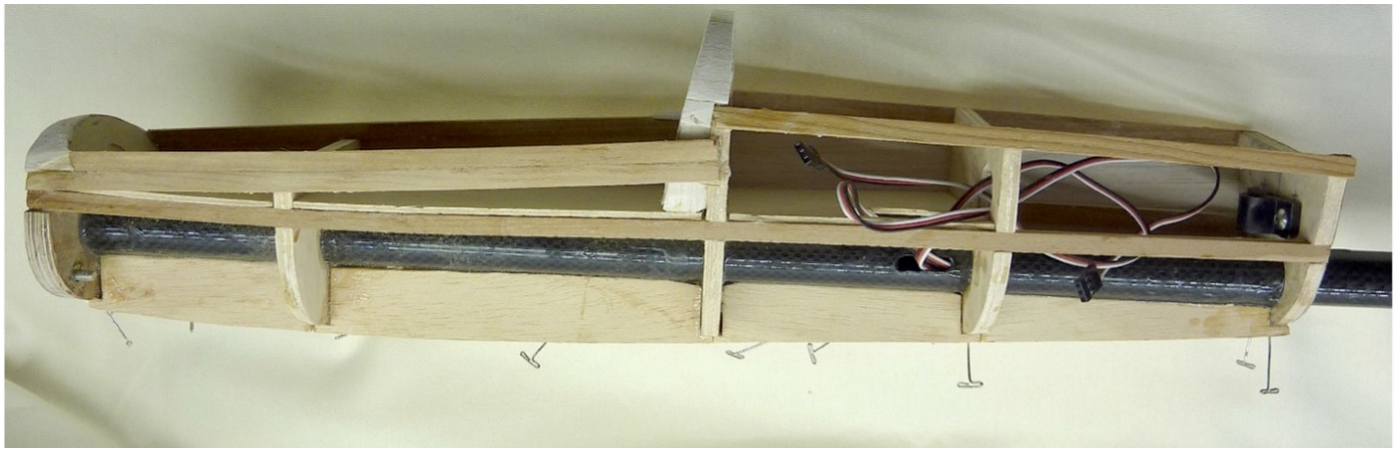


Filled and sanded with two coats of *Eze-Kote*, before glassing:

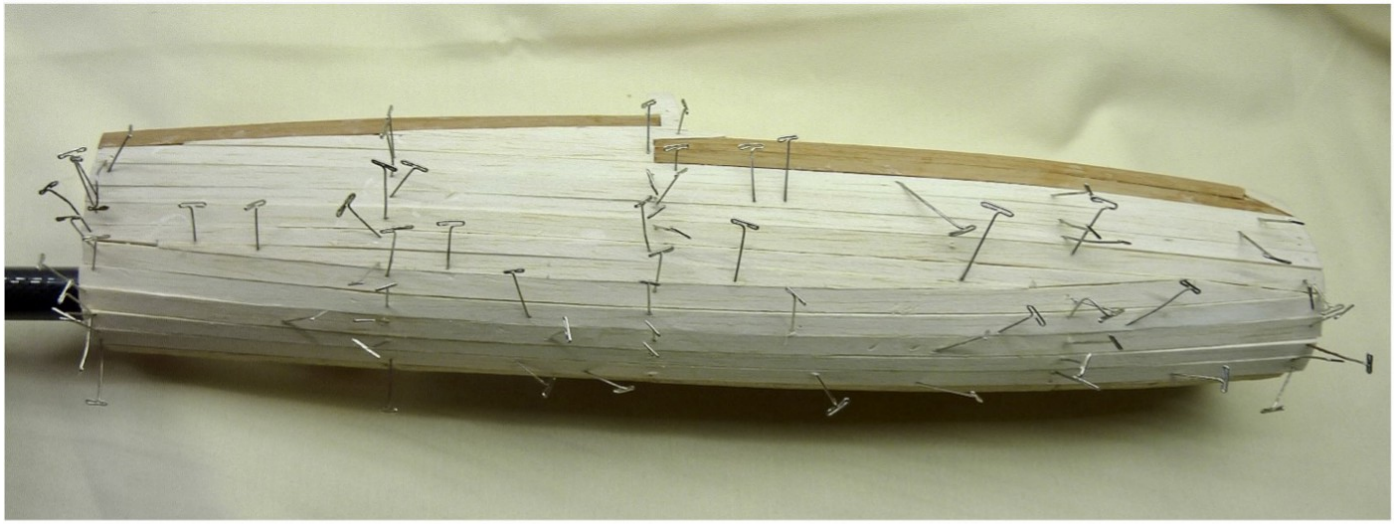
Finished model:

Sirius: 3.5m Thermal Soarer Using Graupner Cirrus Wings and Tailplane

Ready to plank:



Planked, unsanded:



Sanded and glassed using *Eze-Kote* and 48g/m² cloth.

The model is fitted with a glass fibre moulded canopy:

And here is the finished model:

Good luck with your planking project, and thank you for reading!

Resources

- ***Bowlus 1-S–2100 Senior Albatross 'Falcon'*** — From the Smithsonian's outstanding *National Air and Space Museum* website: "Monoplane glider with strut-braced, gull-type wing mounted high on monocoque fuselage…"
- ***Strip-Plank like a Pro*** by Henry Holcombe — A web search did not reveal any source where this article may be downloaded while respecting the original copyright of the author and/or Model Airplane News, where the article appeared (see next item).
- ***Model Airplane News*** — From their website: "Published by Air Age Media, the largest multi-media company dedicated to enthusiasts of radio-control planes, helicopters, cars and boats, aviation and diecast

collecting, Model Airplane News is distributed around the world…"

- ***Master Airscrew Balsa Stripper*** — From their website: "engineered to accurately cut balsa sheets up to 1/4" thick into strips up to 1/2" wide. The design has a lead screw with 32 threads per inch…"
- ***Eze-Kote*** — From their website: "Laminating and finishing resin for balsa and foam models. Eze-Kote is a one-part water based foam-safe, low odour, resin alternative to epoxy…"
- ***The Skyscraper Method for Fuselages*** — Previous articles by Peter Scott which feature the *Sirius* aircraft described above. It consisted on two parts, in the ***July, 2021*** and ***August, 2021*** issues of the *New RC Soaring Digest*.

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

Have to Travel and Brought a Sailplane?

An homage to the RC soaring travel blog articles of years past.

Ryan Woebkenberg

Wachthütte in Switzerland. Perfect day for flying, although I just wish there had been a bit of wind.

Earlier in May, I had a somewhat last minute business trip to my company's headquarters in Zurich, Switzerland. Switzerland is kind of a slope soaring mecca. As a resident of flat central Indiana, I always enjoy trying to get some RC slope soaring in whenever I am near a place with actual slopes. With the goal of getting some flying in after the business trip portion I packed my trusty Chinook in my carry on luggage.

Any good flying trip starts with some research. First I needed to find out what the laws are in Switzerland for RC flying. I won't bore everyone here with my findings but my research lead me to believe that I would be okay as long as I was flying away from airports, not flying at a place where RC sailplanes are prohibited, and flying models under 500g. Above 500g requires some sort of insurance which I'm sure I could have acquired had I been flying in a contest or something with a bigger model. My read is flying is relatively unrestricted. After researching the laws the next item of business was to scope out some possible places to fly.

Although Switzerland pretty much looks like one continuous postcard that you could throw a rock in any direction and find a suitable place to fly it always makes sense to check with the locals and have a plan for where to fly. To that end before my trip I reached out to Reto Fiolka, a well known pilot in the RC soaring community and former Switzerland resident. He gave me some suggestions for places to fly given where I was going to be staying while working and where my wife and I would be traveling after the work portion of the trip. My other resource was Slople.com (see *Resources* below), a great resource although you do have to be a bit careful because some of the flying site information can be dated.

The post-work part of the trip took us to Lausanne, Interlaken and Bern. Sunday the May 15th in Bern was the best opening to fly. Unfortunately when I looked at the weather forecast for that day there wasn't a prediction of a lot of wind. Or really *any* wind. I ended up choosing to take a chance on a flying site listed on Slople.com as Wachthütte near the small town of Krauchthal northeast of Bern, that would be relatively on the route we were driving toward the end of that day.

The red pin is the place where I flew.

The drive to the slope from Bern was picturesque although as we got closer to the slope the small farm roads started to concern my wife a bit. The text on the Slople.com entry for this field is below:

> *Sehr gut bei Bise! Zufahrt mit dem Auto möglich. Parkplätze sind im Wald vorhanden.*

That roughly translates to say that access by car is possible and that parking is possible in the forest. Although the roads were a bit narrow and at points we were driving on rock roads we were able to drive to a nice little wooded area with a few pull offs that was right at the top of the slope. As we were getting near the slope I spotted the all too familiar site to me of a RC sailplane zipping around. That also helped assure me that the navigation instructions the phone was giving us was correct. We parked and I stepped out and introduced myself to the man flying the plane (he had just landed) and met a nice fellow pilot named Heinz.

Heinz and his scratch-built hotliner.

Although my German skills have atrophied from when they were at their peak during my school years, Heinz and I were able to communicate well enough for me to learn that this was his second time at this particular flying site and that his model was a scratch built hotliner. That was a good choice of model given the lack of wind. I didn't catch Heinz's last name or his contact info, so Heinz if you are reading this article drop me a line sometime and maybe next time I am in Switzerland we can fly together again.

The author with his trusty well travelled Chinook.

I did end up assembling my Chinook and getting a few flights in but with the lack of really any wind to speak of flights were pretty short. That didn't make for a particularly exciting first flying session in Switzerland but I do expect to make future trips to Switzerland for business and will make future attempts at flying. Maybe I'll even find a way to attend a contest.

Resources

- ***Slople.com*** — Scrollable map of RC slopes with GPS coordinates and information about the flying site.

*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**.*

Soaring the Sky Podcast

E112: Project AK-X Flying Wing | Dominic Poppe Interview

Chuck Fulton

The AK-X over Karlsruhe, Baden-Württemberg, Germany. (credit: Akaflieg Karlsruhe)

We are delighted to kick off an ongoing series where we select and present episodes from Chuck Fulton's highly-regarding soaring podcast. We have linked all of the services where you can find Soaring the Sky*, or simply click the green play button below to start listening to this selected episode immediately. Let us know what you think! — Ed.*

We are excited to have glider pilot and project manager of the *AK-X* flying wing, Dominic Poppe with us. Join Tom Coussens, our guest host, as he gets the full story from Dominic behind the scenes at Akaflieg Karlsruhe in Germany. What does it take to design and build such an amazing aircraft?

Later in this episode *Sergio The Soaring Master* will join us to talk cross country soaring and turn points. Join us now for another soaring adventure now on E112 of *Soaring The Sky*.

Resources

- ***Soaring the Sky*** (home) — From the website: "*Soaring the Sky* is an aviation podcast all about the adventures of flying sailplanes. Join host Chuck Fulton as he talks with other aviators around the globe. You never know who the next guest will be on *Soaring the Sky*." You can also find the show on **Instagram**, **Facebook** and **Twitter**.
- ***Akaflieg Karlsruhe AK-X*** (home) — From the website: "Since October 2010, we have been working on the AK-X project, the development of a novel all-wing glider. Conventional concepts have been extensively researched and iteratively improved by manufacturers and Akafliegs in recent years. With the design and development of a single-wing glider, Akaflieg Karlsruhe is pursuing an unconventional idea with great potential." (translation: Apple Safari)

Subscribe to the *Soaring the Sky* podcast on these preferred distribution services:

- ***Podbean***
- ***Apple Podcasts***

The AK-X 1:2 model at the AERO 2015 in Friedrichshafen. (credit: Akaflieg Karlsruhe)

Chuck Fulton is a glider pilot from the Mid-Atlantic who fell in love with soaring like many after his first flight. Soon he was bringing his friends to the glider port to share this great sport. Chuck wanted to share it with as many people as he could and found it hard to believe so many people were not aware of soaring. With a background in broadcasting, he was looking at podcasts only to find there was little to be found on soaring. After lots of thought and planning, he launched the first episode of the podcast Soaring the Sky. *Since then the podcast has had many great guests from all over the globe with some amazing stories and journeys soaring the sky.*

*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**.*

Letter from the Vintage Glider Club

Some excellent inspiration for your next 1:1 scale project.

Andrew Jarvis

"Your readers will also be interested in this cutie — *the BG-135*. BG Stands for Birmingham Guild (not British Glider?) and I think 135 must be the span."

We are pleased to have as our friends the Vintage Glider Club*, which is based out of Basingstoke in the UK. We're honoured to receive the occasional, informal but always entertaining update on activities. In turn, we like to pass them along to readers. And, yes, we are officially predicting quite a few scale* BG-135*s at next season's meets! — Ed.*

Hello RCSD Readers!

First, about my K-14 (G-AWVV — though the letters haven't even been put on yet) *might* be finished this year. Not sure. However, there are two more flying, in the UK. I am familiar with David Shrimpton's example — G-BSIY. It was covered in *Pilot* magazine about three years ago. The other one, I fear I can't remember even the registration.

I'm just back from the UK National Rally of the VGC, at a lovely site called *The Park*, in Wiltshire. The attendance was thin, and I think that's a shame. [RCSD contributor] Chris Williams did put in a cameo appearance, with two mates, but without any models. Oh well — it's a start.

Justin Wills was there with his Rhonbussard. He did a great flight of 125 kms I think.

Your readers will also be interested in this cutie — *the BG-135*. BG Stands for Birmingham Guild (not British Glider?) and I think 135 must be the span. It looks so like the *Fauvette*. I owned one of those, even in the same colour

scheme, from 1997–2003. My *Fauvette* is now owned by Jurgen Doppelbauer who adores it; it's painted in rather vivid green and yellow — fuselage and wings, respectively.

I had a flight in the *BG-135*. Flies beautifully of course. Only a few were built — such a shame. It then morphed into the Swales, which had a t-tail and I think 15 metre span. The trouble was, German gliders were available off the shelf, and only a die-hard Brit-o-phile would have bought one of these home-grown products.

For the rally, our Slingsby *T.21* (1950's silver/yellow, WJ306) was aerotowed by this handsome *Chipmunk*, from Middle Wallop, which is the Army flying centre in Wiltshire.

I hope these snippets are of interest. Best wishes and until next time,

Resources

- ***Vintage Glider Club*** — From the website: "The Vintage Glider Club (VGC) was founded in 1973 by vintage glider enthusiasts under the vision of Chris Wills…The club's objective was and still is to maintain and preserve the rich gliding history of yesteryear and to ensure that the machines which charted the path of gliding history will still be here for the next generation to experience and enjoy…"
- ***The Park*** — Listing from the *Airfields of Britain Conservation Trust* website.

Andrew Jarvis is the President of the Vintage Glider Club. All images provided 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****.*

Stamps That Tell a Story

We kick off our regular series on glider-related aerophilately.

Simine Short

The Otto Lilienthal commemorative stamp issued by the Deutsche Bundespost in 1978. On the right is the 1895 photo on which the design of the stamp was based. (credit: heureka-stories.de / Otto Lilienthal Museum)

Simine Short has a special interest in aviation postage stamps, but is especially interested in those representing motorless flight. Each month she has promised to tell us a little of the background behind some of the favourites in her collection. Sometimes it will be a story about the stamp, or perhaps the history of the glider shown. She says that unlike her husband Jim she isn't a glider pilot but feels very comfortable in a cockpit, though not as a solo pilot. Doug Lamont, the legendary Editor of Soaring *way back in*

the 1970s and 80s, called Simine a 'paper pilot' because, as he wrote in the March 1981 issue of the magazine, "not all soaring history is kept in books, and not every pilot flies in a cockpit". She promises that this will be a fun to read column which will encourage readers to send in their contributions, as Simine explains below. — Ed.

There are many ways to collect stamps and many kinds to collect. Everybody chooses according to his/her own taste (and pocket-book). I collect postage stamps showing gliders, model gliders, images with air currents and clouds, or aviation pioneers with some connection to soaring. One can easily include stamps showing soaring birds and mythical gods soaring or even gliding sites.

As of today, there are about 800 gliding/soaring postage stamps and postal stationary pieces issued by about 105 countries.

To get you, the [RC] soaring pilot, started on a different approach to having fun with our sport, each month I will show you a picture of a stamp with a short story, giving not only the basic information (which country issued the stamp and the date) but also some of its background, because each of these small pieces of paper can tell us something. The stamps being featured over the next months will depict:

- One of the many aviation pioneers from the last turn of the century, thus it will be a little educational.
- High performance machines from days long gone.
- High performance sailplanes which you may have flown recently.
- There may be some political stories of how the postage stamps came to exist.
- Stamps showing a pilot who has many glider stories to tell, some of which will be passed along to you.

- Or the stamp may show something special to you, the reader.

We will start with some of the stamps used for the *Mail Box* heading in the *Motorgliding International* magazine, published in 1998/99. The goal is a two-way sharing of information. I will tell what I know, but then you, the reader, may wish to respond with some of your stories about this same stamp. Perhaps you will have flown a particular ship being featured; flown over the same area shown on the stamp or there may be other intriguing details you would be happy to tell us about. *(Please post your contributions in the* Responses *section below. — Ed.)*

We will make this a fun to read and fun to write series, hopefully bringing out new information. To whet your appetite, I will start this series with a stamp that honours one of the seminal gliding pioneers to whom many, including the Wright Brothers, acknowledge as influential on their own thinking:

Otto Lilienthal

This stamp was issued in Berlin, Germany, on April 13, 1978, called Aviation Pioneer Otto Lilienthal and designed by Fritz Haase of Bremen.

In 1978, the Deutsche Bundespost started a new semi-postal ‘For the Youth’ stamp series. The theme was the development of aviation in Germany. The four-stamp set, issued in Berlin, was in conjunction with the 130th birthday of Otto Lilienthal who did most of his flying experiments in Berlin-Lichterfelde in the early 1890s.

The stamp’s design was adopted from this photo showing Lilienthal in the Vorflügelapparat taking off from his Fliegeberg (take-off hill). It was taken by Dr Richard Neuhauss on May 29, 1895. Image No. OLM F0113LF is available through the Otto Lilienthal Museum, Anklam, or their website.

There have been some misprints of the stamp with 40Pfg omitted.

For more than twenty years, Otto Lilienthal and his brother Gustav studied aerial navigation by watching the way birds flew. After many experiments with flat wings or plane surfaces, Otto became convinced that it was the gentle parabolic curve of the wing which enables a bird to sustain itself without apparent effort in the air, and even to soar, without moving the wings, against the wind.

Resources

- ***Lilienthal, eine Biographie***, by Werner Schwipps, published by Arani-Verlag, Berlin in 1979.
- ***Moedebecks Taschenbuch zum praktischen Gebrauch für Flugtechniker und Luftschiffer***, by Hermann W. L. Moedebeck, published in 1906.
- ***Pocket-Book of Aeronautics***, by Hermann W. L. Moedebeck, published by Whittaker&Co, London in 1907.
- *100th Anniversary of Human Flight, Otto Lilienthal, history, postmarks and stamps* by Simine Short. ***Airpost Journal***, Vol. 62 №7, July 1991.
- ***Glider Mail: an Aerophilatelic Handbook*** by Simine Short and Dan Barber.
- ***Otto Lilienthal Museum*** — From the website: "In 1891, the civil engineer Otto Lilienthal (Germany) succeeded in achieving the first safe, multiple gliding flights in history. Lilienthal's experiments and his scientific approach were adopted by the Wright Brothers…in their quest to develop a controllable, self-propelled flying machine."
- *The Flying Man, Otto Lilienthal's Flying Machine* by Vernon, published in McClure's magazine, September 1894.

- *Otto Lilienthals Luftfahrtkonstruktionen auf Briefmarken und in postalischen Stempeln — Motivbestimmungen nach neuestem Stand* by Manfred Neumann, Luftfahrt, Vol. 25 №4, December 2001.

This article first appeared in the February, 2002 issue of Gliding *magazine. Simine Short is an aviation researcher and historian. She has written more than 150 articles on the history of motorless flight and is published in several countries around the world as well as the United States. She is also the editor of the* Bungee Cord*, the quarterly publication of the Vintage Sailplane Association.*

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 VII: kV and How Not to Burn Out a Motor

Peter Scott

Topmodel CZ's elegant Sailplane Power Pod Launching System. You'll definitely want to avoid burning it up with a faulty combination of motor, propellor and battery. (credit: Topmodel CZ)

Electricity is by its nature more complicated than liquid fuel. The former simply has energy per litre or kilogram. Electricity has three quantities — voltage, current and resistance — all of which interact. When flying electric, one key decision is what propellor to use. I discovered to my cost (literally) how easy it is to make a mistake. I'll describe it later so you don't blunder in the same way.

However from conversations on the field I think people are still not clear about a number that they see in motor specifications. Yes, it's kV. Properly

used it means kilovolts, which probably accounts for some of the confusion, because it feels as though it ought to be to do with energy or power. It is not. The symbol kV has nothing to do with either. More later.

What Do We Want?

Two things. First we want as much power out of our motor as we can get. Secondly we do not want to increase current so much that we break the motor. Electrical things are best run at a bit less than their rated maximum. The big difference between electric motors and internal combustion (IC) engines is that the latter have a natural maximum power that they cannot exceed. Electric motors try to be helpful so they just keep on going like lemmings.

The Science Bit

Propellors are rotating wings. They have two main dimensions — diameter and pitch. Pitch is the theoretical distance the prop moves forward in one revolution. Motors make thrust by speeding up air. As the propellor pushes the air, the air pushes the propellor. Remember Newton's Third Law? 'When you push something it pushes back.' The key factors for propellors are the mass of the air speeded up and by how much and how rapidly it is speeded up. Remember F = ma? A bigger prop has a bigger area so speeds up a bigger mass. A larger pitch pushes the air further in one revolution so the air goes faster. So a big prop imposes a larger load on the motor, especially a prop with a large pitch, and the current has to rise to increase the power.

Prop Geometry

A prop blade has an aerofoil. You can see it if you look at a broken blade. Not got one? Borrow one of mine or look at Figure 1 later in the article. As it turns

it cuts the air. When static the angle of incidence is effectively the angle of the prop blade, which is about 12°, so it is stalled and very inefficient. When moving through the air the prop's angle to the air will drop almost to zero. In theory then, if you measure the angle of the blade, simple geometry should tell you the pitch. For each revolution the tip of the propellor travels in a spiral through the air. Apparently a good propellor has about 85% efficiency.

kV — At Last!

As the voltage supplied to a motor rises so do the revolutions per minute (RPM). Each motor has a rating called kV. It means the number of thousands (k) of RPM that the motor naturally rotates at for each volt (V) you give it. It would be clearer if it was written k/V. A 500kV motor will turn at 5,000 RPM on 10V and 15,000 RPM at 30V.

A battery with fewer cells and hence lower voltage will produce a lower speed, so needs a larger prop to push the same mass of air. If you use the same large prop running at high speed on a battery with more cells it will demand more power from the motor, and hence current. This might well cause the current to rise beyond the motor's rating. So the higher the voltage the smaller the prop. That is counter-intuitive, but unlike the power limit caused by a fuel's energy density and the upper limit of oxygen going into a carburretor's throat, our batteries will supply pretty much as much current as we could ever demand.

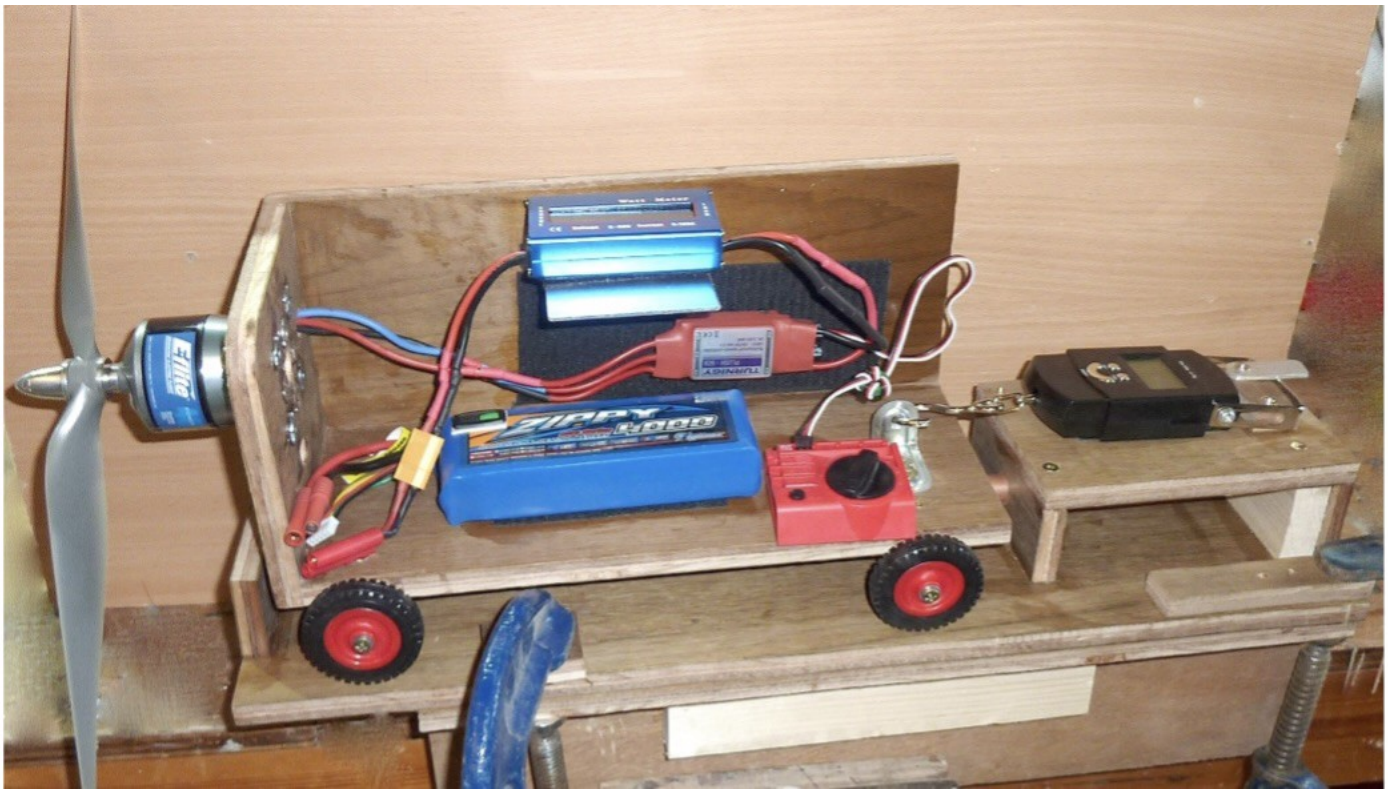
An example will help. Suppose we have an electric motor with a rating of 1,200kV:

- On a fully charged 3S battery of about 12.6V this turns at `12.6 x 1200 = 15120 RPM`
- On a 4S of 16.8V this changes to `16.8 x 1200 = 20160 RPM`

- On a 6S of 25.2V it's 30,240 RPM! Now that would howl.

How Did I Blunder?

I have built a test rig for motors using an excellent design by Martin Phillips in the April 2016 edition of the UK *Radio Control Models and Electronics* magazine (Picture 1). This allows me to measure thrust against power and various other data for different motors and props. To start with I used a light detecting tachometer and the setup in the picture, though I have now switched to a FrSky receiver and Neuron ESC.



Picture 1: Test rig for motors employing the Martin Phillips design featured in RCM&E. (credit: Peter Scott)

I decided to test out a new 4Max 5065 motor. I opted for two 4S batteries in series and an 18 x 10 wood prop. All went well until I went above 1,500W. The motor speed was still around 3,000 RPM but the thrust was enormous at 5.5kg. Alarm bells should have been ringing in my brain. But they weren't and as I increased the power to 2,000W, and the thrust approached 7kg,

suddenly the motor stopped. I checked the batteries and the ESC was cool but then I noticed the smell. You probably know that burning electric smell. The motor wasn't very hot but I let it cool down and tried the throttle stick again. No, it was dead.

So What Did I Learn?

- With a higher voltage you need a smaller propellor, very likely smaller than you expect. The smaller area is compensated by the higher rotation speed. It is probably best to go at least one inch smaller than specified for the first try.
- Work out the maximum power the motor will stand. This will be the specified maximum current multiplied by the maximum battery voltage. Do not exceed it.
- Do a trial run gradually moving up to full throttle and watch the current reading. If it rises above the rated maximum, immediately throttle down and reduce the prop size or pitch. As you test, continue to check the current on the watt meter.
- Motors with a high kV rating are intended for lower voltage batteries with fewer cells. For example stick to 3S for kVs over 1,000.
- If you are using batteries with a high cell count and voltage, use a motor with a kV in the low hundreds.

If you plan to use full throttle for much of your flight, the prop must have a diameter and pitch that results in a current maybe 10% less than the rated maximum. If you only use full throttle for a few seconds at a time you could go up to the maximum. I later calculated that at 2,000W my poor motor was drawing 76A. The ten second maximum for the motor was 58A so no wonder it gave up trying. The ESC was a high voltage one rated at 120/140A. Ironically a lower current ESC might have shut down and saved the motor.

And What's the Final Message?

If you decide to power a motor with a higher voltage battery, say going from 3S to 4S, fit a smaller propellor. Then the motor can turn at a higher speed. If you don't you will waste energy through heating the motor, or at worst burn out the motor or ESC.

Propellors and Load Factor

Except for scale powered models, propellors are always two bladed. There is a good reason for this. The fewer the blades the better the efficiency. Apparently a single blade, balanced with a weight is best of all. However we mostly settle for two. A few scale model gliders use three-bladers.

Let us look at an example. Powered scale aircraft often have three, four or more blades to reduce the diameter and improve ground clearance. I am building a DH *Mosquito* that has three-bladers. Fortunately designer Tony Nijhuis did the sums for the one-ninth machine that I am building. However if I can fly that, I am going to build a one-fifth scale one. So of course the question is how heavy and what motors? I guess somewhere between 15 and 20kg. I tend to build light so I think top of the range 4Max motors should be powerful enough. The specified propellor for the 4Max PO-6366–230 on 10S lipos is 20 x 10. What I needed to know was what three-blader would be equivalent.

Calculating Load Factor

It turns out that you need to calculate something called 'Load Factor'. This is a measure of the load the prop puts on the motor or engine. It isn't a real quantity but just a number to allow comparisons.

I like Master Airscrew propellors so decided to see if their largest prop would

do. Please excuse the use of ancient imperial dimensions. Props are usually specified in inches and I find propellor conversions to metric prone to error.

The formula is load factor is $LF = d^3 \times p \times (n-1)^{-2}$

where d is diameter, p is pitch, and n is the number of blades. D and p can be imperial or metric. As you can see it won't work for a single blade prop.

For the specified 20 x 10 two-blader:

$LF = 20^3 \times 10 \times 1 = 80000$

To give the same LF the diameter of the three-blader should be:

$LF = (80000/(10 \times 2^{-2}))^{-3} = 17.8$”

The biggest three blade Master Airscrew prop is 16 x 10:

$LF = 16^3 \times 10 \times 2^{-2} = 40960 \times 1.414 = 58000$ (approx)

So in theory the 16″ prop is too light a load. However Master Airscrew (MA) blades are wide so hopefully impose a greater load. MA don't make a larger propellor so I will have to use it. Using my motor tester, I will test the 16 x10 on the 4Max motor using two 4S lipos in series to find the thrust, RPM and power. I want to get the thrust to around 6kg on each motor if possible. I can go up to two 5S lipos if necessary.

Propellors Unloading in the Air

Intuitively we think that when a motor is turning a propellor static on the ground it uses more power than when it is flying. In fact at high speed some parts of the prop might be stalled and turbulent. The reduction in power needed when flying we normally call 'unloading'. However I have seen no

data about it. When I started using FrSky Neuron ESCs I was able to make the comparison.

To test I ran at full throttle on the ground and in the air. I put `EscA (current)` and `EscA+ (maximum current)` on the transmitter screen. This allowed me to read the actual current EscA on the ground at full throttle and maximum current `EscA+` in the air. In the same way I measured RPM using `EscR (RPM)` and `EscR+ (maximum RPM)`. I reset the telemetry before take-off. These were the results:

Full Throttle	Static	In The Air
EscA and +	55A	48A
EscR and +	9,320	9,974

Thus you see that in the air the power load the propellor is placing on the motor is about 87% of the value on the ground and RPM in the air was 7% higher. Other data: taxiing 12–20A; cruising at half throttle 20–30A

Finding the Pitch of a Propellor

Two things sparked my wish to know more about propellors:

- For my indoor lightweights I make prop blades that plug into a tissue-tube hub. This means that they are easily replaced but it is tricky to get both props equally set. This means the model sometimes vibrates and I am sure that I could get longer flight times with a bigger pitch. So I wanted to know how to make a jig.

- The second was chatting to a club member who flies 3D behemoths with enormous props. He was talking about fitting an even larger prop than the twenty-something inch one on the model. I think he told me that the pitch would be 18 inches. I wondered why the pitch was so large.

What Do You Do If You Have a Prop with No, or Indistinct, Markings?

At radius `r` on the prop the following measurements are made:

- Width of the blade `W`
- Difference in height of leading edge `h1` and trailing edge `h2`, measured from a flat surface.
- The tangent `T` of the angle of attack is `(h1 – h2) / W`

The circumference of the path of the measurement point is found:

- `Circumference = 2 x Ω x r`
- `Pitch = Circumference x T`
- `Pitch = 2 Ω r (h1 – h2) / W`

Picture 2: I marked the 75% point out from the centre. Here the diameter was 380mm. (credit: Peter Scott)

From the sites listed in the *Resources* section below:

> *"The reason we measure pitch at 75% of the diameter is two-fold. Generally, the pitch of a propellor is not completely constant, varying somewhat from hub to tip to optimize it for the different linear speeds at each point along the blade. The pitch at 75% corresponds roughly to the average effective pitch of the propellor. Secondly, the propellor is sufficiently wide at 75% to allow one to get reasonably accurate measurements of blade width and height.*
>
> *The angle of a blade changes as you move outwards because the outer parts of the prop are travelling further (circumference) so must have a lower angle to give the same pitch.*
>
> *To put it another way, propellor blades are twisted to change the blade angle in proportion to the differences in speed of rotation along the*

> *length of the propellor and thereby keep thrust more nearly equalized along this length. If the blades had the same geometric pitch throughout their lengths, at cruise speed the portions near the hub could have negative angles of attack while the propellor tips would be stalled." Put yet another way, "propellors operate most efficiently when the aoa [angle of attack] at each blade station is consistent (and, for propellor efficiency, that giving the best lift drag ratio) over most of the blade, so a twist is built into the blades to achieve a more or less uniform aoa."*

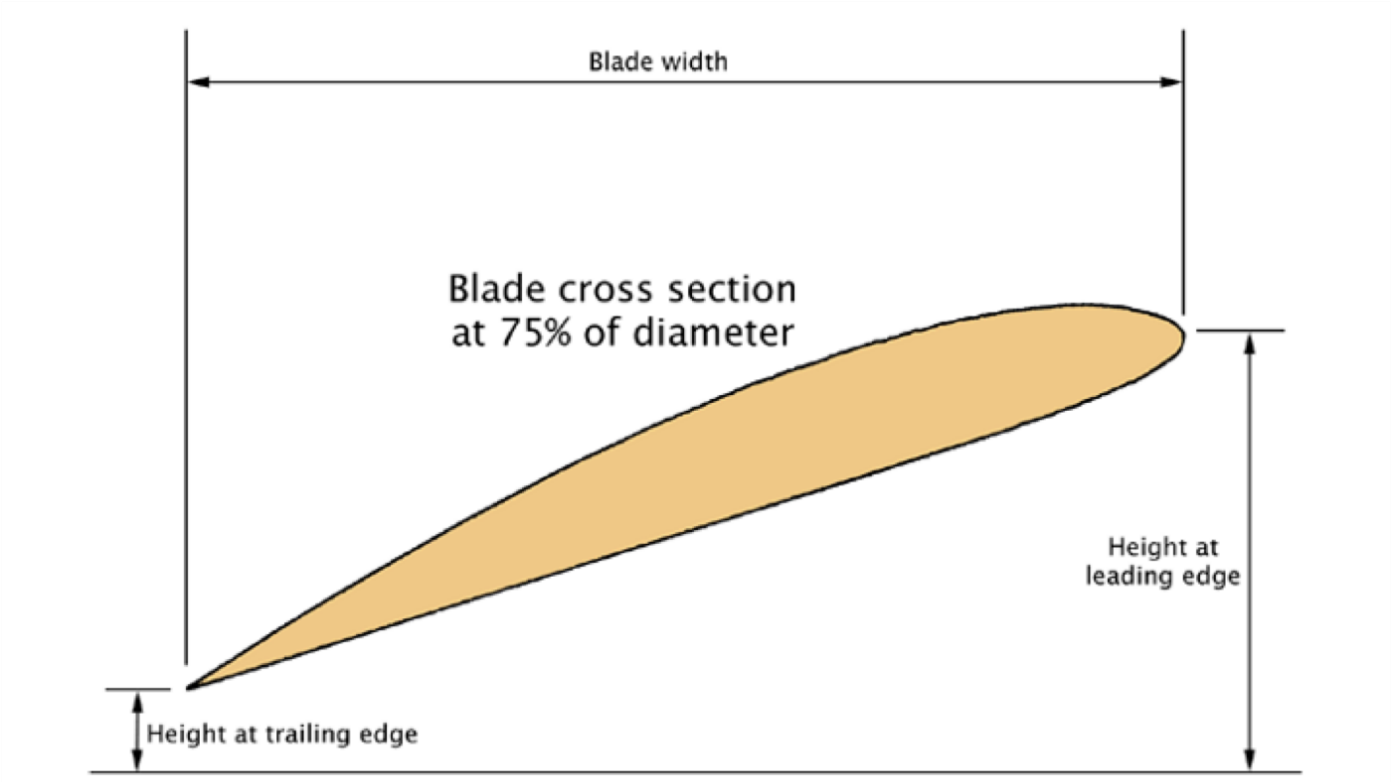


Figure 1. (credit: *Sailplane & Electric Modeler Magazine*)

I gave the maths a practical test:

- I used a fairly large prop to make measurement easier. (Picture 2)
- I covered the markings so I couldn't know the answer.
- I marked the 75% point out from the centre. Here the diameter was 380mm.
- I held the prop firmly down on a flat surface.

- I measured the heights of the centres of the leading and trailing edges (see Figure 1): rear, 4.5mm; front, 12.5mm; difference, 8mm.
- The blade width viewed from above, 36 mm
- So the tangent of the blade angle is `8 / 36 = 0.22`
- So the pitch should be circumference x 0.22
- `Circumference = Ω x d = 3.142 x 380 = 1194mm`
- `Pitch = 1194 x 0.22 = 265mm`
- In mediaeval units this is 10.5″
- And what was the marked pitch? 10″.
- Considering the systematic errors in measurements (+/- 0.5mm) this is pretty good.
- QED

So What Are the Answers to What Started All This?

To build a jig I must decide on a prop diameter. Then I must decide on a pitch. Then I settle on a prop width at 75%. Then I calculate the angle needed. Then I make a card jig. Done!

Why was the pitch so big on the big prop? Because as the diameter goes up a prop with the same angles will automatically give a larger pitch because the circumference is bigger. A given geometry will give a 200mm pitch on a 300 mm prop and a 400mm pitch on a 600mm one. The performance will be the same. So if you have a small and a large prop with exactly the same angles of attack the larger one will have a larger pitch.

On one site I had asymmetric blade factor explained. This occurs during takeoff. The propellor disk is tilted so the top is further back. This means that, as it starts to move forwards, until the tail lifts the downward moving blade has a larger angle of incidence and produces greater force. With conventional rotation this means the aircraft will turn to the left.

For an explanation of the various upsetting forces due to the engine and prop (torque reaction from engine and propellor, corkscrewing effect of the slipstream, gyroscopic action of the propellor, asymmetric loading of the propellor or 'P factor') go to *Propellor Aerodynamics* article linked in the *Resources* section below.

Thanks for reading and see you next time!

Resources

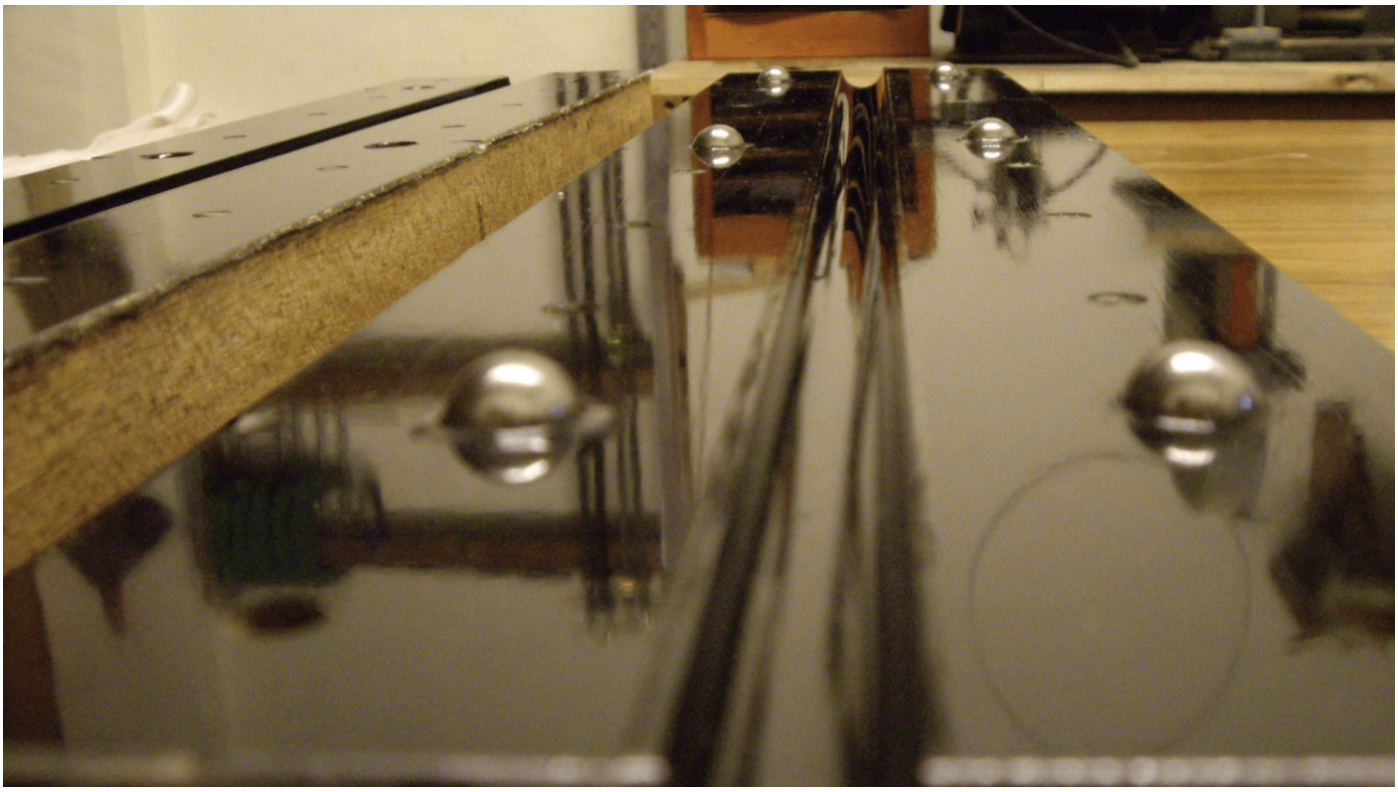
- ***Sailplane Power Pod Launching System*** — From the Topmodel CZ website: "Introducing our brand new electric Power Pod Launching systems. These high quality units allow you to reach optimal thermal hunting altitudes…"
- ***Propellor Aerodynamics*** — From the *Free Online Private Pilot Ground Ground School*: "The airplane propeller consists of two or more blades and a central hub to which the blades are attached. Each blade of an airplane propeller is essentially a rotating wing…"
- ***Propellor Basics*** — Originally published in the March, 2002 issue of *Sailplane & Electric Modeler Magazine*: "The majority of powered model airplanes use a propeller as part of their power system…"
- ***Propellers*** — From the *PilotFriend* website: "Propellers may be classified as to whether the blade pitch is fixed or variable. The demands on the propeller differ according to circumstances…"

*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 VII: We Finish Both Sides of the Fuselage and Nosecone Moulds

James Hammond



The boom mould just after opening — note this time I DID use coloured gelcoat.

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

First, a Few Notes on Finishing off the Moulds before Opening

It's time to trim all those nasty needle-sharp glass edges off the new mould.

There are several ways to do this, ranging from a simple hacksaw, through filing to using a hand angle grinder. Use the way that is best for the place and the equipment you have, but please do be very careful — those super sharp glass shards projecting from the edges of your mould can lacerate your skin in a heartbeat. Please do wear stout working gloves!

Finally! After all that hard and careful work, it's time to see the fruits of our labours, as shown above.

Opening the Moulds

First, put the mould on its edge, seam up, and take a good look at the mating edges of the lands. If you look carefully you should be able to see a microscopic line where the two halves of the mould mate. Take time to try to find it if it's not obvious at first. After locating the joint, take a box cutter knife and gently work the blade down into the line between the two halves of the mould. Don't push too hard but try to wiggle it in a little way. If the mould does not separate immediately, have patience and try the same thing at several points around the circumference. By now — especially if you opted to use PVA release as an insurance — it's likely that one half of the mould has separated and the plug is still embedded in the other half. Tug the plug out of the other half of the mould — it should come out quite easily — and then sit back to admire your work.

Mould Not Cooperating?

If the mould still refuses to separate, then a little more 'persuasion' might be in order. Using a mallet (not a hammer!) tap the tip of a screwdriver into the mould seam. A couple of light taps should be enough to part the mould. But if it's **still** being difficult you can gently tap several screwdrivers (or thick bladed table knives — but I didn't tell you that) into the seam to provide more

pressure. If that does not do the trick then you have a stuck plug and only agricultural methods can be used to recover the mould, but it's likely the plug will be damaged or destroyed in the process.

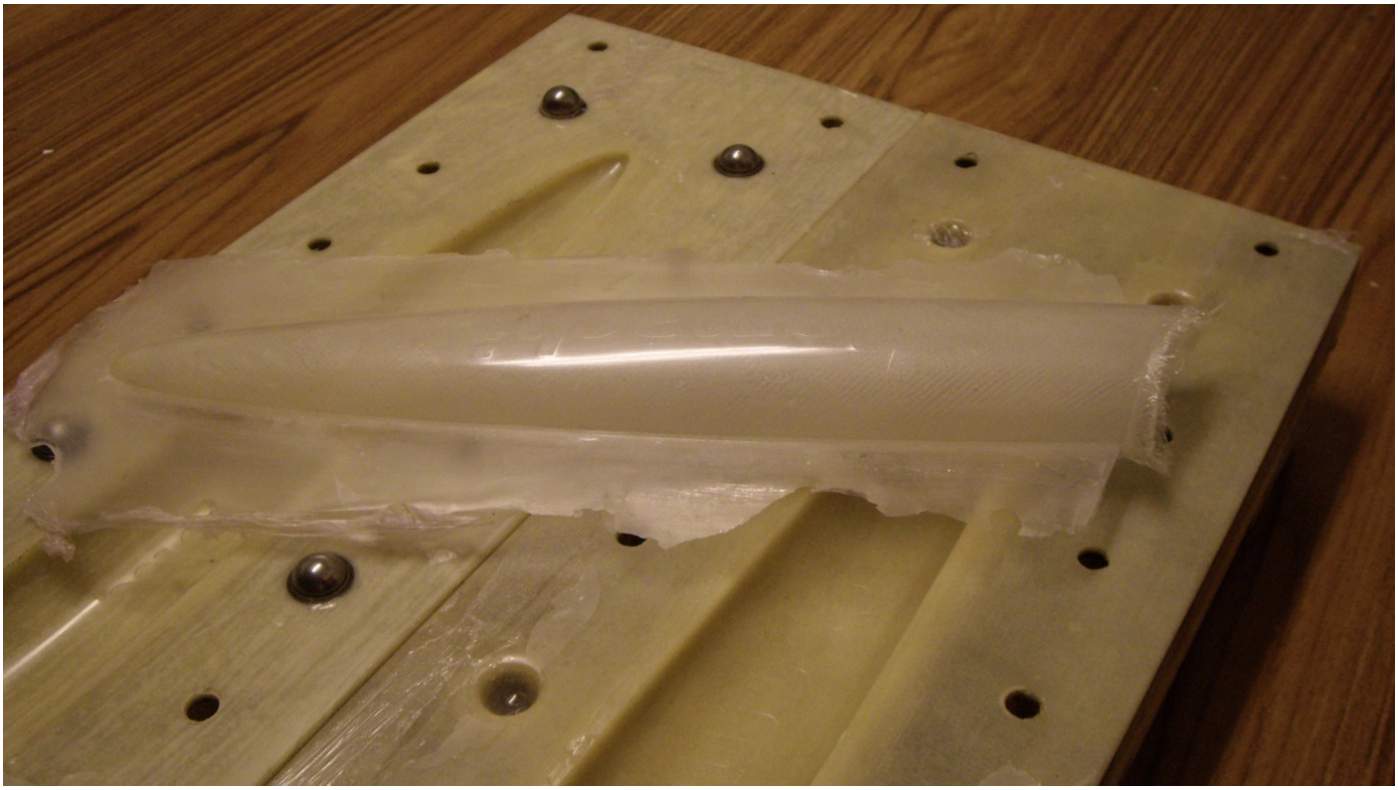
Time to make more progress on our fuselage moulding project. Assuming you have been diligently beavering away and now have the first sides of the nose cone finished, you should be seeing something like this:

Nosecone mould, untrimmed — note the needle-sharp glass fibres.

I use an electric hand grinder to remove my sharp mould edges, but I do it outside in the open air, well away from anybody and always wearing a good quality mask and Kevlar gloves. Saw, file, or grind the exposed glass edges back to the wood reinforcement and please do make sure there are absolutely no sharp edges.

Mould Clamping

The mould needs to be clamped shut for joining after laying up the part; and as usual there are several ways to do this. When I made the Shinobi mould set, I opted to use captive nuts and countersunk screws — why? Because I had a box of them left over from another project, and I also have an air screwdriver and no other reason! In fact, using G-clamps, C-clamps or other types of linear clamping systems are adequate and might be better than a bunch of fiddly screws. As I found to my dismay, sometimes epoxy gets on the screws and if you have forgotten to wax them, you can end up with a troublesome bind up.



Here is a part freshly pulled from the mould. Note the finish on the moulded part transferred from the mould.

Cleaning and Polishing

First, it’s always a good idea to wash the inside of the mould with hot soapy water — especially if you have used PVA release agent which is water soluble. After that, dry the mould and then you can begin polishing.

To polish or not to polish? If you have used a proprietary gelcoat then the mould surface will be hard and non-porous and so it won't need, or may not even accept much polishing. But if you are like me and have made your own colloidal silica/epoxy gelcoat, then the mould would be better with a good polish for two reasons:

1. If we could look at the mould surface under an electron microscope — which incidentally I have done several times — the surface would appear to be quite uneven, maybe like a long series of peaky hills and valleys, but the problem is, those hills and valleys don't hold wax that well. What we need is more like the surface of a ploughed field, where the furrows hold the wax and the peaks provide minimum surface area in contact with the moulded part.
2. Rubbing the inside of the mould exposes any slight defects that you may have missed when you made the plug, as the surfaces are now all negative and in relief, rather than positive.

The other extreme: Redshift F3f model nose cone moulds CNC machined from Alcoa cast bar aluminium. But still hand-polished.

Using a soft block to wrap the paper around — I use a common rubber pencil eraser as these can be bought in small convenient sizes — and soapy water — I use a squirt of washing up liquid — rub the inside surfaces with 400 or 600 grit wet-and-dry evenly to a nice matt finish. Follow that with finer and finer grit paper 400–600–800–1000 until a nice low polish is achieved. Use

‘tools’ — I mean borrowed household items — if needed to get into those harder to reach places. Follow that with a nice rub down and then a buff with car paint restoring cream as the medium — I use ‘T-cut’ to give a high polish. A rotary linen mop in a low speed electric drill works well for this, or just good, old fashioned elbow grease. It’s amazing what you can do if you stick at it.

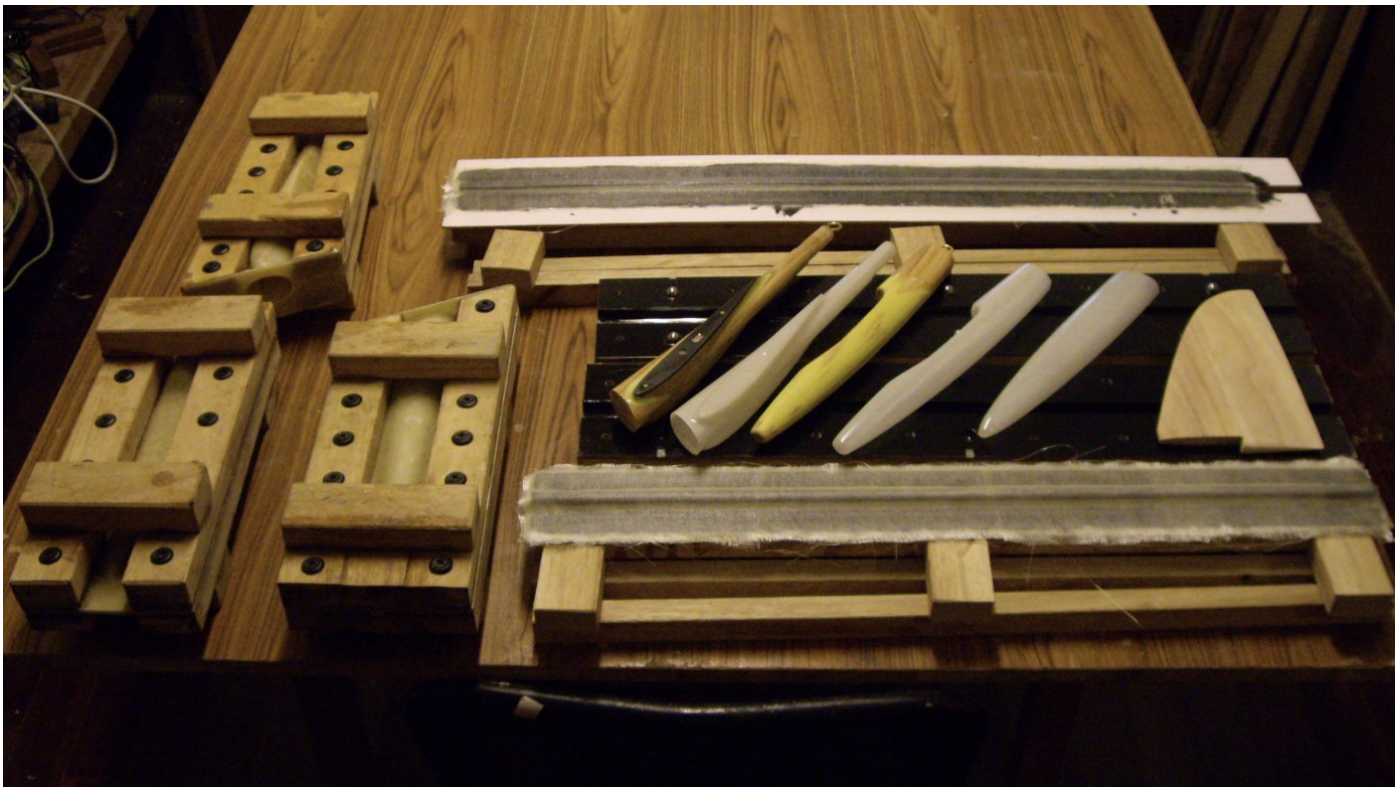
Here is a commercially available flexible sanding block. (credit: Konrad Dudek)

Note that there is no real point in trying for a glass-like mirror finish as the mould will have to be re-polished from time to time with a lot of use, also the actual mould surface finish will not transfer exactly to the surface of the part — but it will be close.

Preparing the Moulds for Use

There are a number of mould sealants on the market and some people swear by them providing a really hard glossy surface, however they do tend to be

expensive and of dubious use in home projects where just a few parts are likely to be moulded. I prefer rubbing the mould surface down with fine abrasive paper to a semi-polish and then a thorough polish and buffing to a good shine with cutting compounds. Incidentally metal polish often makes a really good cutting compound. Thorough cleaning with denatured alcohol and a few hours of drying will provide a microscopically scored surface that is highly receptive to mould release wax and will give the part to be made a really good finish. For the mould release wax, please do follow the manufacturer's simple instructions for use, and also do give the new moulds a few coats.



Here is the entire mould set finished or almost finished with some of the plugs and a couple of the moulded parts.

Next Time

In the eighth and final part of this series, we make the inner nosecone plug from the original nosecone — how it's done, along with a lot of useful tips and tricks.

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

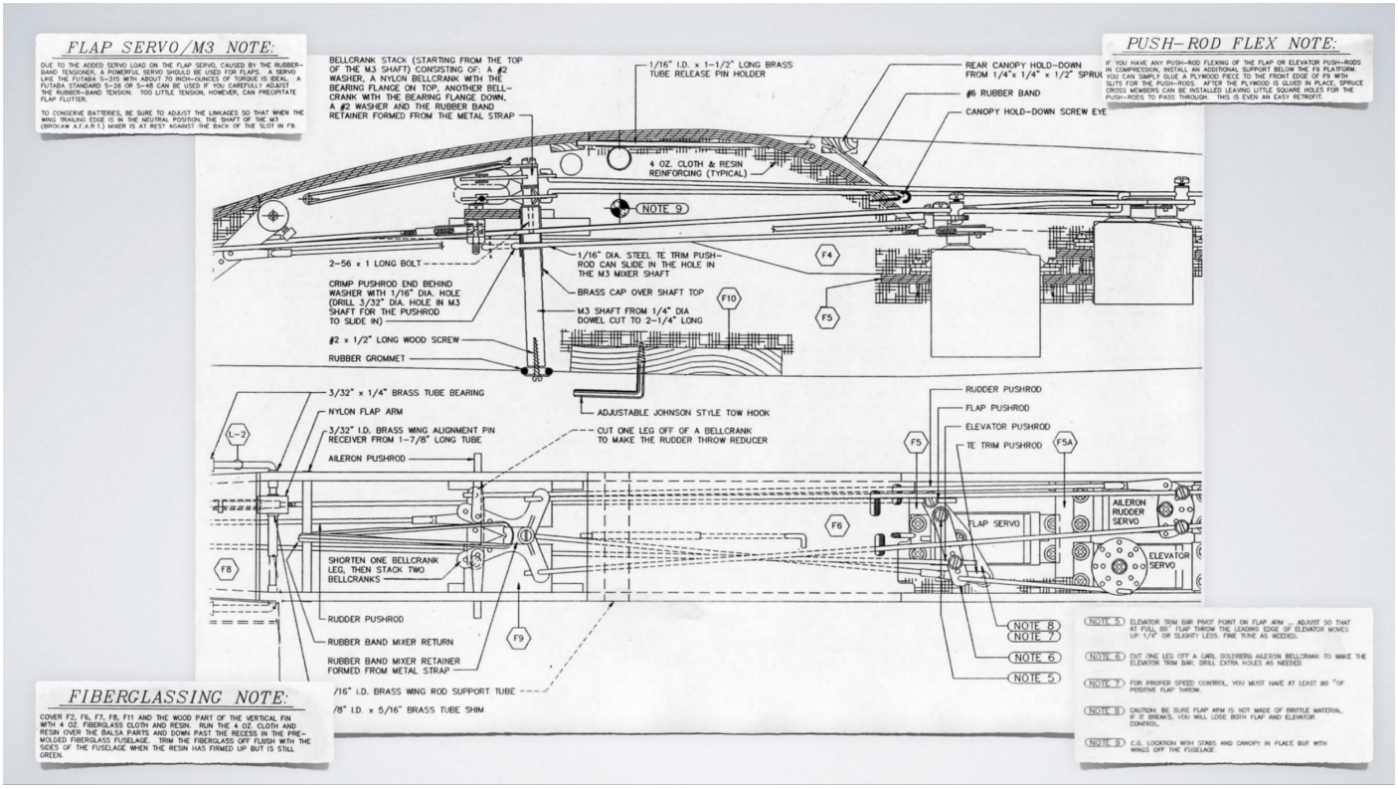
Thanks for reading and good luck with your project!

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

Automatic Flap — Aileron Reflex Trim

The complex yet ingenious control mixing linkages required before affordable computer radios were widely-available.

Bob Dodgson



One of the things we miss the most are these beautiful drawings — they were more like industrial works of art more suitable for framing than getting all covered with gluey fingerprint stains. (credit: Bob Dodgson)

The first mention of AFART was in №89–1 of Dodgson Designs' Second Wind *newsletter. This article from back in that era explains it's setup and use. It was a highly effective analogue solution in a simpler time before everything went 'software and servos'.— Ed.*

Dodgson Designs is thrilled to be able to offer our customers a new and most effective control innovation. It can be installed in *Lovesongs*,

Windsongs, *Camanos* and *Pixys* and it can easily be retrofitted into ones that are already built. This amazing mixer was designed by Gary Brokaw of Spokane, Washington, an innovative *Windsong* flyer.

We call this new device our *Automatic Flap — Aileron Reflex Trim* or simply AFART for short. Now for the first time, anyone can have full-span flap and aileron reflex on a single trim lever and with only three servos in the *Pixy*, *Camano*, *Lovesong* and *Windsong*. Aileron trim was not practical before, on the *Pixy* and *Camano*, due to the added weight of the extra servo and minimal space in the fuselage. Now it is easily accomplished and with nearly zero weight gain and with no increase in aileron slop.

The advantages of using AFART on the *Lovesong* and *Windsong* are simply that the weight of a one-and-a-half ounce servo can be saved and that you can reflex the flaps and ailerons simultaneously from a single trim lever, even with any simple transmitter. The disadvantages are that you may need an extra powerful servo on the flaps, such as a Futaba *S-31S*, to handle the added load and you will lose the spoiler function on the ailerons. The trade-off of the aileron spoiler function to achieve the single lever for trailing edge reflex trim is well worth while as the spoiler function is seldom used.

AFART consists of a simple 1 /4" hardwood dowel that is cut 2-1/4″ long for the *Camano* and *Pixy* and it is cut 2–3/4" long for the *Windsong*. It is capped with a brass tube 9/32" OD x 1" long. Secure the cap with *Zap* or epoxy. A 3/32" diameter hole is drilled through the cap and dowel at 3 /4" from the top, a 1/16″ diameter hole is drilled into the center of the top and is about 1/2" deep. A tiny pilot hole is punched into the bottom of the dowel for the 3/8" long screw. This dowel becomes the support for the two bellcranks that are normally used in our kits. The slot in W9 should be cut so that when the dowel is all the way to the rear of the slot, the bellcranks are in the same location that they were on our conventional installation, as shown on the

plans. A razor saw can be used for this task in a retrofit installation. The slot should also be cut a hair under sized so that it can be filed to a no slop fit, side-to-side, for the capped dowel. Locate the hole for the bottom screw so that it goes through the center of the fuselage at the point where the dowel is vertical, in the fuselage, when resting against the back of the slot. Make the hole just large enough so that you can install a very small rubber grommet in it.

Install the two bellcranks onto the top of the dowel, as shown on the back of this sheet, with the bearing flanges together in the center. Use a 2–56 flat washer both under the bottom bellcrank and on top of the top bell crank. Bend one end of the 1/4" wide x 5 /8" long metal strap (with holes at each end) to the shape shown for the rubber band retainer and install it on top of the bellcranks before inserting the 1" long bolt. Install the 1" long 2-56 bolt by screwing into the hole in the dowel top. Make it snug. (**NOTE**: you will probably want to install the aileron push rods onto the bellcranks, as the regular plans show, before securing the bellcranks to the dowel.)

Now put a washer on the 3 /8" screw and put the screw through the grommet in the fuselage bottom and screw it up into the small hole in the bottom of the dowel. Snug the screw up gently leaving enough play in the grommet so that the dowel can be pivoted forward in the slot about 1/4″. Make the AFART pushrod out of 1/16" music wire and crimp one end so that when you put the small washer, with a 1/16" diameter hole in it, the washer will not slide off the end. This type of washer is supplied with sets of Du-Bro *E-Z Links*, which you may need anyway to secure the aileron pushrods to the aileron servo arm. Cut the AFART pushrod to length so that the end washer is against the dowel (with the dowel against the back of the slot) and the flap servo is set at neutral flap. Solder the threaded coupler onto the servo end of the pushrod and screw on a metal ‘kwik link’. Put rubber bands as needed (or a spring) from the brass wing alignment pin tube extending to the rubber

band retainer on top of AFART. Adjust the transmitter flap trim or put a metal or wood stop where needed on the transmitter case, so that when the trim is thrown down the flaps are in perfect neutral and when the trim is thrown full up, the flaps are at the six degree negative position. Adjust the AFART pushrod so that the ailerons are not affected when positive flaps are used and when the flaps are in neutral. Set it so that when you move the trim lever up, to reflex the flaps, AFART is pulled forward just far enough to also reflex the ailerons six degrees like the flaps.

Better yet, install a 0–20k pot in your transmitter connected to a toggle switch between the flap trim pot center wire and one of the trim pot outside wires (which outside wire depends upon which direction on the stick that you have neutral flap at.) With this new switch installed, you can adjust the 0–20k pot to give the perfect throw for the six degree reflex, allowing you to simply flip the switch to toggle back and forth between reflex and neutral flap/ailerons without having to move the flap trim lever.

The tension on the rubber-band or spring should be adjusted so that when you put reasonable pressure on the ailerons, AFART does not shift forward at all. Yet you do not want so much force on the elastic device that the flap servo cannot readily move AFART, forward when told to do so. If the elastic tension is too slight, high speed aileron flutter could possibly occur. This could also occur as the result of a sloppy fit of the dowel in the slot. If the fit is too loose, shim the inside of the slot with 1/64" plywood or coats of glue, *Hot Stuff* etc . until the fit is snug. With a snug fit, AFART produces no more slop than the bellcranks do all by themselves without AFART.

Properly installed and adjusted, AFART should require no further service and should give precise neutral and reflex flap positions. Since the 90 degree flaps, with the built-in elevator trim compensation, are so unbelievably effective for landing, speed and glide-path control, *Lovesong* flyers find that

they rarely use the aileron spoiler function, provided with the fourth servo. The good flyers do, however, rely heavily on the performance edge that they can get by reflexing the entire trailing edge of the wing. Now, anyone can use even any cheap four or more channel radio and get full trailing edge reflex capability at one fingertip and with only three servos. All that is being given up is an extra servo and an additional trim lever to fool with, along with the aileron spoiler function that is not normally used much anyway.

> If you think that you can't get something for nothing you haven't tried AFART.

2022 Commentary

Only a handful of Dodgson Designs glider flyers bought the earliest computer radios before the AFART system came out. The new radios had just arrived and they cost about $700 and were quite complex to program.

Being able to get full function on my gliders with just a simple radio was a big deal — especially to be able to switch between minimum sink thermalling mode to higher speed cruising mode by simply moving one trim lever to reflex both the flaps and ailerons.

My gliders could do it all using regular bigger servos in the nose — they helped get the CG in the correct location and, significantly, kept the gliders lightweight which improved overall performance. Most Dodgson Designs glider flyers did not go to computer radios until the costs came down on the radios — there was no urgent need to.

My gliders could do it all using the supplied hardware. Thank you all for reading and happy flying!

Resources

- ***Du-Bro E/Z Links*** — Yes, you scan still get them! That said, almost everything else mentioned in this article is in permanent backorder status.
- ***The Dodgson Anthology*** — The complete works of Bob Dodgson as featured in the New RC Soaring Digest.

Are you a fan of the retro Dodgson Designs logo? Is so, you might want ***one of these*** *for your flying field attire. Otherwise, now read the* ***next article*** *in this issue, return to the* ***previous article*** *in this issue or go to the* ***table of contents****. A PDF version of this article, or the entire issue, is available* ***upon request****.*

Sanding Mops

This cost-saving alternative will let you clean up while you contour your fuselage.

Tom Broeski

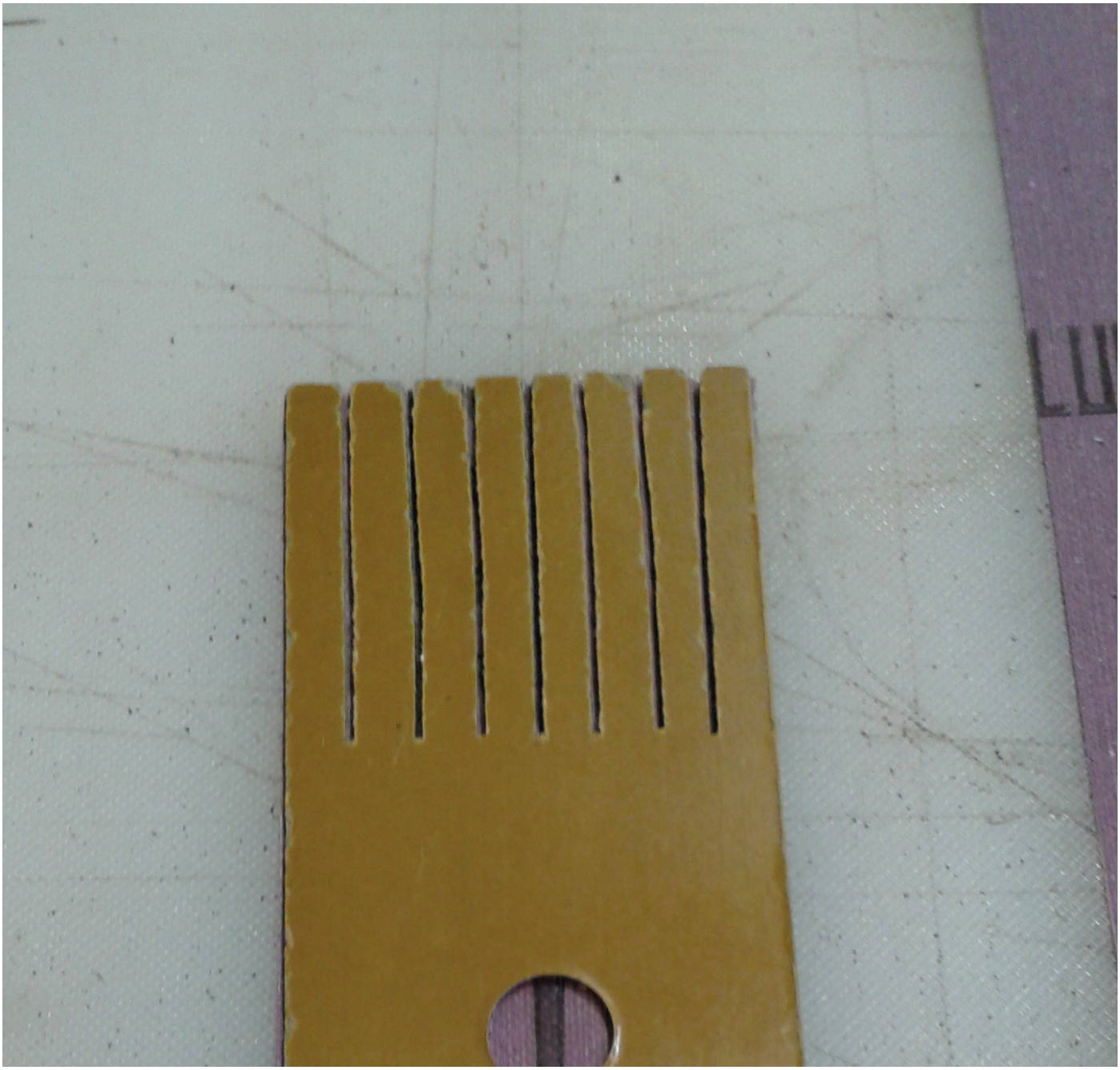
Over the years I've bought sanding mops from various places. My favorite is Klingspor's Woodworking shop. There is lots of information and a good video from them linked in the *Resources* section.

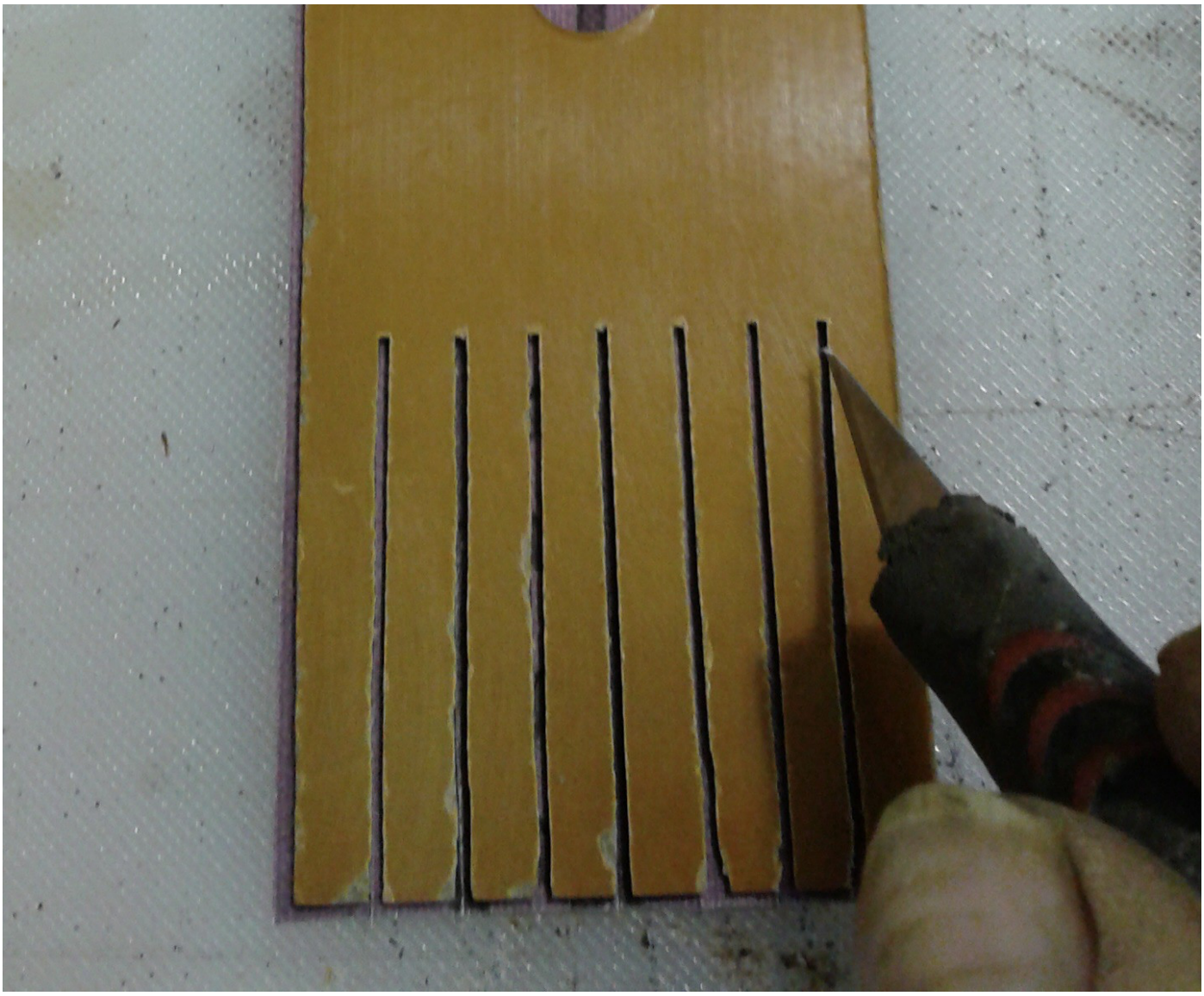
However, when I don't have time to wait, or I need a specific grit, I make my own with cut sandpaper. Normally, I cut 2" x 6" cloth pieces. Takes about 25 minutes to make and mount 48 sheets. Normal cost would be around $30 + shipping.

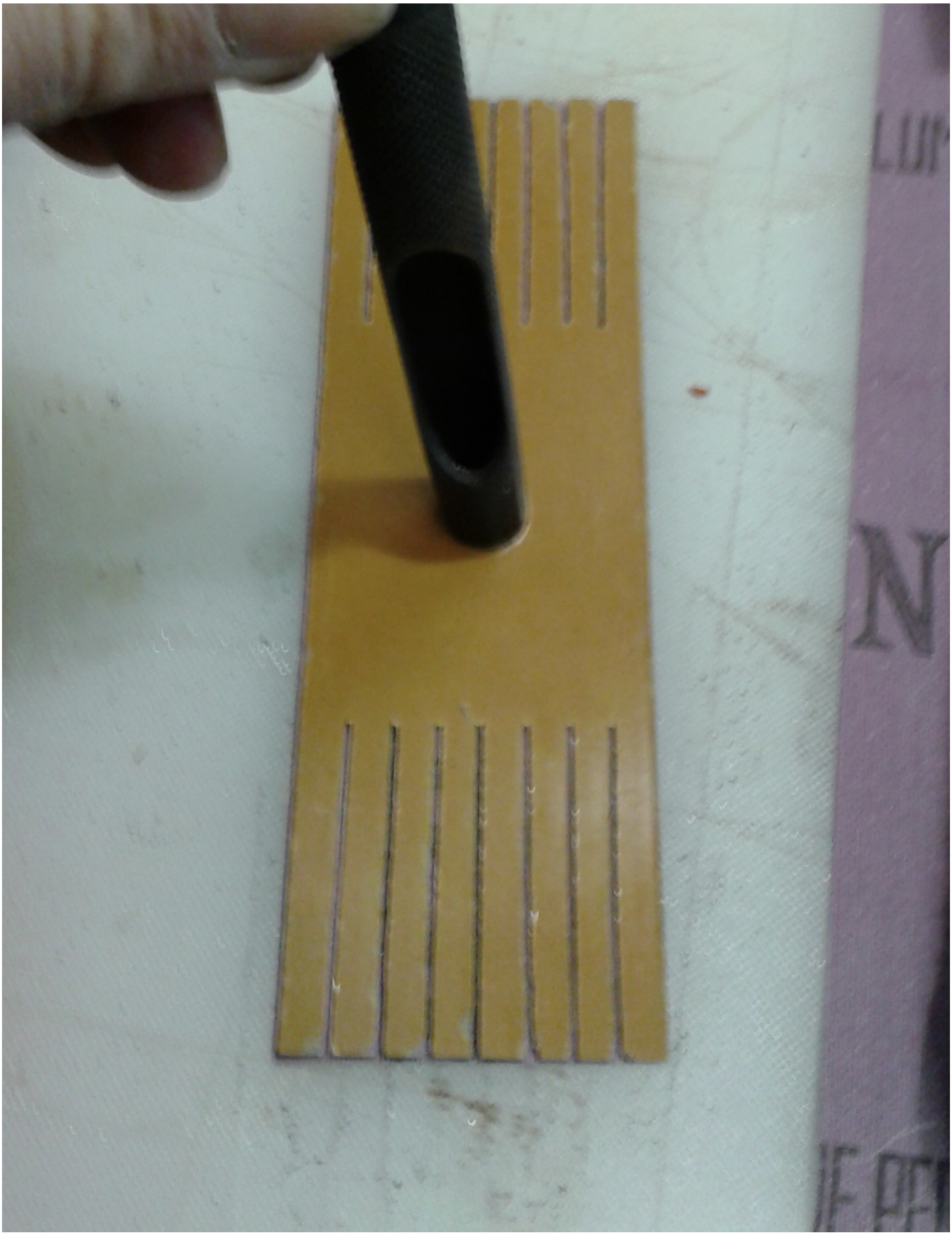
I made a simple template from some scrap phenolic sheet I had. Marked and

cut the slots and drilled a hole for the center. I get eight pieces from a 9" x 12" sheet.

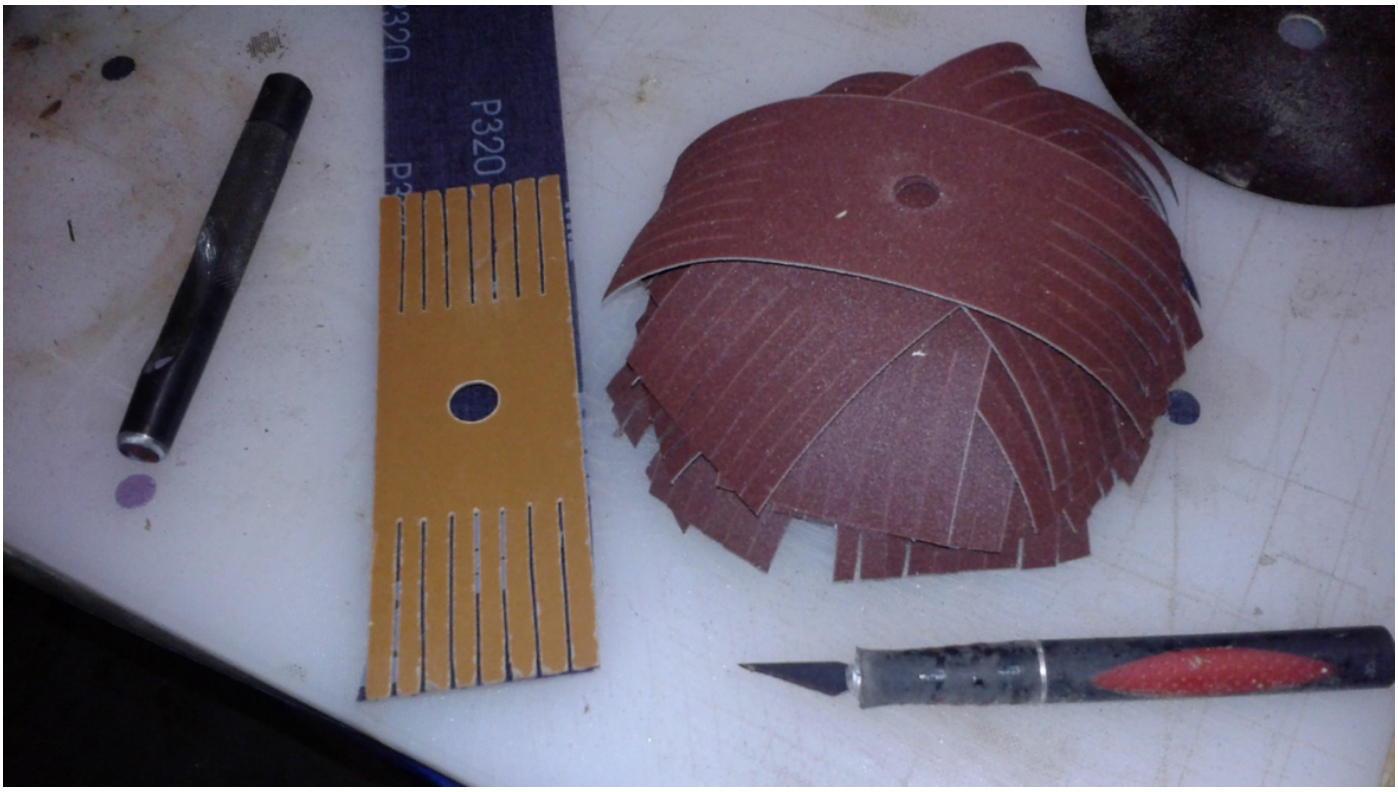
Slit the cloth. I have a bunch of slightly used blades from cutting covering material — I change blades often when cutting covering material. I get about eight pieces before I toss the blade. You can also make a couple passes on a diamond hone, but blades are pretty cheap, so I don't do that much anymore. Use a punch for the center hole.





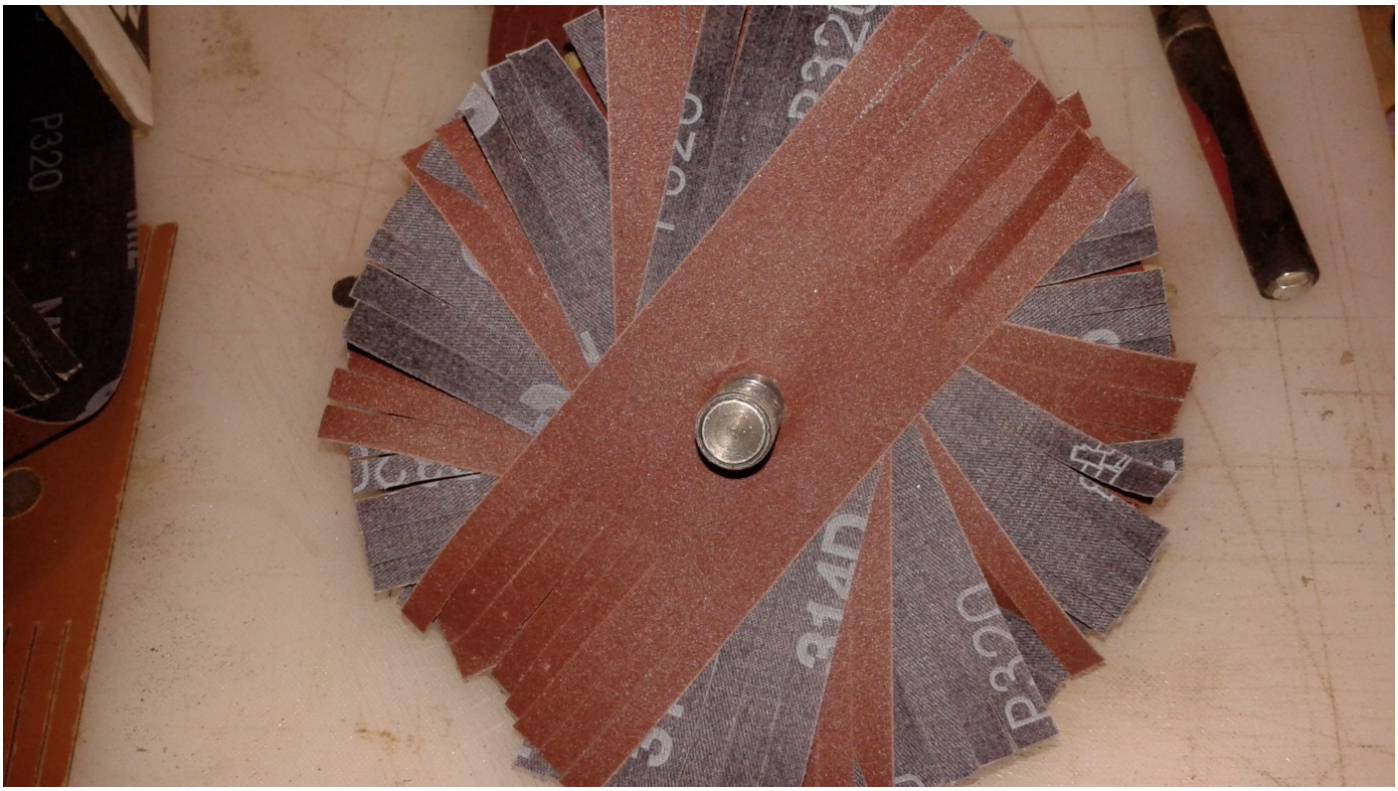


I also use 2" roll cloth. This goes a bit faster.



The mandrel can be as simple as a bolt, couple of washers and a nut.

Alternate face up, face down with a half overlap.



You can use it either fixed on a drill press or using a handheld drill.

I often use several different grits on my long mandrel. I also use the sheet scrap on my Dremel.

I also have a simple sander/buffer made from worn out hook and loop discs. (I don’t like throwing much of anything away). I cut a round template from phenolic (you can use plastic, wood or whatever you have around for templates).

I also mount these face up face down.

I use this without buffing compound mostly for fine finish on wood, and a regular buffing wheel with compound when doing metal.

Good luck, please let me know if you have any questions and thanks for reading.

Resources

- ***Gold Sand Mop 2" x 6" 320 Grit, 48pk Refill of Flutter Sheets*** — From the Klingspor's Woodworking Shop website: "Ask woodworkers from across the country and they will tell you that this is the very best contour sanding system on the market today…"

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

*article, or the entire issue, is available **upon request**.*

The Trailing Edge

End of days.

The New RC Soaring Digest Staff

‘Sunset at the Great Orme’ (credit: Jonathan Demery)

There’s a summer sunset ritual on the Oregon Coast — and undoubtedly on western coasts around the globe, although we have no first-hand knowledge of those. For those still out on Highway 101, it’s time to find one of the many waysides or turnouts on the west side of the road and watch the last few minutes of the day drain away into an amber-gold pool of at first spectacular, and then quickly fading light.

The standard to which all sunsets aspire is a full, round disk which first kisses the razor-sharp Pacific horizon. It then evolves into varying degrees of semi-circle which propagate a great, fiery hug that stretches north and

south. That recedes and finally there's a tiny sliver of light clinging to what remains of the day and injects what's left of it with a little pathos. Then the sun is quickly gone. There's supposed to be a flash of green just after sunset, but we've never seen it. Sunset worshippers then get back into their cars and finish their journey in the dark, which arrives quickly once the summer sun has coursed westward to light up someone else's day.

We don't think about it, usually, but sunsets would be unbearably sad if there was the slightest possibility the sun would not swing around to the eastern horizon and fill us with a sense of wonder about the day ahead. The sun also rises, as Hemingway wrote.

There has been a veritable torrent of horrific news of late — all of which fill us with a combination of emotions ranging from white hot outrage at one end of the spectrum all the way into the gaping jaws of the black dog at the other. Sometimes it seems too much to bear. It serves no useful purpose for us to enumerate and comment on these events here, but you don't have to go far to be bombarded with coverage of these seemingly terrible times in which we live.

We take consolation from the sunset. While it's easy to be sad that another day has come and gone and there is seemingly only night ahead. However, we know it's just a matter of time before that big, beautiful sun soars overhead once more and we're filled with the endless possibilities of what might be, in the better days ahead.

Our Feature Photo

We were inspired to soliloquise about sunsets — whether they be nearby or far away—by *Sunset at the Great Orme*, above, taken by Jonathan Demery. If that name sounds kind of familiar, Jonathan also provided the great picture

featured in RCSD's most recent *Lift over Drag* newsletter (see *Resources*). That picture featured Jonathan's utterly charming curly-coated retriever Ollie 'supervising' some student glider buffs near St. David's College at Llandudno, Wales. For Jonathan's sunset photo, we'll let him take it from here:

> *"The pilot in the picture is James Maidment (one of our senior students). He is carrying his Phoenix 1600 to the slope edge for a bit of sunset flying. Despite there being about eight of us flying, the image of a lonely soarer walking to the edge at sunset was quite powerful."*

We could not agree more. As it turns out, Jonathan is the program leader for the school's Model Flying Club. In addition to their own flying site immediately adjacent to the school, St. David's is a mere eleven minute drive from the Great Orme, which really needs no further introduction, given that it's safe to say it's on *everybody's* bucket list of places to fly someday.

If we'd had a Model Flying Club and were spitting distance from a one-in-a-million slope, we might well have done better in school in our short time there — which didn't do much for us except, perhaps, serve as a source of disappointment for our parents.

Thanks so much for the opportunity to share your great photos with our readers, Jonathan, and we hope there's many more in the future.

What's New in The RCSD Shop

This great new t-shirt just hit the shelves in The RCSD Shop. Available in a wide variety of sizes and six great colours. We manufacture and ship cost-effectively worldwide.

While it is new to The RCSD Shop, we tend to run a few months behind with our *Cover Photo T-Shirts*: as such, back in the October 2021 issue we featured the always breathtaking photography of our friends at *Speedamigo-Modellflugfilm*. In this particular shot their FW-Models *LS 6c* is captured against that inimitable 'cielo azzurro italiano' near Cantiano, Italy. We love the light in this picture — summer with just a tinge of fall. Makes us wish we had it in the store much sooner! **Get yours today**.

Also, in honour of Part 7 of Norimichi Kawakami's *1/3 スケール三田式 3 型改 1 製作記* (*Mita 3 Production Notes*) which appeared in the October issue, we are also providing **a Japanese version** — be the first kid on the slope to have one.

Make Sure You Don't Miss the New Issue

You really don't want to miss the July issue of RCSD when it's out — we have some exciting things in the works. Make sure you connect with us on **Facebook**, **Instagram**, **Twitter** or **LinkedIn** or subscribe to our **Groups.io mailing list.** Please share RCSD with your friends — we would love to have them as readers, too.

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

Resources

- ***Lift over Drag*** — The June edition of our newsletter featuring that wonderful photo of Ollie mentioned above. *Lift over Drag* is our more-or-less monthly newsletter which provides advanced email notice about the upcoming issue. And word to the wise: there's quite often an exclusive, *Lift over Drag*-readers-only RCSD Shop discount contained therein. *Lift over Drag* is entirely free, but you do have to ***sign-up*** if you want it to arrive in your email inbox each month.

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