The NEW RC Soaring Digest

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In The Air

So you want to do for a living what you now do for a hobby?

Terence C. Gannon

Iñaki Elizondo Casado's *Weberschock* 'Radical' amidst a backdrop of balsa-hungry wind turbines at the world famous Bwlch in South Wales, UK, at the 2017 Welsh Open F3F. (image: Kevin Newton)

A number of years ago, I had the good fortune to see Chris Anderson, the former editor of *WIRED* magazine, speak at Mount Royal University here in Calgary, Alberta, Canada. Amongst his many accomplishments in addition to his time at the helm of *WIRED*, he founded *3D Robotics*, an early entrant into the commercial drone business, and he's the author of a number of bestselling books including most notably *The Long Tail* and *Makers: The New Industrial Revolution.* I have thought for quite some time that Anderson is very capable of Gladwellian insight into popular culture, but doesn't seem to get the same kind of credit Gladwell himself does, which always surprises me.

Anderson spoke on many topics that night (his thoughts on LEGO have also stuck with me to this day — it's nice to encounter a fellow fanboy) but in particular I was intrigued by his comments about his '*tendency to industrialise his hobbies*'. I'm sure I am hopelessly mangling his words but I believe the essence was along these lines — so often we enjoy doing something so much we seek to turn that hobby into a profession. Anderson has done it at least a couple of times and the impression with which I was left was it was a decidedly mixed blessing for him. While I am now lapsing into pure speculation as to what was in Anderson's mind that night, my sense was along the lines of '*sure, do it, but be prepared to pay a price*'. Not the least of which is that even the most compelling subject can be made a drudge if we *have* to get up and do it every day.

I started thinking about this when I read the third part of Bob Dodgson's autobiography *The Implementation of a Dream* in this issue. In particular, that with a quarter of a century of producing some of the best glider kits around, Bob eventually wrote: "after we closed *Dodgson Designs* I did very little glider flying. I had lost my boundless passion for it — having turned my great hobby into my job for 25 years." Clearly that many years is a good run, by any standard, but his comment still made me a little sad. Actually, a *lot* sad. I would hate to think a stiff breeze blowing straight up a seaside cliff, or a booming thermal sucking up everything in its path would ever become — well — boring. Just another crappy day in paradise.

Make no mistake about it — I doubt many, if any, of us would take a pass on the opportunity to hit the slope for a couple of hours for a living as opposed to working on the killing floor at the local slaughterhouse. Or, much less bombastically, even a stuffy office with all the nonsense which goes along with that. But, let's be realistic, there's a pretty good chance no one, any time soon, is going to pay you to carve up the ridge while polishing up a perfect eight point roll.

That said, it's never going to be a choice which is so black and white. There are a millions shades of grey between those binary extremes where at least some of what we enjoy about our collective interest can be used to put bread on the table and maybe a little money in the bank at the end of the day.

What strikes me, in particular, is the skill set that is so intrinsic to our hobby just happens to line up with some pretty important trends in broader society. For example, I don't know where you're likely to find a higher concentration of people who know more about making things fly with extreme efficiency. Most of the time, consuming no fuel at all — as exemplified by the fascinating work described in *Like Soaring on Mars* in this issue. But even those pursuits such as F5J (as ably described by Mike Vos in *South Africa F5J Team Qualifier*, also in this issue) which actually *do* involve the consumption of energy, it's amazingly little, and green energy at that. It's then converted into a *lot* of flight time. The doing-a-lot-with-a-little ratio is pretty outstanding.

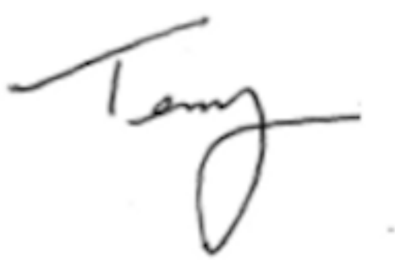
I enjoyed the recent NOVA episode entitled the *Great Electric Airplane Race*. They did a good job at painting a fairly accurate assessment of where things really stand in this area. Progress has been impressive, for sure, but they certainly didn't claim that we'd be flying the transpacific routes on a batch of lipos and a couple of outrunners any time soon. In fact, they were fairly candid that was a long, *long* ways off — with much of the technology still needing to be invented or requiring unobtainium as the primary building material. But the important point is this: we are at least on right trajectory that will eventually, in the **distant** future, include flying lots of passengers great distances without blowing big holes in the only atmosphere we have.

Here's what I know for sure. If I was one of those talent-hungry companies featured in that recent NOVA episode, or some other greentech industry like wind energy, and I was looking for people who have relevant domain expertise, knowledge of advanced materials, an ability to set up efficient and effective R&D programs and possess a can-do attitude while working and playing well with others…

I would look no further than the readers of RC Soaring Digest.

We have now reached that critical mass where there are now too many great articles to enumerate and summarize them here. I simply encourage you to dive in with the link below. I hope you enjoy what we have been able to put together for you this month.

Fair winds and blue skies!



The out-of-this-world (literally) cover photo is of Stratodynamics' F5J-based HiDRON™ *high altitude research platform as it cruises around the New Mexico desert at over 80,000 feet. For the whole story, check out* Like Soaring on Mars, *the* ***first article*** *in this issue. Or go to the* ***table of contents*** *for all the other great articles. A PDF version of this article, or the entire issue, is available* ***upon request***.

Like Soaring on Mars

Stratodynamics continues to prove out its RC glider-based high altitude research platform.

The NEW RC Soaring Digest Staff

The HiDRON™ moments before it was released from its launch vehicle at 25km (82,000ft) over the New Mexico desert. (image: Stratodynamics Inc.)

Readers of RC Soaring Digest have been known to go to some rather extraordinary lengths to find exactly the right spot to launch their latest ship. But it's safe to say the recent flight of Stratodynamics' HiDRON™ high altitude research platform likely has achieved a new 'high bar' for great places to start a great flight — how about 30km (98,000ft) above the New Mexico desert, as was the case on June 6th, 2021. Five hours after being released from its weather balloon launch vehicle, HiDRON™ landed safely at

Spaceport America, located at Truth or Consequences, New Mexico which was also where the flight originated. During the time aloft, HiDRON™ collected reams of sensor data which will now be used to further research clear air turbulence in Earth’s atmosphere.

The HiDRON™ and its balloon launch vehicle as they depart Spaceport America on June 6, 2021. (image: Stratodynamics Inc.)

Of particular interest to RCSD readers is that part of the flight program included Auto Soaring (which we covered in last month's issue). One segment of the flight involved first identifying and then circling in a thermal rising from the desert floor, wherein HiDRON™ was able reclaim one kilometre (3,280ft) of altitude and extend the flight.

At 30km Earth's atmosphere — at 1.15 kPa (11.5 mbar) — is roughly the equivalent to at least parts of Mars. The extremely thin air at the drop altitude explains why after being released from its launch gondola, HiDRON™ quickly accelerated to 480km/h (300mph) during its pullout manoeuvre and achieved controlled flight at 28km (92,000ft).

If RCSD readers think they recognize the aircraft which is the basis for HiDRON™, that's because it features "a Simitri F5J main wing with a customized fuselage and empennage, designed to improve stability in low Reynolds number conditions", said Stratodynamics CEO Gary Pundsack.

Following the successful series of increasingly ambitious test launches commencing on June 1st and concluding with the June 6th flight, CEO Pundsack commented:

"*This mission represents a major milestone for Stratodynamics in achieving controlled, autonomous flight at record-setting altitudes and with aircraft's aerodynamically efficient airframe capable of utilizing available natural energy. The HiDRON™ also performs as an extremely sensitive instrument that can detect turbulence and correlate data collected from payload sensors. This campaign will contribute to Stratodynamics' turbulence detection systems currently in development for multiple aviation-based applications.*"

Spaceport America Launch. (video: Stratodynamics Inc.)

While the 30km New Mexico launch is impressive, it does not represent the absolute maximum for the HiDRON™. In September of 2019, the platform achieved an altitude of 33.9km (111,434ft) after a launch originating near Timmins, Ontario.

The New Mexico flights represented a broad collaboration of agencies and institutions including Stratodynamics, UAVOS, the University of Kentucky, New Mexico State University, Spaceport America and was supported by the NASA Flight Opportunities Program.

We hope to provide additional, in-depth coverage of this fascinating project in the future. We would also like to think we could someday feature Gary Pundsack and his team in a future episode of the still-in-development RCSD podcast.

Resources

- *Technology Advancement Utilizing Suborbital Flight Opportunities* (NASA research opportunites using Stratodynamics technology)
- *Auto Soaring* (RCSD article by Norimichi Kawakami)

The HiDRON™ crew after the successful flight on June 6th, 2021. Pictured, from left-to-right: Flight Technician Ryan Nolin and Principle Investigator Sean Bailey from the University of Kentucky; Stratodynamics CEO Gary Pundsack; Autopilot Designer and UAVOS CEO Aliaksei Stratsilatau. (image: Stratodynamics Inc.)

We would like to thank Nick Craine, Business Development Lead at Stratodynamics, who provided tireless assistance organising the images and video for this article. *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**.*

Wild Faroe Islands Soaring

Go north at England and turn left at Norway.

James Hammond

A landscape which would not be out of place in the next Peter Jackson movie. (image: Regin Eyfinnson Poulsen, Tórshavnar RC — felag)

Want to try some really spectacular sloping? OK, go north from the UK, then turn left at Norway. The next stop is the Faroe Islands — a breathtakingly beautiful and wild place. When thinking of the planet's most idyllic slope soaring sites, the list could be very long indeed, and it's unlikely that the Faroe Islands would be the first place that to comes to mind. But, well every picture tells a story.

The slopes are — well — everywhere. (image: Tórshavnar RC — felag)

The Faroe Islands are a well-kept secret, an 18 island archipelago nestled in the north Atlantic to the west of Norway and to the north of the British Isles. It’s a green-banked paradise, with most of the islands linked by roads and bridges, and here’s the best bit: it’s beset with fantastic slope soaring sites and inhabited by a fanatical, warm-hearted band of modelers.

How about that for a flying spot? (image: Tórshavnar RC — felag)

It is there, in this virtually unknown sloping paradise, that dwells *Tórshavnar RC — felag* (in the local language Faroese — yes, they even have one of those)! Or in English, *Tórshavn RC society*, a model club with 45 years of history.

The club was first founded in 1976 by Birgir Simonsen, Carlo Petersen, Magnus Gunnarson, Finnbjørn Johansen, Zacharis Hansen and Bjarne J. Petersen.

Here a very special tribute must surely be made to Birgir Simonsen — founding member of *Tórshavnar RC — felag* and still going strong as an active, well-loved and respected flyer, and also a kind mentor offering his good advice at over 88 years old.

Birgir at 88 years old with a special wing design. (image: Tórshavnar RC — felag)

Birgir is the pioneer, and definitely the father of RC flying in the Faroe Islands. He started building his first plane in WWII, a Spitfire using a rubber motor. As enthusiastic club member Jógvan Hansen comments: “I started early — I remember the day very well when I was a young boy around the year 1978, my father and I went for a little drive outside town. That day was the first time I ever saw an RC glider. It was Birgir Simonsen who was flying that glider and I thought that was very cool.”

Father of RC gliding in the Faroes — Birgir Simonson. He bought his first RC radio in 1967—it was a four channel Futaba radio. (image: Tórshavnar RC — felag)

Back in the seventies, the embryo club was simply called *Tjørn* (Lake) as initially it was only meant for members with boats. But when the club was reorganized and re-founded in year 1980 its name was changed to *Tórshavnar RC — felag*. Now with 70 members, the club caters for all branches of R/C: boats, planes, helicopters and cars.

A Dynamic awaits it turn. (image: Tórshavnar RC — felag)

Jógvan goes on: “Now we fly mostly slope gliders near our clubhouse on the island named Streymoy. On the west side are the best spots with nice stable wind from the ocean, but we fly also on the east side of Streymoy. Sometimes when the wind is coming from a different direction, we go for a drive — typically up north searching for a good spot.”

The beautiful thing: in the Faroes, the ‘good spots’ are almost limitless.

Flown by Regin Eyfinnson Poulson, a Typhoon takes to the air above Tórshavn. (image: Jógvan Hansen, Tórshavnar RC — felag)

Jógvan continues: “We are very lucky here in the Faroe Islands because we do not have any restrictions when we go flying. The only restrictions I can think of are if winds are too strong, too little, or when raining. We are flying all year round with gliders, in winter too when islands are white with snow."

Birgir and Regin stop for a coffee break. But is it coffee that they are drinking? (image: Tórshavnar RC — felag)

Asked if the club has scheduled meetings, Jógvan replies: "For those of us flying, no not really, but members with cars and boats do have regular meetings. We just call around to see who will be going flying and where, when it looks good. Mostly we fly slope gliders. All-round gliders are most dominant and some aerobatic and F3F models are also flown."

A Sessanta 60 shrieks past in the skies above the Faroes. (image: Jógvan Hansen, Tórshavnar RC—felag)

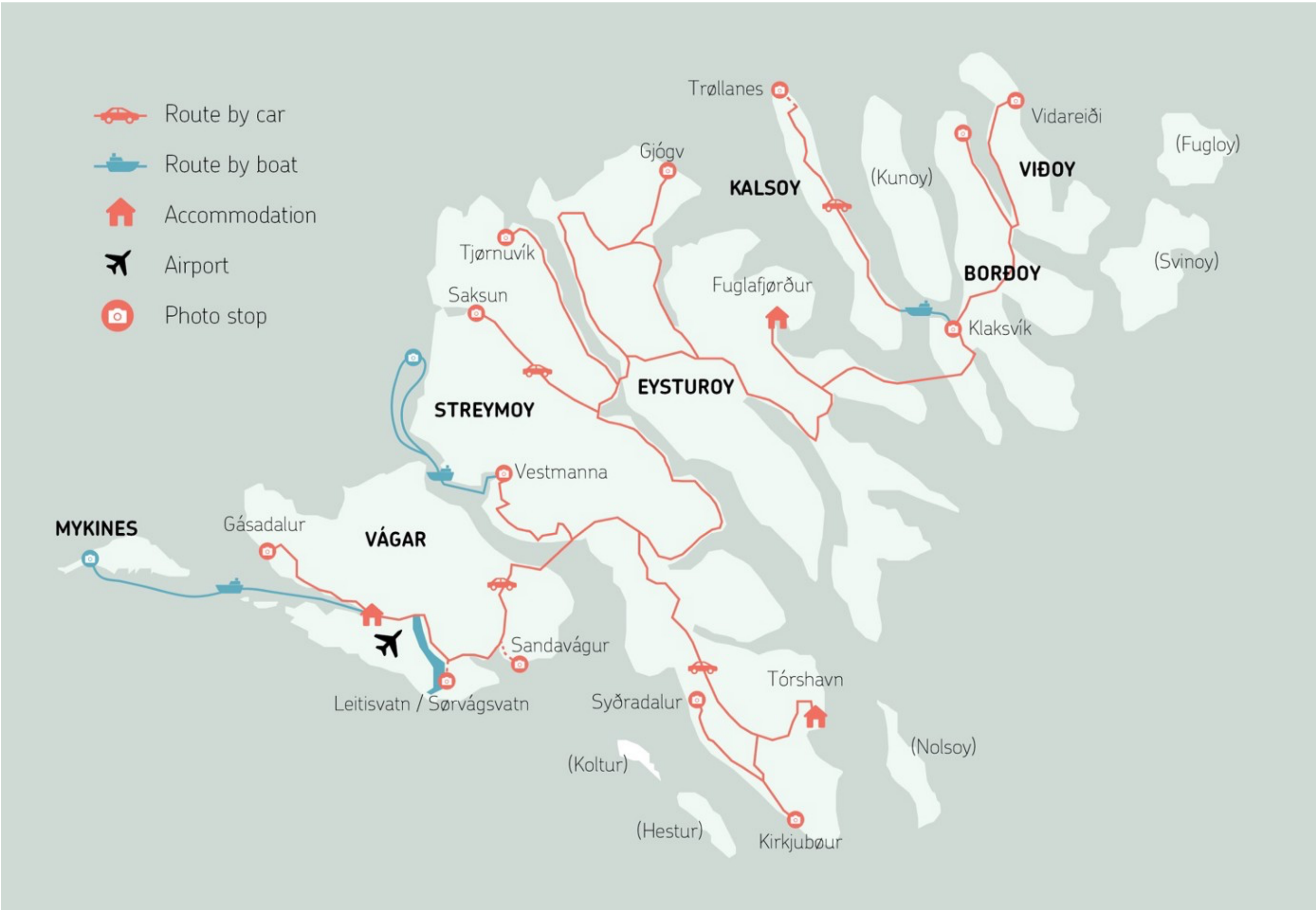
I have flown all over the world, but I have never visited the Faroes — but with its breathtaking scenery and fabulous array of superb soaring sites, it's definitely on my bucket list!

Parting shot of Birgin Simonsen — just about to loft a Stormbird — not a model for the faint of heart! (image: Tórshavnar RC — felag)

Faroe Islands Facts

- A well-kept secret, for radio glider flyers at least, the Faroe Islands archipelago is a group of 18 volcanic islands separated by fjords and sounds and situated in the middle of the Gulf Stream in the North Atlantic at 62°00′N and 06°47′W, halfway between Scotland and Iceland.
- Total land area: 1,399 km² (540 square miles) with the highest peak 880m (2,887ft); average height above sea level 300m (980ft).
- Because of the Gulf Stream flowing around the Islands, the climate varies very little, in fact averaging between 3.8 °C in the winter to 11.1 °C in the summer
- Population: approximately 52,650 of which over 22,000 people reside in the capital, Tórshavn.
- The Faroes is a self-governing region within Kingdom of Denmark, and even has its own Faroese language, though of course Danish is almost universally spoken.

- The main industry is blue water fishing, and this amounts to 80% of the GDP of the Faroe Islands.



The 18 volcanic islands which make up the Faroe Islands archipelago are well connected by both land and sea routes. (image: Sarah in the Green)

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South Africa F5J Team Qualifier

A full report on the first class competition in Gauteng, South Africa on May 30th, 2021.

Mike Vos

F5J flight line ready for launch. Brett Lewis closest to camera.

For those not familiar with the FAI alphabet soup of class names, F5J equates to "thermal duration gliders with electric motor and altimeter/motor run timer" and Mike provides an excellent further explanation in his article. — Ed.

It's a cool, sunny morning at GEMS field, Gauteng, South Africa, and the first group of F5J pilots is standing ready to launch for the first flight of the day. The competition system counts down to the start horn and then you hear the power unleashed to get up and out of the hand to let the timers start the clock. This early flight requires a high launch, but how high — every meter is penalty points against your score. Then 30 seconds later all the motors cut and it's quiet. Just pilot skill and experience searching for thermals and flying the plane as carefully as possible to maximise the opportunities.

Photo 2: *Aldo Vos launching a Maxa 4m glider.*

The run-up to the Team Qualifier competition starts early in the year with planning and communication of the dates to the community and registering the events with the South African Model Aircraft Association (SAMAA). The team qualifier events follow a more formal approach from scheduling dates to running the event. This is to ensure all pilots who would later be interested to be in the running for the South African team to represent the sport at the next World Championship have had a chance to participate. About two weeks before the competition the online entries open.

Two days before the competition the entries close to allow time for the competition organisers to create the setup and do the random draws for pilots to rounds and groups. For this specific event, we had eight pilots entered who would then fly in eight rounds of two groups each in a random selection order. The scorecards are created for the pilots to record scores consisting of the flight time starting when the plane leaves the pilot's hand until it touches the ground, the launch height is recorded and the landing distance of the nose of the plane to a marker on the ground is also recorded.

Photo 3: Model Gliding Association (MGA) *competition setup with timer to indicate working time left in a round*.

On the day the pilots start arriving in the early morning to unpack and assemble the beautiful gliders. The Model Gliding Association (MGA) trailer is there from which the large timer display, audio equipment, gazebo, 'spots' and other items are unpacked and set up by many helping hands.

Photo 4*: Aldo Vos chilling next to his F5J Maxa.*

At this event two brand new *Plus X* F5J planes by Vladimir were taken out still to be set up and a 3rd *Plus X* also came in all the way from Natal. What beautiful planes. The field where we fly most of the Gauteng gliding competitions is at the East Rand Polo Fields surrounded by farmlands and open areas. A pilot's briefing starts the day, to get general rules highlighted before the start.

The competition then starts and effectively runs automatically on the audio announcements and large timer board. The rounds start with announcing the pilots from the group and then a preparation time followed by 10 minutes of working time when the planes are launched and pilots must try and use as much of this time as possible. F5J is a very strategic and difficult glider class. The pilot must try and launch his 4-meter glider as low as possible to minimise height penalties but ensure a safe height to try and make the 10 minutes of working time. In the minutes and seconds before the launch the pilots will scan the air, observe wind direction changes, look for birds or insects that could indicate the presence of a thermal in the area close to the ground to target for the launch.

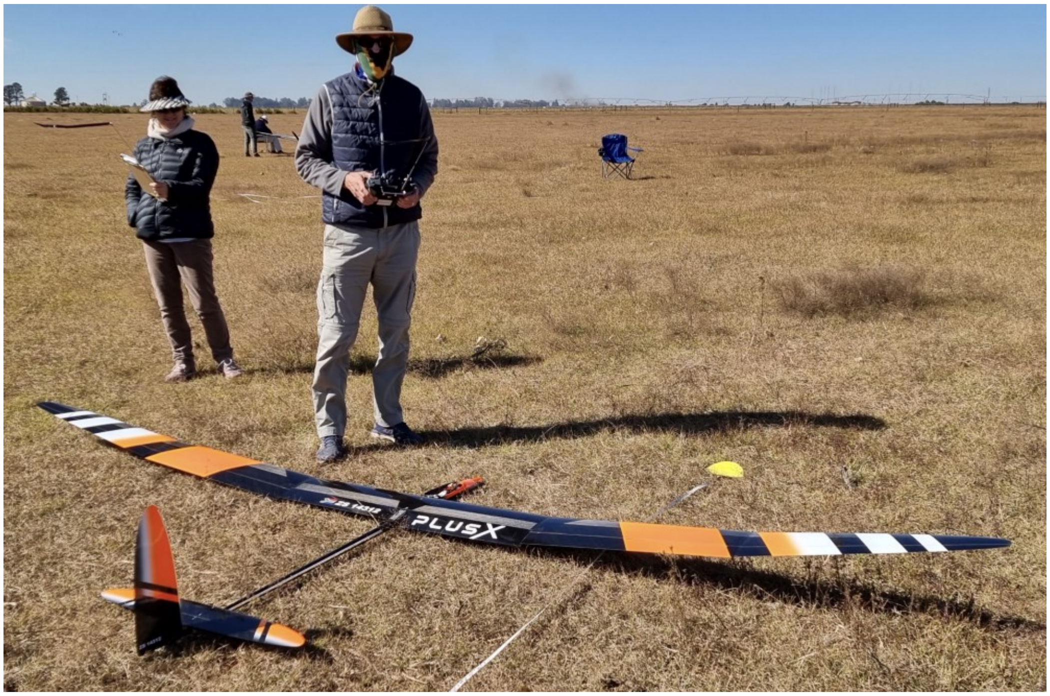

Photo 5*: Neil Murray assisted by wife, Eileen. Landing his Plus X F5J close to the spot.*

Once the gliders are in the air, the pilots focus on the plane to observe any movement of the wings or tail that may indicate the presence of thermal activity. Then they start circling the plane in the area the thermal is believed to be in order to gain maximum height and energy from the rising air. In a competition, the pilot has a caller/timer that will stand next to him who needs to keep the time and score of the flight but also assist the pilot in helping to read the conditions and provide info to the pilot of conditions around the area. This helps the pilot to decide where the best places may be to maximise the flight. The helper will also tell the pilot how other gliders in the air perform and often a couple of gliders will use the same column of rising air. On our day of flying there was quite a bit of wind in the morning and that caused some of the first flights to be difficult and some pilots were caught and landed far out resulting in zero scores for a flight.

Coming in for landing the pilot tries to get the plane as close as possible to a landing spot. This is another tricky part with an F5J glider with quite an expensive motor and propeller setup that you rather not want to push hard into the ground but need to stop where you want it. When gliders come in at the end of the working time the countdown and approaching planes raise the adrenaline and it is exciting to see who cuts it the closest without overflying the time and forfeiting landing points.

Photo 6: *Brett Lewis with his F5J Shadow assisted by Wolfgang Steffny.*

The pilots help each other and although competition is stiff the atmosphere is friendly and social. The key is to have fun and enjoy it. Helping another pilot with timing also allows sharing of tips and experience to improve. Competitions are therefore probably the best scenarios to learn very fast from experienced pilots on how to improve. The competitions also push you a bit to ensure your planes are in good condition and always improving your flying skills beyond the point of just cruising around the sky.

Photo 7: *Craig Goodrum won the lucky draw of the day.*

On this day the weather improved and around midday the pilots were starting to try lower and lower launches with varying degrees of success but always learning for the next time. Low launches are exciting. The pilot must work hard after the 30 seconds of motor run to get the weakest of thermals to lift the plane to heights to sustain the maximum working time. It is also great to watch this as the pilot can spend minutes a couple of meters above the ground and sometimes not make it and have to then at least try and get a decent landing.

After the days flying the pilots all handed in their scorecards and the calculations on the software then revealed the ranking of the pilots for the day. Whatever the outcome, everyone enjoys it even when there are unfortunate mishaps of a plane hitting the ground with a 'thud'. That will be fixed and the plane will soar again and probably win the next round. The challenge of finding thermals and having to read these subtle signs of nature's hidden energy pockets makes glider flying exciting, challenging and fun.

At the end of the day we also had a lucky draw for all the pilots that participated and the lucky pilot was Craig Goodrum!

F5J TQ1 20210530 - Overall Results
[GEMS 30/05/2021]

www.GliderScore.com

Rank	Name	Ctry	RegnNo	Club	Score	Pcnt	Raw Score	Rnd1	Rnd2	Rnd3	Rnd4	Rnd5	Rnd6	Rnd7	Rnd8
1	GOODRUM, Craig				6872.1	*100.00*	7268.2	1000.0	*396.1	1000.0	993.6	878.5	1000.0	1000.0	1000.0
2	VOS, Aldo				6263.3	*91.14*	6263.3	*0.0	1000.0	1000.0	1000.0	1000.0	932.1	331.2	1000.0
3	GOODRUM, Michelle				6179.8	*89.93*	6179.8	860.0	1000.0	835.7	*0.0	1000.0	592.7	1000.0	891.4
4	MURRAY, Neil				5238.0	*76.22*	5238.0	577.3	642.3	924.2	*0.0	353.2	934.3	951.5	855.2
5	STEFFNY, Wolffgang				5226.9	*76.06*	5711.8	647.9	751.5	599.6	755.3	961.3	726.8	784.5	*484.9
6	VOS, Mike				4925.1	*71.67*	5227.3	1000.0	396.1	940.9	681.3	621.1	973.2	312.5	*302.2
7	VAN DER MOLEN, Jethr				3447.9	*50.17*	3447.9	0.0	0.0	0.0	*0.0	958.6	1000.0	878.2	611.1
8	LEWIS, Brett				3022.2	*43.98*	3022.2	0.0	0.0	0.0	1000.0	550.9	806.2	665.1	*0.0

***Figure 8**: F5J Team Qualifier 1 overall results for the day.*

An F5J Scoring Primer

The competition rules and scoring of F5J must be well understood to help perform well during a competition. Every pilot's score is compared to the best score of the group and calculated as a factor of 1000 of that score.

For example: Pilot A flies the best score at 3 minutes and 12 seconds and has a landing with a 50 bonus points score, that is a 'raw' score of 3 x 60 = 180 + 12, flight score is 192, add 50 points for the landing equals 242 points. This excludes the launch height penalty still to be calculated. This becomes

1000 points for that group.

Pilot B flies 3 minutes, 6 seconds and has a landing with a 40 points score — 'raw' score of 3 x 60 = 180 + 6 = 186, add 40 equals 226.
This becomes (226 / 242) x 1000 = 929.75 points for that flight group. Still excluding the launch height penalty.

Now let's add the launch height penalty calculations. Scoring starts when the aircraft leaves the pilot's hand with the motor running. The pilot may stop the motor at any point, but the higher he climbs the more the penalty points mount up. After 30 seconds the on-board system stops the motor automatically. The launch height is defined and measured by the onboard system (Altis) at the highest point during the 30 seconds of motor run and 10 seconds after the motor stopped.

The penalties are as follows: 0.5 penalty points per meter gained after release up to 200 meters and then 3 points per meter above that. As you get one point score per second flown for 10 minutes — 599 points (in practice 9:59 maximum) — if you fly to 300 meters (100 penalties plus 300 penalties) you can get a maximum of 199 points plus your landing points. Conversely if your launch height is only 30 meters because you could find a thermal and fly to a time of 9:59 minutes your score is — 599 minus 15, equals 584 points plus landing bonus points.

If we take the flight examples above and apply the following height penalties — for Pilot A, launch height of 94 meters and Pilot B launch to 50 meters scores change as follows: Pilot A — 3 min 12 sec = 192 minus 47 = 145 plus 50 landing points = 195; Pilot B — 3 min 6 sec = 186 minus 25 = 161 plus 40 landing points = 201.

Now Pilot B has the upper hand at 1000 points. Pilot A now has (195 / 201) x 1000 = 970.15 points for that flight group.

Photo 9: *MGA Phoenix Voltanix 2m for training new pilots.*

Competitions do not require special gliders. Any glider that can launch with an electric motor, fitted with an Altis unit to limit run time and record launch height, can be used. Even a 'foamy' can be used and compete.

We want to get more pilots to fly in this exciting young class that only had its first world championship in 2019. The MGA bought three Voltanex *Phoenix V2* gliders recently with the goal to attract new pilots, especially juniors, to train and try this sport under the guidance of experienced pilots. In this way, they can join in the fun with a very low barrier to entry.

Resources

- FAI Sporting Code for F5J Competitions
- Location of Greenfield Eastern Models Soarers(GEMS) field.
- South African Model Aircraft Association (SAMAA)
- Model Gliding Association of South Africa (MGA)

Text by Mike Vos and Jan Sime. Images by Mike Vos. 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.*

Petrels I Have Known and Loved

A photographic review of examples of the iconic Slingsby Type 13 Petrel that have appeared since the publication of the 1:3.5 scale plan, back in the last century.

Chris Williams

Two 1/5-scale Petrels in a simultaneous landing.

When Fred Slingsby produced the Type 13 Petrel in the late 1930's, three examples were built. Of those three, two remain to this day; one in the US, and one in the UK, both in flying condition. The most noticeable difference between the two is that the US version sports the original all-moving-tailplane, whilst the one in the UK has a modified, conventional tailplane.

A new 1/4-scale Petrel at the County Model Flying Club.

I seem to have established some sort of connection with this glider, producing a plan at 1/3.5-scale back in the last century, that has produced many a variant since. Perhaps the one produced by veteran aeromodeller Dave Stokes stands out the most, as he chose to finish her in the original varnished wood finish, which necessitates the painstaking replication of all the original plywood panels; truly a poem in the art of woodwork!

My own current 1/3.5-scale example is the second from the original plan, although the wing design benefitted from some digital updating.

In recent times I have produced a 1/5-scale version which was featured as a free plan in RCM&E magazine, followed by a scaled-up 1/4-scale version, which is available from Sarik Hobbies as a plan or plan/laser kit.

Below, here is the aforementioned Dave Stokes with his all-varnished wood Slingsby Petrel along with some photos of this magnificent aircraft in action, and on the tarmac at Middle Wallop aerodrome. The attention to detail is extraordinary.


PETREL

Below, top left, is my current 1/3.5-scale version of the Petrel. Top right is Darren Maple's Petrel at Middle Wallop. Below that, three 1/3.5-scale versions also at Middle Wallop aerodrome.

Against that beautiful blue sky backdrop, Steve Fraquet launches his much-flown version at a White Sheet Club Scale Fly-In. On the right is the same aircraft in an atypical attitude which shows the versatility of the HQ wing section.

Here I am launching my 1/5-scale version at White Sheet Hill along with a shot of the it in the air on the same day.


3

The following video brings together all of my love and enthusiasm for this classic glider both on the bench and in the field.

I hope you enjoy watching the video and listening to the original soundtrack, which I also composed and performed.

Aircraft Specifications

- 1/3.5-scale Petrel: Span: 4.9m, weight: 22lbs (10kgs), wing section: HQ35/17 at root, transitioning to 35/12 at the tip
- 1/4-scale Petrel: Span: 4.3m, weight: 14lbs (6.3kgs), wing section: HQ35/14 at root, transitioning to 35/12 at the tip
- 1/5-scale Petrel: Span: 3.4m, weight: 8.5lbs (3.9kgs)

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The Aeroic Sine Wave Spar

Let’s get a wiggle on.

James Hammond

Aeroic Sine Wave Spar installed on a Corsa 118″. (image: James Hammond)

This time I’m going to let you know a little about the Aeroic Sine Wave Spar *— what it is, how it happened, what it does, and how it’s made. I’m not going to bore you with loads of math because I have never used any for this application. Once the idea came, like the wheel almost, it seemed so damn logical. I still don’t know how effective it is in the numerical domain. The proof, I hoped, would be in the testing and so it proved to be. — JH*

Is This a New Idea? Emphatically: No.

The *Aeroic Sine Wave Spar* (ASWS) is far from a new idea and has been used in several military and commercial aircraft by Boeing and Grumman among others — but I actually didn't find this out until I began to cook up my own idea. After I actually tried it, it seemed to be such a good solution to many problems that I was sure it must have been used before on full sized aircraft. So I went looking for it on Google and sure enough I found it. That said, now, if you look on Google, half the references are to my own work and the excellent explanations of good buddy and co-conspirator Konrad Dudek.

Photo 2: A sine wave aircraft spar section. (image: James Hammond)

How Did the ASWS Happen?

Going back a bit I have to admit that the ASWS was born from laziness, or maybe boredom or a bit of both. In my time, actually from the mid-1970s when I first began in radio, I have made a great many model sailplane spars of different kinds, but I had never been totally happy with what I'd done for quite a few reasons — in order of my dislike:

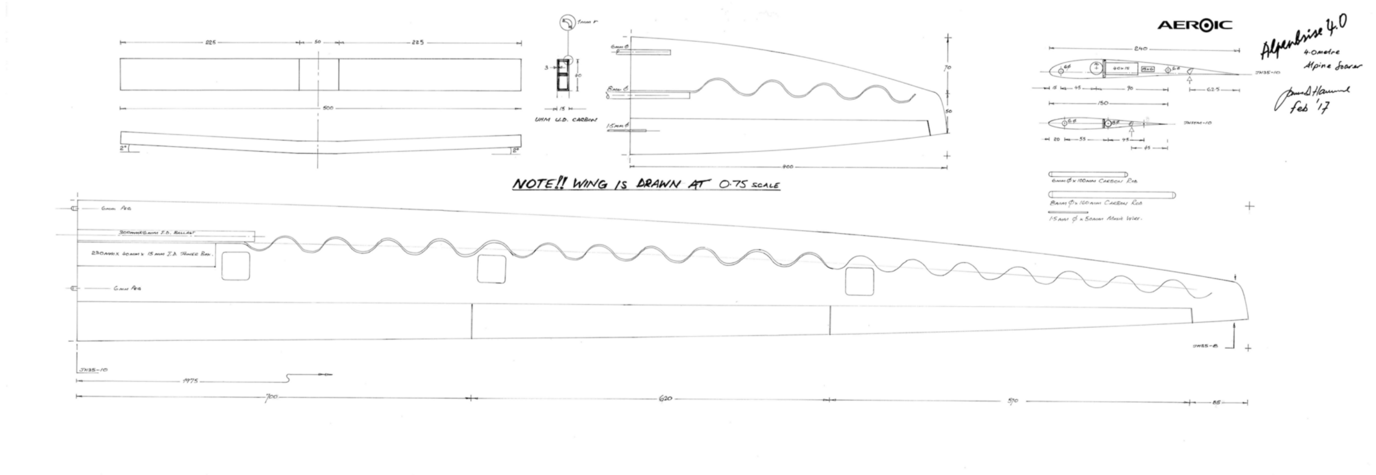
- Heavy
- Bulky
- Expensive
- Difficult to make
- Time consuming to manufacture
- Poor in torsion unless wildly reinforced with larger than life spar caps
- Dubiously effective

The situation was that I was always wracking my poor brains for some way to make lighter, slimmer, less costly, easier and faster-to-make spars with good torsion resistance, and overall more effective than the alternatives. Seems like a tall order, and for many years it was just a dream. Until one day I had an epiphany.

Bingo

I discovered the humble carboard box, but this was not just any cardboard box, it was a super strong thick-walled version used to pack heavier marine engine parts, and maybe it was that feature that attracted my attention. I guess I may have been studying the box somewhat wistfully, remembering that my old friend Roland Sommer — another Taiwan 'refugee' and now sadly passed away — had in his younger days used corrugated cardboard as a core material for F3B model wings. A true modeller, and owner of *Wowings*, Roland was always a dab hand at repurposing everyday materials.

My eyes fell on the centre section of the box material — made of heavy folds of corrugated paper. Then suddenly it occurred to me, in fact like a flashbulb going off; I could see a potential new way to use those wave-like folds, this time by situating them vertically instead of horizontally, and that's how it all started. I hate to say it, but this was a real case of 'thinking outside the box' (pun entirely intended).



Drawing 3: ASWS in the Alpenbrise alpine soarer flying surfaces. Note that the spar is curved to follow the maximum thicknesses of the flying surfaces and has a straight portion near the root to mate with the wing joiner box. (drawing: James Hammond)

Got to Try It…I Was Fired Up

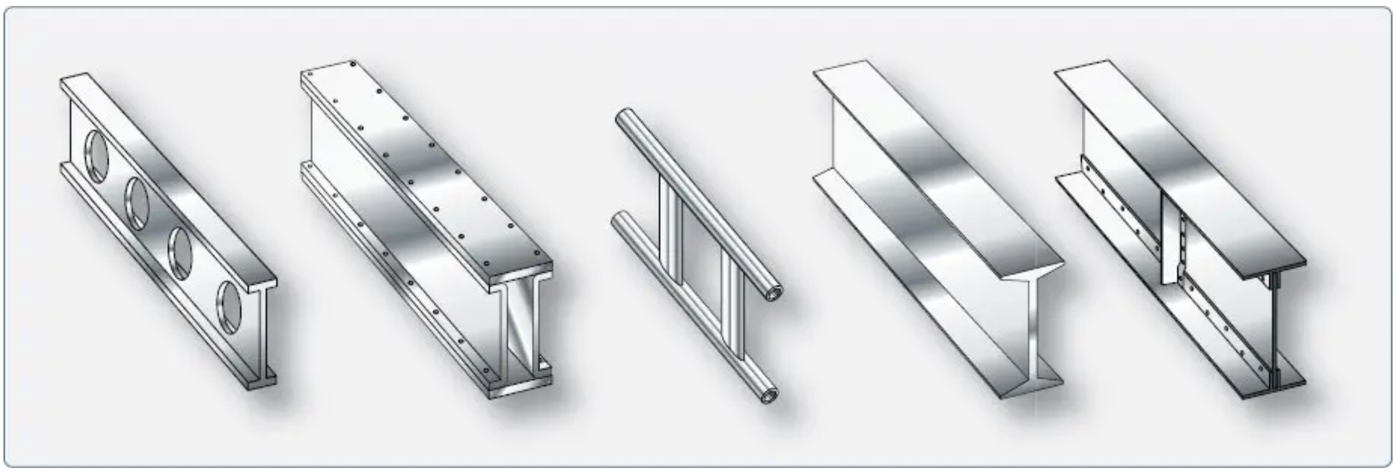
That was one of those occasions where I was almost falling over myself to get something made up that could prove the theory that was developing like an erupting volcano in my brain. The mould was easy — I just drove to the local DIY shop down and came away with a 6 x 3 sheet of plastic roofing material, with about 50mm peak-to-peak frequency. By that time, I was already calling it a 'sine wave spar' though I have to say I'm not actually sure that roofing material is a true sinusoidal profile, but it was going to do what I wanted which was to prove or disprove the idea. Perfect.

Photo 4: A whole sheet of early spars. Later the carbon was reduced and carefully oriented for optimum strength. (image: James Hammond)

I soon had the plastic sheet mounted and turned into a serviceable tool to lay up my first effort. Not wanting to go too crazy I just did a simple six ply lamination of carbon with the plies all in the same 180-degree orientation — in other words the worst case. After curing I cut the sheet and mounted the resulting "spar" into an old (damaged) Redshift model wing mould with a normal glass/balsa/glass layup and a pair of double carbon spar caps. I hardly slept during the 48 hours it took to get it out of the mould and honestly it wasn't the best job with imperfect bonding at the top — but it was enough. By this time, I was completely convinced that it was going to work — logically it just had to; but he big question was — how well?

Now, with my thanks, here's a slightly edited explanation from Konrad Dudek which was originally posted on the Aloft Hobbies Slope Forum:

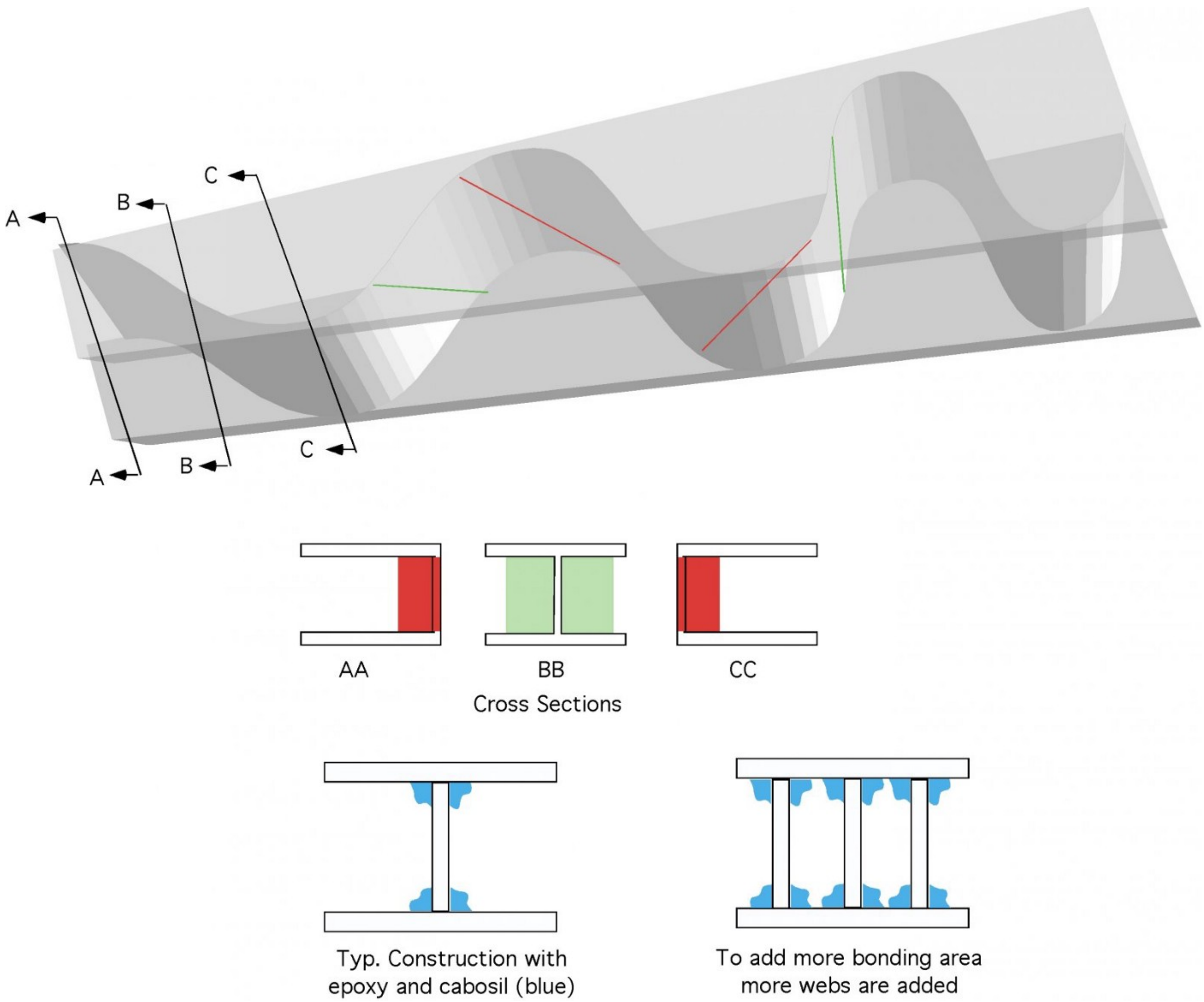
> *Let's set a base line using the I-beam and box beam models.*



Drawing 5: Various spar configurations.

> ***I-Beam***
>
> *It offers a lot of strength for any given amount of material (cross section) against bending. The further apart one can place the spar caps the stiffer the beam is against bending, as I recall this goes up by the square root of the distance. But the I-beam performs badly against any torsional loads it is very easy to twist.*
>
> ***Box Spar***
>
> *It performs much better against torsional loads. But if keeping to the*

> *cross section (mass) the same size spar caps would need to be brought closer together to allow for the material of the box webs. This is a huge cost in bending moment if one recalls the advantage of keeping the spar caps apart. Therefore, most box spars will need to suffer a weight penalty in added material to keep the spar caps as far apart as possible.*



Drawing 6: Cause and effect. (drawing: Konrad Dudek)

> ***Sine Wave Beam***
>
> *The serpentine web offers the best of both the I beam and box beam. With the vertical web going from one side of the spar caps to the other*

> *side of the caps the sine wave beam is much stronger against torsional loads than the box spar. The resulting sine wave beam is almost as light as the classic I beam but there can be slight weight gain compared to the I beam as the effective length of the vertical web is longer; but this can be adjusted in practice by judicious use of the carbon fibre during manufacture. Alternating the UD carbon layer numbers and layer directions between 180 and 45 degrees provides optimum strength.*
>
> *The advantages over 'conventional' spars are easy to see and measure by load and torsion testing of a sacrificial sample wing, as Doc H did in the beginning.*

Other Advantages of the ASWS

Flexibility

Although its technically monolithic after manufacture; until the ASWS is bonded into the wing, it is relatively flexible laterally, and that means it is really easy to train it onto the thickest part of the wing throughout its length — thus making it the most effective that it can be. This ideal positioning is hard or impossible for straight spars to emulate without cranking.

Strength Distribution

The strength and weight distribution are very easily controlled and easy to vary by layering the UD carbon plies according to the position of the spar in the wing. i.e. More fabric at the roots and less at the tips.

Bracing Directions

By changing the angles of the UD fabric plies to give directional bracing between 45 and 180 degrees, the strength distribution and resistance to bending and torsion can be infinitely varied and applied exactly as needed for the position.

Testing

When tested ‘against’ or maybe it’s better put as compared to a well-made conventional box spar, the ASWS showed up as about 30% of the total weight and gave a 15 to 20% increase in tension/compression stiffness while improving the torsional stiffness by about 75%. Quite impressive.

How It Turned Out

Running through my list, I was startled at how well it had come out:

Photo 7: An early experimental ASWS on some G10 glass plate. This method was abandoned in favour of direct bonding to the spar caps. (image: James Hammond)

Weight

About half the weight of a "conventional box spar assembly that I had been using.

Bulk

The ASWS is really skinny and although it takes up more space laterally, it’s also somewhat flexible and will conform easily to the maximum thickness point of an elliptical planform wing — which I always use.

Cost

Possibly slightly more expensive that a box spar in the beginning (It turned out that I had used a lot more carbon than was actually needed.

Difficulty in Manufacture

No, it’s the simplest spar even and can be made in large sheets that are later cut to suit.

Manufacturing Time

There isn’t a lot — it’s fast to produce.

Torsion

Compared to what I had before — ***wow***.

Overall Effectiveness

Massively improved.

Amazingly, it wasn’t just a bit better than a box spar but for strength to weight ratio, the ASWS — yes, by that time I have to admit that I had claimed it — was in a whole new league of its own. Hence, the *Aeroic Sine Wave Spar* has been a feature in all of the Aeroic Composite Aviation Products model sailplanes since 2014.

I invite you to give it a try and see if you don't agree!

*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**.*

A GPS Triangle Primer

A basic introduction to this increasingly popular competition.

Stéphane RUELLE

Some of the pilots and sailplanes present and, of course, the towplanes and towpilots — without them, there would be no aerotow!

I have flown sailplanes for the last 30 years, and have especially enjoyed flying scale models, as much on the slope as on flat land. Without a doubt staying up on a flat land area is more challenging than on a slope. Finding lift and being able to stay up in the air brings you a feeling of joy and happiness that is difficult to explain. In essence, that is what inspires me about it!

When the lift is good you enjoy jumping from one thermal to another exploring the flying site; when the lift is weak, flying is usually more conservative, trying to not take too much risk to lose precious altitude. The approach is usually to stay in lift you have found and to do not dare go anywhere else as, for sure, sink with bring you down in no time. I have been happy with this for about 25 years, but five years ago things changed!

A small group of addicted cross-country guys in the west of the US (John E., Dean G. and Rick S.) started using GPS equipment to do some GPS Triangle racing, and were extremely enthusiastic about it. They brought that idea to the Midwest, lending their equipment during some of the JR Aerotow events for anyone who wanted to try. We were not ready to embrace it yet — go fast, losing altitude, turning laps — what was the point? For me it was “Racing? What for? I just enjoy flying and most of the time I am alone!”

Photo 2: Rick S., one of the promoters of GPS Triangle racing in USA.

Well, folks, I was wrong. In 2019 Peter G. went flying with these guys in Montague, California and was just so enthusiastic about it that we had to try it again! I would say that he found the right words to convince us, not on the racing part, but in forcing ourselves to improve, alone, by not staying in the same area and exploring the entire field; to prove yourself that you can do better, with the best competition being against yourself.

So, what is GPS Triangle? It consists of a task that is defined by a triangle where the turn points are located 500m 90 degrees to the right (referred to as TP1) of where the pilots stand, 500m in front of the pilots (TP2) and 500m to the left (TP3). The starting gate is an imaginary line between TP2 and the pilots. Racers must cross the start gate lower than 500m altitude and less than 120km/h, then do as many laps as possible in 30 minutes. Energy management is key between being conservative and keeping altitude and being audacious (‘push it’ as Dany A. describes in his videos) to optimize the number of laps while still looking for thermals. During a competition, ‘work time’ (generally speaking 15 minutes) is defined as time in which you have to be towed up and cross the start gate.

There are other less formal formats: for example a ‘Cup Challenge’ where, during a meet, you can fly when you want, make as many attempts as you want, and keep your six best flights. This past year with COVID, some virtual cups have been organized: not at the same field but during the same weekend, just for fun, across the globe, so no pressure from shoulder-to-shoulder competition.

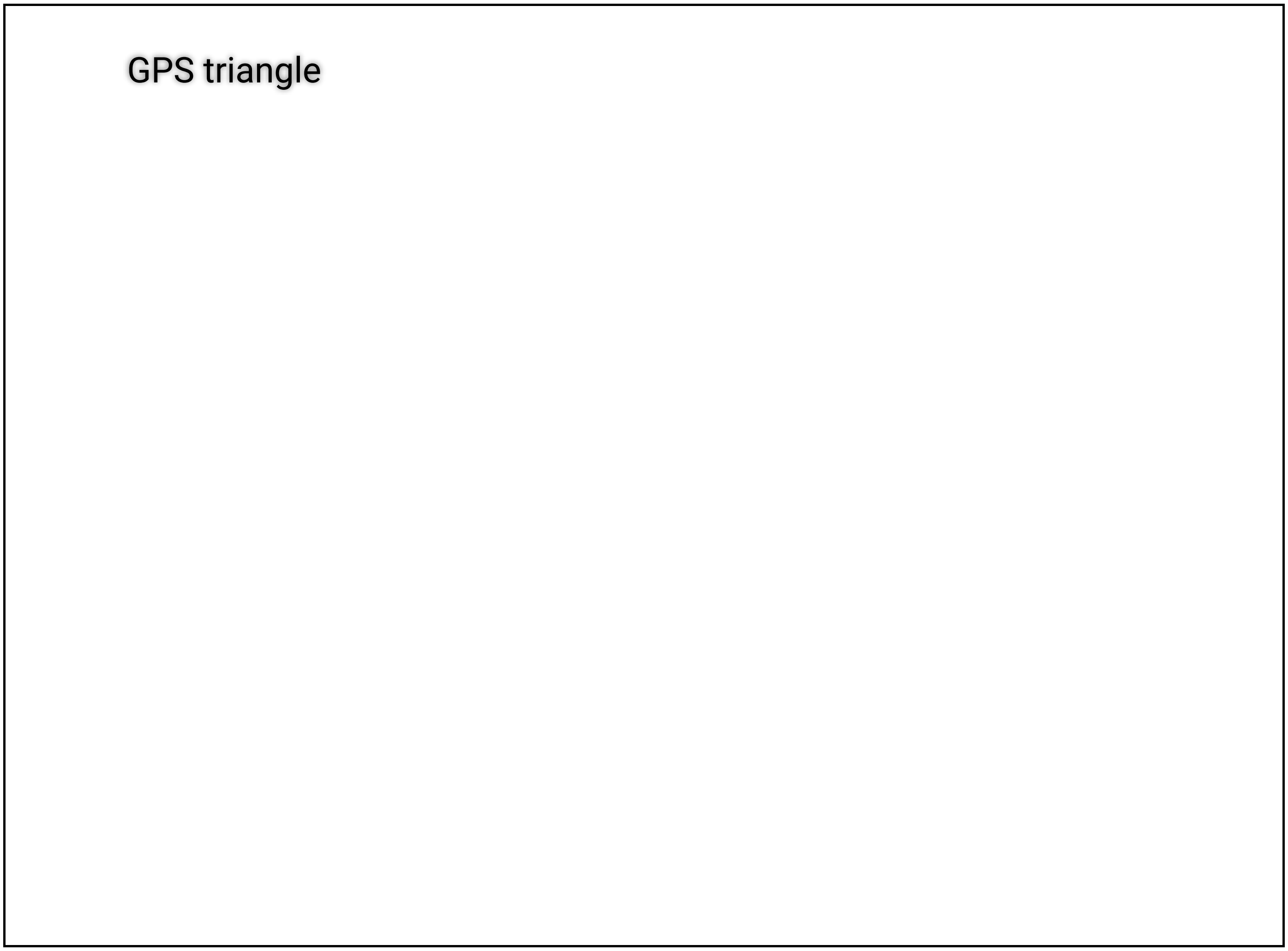


Figure 3: Visualization of the task at my home field.

Some new classes appeared in the last year to expand the range of gliders used: *Scale* (1/3 scale max), *SLS* (no limit of size), *Sport* (max 5m 7kg, 30mn, 350m course) and *Light* (F5J type, 20mn, 200m course).

Photo 4: Me and my trusty H9 ASH31, the perfect ship to practice.

I purchased a unit and started to play with it. The main information provided is GPS location, but it also provides additional information about your model to make you more aware of what it is doing: speed, altitude, compensated vario and heading, for example. Using my trusted Hangar 9 6.4m ASH31 I used that unit every time that I went out. I have been able to practice by myself as my model was able to ROG.

I would say that I like a lot the idea of having feedback, and being forced outside my comfort zone, climb as best I can but also dare to prospect the area when the lift is not there and see how to optimize my flying skills.

In 2020 we were planning, with a couple of East Coast guys, to go to the cross country/GPS mecca in the US : the Montague Sailplane Festival located in Montague, California very close to Mount Shasta, and about one hour south of the Oregon border. But as everybody knows, 2020 was a bust. I got a rain check for my airline ticket as the sole prize!

Photo 5: The Siskiyou Mountains at sunset.

We decided with Peter G. to commit to 2021 despite the uncertainties, in the hope that things would get back to some form of normality. We have been blessed as the closer we got more restriction were lifted leaving us with the possibility of participating in the 2021 edition.

Peter drove from Illinois with both of our models, and I joined by air arriving Saturday, just before the training day. Competition was starting on Monday and was ending on Friday after five days of hard flying.

Photo 6: Peter G. bringing his '22 at the start gate.

First let me describe the venue. For me, coming from the Midwest, driving through Oregon and Northern California gave me some memories of my native Alps, just a pure joy ride even before starting to fly. The city of Montague is located on a plateau at 2500ft that is sandwiched in between a pass on the north enroute to Oregon and another one to the south to go to the San Francisco basin, making the scenery and climate quite unique. The vision of Mount Shasta at 14,000ft can justify by itself the entire trip!

Photo 7: My 8.8m ASW22 BL from Baudis in the foreground. That's Mount Shasta in the background.

Dean G., the organizer, hosted us in two full size hangars at the Siskiyou County Airport, an old US Air Force NORAD base, which was very convenient to gather the models and the pilots. The flying site is just two miles from the hangar, no grass like in the Midwest but a level dirt runway that is quite wide and long so you cannot miss it (except if you land down wind — see my video). The country is beautiful, very low density population, annd low density air traffic. A perfect recipe for a good flying site.

Photo 8: Here is the club house — a full size hangar with ASG-32 SLS on display!

It took me a couple of days to get a handle on the atmospheric conditions, which are very different from the place I usually fly. Lift was present, even early in the morning but spotty, inconsistent and weak. This is very unusual for this place as the week was way cooler that what they usually have for June. But after a couple of days I had a handle on it, especially after remembering to plug my compensation probe into my variometer!

Photo 9: The Pilot Stand.

Competition was fierce with lots of very good pilots enrolled, a perfect environment for learning from each other. The number of laps between heats varied between two for the poorest conditions and 16 for some monstrous lift coming through for half an hour! The highlight of the week was for me was deciding to start the task first, not always the best choice as there is no other sailplanes to mark thermals for you. However, conditions were good at the beginning of the heat and got weaker and weaker, giving me an advantage over other pilots during this heat.

Photo 10: Pilot and spotter reading trajectory, thermals, other planes. It's not unusal to request to yell out altitudes just to be sure that you are not flying at the same level in the same thermal!

I had to go back to Michigan early, on Friday, missing the last day of competition so I could watch my son's state water polo tournament. But I was left with some beautiful memories, some willingness to improve my task management, and the will to come back next year to another great event.

Photo 11: Pilots rehashing a great day's flying.

Finally, let me take you on a ride onboard my ASW22 for a lap session in Montague.

Baudis 8.8m ASW22BL @ 2021 US GPS Triangle Nationals

If you cross paths with people familiar with GPS Triangle competitions, ask them to give you their insight on it. I am pretty sure that they will be more than happy to share their experience, to have you try a task with your sailplane and possibly use their equipment. I have demonstrated GPS Triangle in the Cumberland, Maryland aerotow events and will be more than happy to demo it to you should we cross paths at some point in the future.

Resources

- Additional photos
- GPS Triangle equipment

- GPS Triangle rules
- USA GPS Triangle Facebook group
- ScaleSoaring.com forum

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****.*

J'Adore PicaSim!

A superb — and free — flight simulator for slope soaring.

Chip Kaye

François Cahour's Quartz model in flight in PicaSim.

Flight simulators are, of course, no substitute for the natural-world pleasures of RC soaring. But they ***can*** be loads of fun to fly and can serve as an excellent, risk-free training tool. With PicaSim you will be able to put in stick time easily wherever/whenever to refine your existing piloting skills or develop new skills and the related muscle memory needed for true piloting fluency without thinking. As one personal example with many, ***many*** crash-free hours of practice I was finally able to crack the code on the previously disorienting inverted rudder control!

PicaSim introduced me to RC soaring in general and the marvels of slope in particular. Living in New England where much of the otherwise wonderful slope terrain is rendered unflyable by heavy tree cover, PicaSim has been my constant partner and most reliable flying locale (NOTE: Terence C. Gannon's delightful column *In The Air: Is great flying right on your doorstep?* from last month is an inspiration so I am ***not*** giving up!) I first learned of PicaSim through the wonderful video tutorial (Video 1) immediately below from Steve 'Surfimp' Lange flying his influential Le Fish design — seeing this I was instantly and completely hooked with slope soaring, aerobatics and PicaSim:

Video 1: Intro to R/C Slope Aerobatics with PicaSim.

First released in 2013, PicaSim began life earlier as the popular *Slope Soaring Simulator* (SSS), both developed by the generous and productive Danny 'Mr. Rowl' Chapman. Over time PicaSim has seen steady improvement with new features, planes and flying locales and is available on desktop for Windows (and MacOS by using Windows emulation software like *PlayOnMac*) or as a mobile app for both iOS and Android. I fly the desktop version which is entirely free to download and use but can be supported with a small donation on the *RowlHouse* website which I'd encourage for all who use it regularly. The two mobile apps are available through their respective app stores either as a free/limited version or for a nominal cost for the full/unlimited version (see *Resources*, below, for links to all of these sites).

For slope enthusiasts in general and particularly if you enjoy aerobatics, ultrabatics and VTPR, PicaSim truly stands apart from the competition. While major commercial simulators focus broadly on features and support for powered flight, they are generally limited for wind-powered flight. PicaSim though has gliders and slope soaring in its DNA. Many folks, myself included, feel that PicaSim's features, flight performance and glider and wind modeling for slope are second to none.

While a comprehensive tutorial on PicaSim's extensive features and configuration options is beyond the scope of this article (see related links below under *Resources*), here we will have a brief overview of the features that make PicaSim so special: *Gliders*, *Flying Sites* and *Customisation*. That said, while these technical details and features indeed make for a robust, customizable system, the true joy is in resulting excellence of PicaSim's slope soaring experience.

Setup and Configuration

Assuming you have downloaded and installed PicaSim and configured your radio transmitter as the controller (see related links below under *Resources*), at program startup you will be presented with the main screen. Here you will find access to PicaSim's useful Help system notes (`?` icon at bottom) and choice of PicaSim's two modes of operation: `Free-Fly` and `Challenge`.

Figure 2: Main startup screen.

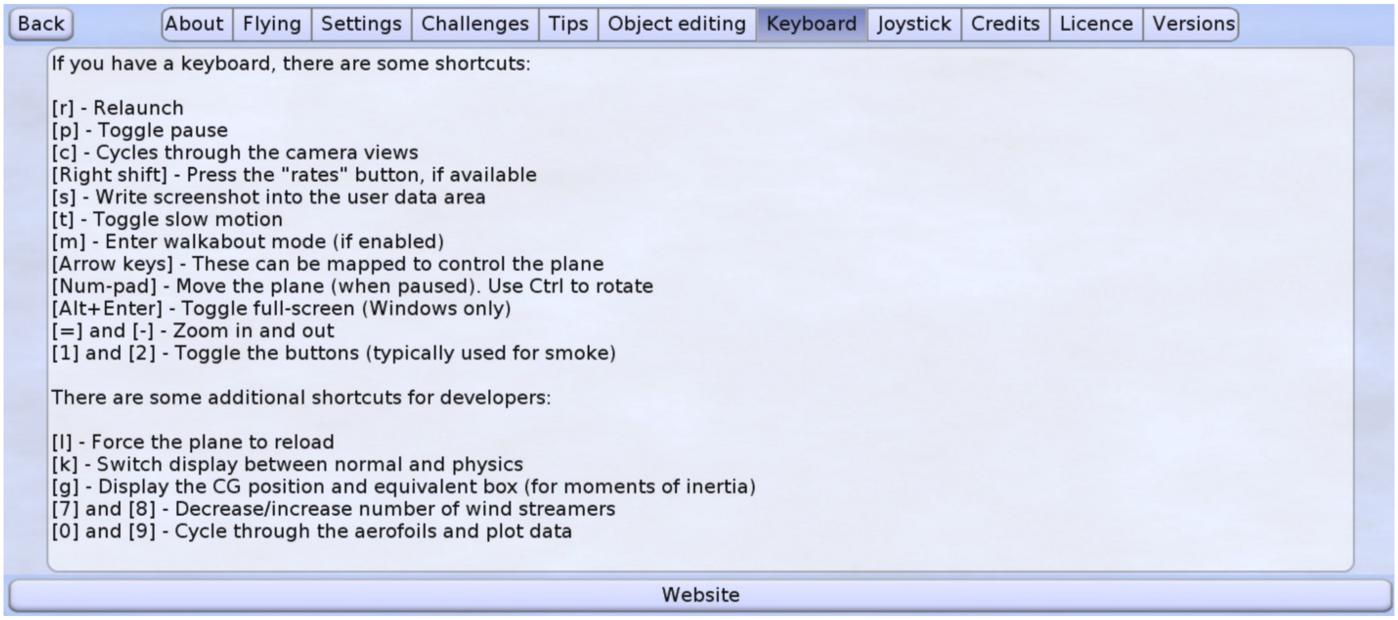


Figure 3: Help system displaying useful Keyboard short cuts

The `Challenge` mode offers a variety of training and contest flying scenarios (thermal duration, F3F racing, gated courses, mountain racing, etc.) which can be great fun. Here though we will be focusing on the `Free-Fly` mode whereby you can choose your own combinations of glider, flying site and other configurations.

PicaSim's configuration sysem is where you can set all manner of options for your glider and flying scenario and is accessed using the `Gear` icon displayed on both the startup screen (Figure 2) or the main flying screen (Figure 4).

Figure 4: Main flying screen with access to PicaSim configuration and walkabout features.

The configuration page includes a set of tabs across the top giving you access to a variety of program feature groups including `Aeroplane` and `Scenery` for tuning your glider and flying site which we will discuss in more detail later. Generally it will be these two tabs along with `Options 1` and `Options 2` you will use to set your own preferences. Each of the tabs can be viewed as an abbreviated 'Simple' set of options to get started or as an expanded set of all possible options by using the `Advanced` button at the bottom of the screen.

PicaSim also smartly provides the ability to save and load your own custom configurations through the `Save…` and `Load…` buttons at the bottom of the configuration page (see *Customization*, below, for details).

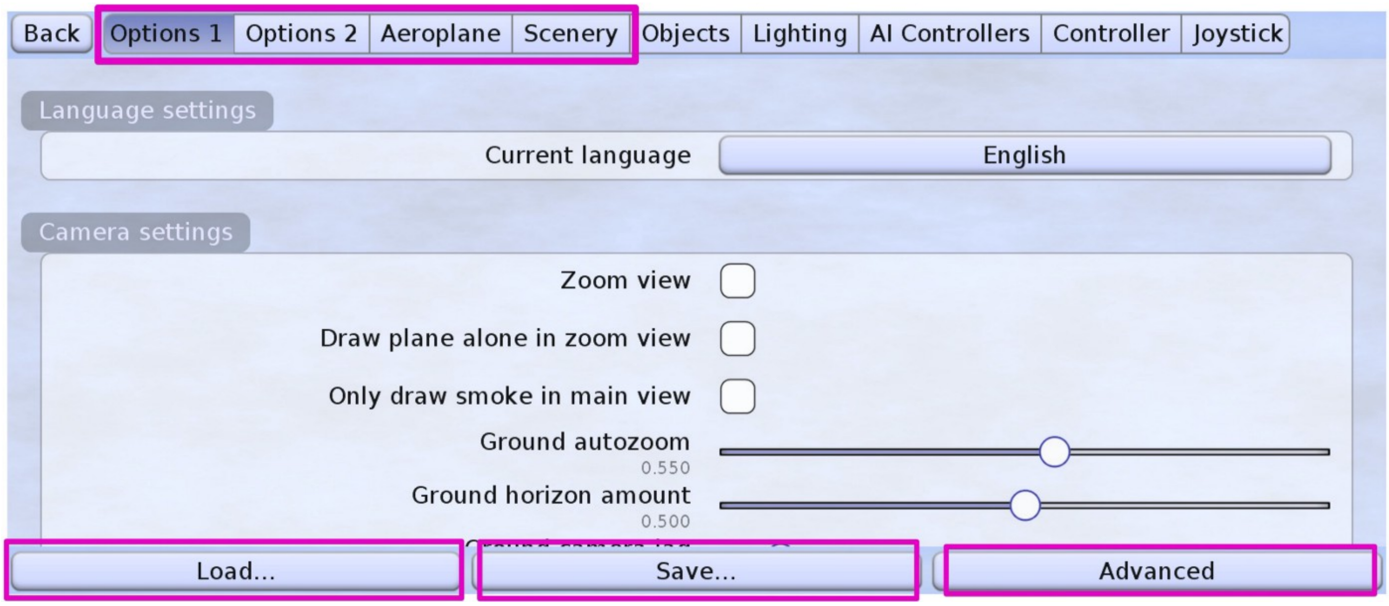


Figure 5: Configuration page.

Gliders (aka `Aeroplane`)

Out of the box PicaSim includes a large variety of glider types and models — slope, F3F, DLG, motor and scale gliders, for example — and among them are a number of well-known slope designs including *Le Fish* (Steve Lange), *Dreamflight Weasel* (Michael Richter), *Quartz* (François Cahour), *Quark* (Island Models), *Phase 6* (Chris Foss) and others. In general these and all of PicaSim's models have been painstakenly tuned to best approximate their real world counterparts, but as we'll see they can be further tuned and customized to match your own preferences.

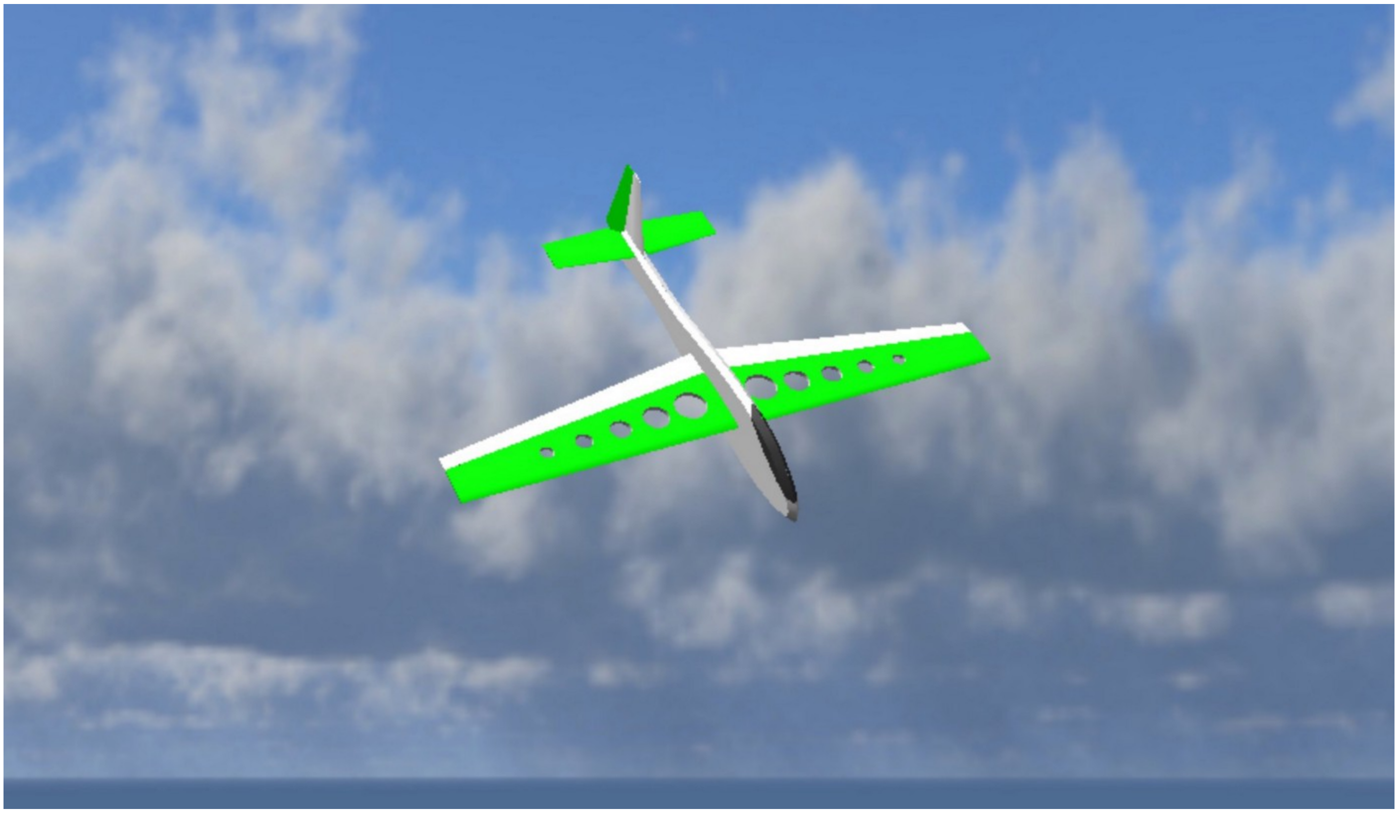


Figure 5A: Le Fish Ultralight (design: Steve Lange)

Figure 5B: Dream-Flight Ahi (design: Michael Richter)

Figure 5C: Quark (design: Island Models)

Figure 5D: Trapeze (design: Paige Anderson)

Beyond PicaSim's included models, new models can also be created and added to the system. The process for creating new models (see *RowlHouse Customisation* page in *Resources*, below) is quite involved, but anyone can take advantage of models created by others. Recently RCGroups member *Bishop_1* created an excellent version of the *Dream-Flight Ahi* which can be easily downloaded (see also *PicaSim Ahi* in Resources) and added to PicaSim for anyone interested as shown in the following video.

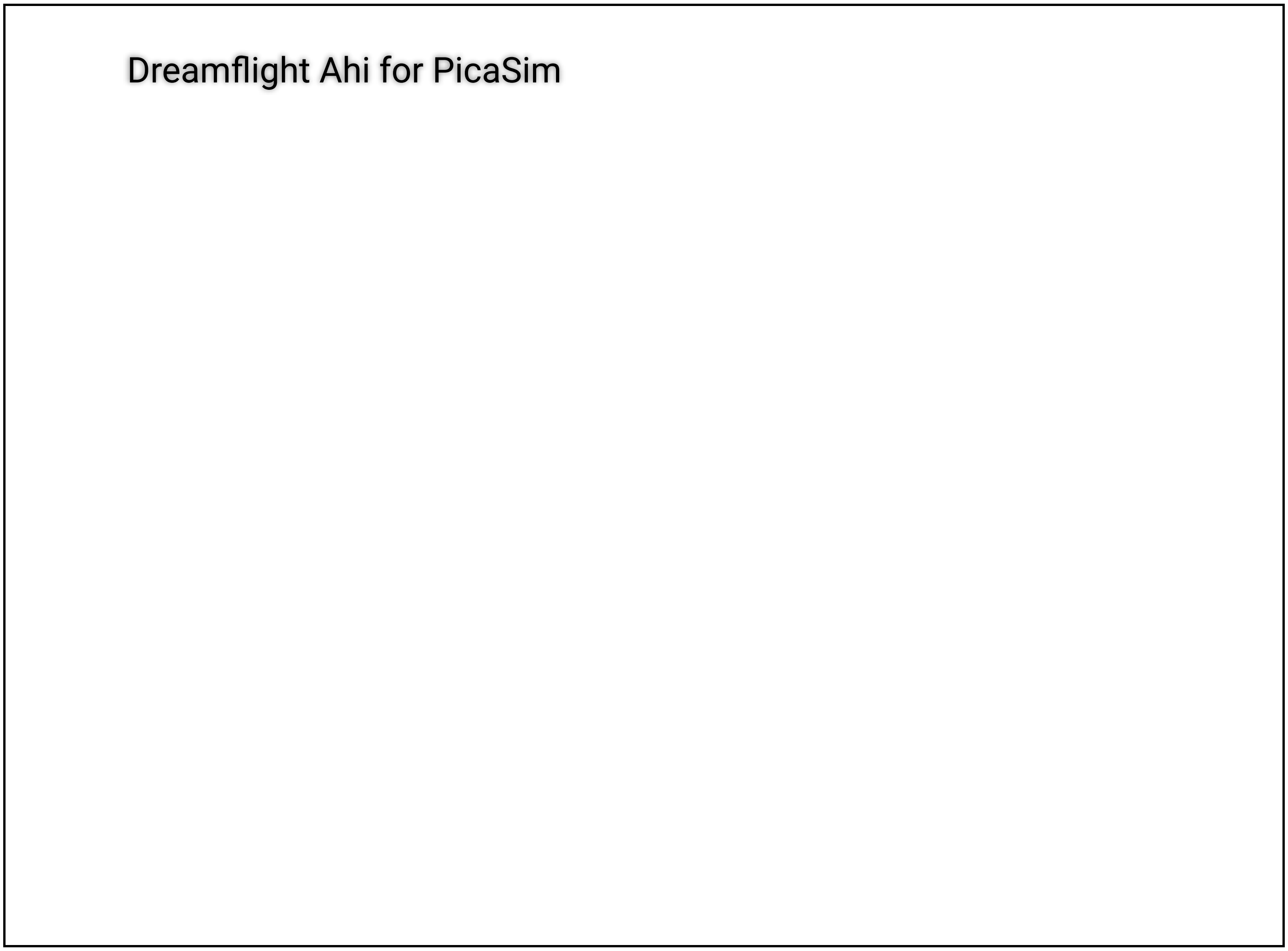


Figure 6: Tutorial on installation of the Dreamflight Ahi.

The default configuration for each glider is modified through the config page `Aeroplane` group tab. The group's many options are broken up into several sections and below we see the first `General settings` section which provides quick access to the primary flight and airframe tuning features. Here you have the ability to add and adjust ballast and modify the size, mass and drag of the airframe giving you a great deal of control to customize the flight characteristics to your own preferences or even to create what effectively is a different model—for example, ever flown a 3m *Le Fish*?

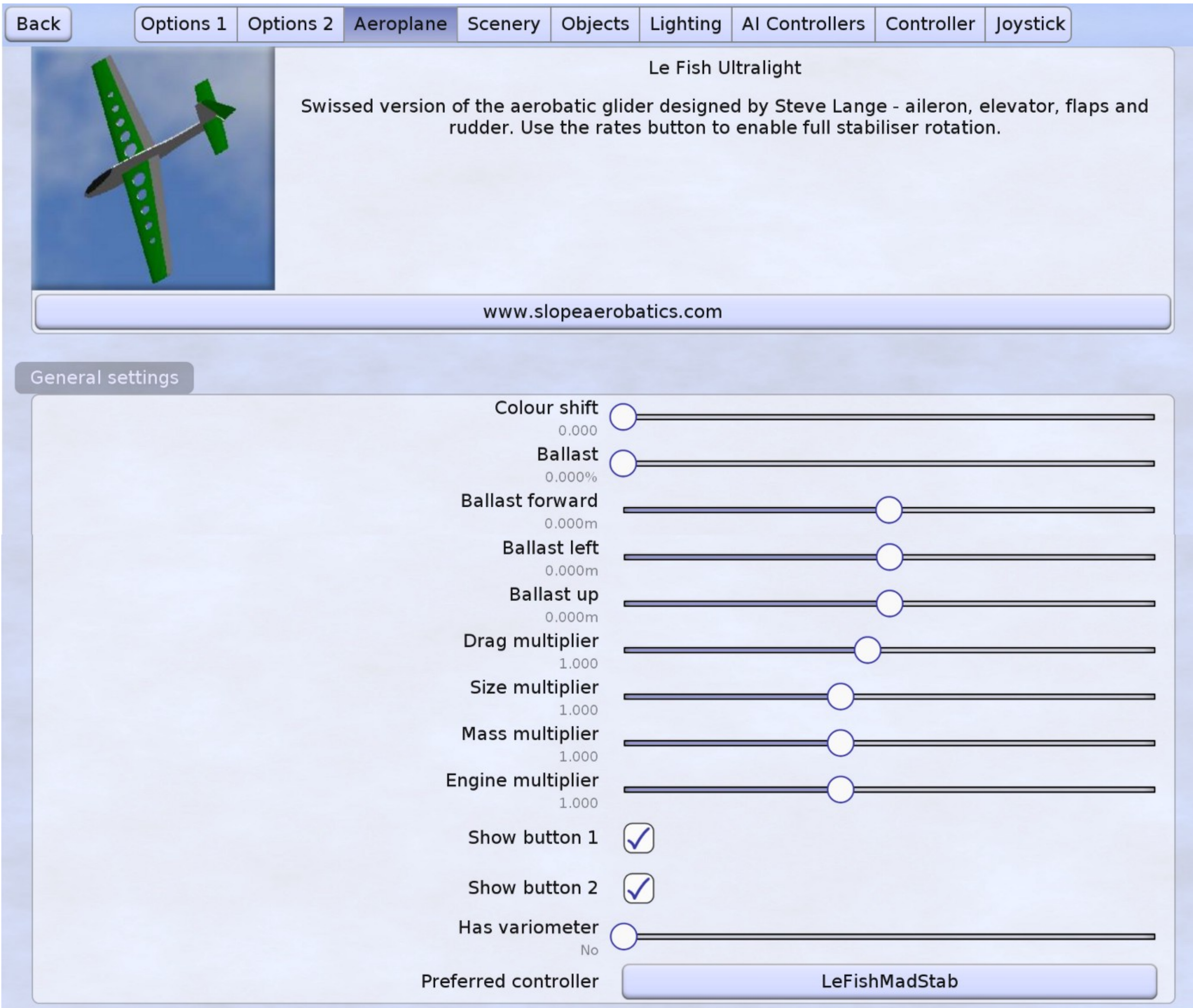


Figure 7: General glider configuration settings.

Flying Sites (aka `Scenery`)

To my mind, PicaSim's many slope flying sites are perhaps it's greatest strength. Below you can see a number of the many sites which can be accessed throught the `Load…` button (Figure 5) on the configuration page `Scenery` tab. Using the tabs shown at the top right of the `Load scenery` screen you can view all of the flying sites or choose a subset including `Slope` as shown below or `User` which will display your customized flying sites created with the `Save…` button (Figure 5).

The `Cliff` site first on the list is a great place to start and seems to be especially popular as seen in many PicaSim YouTube videos where it is featured. But don't let that obscure the enormous variety of slope gliding experiences contained in the other options as described below (Figure 8).

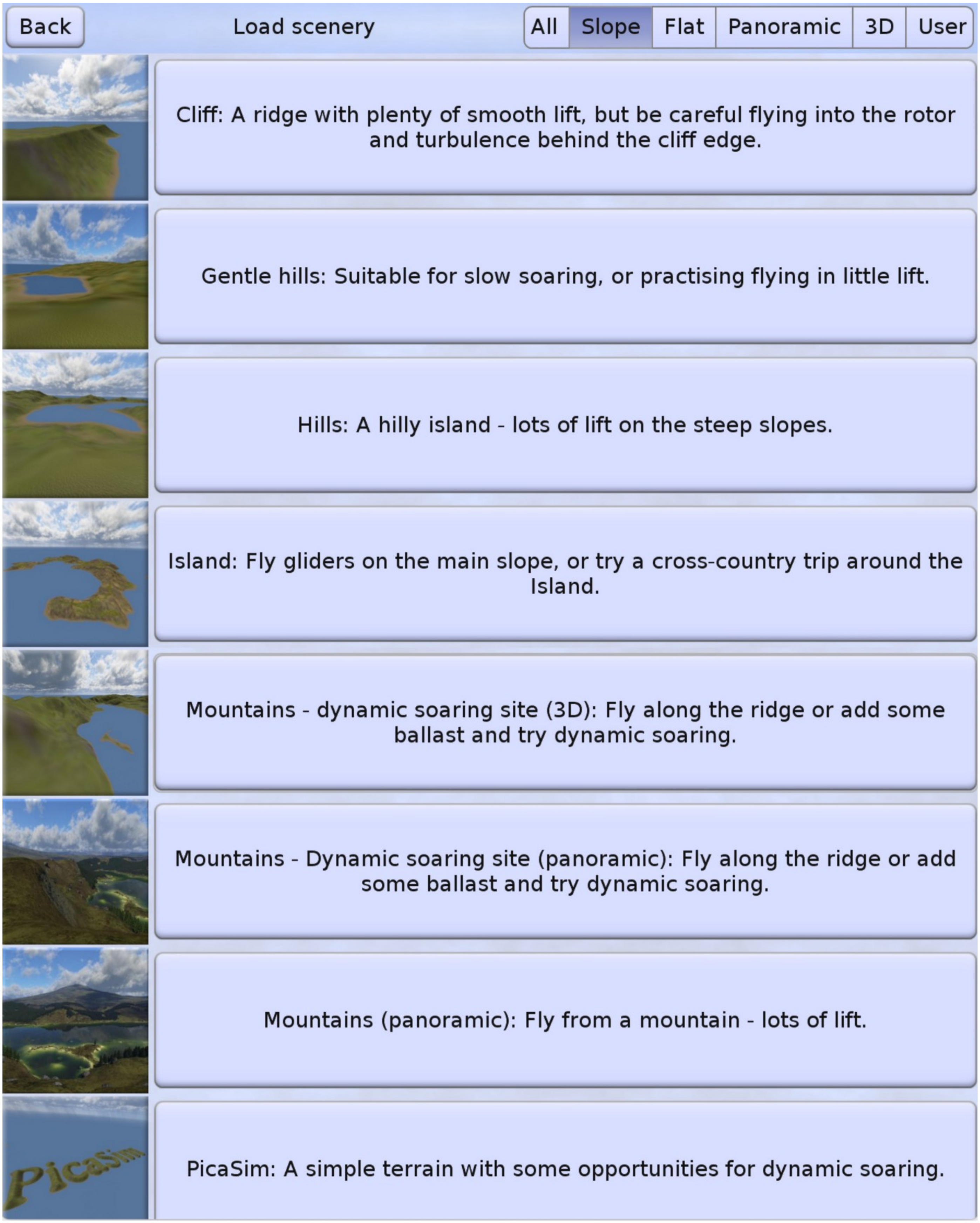


Figure 8: Selection of slope flying sites.

Of special interest for selecting flying sites is PicaSim's *Walkabout* feature. Clicking the walking-figure icon (Figure 4) puts you into a mode whereby you can use the right stick on your transmitter to move throughout the selected scene to find new slopes to fly. Once you find a new spot you can immediately begin flying as the program will automatically configure the wind direction to blow directly into the slope. And if you like the new slope position you can save it as part of your user configuration by using the `Save…` button (Figure 5).

As with the `Aeroplane` tab discussed earlier, the configuration page `Scenery` tab is broken up into several sections. Below we see the first `Wind settings` section which provides quick access to the primary parameters for controlling wind and lift. In particular the `Wind speed`, `Wind bearing` (for off-axis wind direction), `Turbulence amount` and `Rotor tendency` parameters allow you to dial in anything from near perfect conditions — great for practicing new aerobatic manoeuvres without fighting the wind — to near impossible conditions — great for honing your skills and saving your fleet from disasterous flying in sub-optimal conditions in the real world.

Figure 9: Flying site wind configuration settings.

Customization

Once you have dialed in settings for any of the configuration screen tabs, you can save it as a `User` configuration to be loaded at any time. Below we have customized the standard `Cliff` flying site by dialing down the values `Wind speed` and `Turbulence amount` (the values shown happen to be standard settings I use for flying the *Le Fish Ultralight* model). Once you are happy with your own settings you can click the `Save…` button at the bottom of the screen.

Figure 10: Customized "Cliff" configuration, ready to be saved.

Here we see the display after clicking `Save…` above. In this example I am naming my custom `cliff` configuration as `my_cliff`.

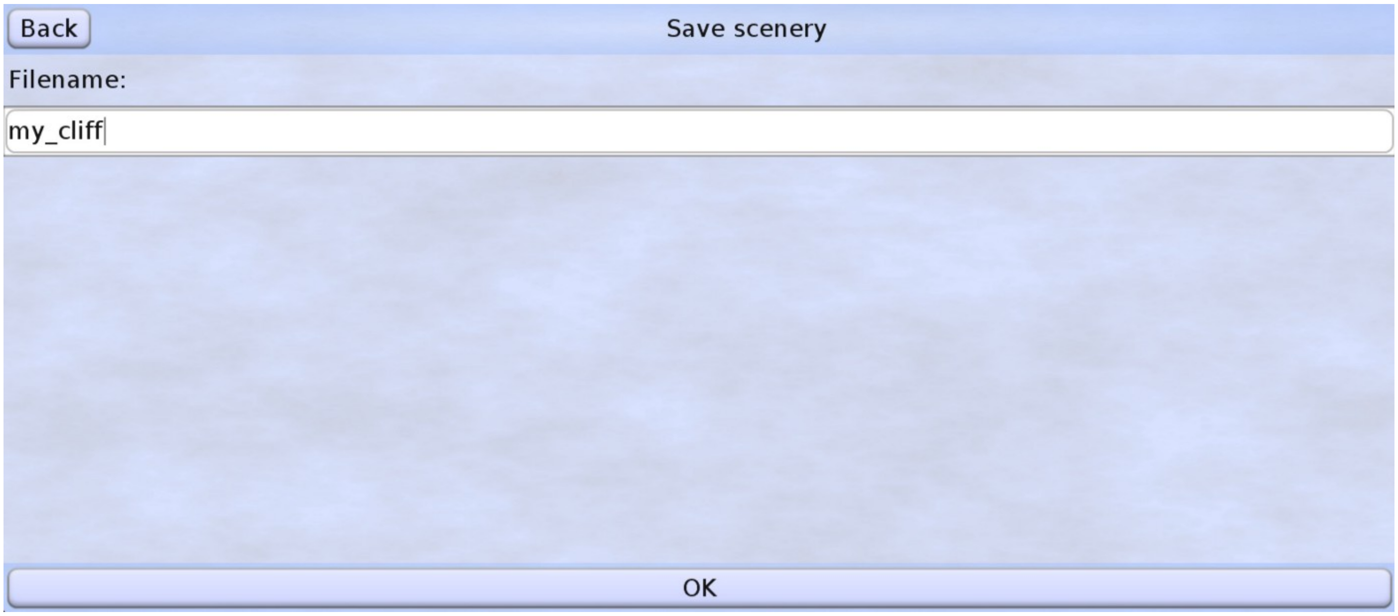


Figure 11: Saving '`my_cliff`' configuration on the 'Save… button screen.

And here we see the display after clicking the `Load…` button above. By selecting the `User` tab at the top right we are presented with only our custom configurations for easy access, in this case the `my_cliff` configuration saved above.

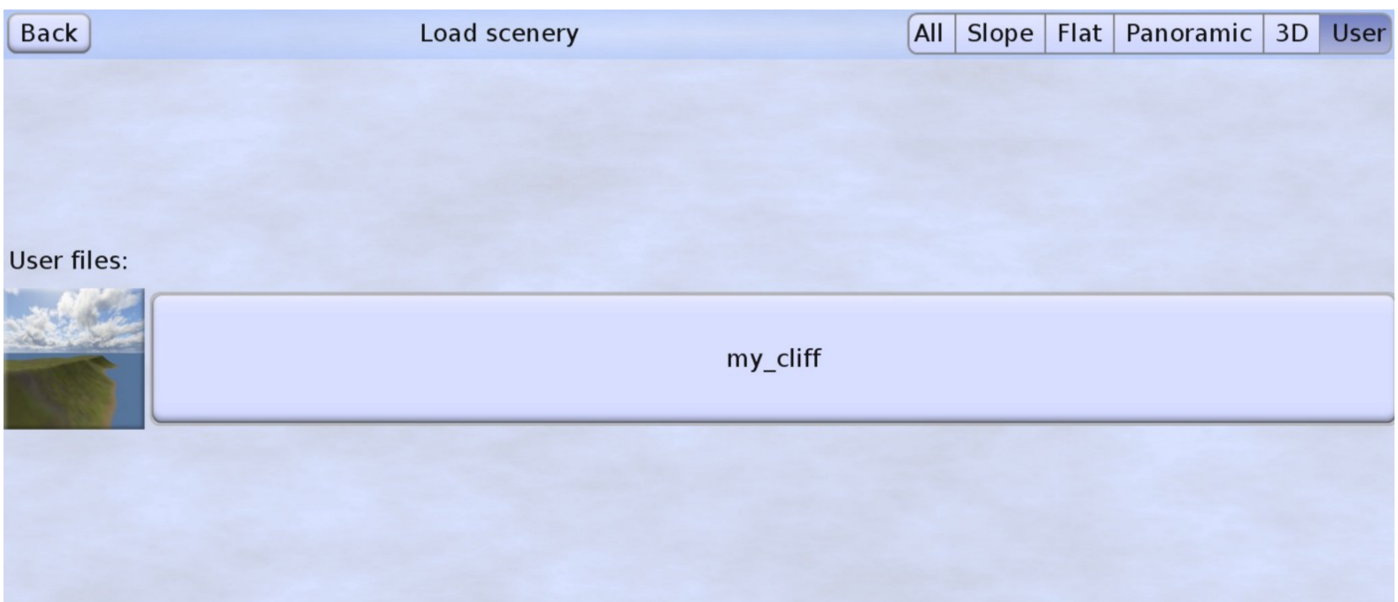
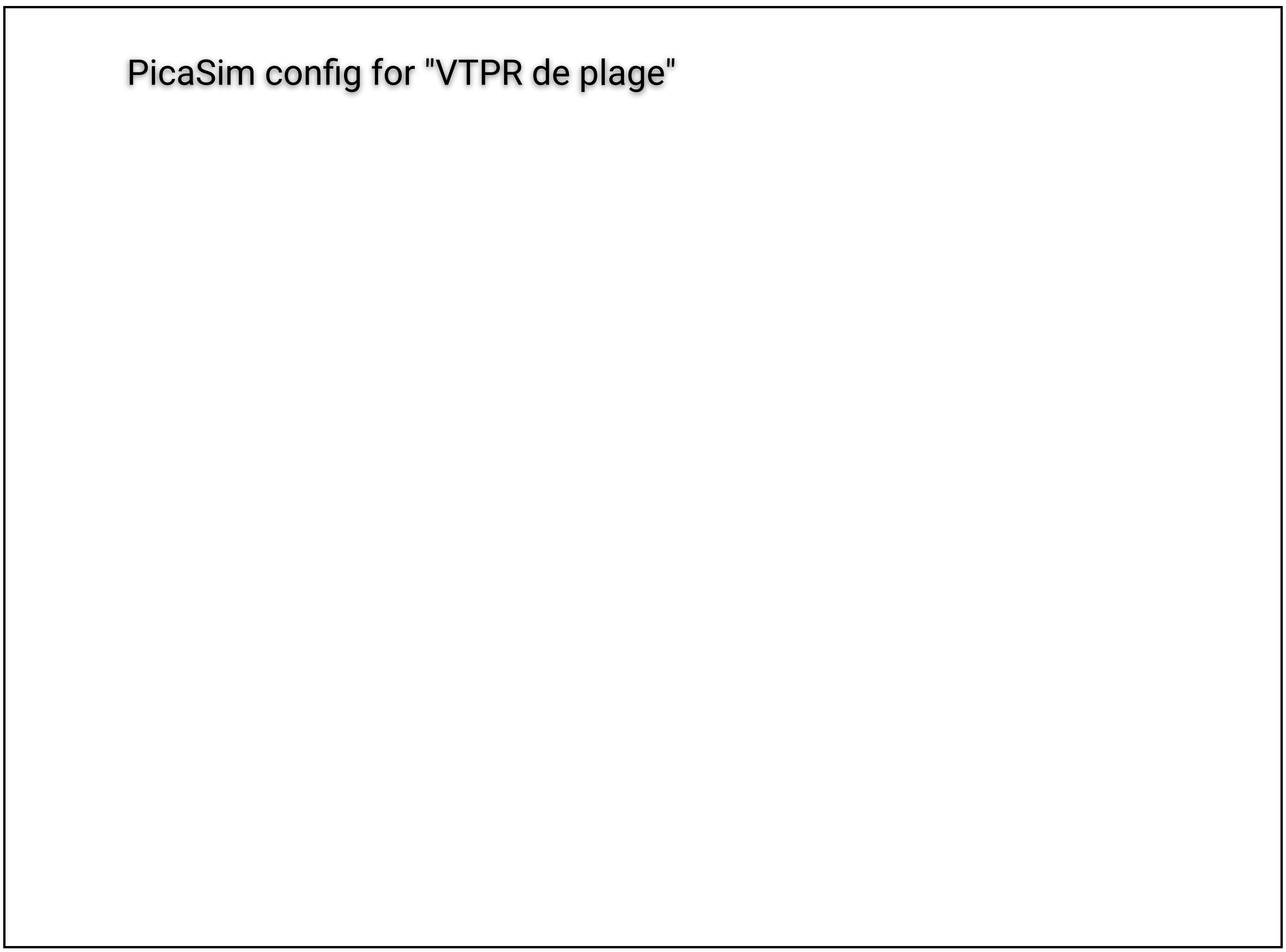


Figure 12: Loading custom 'my_cliff' configuration on the 'Load…' button screen

Note again this `Save…` and `Load…` functionality applies to all of the configuration page tab groups so you can save custom settings for all of PicaSim's configurable options.

Finally, going beyond the main wind settings in the example above, the following video demonstrates how you might use more advanced `Scenery` parameters to develop a highly customized flying site. In this example I am configuring the standard `Cliff` site to approximate a flying site based on a remarkable video of Eric Poulain flying his iconic Excalibur design on a low 2m slope directly on a beach in France (see *VTPR de Plage* in *Resources*, below).



Video 13: Customizing a flying site to match it's real-world counterpart.

End Note

With this very brief overview of PicaSim my sincere hope is that it might spur your curiosity enough to give it a try — you may well be surprised at just how useful and fun it can be to fly virtually! And I would invite anyone to post to my RCGroups thread *Documenting PicaSim for Slope and VTPR* (see *Resources* below) with your questions and — hopefully — your PicaSim experiences ahead. Cheers.

Resources

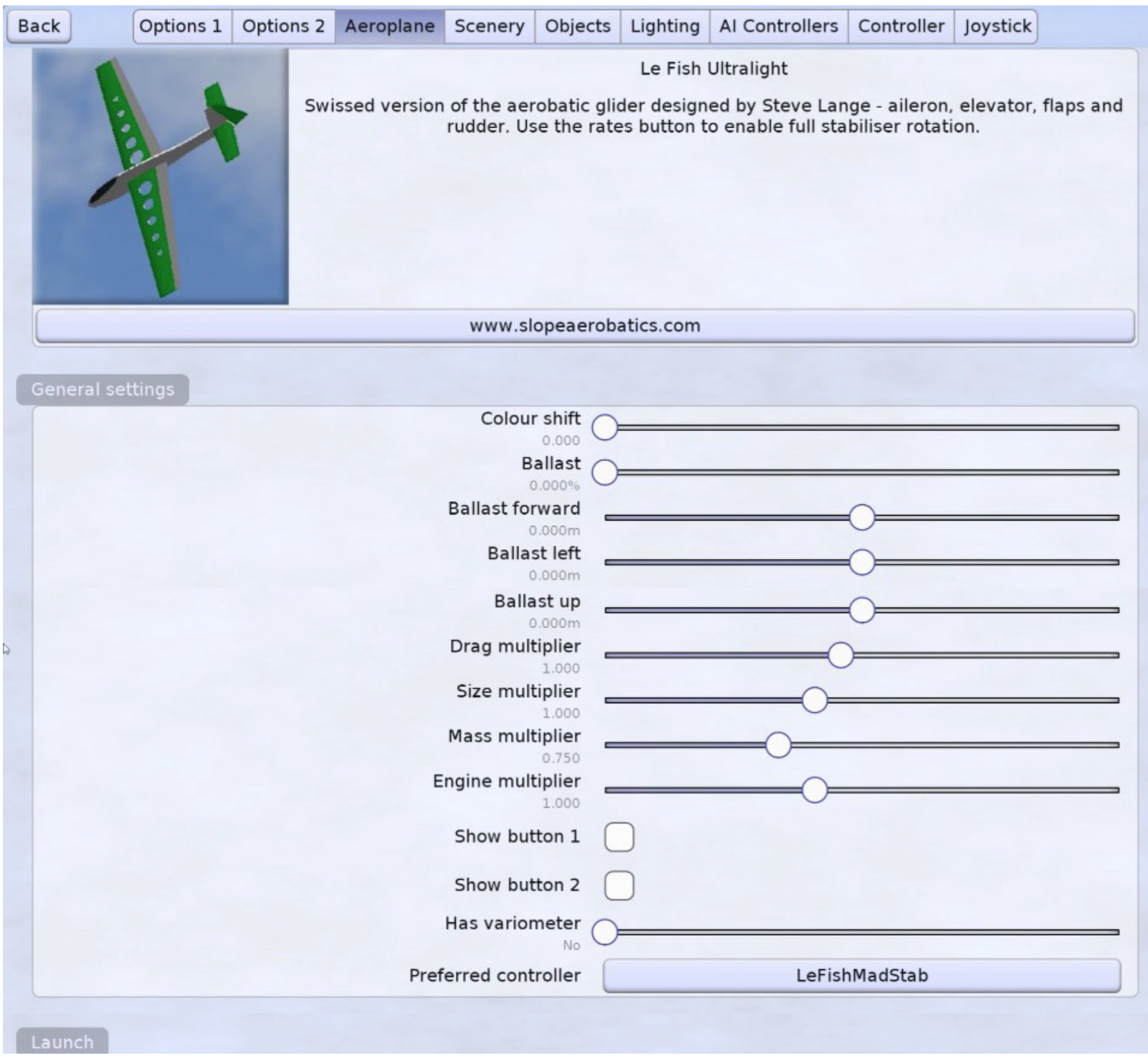
Below are a few resource links to help get you going with PicaSim and later perhaps to dive deeper into it's more advanced features and configuration.

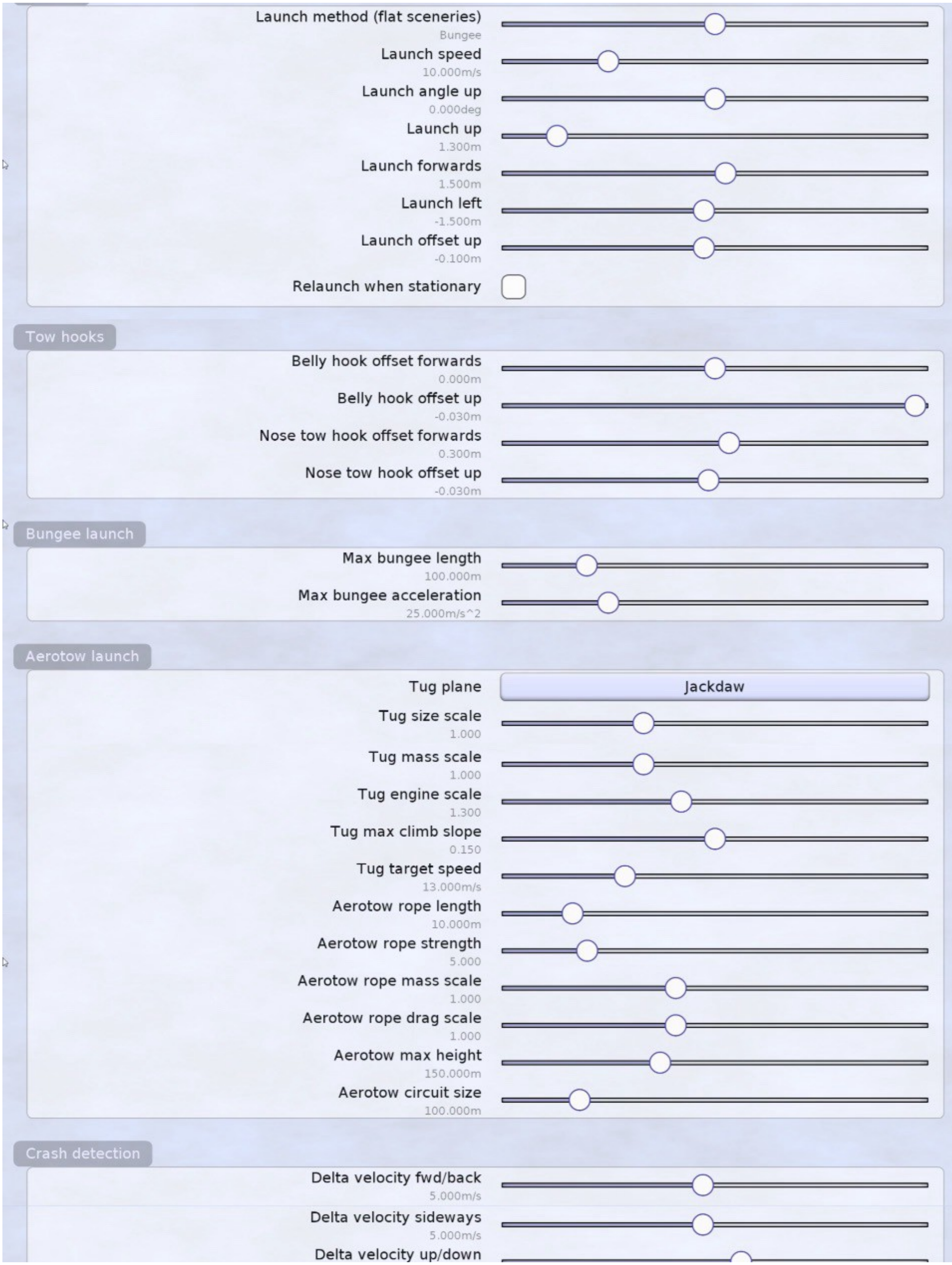
- The Official PicaSim website
- Downloading PicaSim
- Free *PlayOnMac* software for running PicaSim on Mac
- Glowing words about PicaSim from François Cahour
- RCGroups thread — *Documenting PicaSim for Slope and VTPR*
- RCGroups post — *PicaSim Ahi model files and installation*
- RCGroups threads search for 'PicaSim'
- Danny Chapman's official PicaSim YouTube channel (videos)
- *PicaSim: Controller setup with R/C Transmitter* (video)
- *Intro to R/C Slope Aerobatics with PicaSim* (video)
- PicaSim for aerobatics practice — *Studying the Masters: BPLR's Mad Snap in PicaSim* (video)
- *François Cahour's Quartz in PicaSim* (video)
- *In The Air: Is great flying right on your doorstep?* by Terence C. Gannon
- *Slope Soaring Simulator* (SSS)

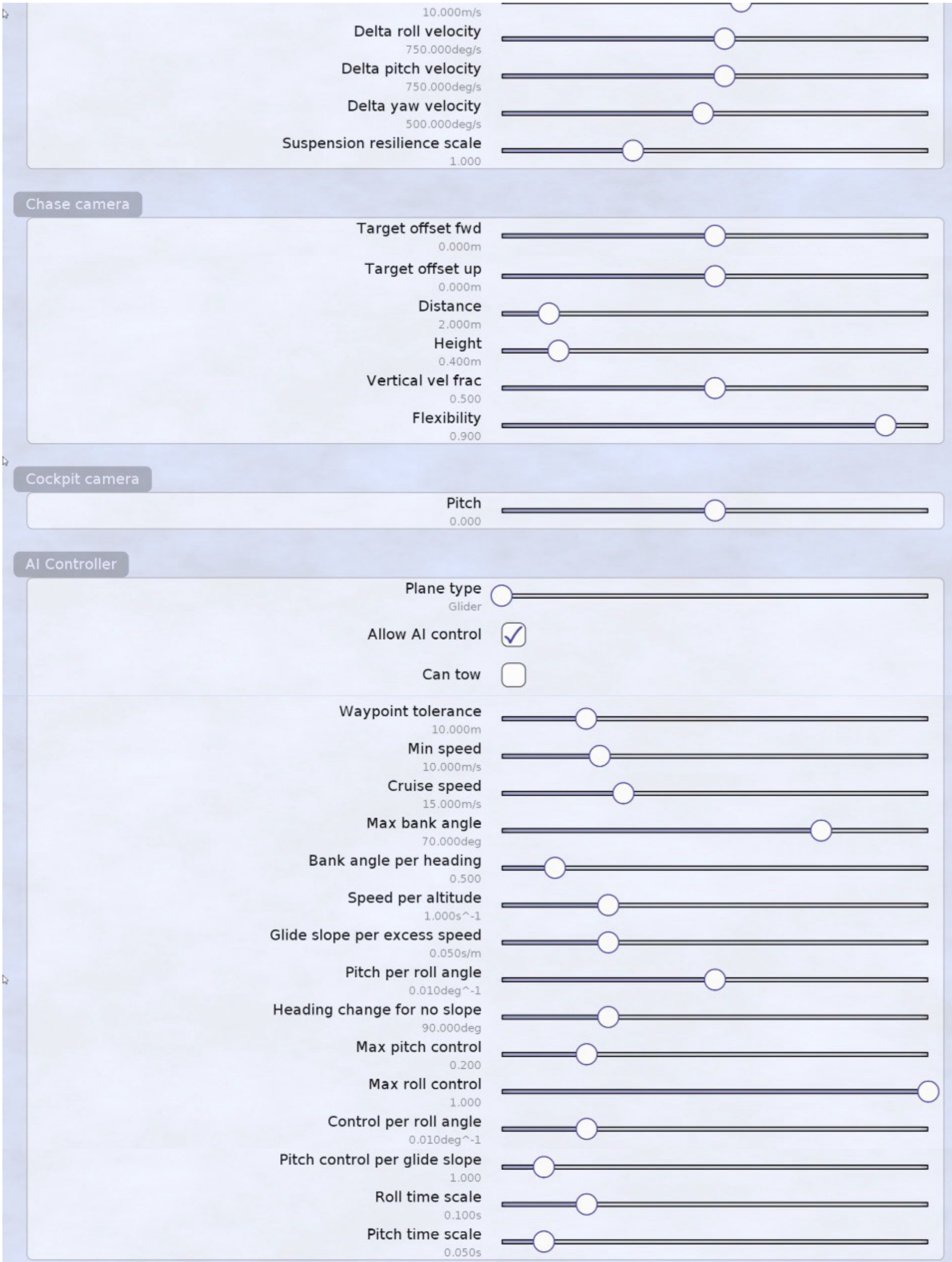
- RowlHouse Customisation page
- Dream-Flight Ahi (promo video)
- VTPR de Plage (video)

Full Configuration Options

The full set of `Advanced` options for each of the configuration page tabs are quite extensive. Below you can view all of the options available for the important `Aeroplane` and `Scenery` tabs.




Launch method (flat sceneries)
Bungee
Launch speed
10.000m/s
Launch angle up
0.000deg
Launch up
1.300m
Launch forwards
1.500m
Launch left
-1.500m
Launch offset up
-0.100m
Relaunch when stationary
Tow hooks
Belly hook offset forwards
0.000m
Belly hook offset up
-0.030m
Nose tow hook offset forwards
0.300m
Nose tow hook offset up
-0.030m
Bungee launch
Max bungee length
100.000m
Max bungee acceleration
25.000m/s^2
Aerotow launch
Tug plane
Jackdaw
Tug size scale
1.000
Tug mass scale
1.000
Tug engine scale
1.300
Tug max climb slope
0.150
Tug target speed
13.000m/s
Aerotow rope length
10.000m
Aerotow rope strength
5.000
Aerotow rope mass scale
1.000
Aerotow rope drag scale
1.000
Aerotow max height
150.000m
Aerotow circuit size
100.000m
Crash detection
Delta velocity fwd/back
5.000m/s
Delta velocity sideways
5.000m/s
Delta velocity up/down


10.000m/s
Delta roll velocity
750.000deg/s
Delta pitch velocity
750.000deg/s
Delta yaw velocity
500.000deg/s
Suspension resilience scale
1.000
Chase camera
Target offset fwd
0.000m
Target offset up
0.000m
Distance
2.000m
Height
0.400m
Vertical vel frac
0.500
Flexibility
0.900
Cockpit camera
Pitch
0.000
AI Controller
Plane type
Glider
Allow AI control
Can tow
Waypoint tolerance
10.000m
Min speed
10.000m/s
Cruise speed
15.000m/s
Max bank angle
70.000deg
Bank angle per heading
0.500
Speed per altitude
1.000s^-1
Glide slope per excess speed
0.050s/m
Pitch per roll angle
0.010deg^-1
Heading change for no slope
90.000deg
Max pitch control
0.200
Max roll control
1.000
Control per roll angle
0.010deg^-1
Pitch control per glide slope
1.000
Roll time scale
0.100s
Pitch time scale
0.050s


AI Navigation
Min altitude
15.000m
Slope Min upwind distance
10.000m
Slope Max upwind distance
20.000m
Slope Min left distance
-50.000m
Slope Max left distance
50.000m
Slope Min up distance
-10.000m
Slope Max up distance
10.000m
Slope Max waypoint time
60.000s
Flat Max waypoint time
100.000s
Flat Max waypoint time
60.000s
Smoke source 0
Enable
Colour hue
0.000
Colour saturation
0.000
Colour brightness
1.000
Position fwd
0.200m
Position left
0.000m
Position up
-0.050m
Velocity fwd
-1.000m/s
Velocity left
0.000m/s
Velocity up
0.000m/s
Max num particles
10000
Channel for opacity
Smoke 1
Min opacity
0.000
Max opacity
0.400
Channel for rate
Hook
Min rate
60.000Hz
Max rate
60.000Hz
Initial size
0.100m
Final size
5.000m
Life span
4.000sec
Damping time
0.100sec

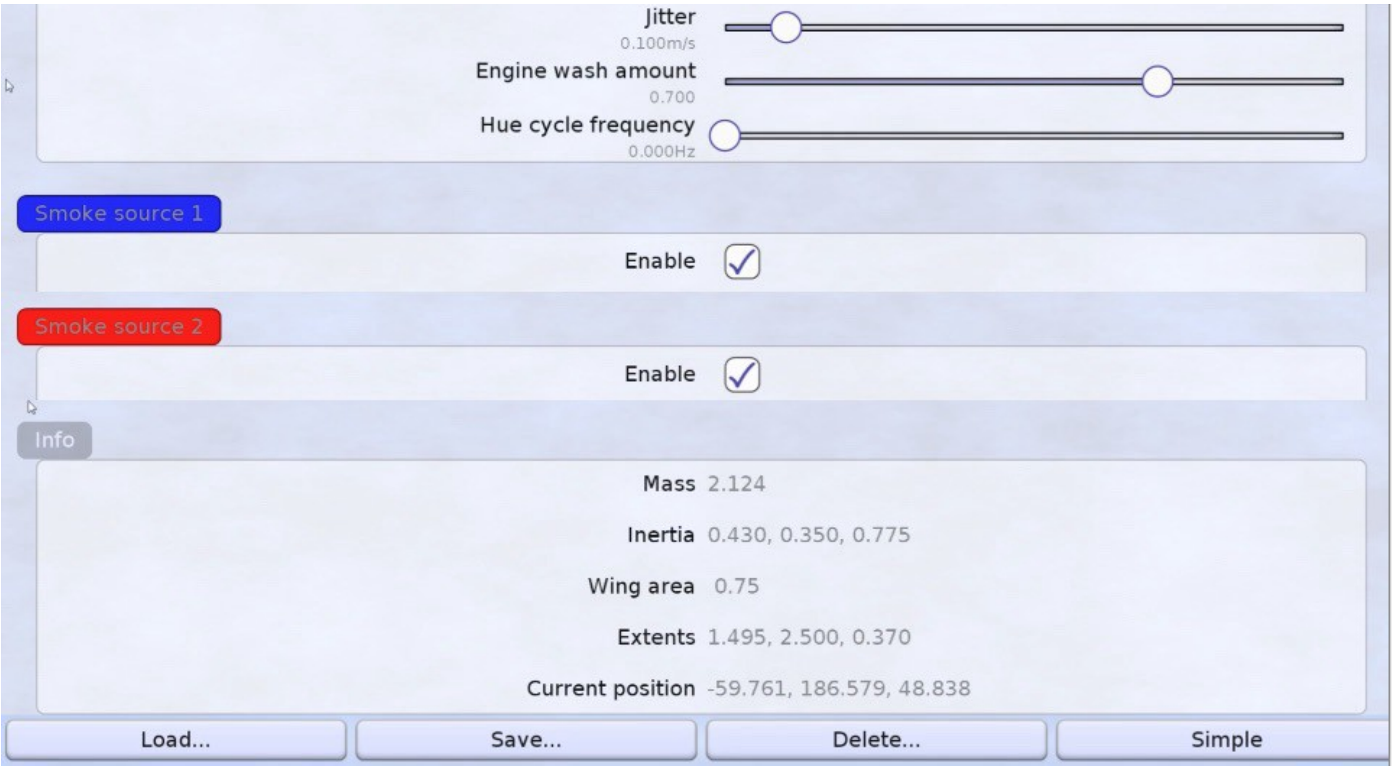
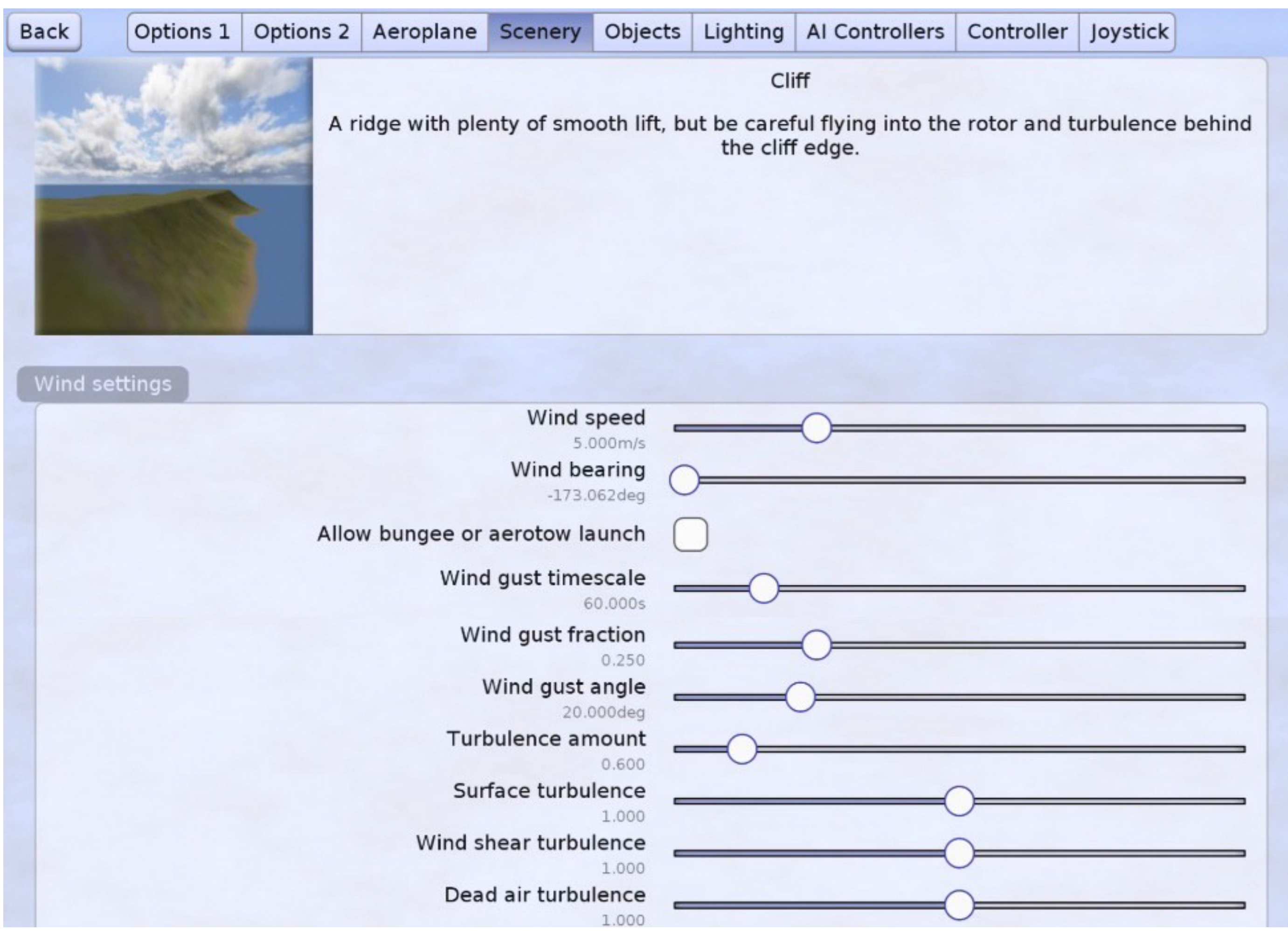


Figure 11: Full 'Aeroplane' glider configuration options.




Wind lift smoothing
3.500
Vertical wind decay height
100.000
Separation tendency
1.000
Rotor tendency
1.000
Boundary layer depth
50.000
Thermal settings (also see lighting)
Density
0.000 per km^2
Range
1000.000
Life span
300.000s
Depth
50.000m
Core radius
40.000m
Downdraft extent
80.000m
Updraft speed
3.000m/s
Ascent rate
0.400m/s
Expansion over lifespan
2.000
Runway
Runway type
None
Length/radius
100.000m
Position X
0.000m
Position Y
0.000m
Height
0.000m
Angle
0.000deg
Width
10.000m
Surface settings
Roughness
0.010m
Friction
1.000
Ridge terrain settings
Height
100.000m
Max height fraction
0.600
Width
100.000m
Height offset
20.000m
Horizontal variation

Figure 12: Full 'Scenery' flying site configuration options.

All images and videos 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****.*

RC Soaring Diaries

Forget what your parents told you — it's great to throw a Tantrum.

[Michael Berends](https://medium.com/@michaelberends)

Me, ready to throw a Tantrum in the local school yard.

First off, welcome back to another installment of **RC Soaring Diaries**! I started as a YouTube Channel — and now as a series in RCSD — because I wanted to share my adventures, experiences and 40 years of knowledge with others. Not only to those already flying gliders, but to also motivate and enlighten pilots within other disciplines of the hobby and newcomers. My hopes are to help shatter the stereotypes associated with gliders. Their diversity is always overlooked and feel that someone needs to promote how amazing, and multi-functional these flying machines are.

Photo 2: The finished Tantrum RE prototype.

I'm invited out to a lot of flying fields that are primarily used for powered RC flying and do glider demonstration flights that always seem to grab everyone's attention. Always showing up with a quiver of ships which normally consists of the largest, smallest, fastest and slowest plane at the field. Its always a lot of fun to setup a glider and always have people make comments such as, “I used to have a glider like that but got bored with it”. Then launch an E-Glider, speck out in 10 seconds, point it’s nose straight down as it starts to whistle fiercely gaining speed then blasting across the runway at 200+km/h (125+ mph)! Followed by using all of that energy to climb back out to a substantial altitude, settling in for some nice cruising and thermal hunting. Listening to all the comments behind me from the onlookers is always entertaining!

On the flipside of that, I can then discus launch glider (DLG) a small one meter glider and lazily fly for over 10 minutes never exceeding 90 meters (300 feet), which exceeds the duration that most of the standard powered craft at the field are capable of. All with one toss and no engine. Which brings us to the topic of this article.

Ever since I was a young teenager in the early 80s I was always fascinated with smaller models and back then, the thought of throwing an RC glider in the air and thermalling it out was unfathomable and just a dream. We had very heavy radio gear and only standard size servos available to us, mixed with heavy batteries. Not a great recipe for success!

As technology advanced the electronics got smaller and smaller allowing us to make this dream a reality. Along the same timeline, composite building techniques evolved and the airframes got lighter and more efficient which gives us what we see as today’s high performance DLGs.

There is however a negative side to the evolution in my eyes.

We used to build all of our hand launch gliders ourselves. Even when composites came into the picture, using vacuum bagging techniques and readily available materials, the average hobbyist could still enjoy and participate in this side of the hobby in an affordable way. Even kits were moderately priced. Today, this has changed dramatically with hi-tech molded composite frames, small servos with amazing precision and a plethora of computer radio mixes for various flight modes. All this is great and I use all of the above, but is it really needed for the average weekend flyer and is it in a price range that's within the budget of average hobbyists? Not to mention the complexity of the models and their flight modes for the entry level glider pilot.

It's kind of like an average person using an Indy car to drive to the corner store and back for a loaf of bread. Unfortunately the chance for the "normal guy" to get a 'real' taste of what DLGs are about, has now really been put at a level that is out of reach for a lot of RC enthusiasts.

This is not only seen in DLGs but in RC soaring in general. Competitive classes getting so expensive to participate in that it's really only for the elite and the turnouts over the years have dwindled. Here in my area of Canada we used to have an abundance of contests every year with great attendance and now there is none at all. It's nice to see classes such as F3-RES (that is, rudder/elevator/spoilers) come into play that put contest flying back in the realm of the everyday hobbyist. Hopefully it will gain some traction and get some more people interested in contest flying.

This Is Where the Journey of the Tantrum Begins

I really liked what F3-RES was doing as a competitive class. So I wanted to challenge myself to design a one meter DLG that was built out of conventional, and affordable, materials but had the performance that was lacking on all the other economical options that I was aware of out there. My experience with most of these designs found that they all suffered from the same performance hindering attributes. The majority of these in weight and airfoil deficiencies. Most of the ARFs (that is, almost-ready-to-fly) and foamies were heavy and the built-up options available in kits or plans used airfoils and planforms that weren't ideal, affecting both launch and glide path, especially when a breeze came up. This also made them launch like potato chips!

I knew that I needed to come up with a design that was light, could launch well and track across sky when the nose was pushed down a bit. The simplicity of two-channel rudder and elevator control was a must, allowing the pilot to concentrate on launching and flying instead of fumbling for switches trying to get in and out of different flight modes. Simplicity is key, especially for the newbies who have their hands full just trying to keep control of their glider. This also goes for experienced power pilots crossing over into gliders as the majority of them have problems with pushing in down elevator when the nose rises which creates stalls and porpoising. It's something very foreign to them and a struggle I see all the time!

My thoughts were to go with an open balsa framework wing covered in film, a balsa pod with carbon boom and sheet balsa tail feathers. This follows the current F3-RES ships that are popping up all over and seems to be a recipe that works well for building light, strong and efficient planes. The added benefit is that it can be easily repaired with standard things readily available at a hobby shop.

Once I had a basic design in mind I then started focusing on an airfoil. Most designs use a Mark Drela *AG03* as it can be easily shaped and built because of it's flat bottom. It does work well but there is always a trade off losing performance for ease of building. After doing some research I came across another airfoil called the *PolyHot* which was designed by Gerald Taylor specifically for small polyhedral gliders. It has a slight undercamber as it approaches the trailing edge and is very similar to ones used on higher performance ships.

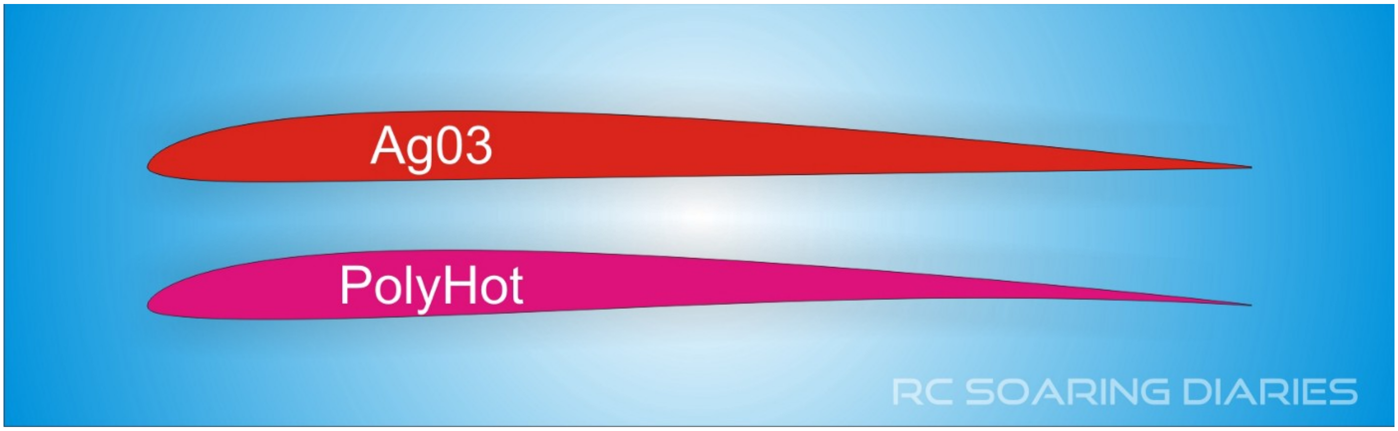
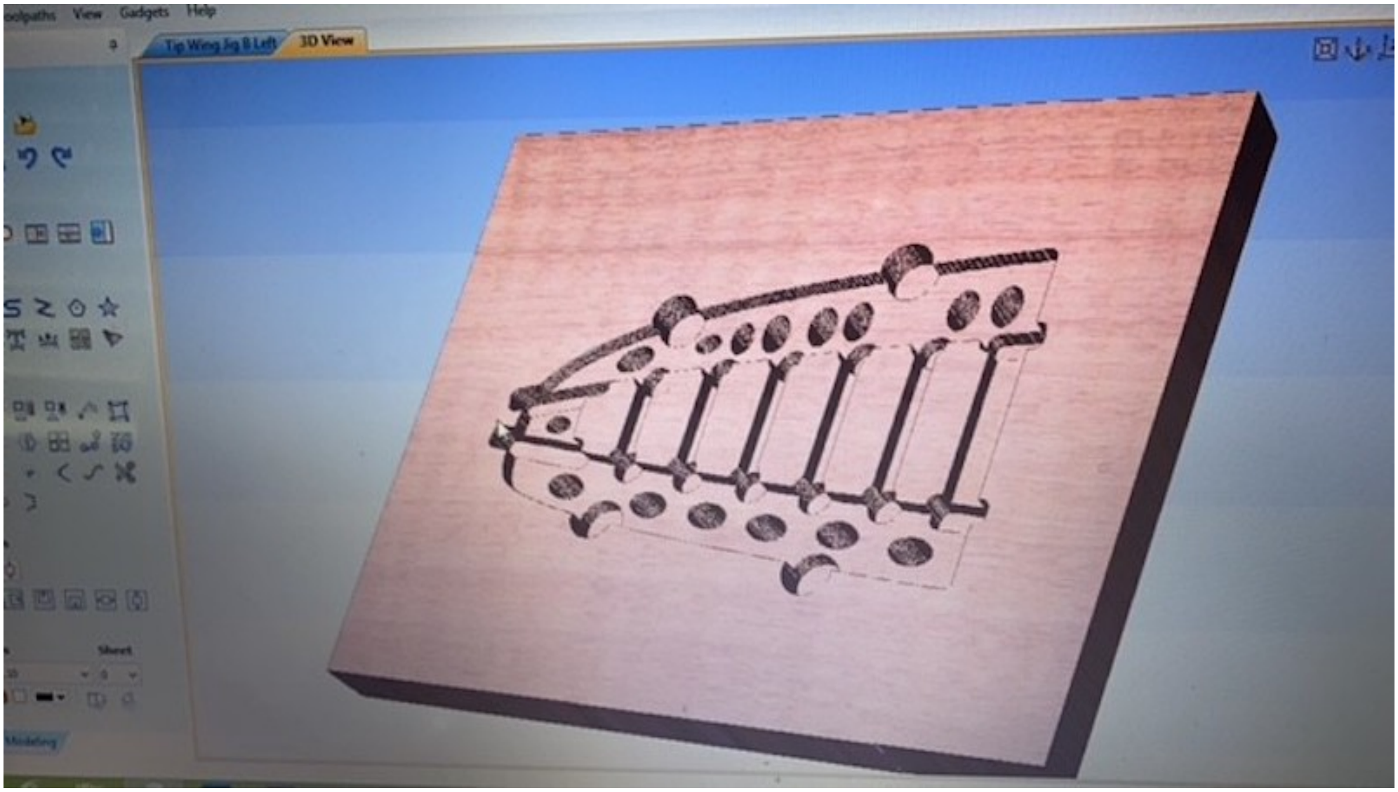


Figure 3: The differences in airfoil shape.

This brought up the question of "how am I going to build this wing?" I originally wanted to build the wing flat and shape it with a sanding block and templates just like I did back in my hand launch glider (HLG) free-flight days but the airfoil was pretty complex and wanted to make it as accurate as possible. So I opted to use the technology I have on hand and CNC shape the entire wing. I came up with a way to make building jigs that I could assemble all the parts in and then lay it down on the vacuum table of the CNC to hold the parts for shaping.


View
Gadgets
Help
Tip Wing Jig 8 Left
3D View
Sheet

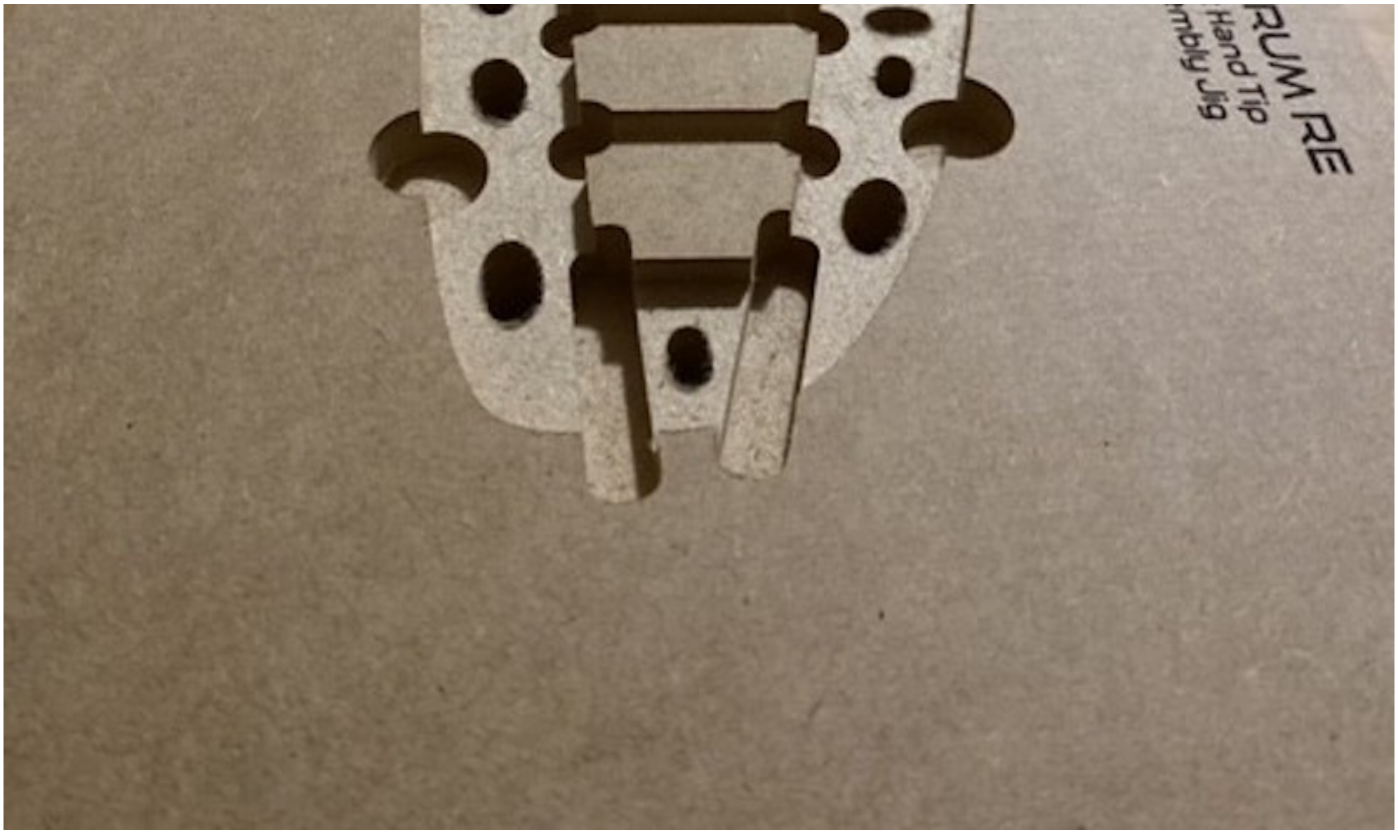
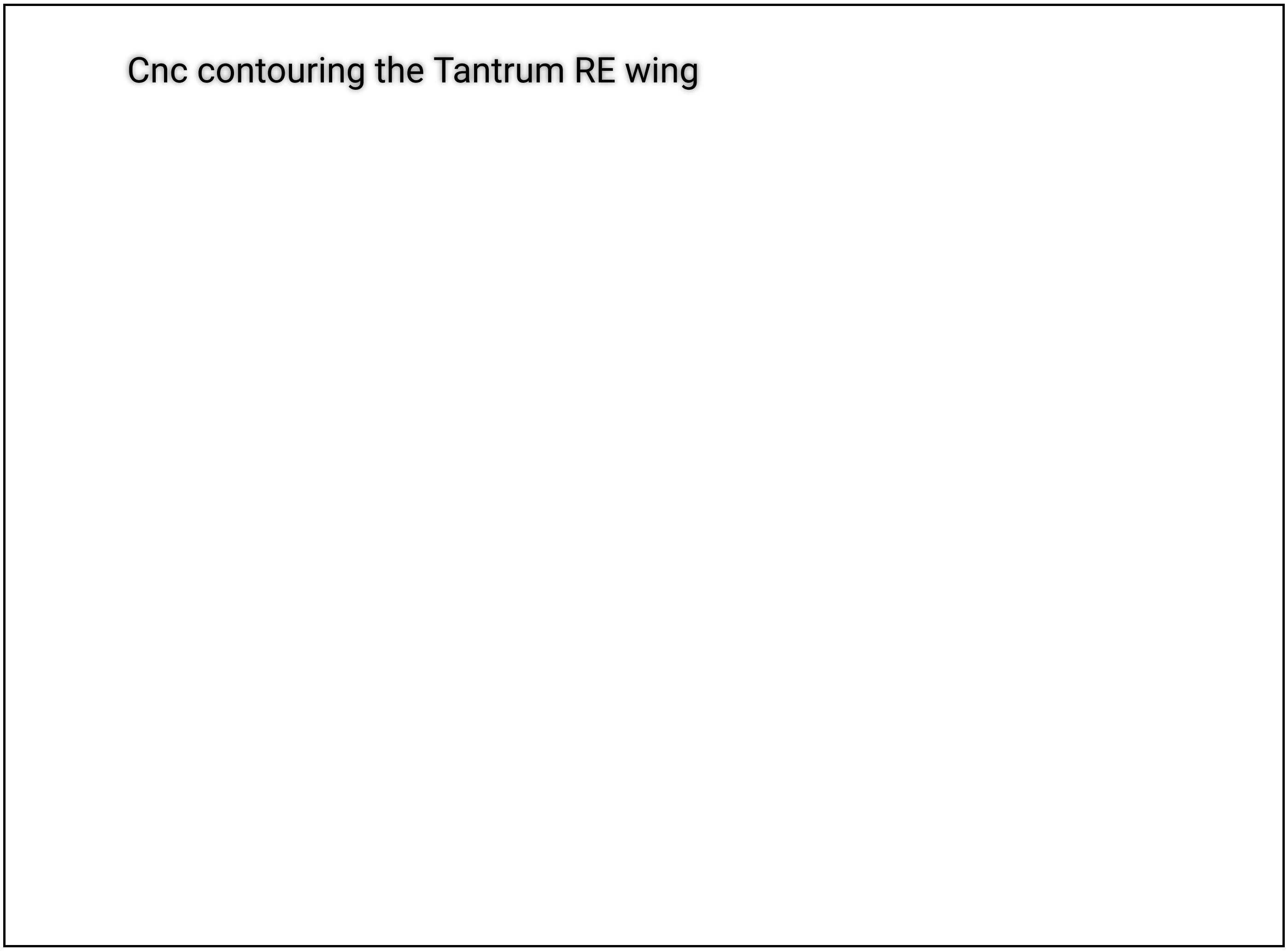


Photo 4 (left)**:** Computer rendering of an assembly jig. **Photo 5** (right): Completed assembly jigs.

The jigs were cut and worked extremely well not only as a holding fixture but as a way to assemble the parts quickly and accurately. It was very simple, and only took minutes, to place all the pre-cut balsa pieces in their appropriate slots and hit them with some glue.

Photo 6: Balsa pieces put into their respective slots and glued.

The next step was to place them on the CNC router table and machine the top surfaces. I was delighted as to how well this worked and it took about 20 minutes for each panel. you can see a time lapse of the process in this video.



Video 7: CNC contouring the Tantrum RE wing.

After the top surfaces were done I created some more MDF jigs to hold the wing panels inverted to machine the lower surfaces. This was easily achieved by inverting the top surface impression in the jig so the panel was cradled in the fixture properly while it was held down by the vacuum. The results of all of this effort was outstanding and I was more than pleased with the results! I had a number of balsa wing panels all precisely made with a sophisticated and complex airfoil ready to be joined and covered.

Joining the panels was done in a very conventional way. Sanding the right dihedral angles into the wing panels, then gluing them together followed by light fiberglass tape around the joints. Voila, the wings were completed and ready for covering.

I designed the tail feathers while all the panels were being cut which is the beauty of CNC. You can do other things while the machine does the work.

Photo 8: Laser cut tail feathers with some cool looking lightening holes.

Nothing out of the ordinary here just some sheet balsa cut to shape on an inexpensive $200 table top hobby laser. It took a number of passes to cut all the way through but it did the job and also engraved the T*antrum RE* (that is, rudder, elevator) logo into them. I liked the design but was under some scrutiny when I posted a picture of them on social media concerning the configuration of the lightening holes in reference to the grain. I had to ensure everyone that the lack of strength wouldn’t affect a glider of this size and the forces that it would see. I actually thought they looked pretty cool.

The fuselage pod was a very easy thing to design as I recently built an F3-RES glider and used the fuselage on it as inspiration for this design. Balsa sides with 1/64" plywood strategically placed doublers along with laminated balsa formers and a small balsa block for the nose. Once again this was designed and done when the wing panels were being shaped. Which means that the majority of the plane was done by the time all the wing panels were completed.

Photo 9 (left): Some hangar flying to see how things were starting to look. Even my cat Ollie was looking on with interest. **Photo 10** (right)**:** Covering on and we can really see how this is going to look.

Covering the tail and wings came next. After some research the choice of covering material was *Ultracote Lite* as the weight was acceptable and knew that it would work well for this project. I actually built a couple of prototypes at the same time and covered them both in different colors.

To finish off the fuselage I decided to use white *Ultracote* as I had some sitting around in the shop but this wasn't done till after the test flights. I moved onto some of the finishing details. The stabilizer pylon was 3D printed and fit on the tail boom perfectly also giving the nylon screw a good place to thread into, securing the tail. I wanted to create a contoured throwing blade so that it felt better on your fingers than a straight one. This was created by making a 3d printed mold, waxing it up, then sandwiching a number of layers of resin soaked carbon cloth scraps in between both halves. This was then clamped together and left to cure overnight. The next day the two mold halves were split apart and out popped a contoured carbon section that I could slice into throwing blades. Its pretty amazing what you can create with a little bit of creative thinking and some scraps for mere pennies.

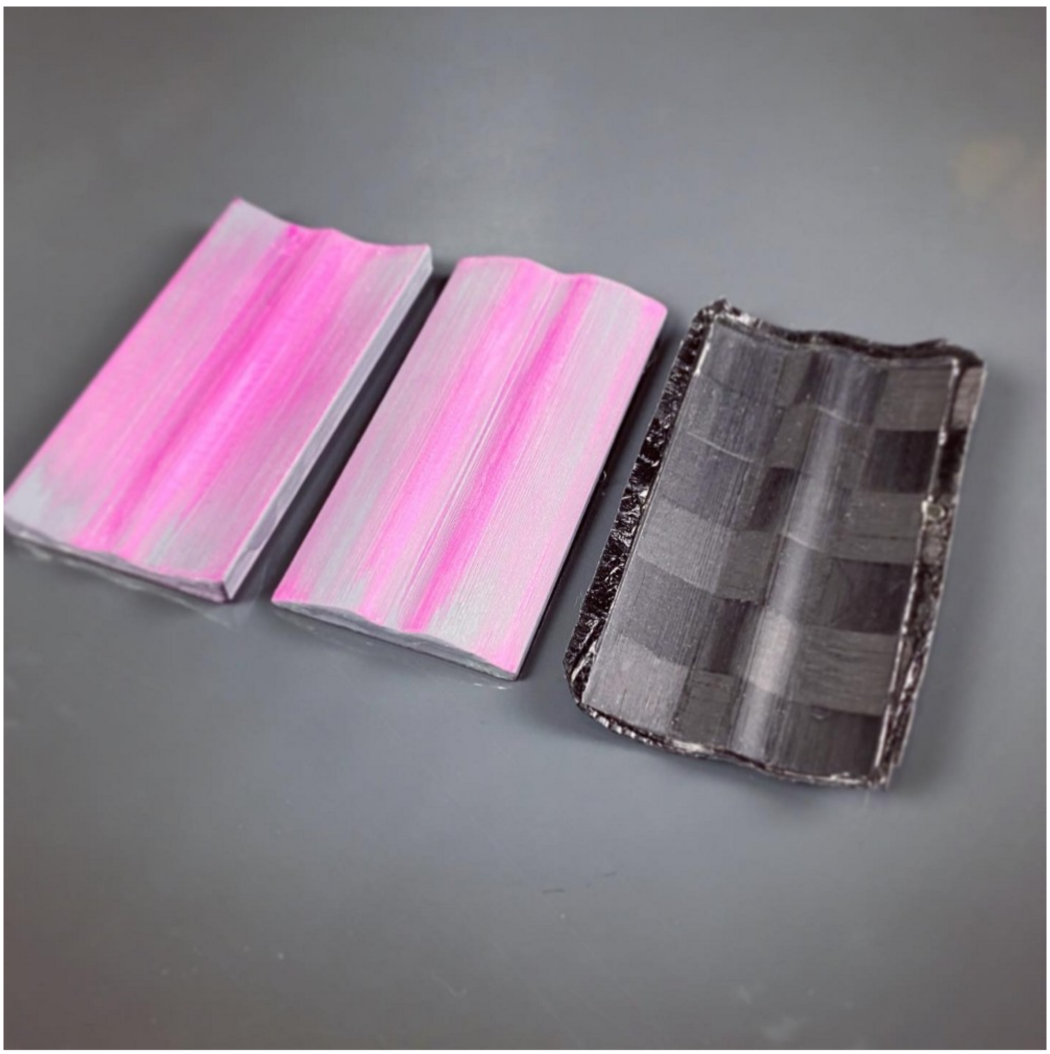


Photo 11: 3D printed molds used for making contoured throwing blades along with the finished carbon fiber piece.

All that was left was to finalize the radio installation. This was easily done with a pull string system and a torsion spring in both the stabilizer and fin. The spring was made out of fine music wire that was taken from an 'E' Guitar string as hobby shops don't carry music wire fine enough for this purpose. This was a tip given to me long ago and wanted to pass it along. The string used was 20lb. braided fishing line. For those unfamiliar with this control system, the servo only pulls on the control surface one way and the torsion spring makes it go the opposite way.

Very little weight was needed to get this little bird balanced on the center of gravity (CG) point that I computed. Which put the all up flying weight at 120grams ready to fly which is were my estimated target was. I was extremely happy with this result!

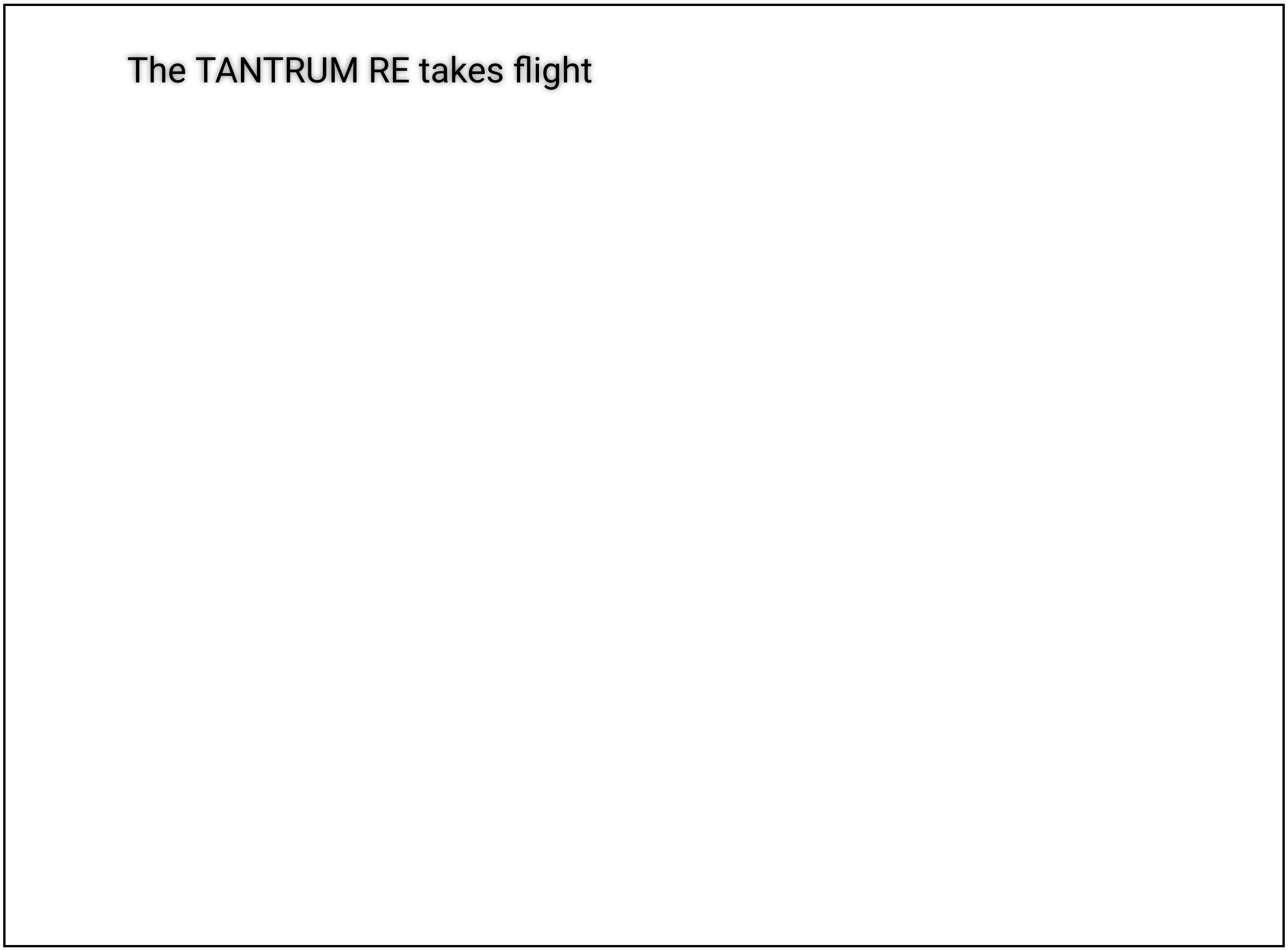
After all the research, work and struggles through the project it was finally time to fly this little machine. Was it going to launch well? Was it going to fly well? Was it going to be strong enough? Did I figure out all my volumes and areas correctly? So many questions run through your head with the anticipation of the first flight. I've been at this for almost 40 years and have built and designed a lot of planes but every first flight brings on some nerves and trepidation.

The *Tantrum RE* was finished during a heatwave in my hot and sticky shop. It was all ready to go but couldn't stand being outside in the heat! There was also a lot of wind associated with the heatwave too, so I waited a few days for better conditions. Then at last one evening the wind died down and it didn't feel like a sauna outside, so I ran to the local school field to see what my little creation would do!

Once I arrived I did the standard testing of my controls and a range check. All that was left was to give it a slight hand toss. I aimed for a spot ahead of me and gave the *Tantrum* a little push to pleasantly see it gently glide away from me nice and straight on a nice shallow glide path without even having to touch the controls. Next launch was a javelin style launch with some more force and was able to turn around come all the way back and land at my feet. So far so good! Now the real moment of truth.

I grabbed the throwing blade, did a half spin and sent her skyward. I was amazed at the height I launched to, it was double what I was anticipating! The next launch was done with more force and was really amazed at the launches. This is exactly what I wanted to see! All the planning and work was all coming together. Not only was it launching well but I really wasn't needing any rudder correction on launch which was a bonus as I thought that I would surely need to come up with a launch mix adding some right rudder. Another noticeable characteristic was how much ground I could cover. Circling down to one end of the field and still able to make it back through the wind and the gusts. I'm also happy to say that I was able to grab a ride on a few evening thermals getting some really decent flights!

You can see some video of that evening in the following episode of *RC Soaring Diaries*:



Video 12: The first test flights of the Tantrum RE.

Since the first flights I've had a number of other sessions with the *Tantrum* and can say that it thermals really well. On a few days, including today, I was able to launch once and fly 'til I got bored. Chasing thermals downwind, then racing back up upwind to snag another one. It's so worry free because of the simplicity of the two channels. Just relax and enjoy the experience.

The rewards of all the hard work have been great! Although the majority of this plane was made with some high tech equipment and not really within the realm of something that anyone can build, the prototypes have shown me that great flying DLGs can be built inexpensively using very common materials. My goal is to further develop this glider and concept into something that's achievable by anyone with basic tools and modelling skills.

Whether by making kits available with pre-shaped wing panels or devising a way to build the wing using standard building techniques with plan or kit.

It will never be a composite plane or have the same performance but I think it bridges a gap and opens the door for people to try DLG and be successful at it without having to break the bank.

I think that everyone should be given the opportunity to **THROW A *TANTRUM*!**

Thanks for giving me your time and reading this article. Wishing you some happy flying and we will see you next time!

*All images and videos 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 Skyscraper Method for Fuselages

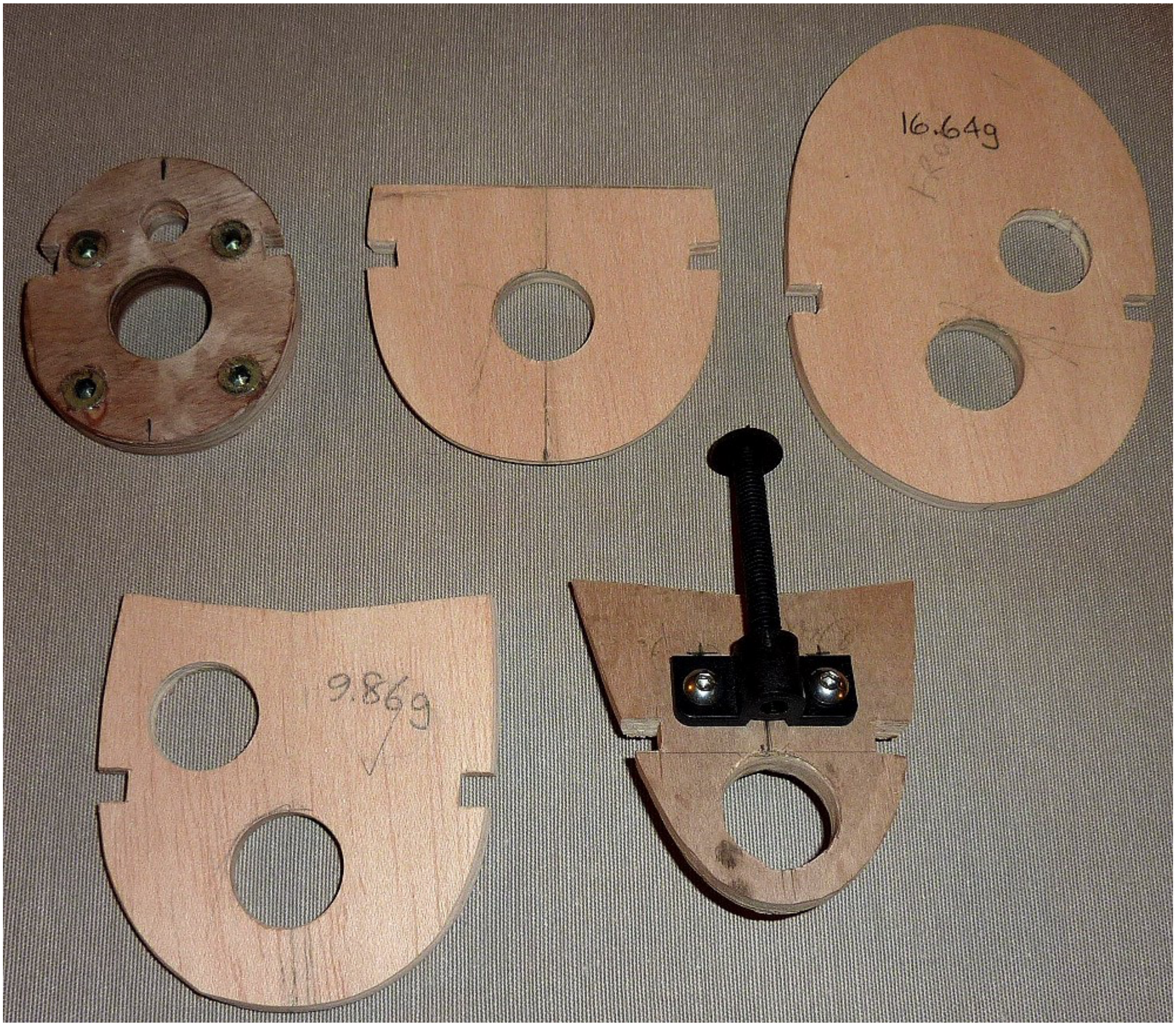
Want to breathe new life into those orphaned wings and tail?

Peter Scott

The wings and tail are from a 40 year-old 3m Graupner Cirrus, and the new fuselage is the subject of this article.

I decided to build a new motorised fuselage for 40 year-old 3m Graupner Cirrus glider wings and tailplanes. It is a credit to the quality of the original kit that all were sound and true after years of storage. I fitted ailerons and airbrakes and covered with Hobby King film.

I decided to use a 20mm round carbon fibre tube for the tailboom. I bought one that was made with epoxy resin rather than polyester so it would glue well with epoxy. It turned out to be exactly the correct length for the complete fuselage and was only 92g.



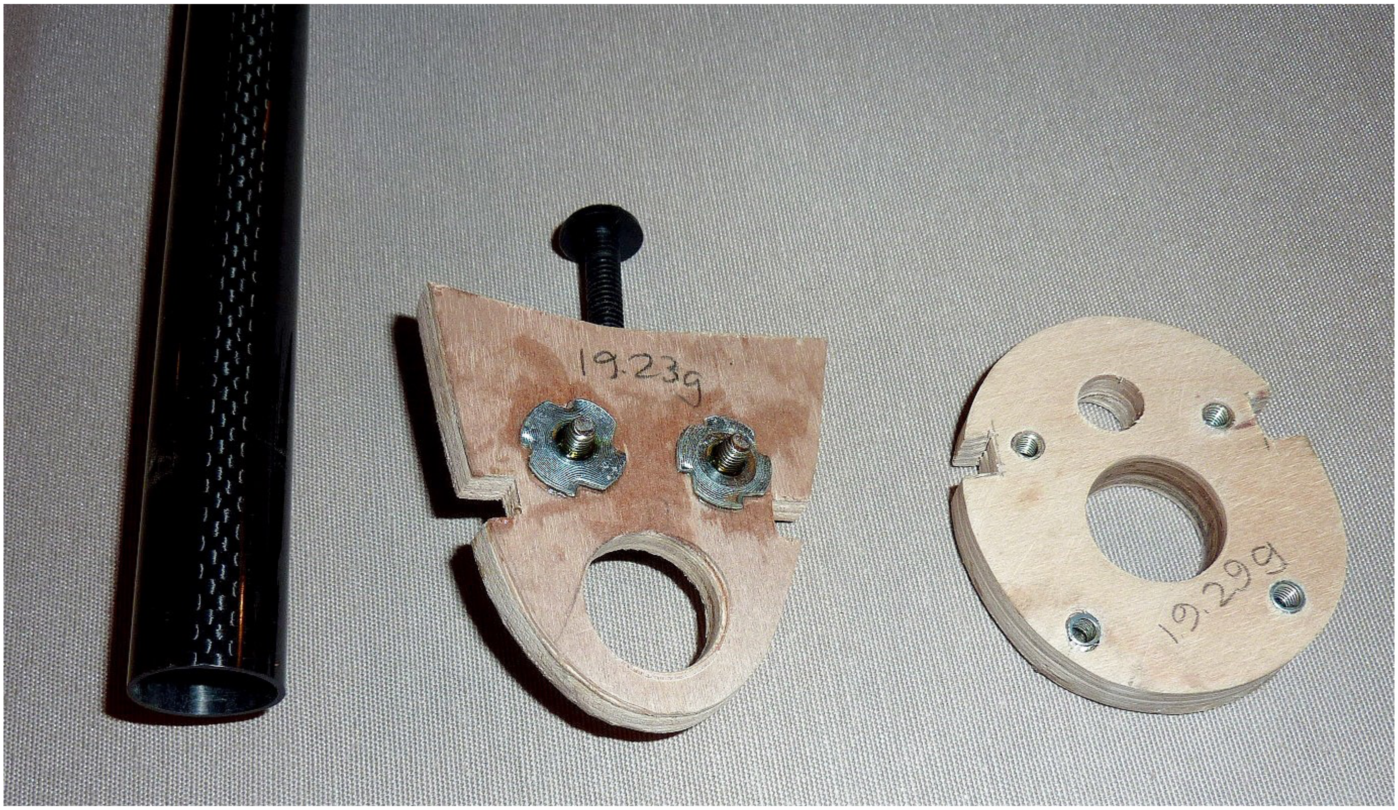


Photo 2 (left): Formers. **Photo 3** (right): Formers and carbon fibre tube.

This set me thinking about not cutting it but taking it right through forward to the motor bulkhead. I decided to use 6mm liteply formers. I love liteply! The only exception was the motor bulkhead, which I laminated from four layers of 3mm birch ply. The five formers weighed a pleasing 48g in total including t-nuts, threaded inserts and wing mounting bracket. The fuselage has a semi-scale curved pod at the front planked with 3mm balsa and then glassed using 24 or 48 g/m2 cloth and Eze-Kote polyester resin. I couldn’t use carbon fibre cloth as it would screen the receiver. Any minor damage to the shell can easily be repaired.

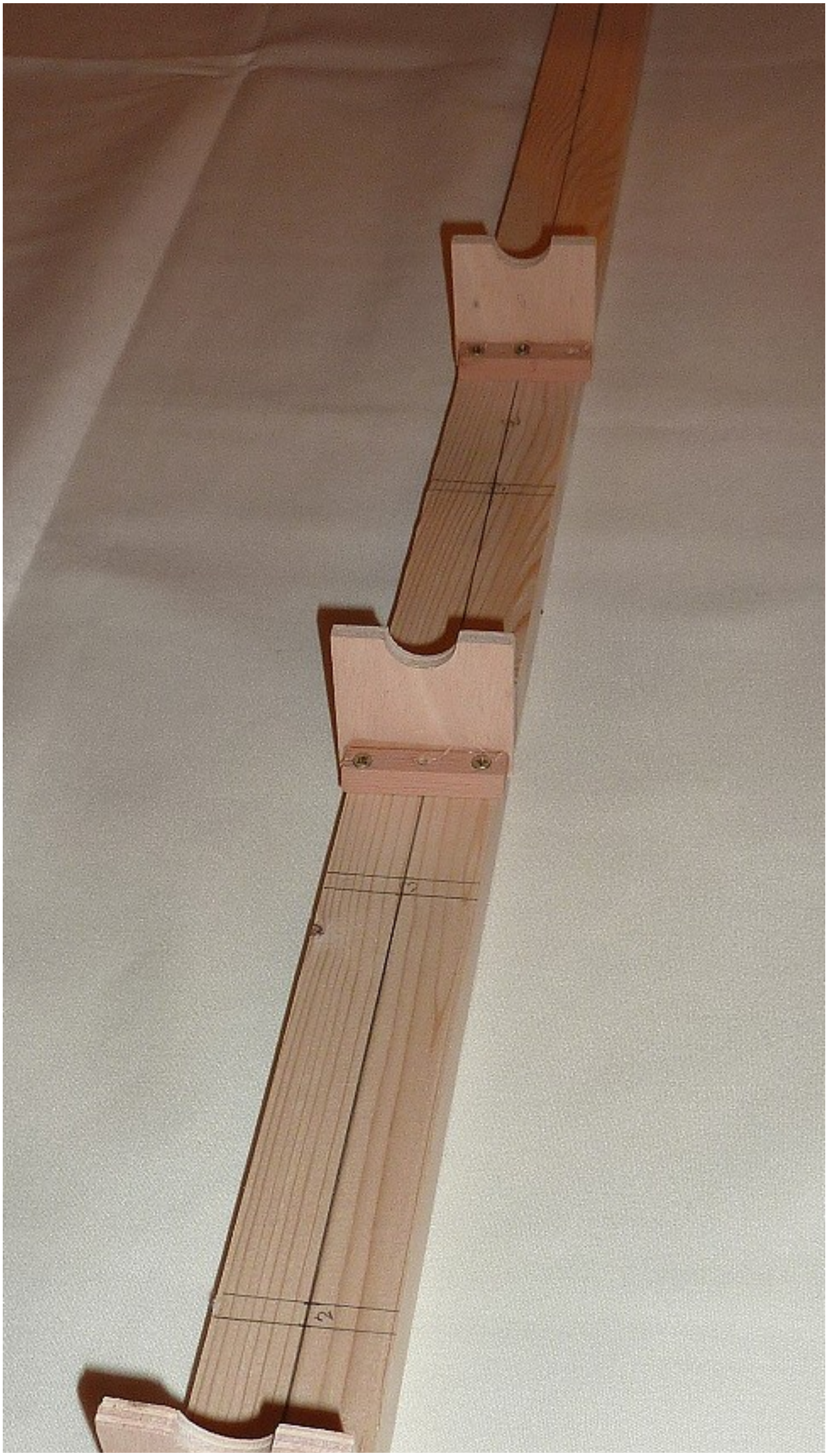


Photo 4: The jig.

I drew the formers on 1.5mm card and cut them out to check that the curves would look good. I then traced them onto the 6mm liteply and cut them using a Makita jigsaw with a fine blade, followed by sanding to exact shape with a belt sander lying on its side. I cut the 20mm holes using a diamond holesaw in a bench drill press. I tested the shapes again for flow on a 20mm wood dowel. I didn't want to scratch the polished surface of the carbon fibre by moving the formers around. I built a jig with cross markings to ensure lateral true and marks at top-dead-centre on each former to get them vertical.

One difficult decision was where to cut a hole in the tube for the servo leads which would go from the receiver to micro servos in the tail for the elevator and rudder. It will be a stress-raiser of course but I reasoned that a 5mm smooth rounded slot cut in the side with a diamond holesaw in a bench drill press should only cause horizontal weakening that the longerons and the ply plate for the radio gear would correct. If I had any residual doubts I could sleeve it with epoxied 1mm ply. I didn't need to. I smoothed the inside edges of the slot with a dribble of epoxy in case the carbon fibres wore the insulation away and shorted the wires.

At the rear I drilled holes top and bottom, with another holesaw, for a 6mm carbon fibre tube leading edge for the fin. I left the tube unglued until all the formers were in place so the bottom could drop onto the datum line on the jig to check that the formers were aligned with the fin.

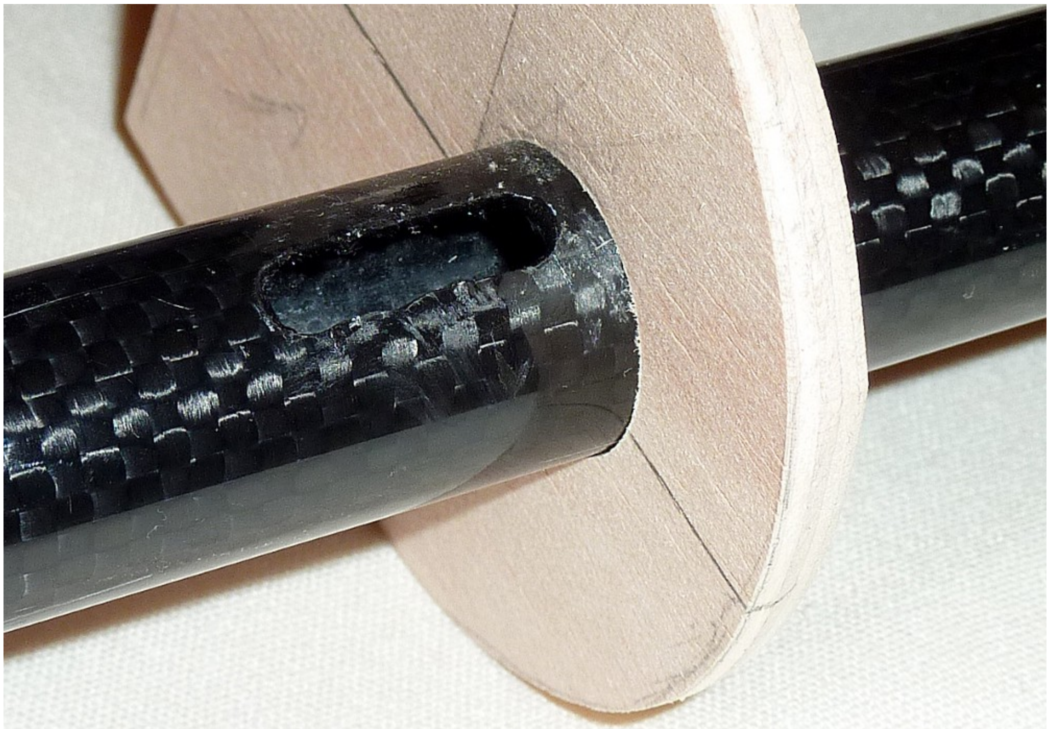


Photo 5: Servo wire slot.

Installing the servo extension wires proved easy. I dropped them in from the tail end until I could see them through the slot then hooked them out with a wire paper clip.

At the rear I drilled holes top and bottom, with another holesaw, for a 6mm carbon fibre tube leading edge for the fin. I left the tube unglued until all the formers were in place so the bottom could drop onto the datum line on the jig to check that the formers were aligned with the fin.

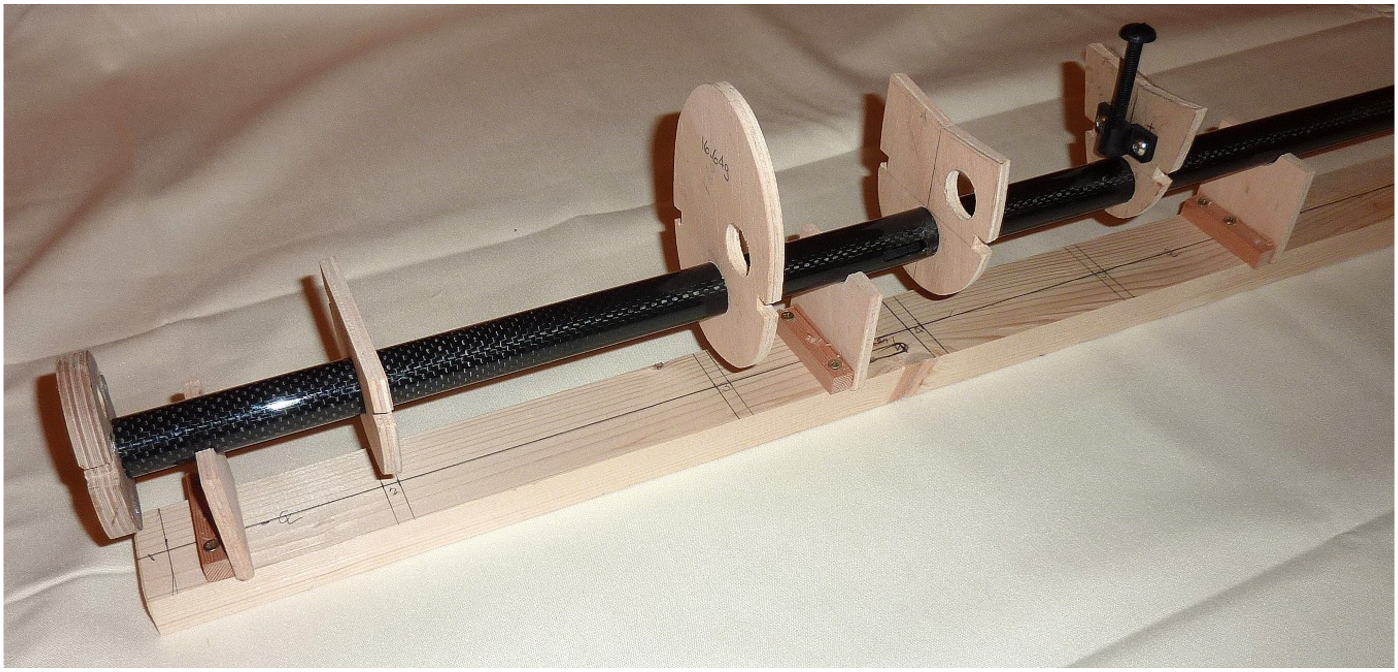


Photo 6: Unglued formers on the jig.

I glued the motor former first using a square, as this would determine the motor thrust lines and so had to be exact. After 24 hours, when the two-part epoxy had fully cured, I glued the others. To measure exactly the two parts of the larger quantities of epoxy needed for this I used a disposable cup on a balance. One big advantage of the tube is that angles of attack are easy to measure and set up and the fuselage is certain to be straight in plan view.

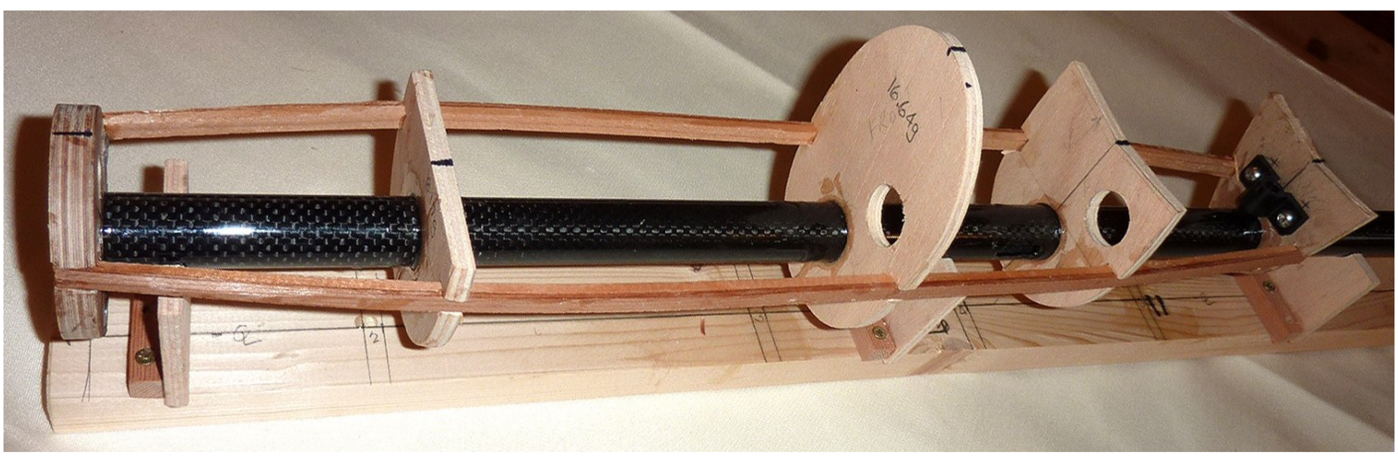


Photo 7: Longerons located and glued in place.

To protect the planking when landing, and to stiffen the structure, I shaped and glued in a keel made of 6mm liteply. It stands 3mm proud of the formers so the planking will be flush.

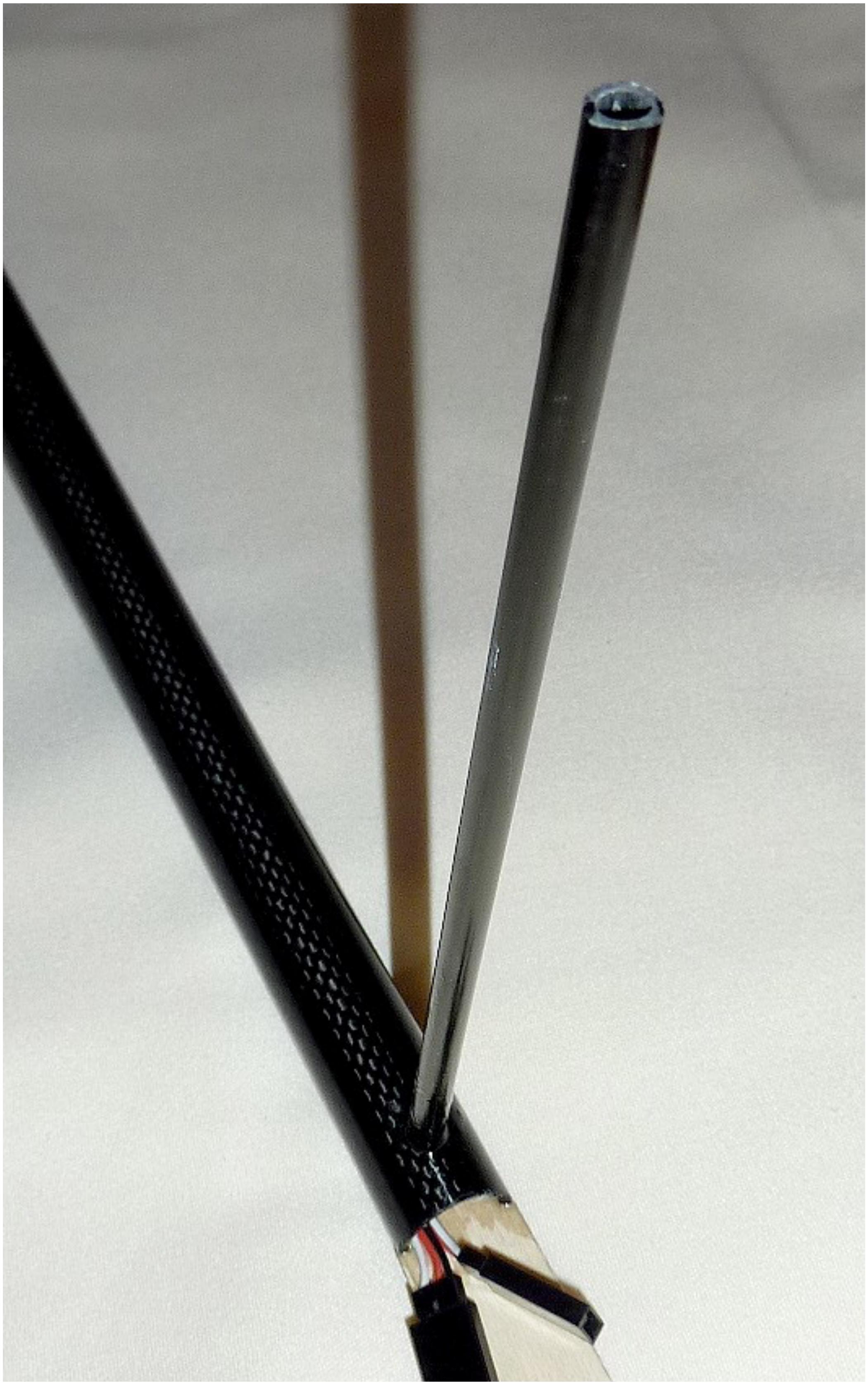


Photo 8: Fin assembly detail.

The fin leading edge is a 6mm round carbon fibre tube with 0.5 mm walls. The 3mm liteply insert helps to lock it in place and forms a fin rib. Because this reduced the space inside the main tube I had to install the servo leads before gluing. I wrapped the wires with plumber's PTFE tape to prevent them being glued. It worked a treat.

The rear of the fin is a 6mm square thin-walled carbon fibre tube. I will use round pivot hinges for the rudder glued into holes drilled in the tube.

For a while I puzzled over how to get the fin perfectly aligned. Then I realised that two spruce spars clamped onto the fin uprights and the wing fixing bolt would do the trick. I was pleased and surprised to find that the spruce was straight enough afterwards to be usable.

Photo 9: Two spruce spars clamped onto the fin uprights.

The main tube takes up a fair bit of room in the pod. However the only electronics under the wing are a tiny FrSky X8R receiver and battery voltage and vario telemetry devices, so there is plenty of room. I put in a sloping plate under the canopy so the battery would be ejected in the event of a sudden stop. In minor bumps it is often the battery that causes damage, which in this case would only be to the canopy. Unfortunately the size of the tube ruled out a retractable wheel. I used an aluminium strip strake instead. I had hoped to use titanium but couldn’t find any 6x2mm strip.

All that is now left is the planking of the forward part of the fuselage and installing the mount for the all-flying tailplanes.

The further constructions details of the fuselage will be described in the second part of this article, coming up in the next issue of RCSD.

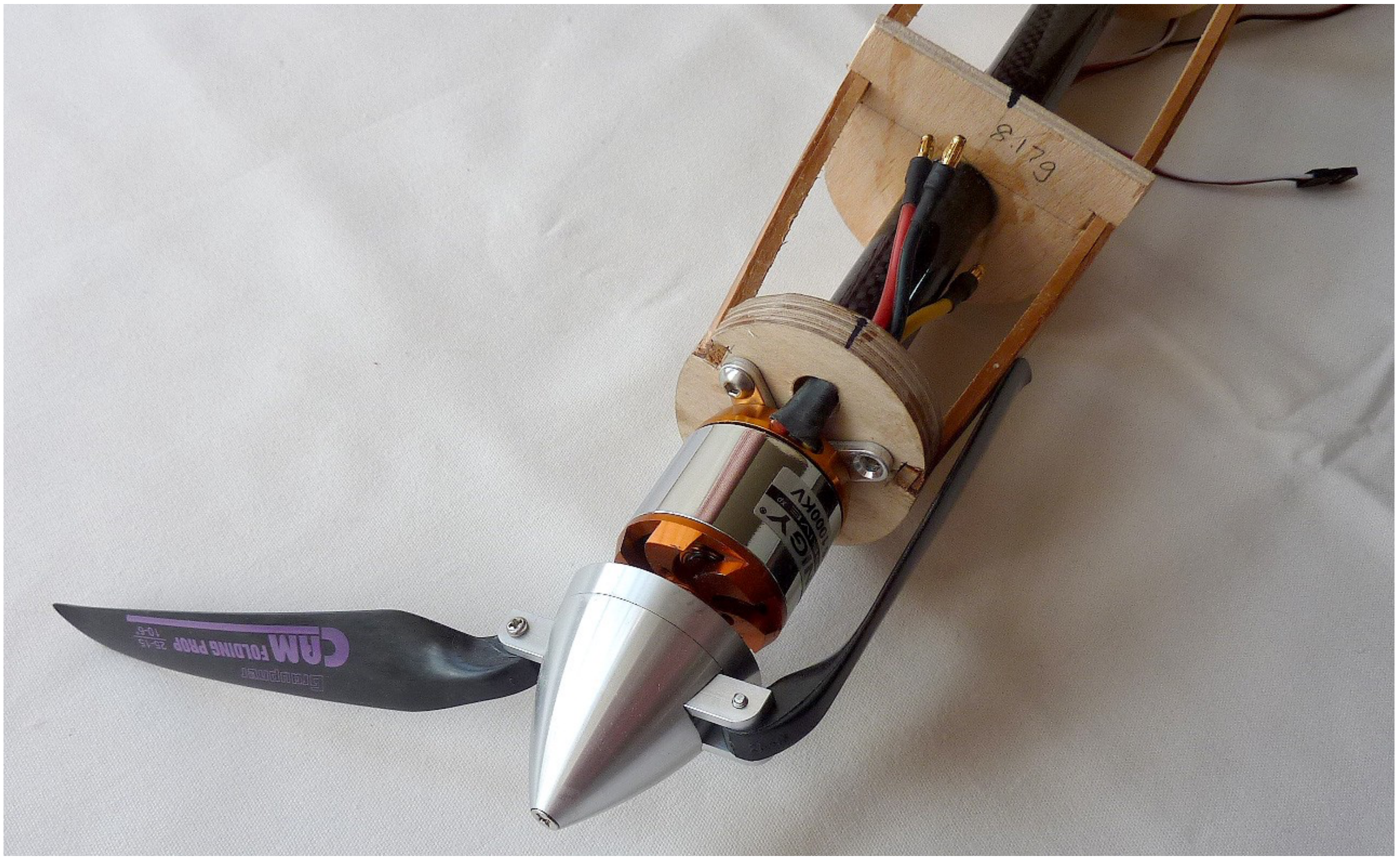


Photo 10: The motor mounted on the motor bulkhead.

I am pleased with my first major use of carbon fibre. It is light and stiff and does not change shape over time. One disadvantage is that all gluing must be done using epoxy, though possibly thick CA is an alternative. Not being water based, epoxy doesn't get lighter as it dries so you have to be as sparing as possible.

A cylindrical tube works well for a curved fuselage. I must try a square one for a square fuselage. It would make lining up the formers and forming a balsa shell very easy.

Why do I call it the skyscraper method? Such buildings now have a strong central core from which floors and walls are cantilevered. Then the glass is put on the outside. Apart from being rotated by 90 degrees my fuselage design is the same, as it has a very strong core with a light shell covered in glass (fibre).

So far as weights are concerned, here's how things turned out: carbon fibre tube, 92g; formers, 48g; all up with formers, longeron and keel, 202g.

Lessons

1. Cover the exposed part of the tail boom with a removable film of some kind before starting to glue things. Despite the greatest of care I have put some glue smudges on the polished surface.
2. Provided you are willing to do planking, this is an excellent method for building accurate circular cross-section fuselages.

This is the first part of a two part series. Watch for the next part in the upcoming issue of RCSD where the author covers the build up of the pod and other finishing details. 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 Implementation of a Dream

"In 1982, I drove our little Odessy motor home on a Toyota chassis back to the AMA Nationals (Nats) at Lincoln, Nebraska…"

Bob Dodgson

"Here's a group picture from Bob's 2019 induction into the AMA Hall of Fame in Wenatchee, Washington. A number of Dodgson fans and friends are in this picture. Left to right: Tom Nielson, Bob Dodgson, Tom Brightbill, Ron Lenci, Jim Pugh (rear), Shawn Lenci (front), Sandie Pugh, Dave Banks, Jim Thomas, Dave Johnson, and Ken Eaton." (image: Jim Thomas)

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

Well, the 100-inch Todi proved to be the first successful multi-channel competition glider kit in the United States. All of the other successful competition gliders had only rudder and elevator control while some some of them did have spoilers also.

The Todi used the first two-control mixer, the Dodgson Coupler, in the model glider industry to mix flaps and ailerons — producing flapperons. Moreover, the coupler incorporated an elevator trim bar to feed in precise amounts of down elevator as the flaps deployed to compensate for the trim change caused by the flap deployment. The Todi did not need spoilers to win contests all across the U.S. and Europe. In fact, half of our Todi and Maestro sales were overseas where our kits were heralded as the wave of the future and won many major and national contests in England, Germany, Norway, Finland, etc.

"Dave Banks holding his 1989 Nationals winning Pixy. Dave won 2-meter by far and he also had the highest score of any sailplane class that year." (image: Bob Dodgson)

The Maestro series of gliders was introduced in 1974. The Maestros used the same control system as the Todi but added spoilers as well. They were larger and most of the Maestro models had a wingspan in the 134-inch range. However, the Maestro Caliente had a wingspan of 99.5″ and could compete in the 100 inch class as well as in open class. The Maestro Megan could be built with either a 128″ or a 140″ wingspan.

All through the 1970s and 1980s most other competition kits still had polyhedral wings and used rudder, elevator and spoiler control systems only. Not so with Dodgson Designs kits! Toward the end of the 1970s, some of the competition flyers of our Maestro kits even started putting separate flaps and ailerons on them rather than using flapperons. In 1979, Dodgson Designs recognized this as a serious option for our kits even talking about it in our catalog.

Then, in 1980, we came out with the Camano to replace the Todi. It was the first successful thermal competition glider kit to come stock with separate flaps and ailerons. The early Camanos also had spoilers. I was still not completely confident in just using flaps for precision landing control.

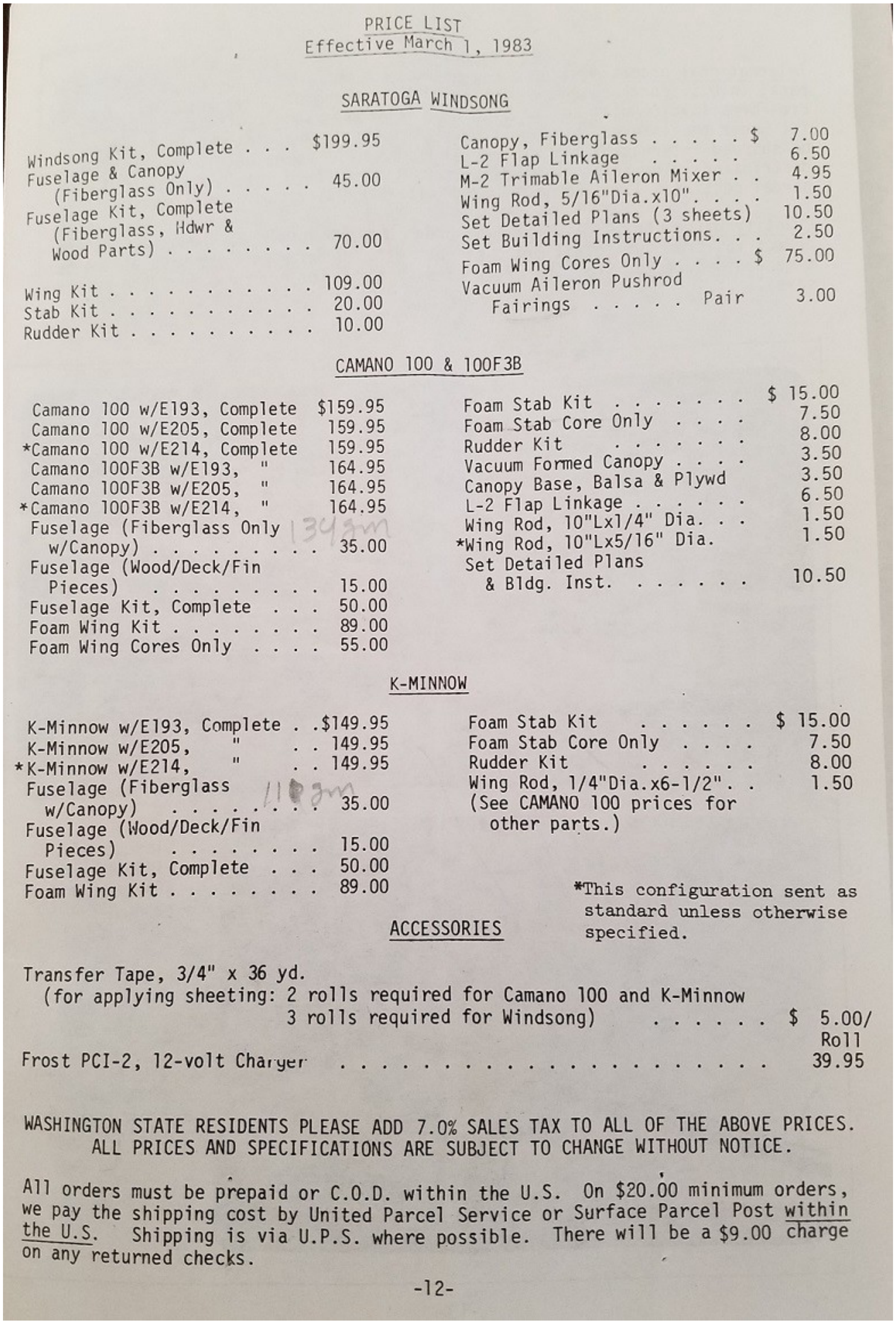
"This is Steve Bowman's Windsong Sorry to say we lost Steve a few years back — RIP." (image: Craig Christensen)

However, it was not long until Camano flyers like Dave Johnson discovered that 90 degrees of flap throw provided the best landing control around. Soon the spoilers came off the Camano and we went to foam core wings.

In 1982, I drove our little Odessy motor home on a Toyota chassis back to the AMA Nationals (Nats) at Lincoln, Nebraska. I was accompanied by several of the top flyers in the Northwest Soaring Society at that time including Tom Brightbill (multiple Nats winner), Tom Neilson (Nats winner), Dave Johnson (multiple season champion, etc.) and Tom Culmsee (Nats contest director). Most of us were campaigning Camanos and Maestros in open class and K-Minnows in two-meter class that year. The K-Minnow was a T-tailed version of the Camano with two-meter wings. It used the same revolutionary control system. We had recently pioneered the use of foam core balsa sheeted wings on the Camano and K-Minnow. These were the first successful competition glider kits to use solid core wing construction.

"Dave Banks spot landing his 'song. Steve Cameron timing." (image: Waid Reynolds)

On the long drive home, the Windsong concept was born in a kind of think-tank atmosphere. We all liked the size of the Maestro MK III with its 134-inch wingspan, but we wanted the more precise control system of the Camano along with a higher performance wing, using the unheralded Eppler 214 airfoil. We also wanted a wing that would be easier to construct than the sheeted spar and rib construction of the Maestro, Todi and the first Camanos. The basic design concepts were pretty well solidified on that long journey home from Lincoln. However, I still had lots of decisions to make and details to figure out.



PRICE LIST
Effective March 1, 1983

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Windsong Kit, Complete . . .	$199.95
Fuselage & Canopy (Fiberglass Only)	45.00
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Fuselage (Fiberglass Only w/Canopy)	35.00
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Wing Rod, 10"Lx1/4" Dia. . .	1.50
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Fuselage Kit, Complete . . .	50.00
Foam Wing Kit	89.00
Foam Stab Kit	$ 15.00
Foam Stab Core Only	7.50
Rudder Kit	8.00
Wing Rod, 1/4"Dia.x6-1/2". .	1.50

(See CAMANO 100 prices for other parts.)

*This configuration sent as standard unless otherwise specified.

ACCESSORIES

Transfer Tape, 3/4" x 36 yd. (for applying sheeting: 2 rolls required for Camano 100 and K-Minnow, 3 rolls required for Windsong)	$ 5.00/Roll
Frost PCI-2, 12-volt Charger	39.95

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-12-

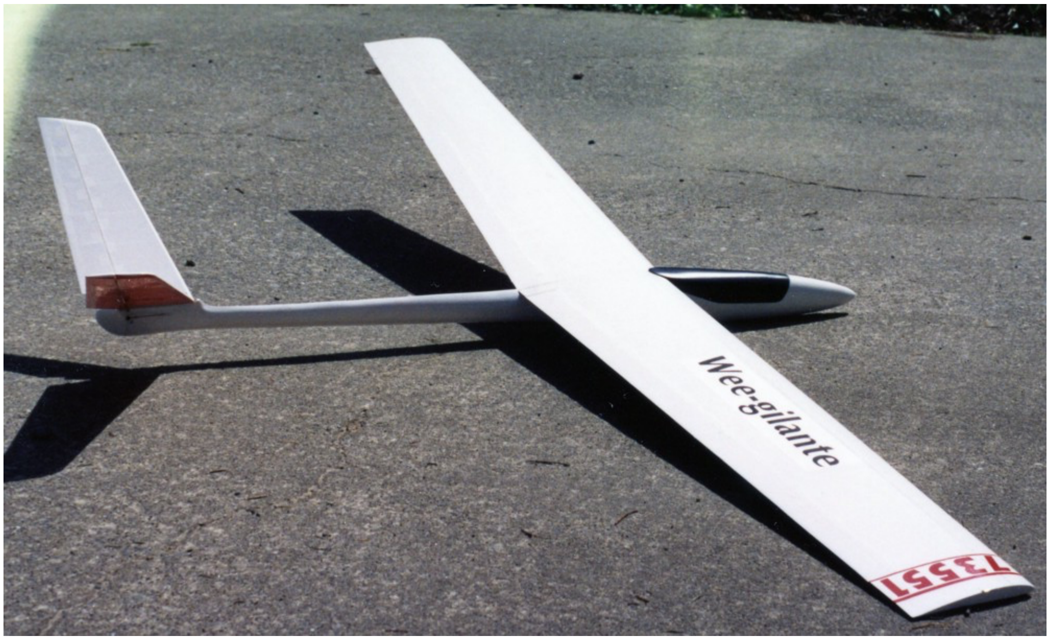
"Man, those were the days." (image: Kristopher Harig)

At home, I carved the plug for the first fiberglass Windsong "taco-shell" fuselage. This innovative idea, first used with the Camano, made it possible to have a graceful fiberglass fuselage that used spruce and plywood reinforcing inside and balsa and plywood for the top deck. It was easier to produce, stronger and more heat-stable than an all-fiberglass fuselage of the day. It was decided to go with foam core, balsa sheeted wings to simplify construction. As first used on the Camano, I figured out an efficient spar system and used lightweight foam to come out with wings that were stronger and yet as lightweight as equal sized built-up thermal glider wings.

While I was building the first Windsong prototype, I heard of a new full-sized German glider that could reflex the ailerons to function as spoilers. This idea got me to thinking. I have always loved simple and elegant solutions to complex problems. So, I decided to not put spoilers on the new Windsong and rather use separate flap control and ailerons that could reflex. I wanted to be able to reflex the entire trailing edge (TE) for high-speed flight anyway, so I would already have all the necessary functions in place. I worked out all the mechanical mixing systems and had the prototype Windsong flying in a few weeks after the trip to Lincoln. Its performance was breathtaking. I had seen nothing like it! At the time there were no computer radios, but the mechanical systems worked great and having all four servos in the fuselage kept the weight forward and gave me a Windsong that flew at about 54 ounces. The aileron spoiler effect used in conjunction with positive flaps was a real crowd stopper. No one had ever seen anything like it.

"Modified Camano and a Pixy against the fence with an Anthem in the foreground." (image: Tim Egersheim)

There it was in 1982, the control system, complete with 'crow' that many years later would become the industry standard and still is to this day. In fact, when computer radios started coming on the market in the late 1980s, they used the Windsong control system as the glider model that they were trying to emulate electronically. Even today the competition DLG gliders use the same basic control system that was introduced on the groundbreaking Todi in 1972.



"And the 2-Meter Wee-gilante." (image: Bob Dodgson)

Also, with the Windsong, we learned that 90-degrees of flaps was about the best precision landing control and so seldom used the aileron-spoiler function except to help dethermalize. In what became known as 'crow', with ailerons up and full positive flap, the Windsong could be pointed straight down dethermalizing at a safe speed of about 40 mph! No other thermal competition glider could dethermalize so fast and yet so safely and so spectacularly!

One of the most exciting sights that was unheard of at the time was watching Dave Banks regularly thermal out with his Windsong from a hand-launch! This is captured on our Dodgson Designs video tape that uses footage shot between 1983 and 1986. 134-inch multi-channel gliders should not be able to do this!

"Walt Volhard's Dodgson Saber at 60 Acres Park, Redmond, Washington 1991."
(image: Waid Reynolds)

Well, the Windsong, and its smaller brothers the Camano and two-meter Pixy, went on to win the Nationals many times flown by people like Tom Brightbill and Tom Neilson. Even I placed second at the Nationals with both the Windsong in 1983 and again with the Pixy at a later time.

The Windsong design evolved into the Lovesong that was a beefed-up version of the Windsong. We improved the mechanical control system too, using the Automatic Flap/Aileron Reflex Trim (AFART) devised by Windsong flyer Gary Brokaw.

Another interesting first for Dodgson Designs in the early 1980s was the introduction of the Pivot. The Pivot was the first successful thermal glider to utilize pivoting wings (wingerons) for aileron type control. This control system had been used some on the slope, but no one had come up with a successful thermal glider kit utilizing this simple control system. The Pivot was the first hand-launch sized thermal glider to use foam-core wings too! It won hand-launch as well as two-meter thermal contests and continued to be one of our most popular designs until we ended our kitting business in 1997. The Pivot could be taken apart easily too so that it could be carried around in its tiny shipping box to be a constant travel companion ready to do great flying at any slope or thermal opportunity.

"The Dodgson Designs planes that won a host of trophies at the 1983 Nationals Left to Right: Tom Neilson — K-minnow & Windsong, Dave Johnson — modified Sprite (I think), Bob Dodgson — Windsong and Tom Brightbill — Windsong, Camano and K-minow." (image: Bob Dodgson)

In 1990, we introduced the Saber which had two firsts for a U.S. kit. It was the first thermal competition glider kit to use the SD7037 airfoil. This airfoil showed great promise from the wind-tunnel tests but had been passed over by designers and pundits — until the Saber. The Saber was also the first U.S. kit to use obechi sheeting for the wing skins. It was not long until the SD7037 airfoil became one of the most popular airfoils following the Saber's successes and obechi sheeting became an industry standard.

Soon after the success of the new Saber, we updated the Windsong/Lovesong using the Saber wing technology and airfoil and called it the Anthem. However, many folks still preferred the Eppler 214 airfoil that the mighty Windsong made famous, so we finally offered an obechi sheeted Windsong Classic and lastly the Windsong Silver in honor of Dodgson Design's 25 years in the glider design and kitting business.

"Ray Cooper holding a Windsong — Dave Banks on right at 60 Acres Park early 90s." (image: Waid Reynolds)

In the early 1990s, we replaced the venerable Camano and Pixy with the 98-inch V-gilante and the two-meter Wee-gilante. These kits featured Saber wing technology along with V-Tails. They used a new Mono-Seam fiberglass fuselage that I developed. This fuselage had the production advantages of the taco-shell fuselage but offered the kit builder the construction ease of a fully formed and joined fiberglass fuselage. These beautiful glider kits offered all the controls that the Windsong had pioneered. They were popular in their size classes until we ended our kitting business.

"Me and my Windsong in 2016." (image: Bob Dodgson)

In 1994 I experienced a serious health problem called Churg Straus Syndrome. After recovering and with some minor lasting physical limitations I was able to continue the kitting and design business –but with more caution as all of the fiberglassing and foam cutting chemicals and the balsa dust exposure might have been a factor in my getting sick.

Then, by 1997, it was evident that serious thermal competition glider pilots were going to expensive pre-built gliders using all space-age materials and they were being manufactured offshore. It was no longer profitable to continue designing and manufacturing high performance competition builder kits. So, I had an opportunity to go to work for Boeing in 1997 and I closed the doors to Dodgson Designs.

Jim Thomas, flying a Windsong (a 20-year-old design) that he had just finished building, placed third at the huge 2002 Visalia, California contest. He was in first place until the final flight where he lost 10 landing points by 3⁄4-inch and had to settle for third — showing that the mighty Windsong can still kick state-of-the-art butt!

When I was 70 years old I retired from Boeing after working there for 10 years plus two years of working at Star Aviation during a Boeing layoff. To my surprise, after we closed Dodgson Designs I did very little glider flying. I had lost my boundless passion for it — having turned my great hobby into my job for 25 years. I have since been enjoying other old hobbies like music. I was never musically talented but when I was kid my Dad gave me some singing lessons to try to help with my stuttering since I don't stutter when I sing. Well that did not help my stuttering but it did improve my singing and pitch from awful to not too terrible. So, I have been enjoying singing along with my old guitar.

I recently saw a unique new opportunity since my Dad had an 8mm movie camera in the mid 1930s and onward and took a lot of good family movies. I have used some of those movies along with movies that Sandy and I took and even videos that we took after 1982 to put with songs of me singing with the guitar on my YouTube channel (see *Resources*, below). The channel also has the shortened Dodgson Designs glider video that I made from old footage for my Hall of Fame Induction.

Needless to say the 2019 Model Aviation Hall Of Fame induction has been the highlight of my fun retirement years and I am still enjoying each day with my wonderful lady and titillating marital partner of 58 years this December. Moreover, I still thrill at the passion and the unique opportunity that so many wonderful glider flyers afforded me by building and flying my kits during our 25 years of the Dodgson Designs business. Thank you all for making my passion and dreams live for me and for my family. You will always keep my spirits soaring!

Resources

- The Last Troubadour (Bob Dodgson's YouTube channel)

For those who have enjoyed entering the 'turn back time machine' with Bob, RCSD has obtained his permission to rerun articles from Second Wind*, the much-loved Dodgson Designs in-house publication. We look forward to bringing those to you in the future.*

Finally, RCSD would like to thank both Bob and the AMA History Project for permitting the use of the AMAHP document as a source for this series of articles in RCSD. In particular, we would like to thank Jackie Shalberg, Archivist and Historian for the National Model Aviation Museum, for the assistance in making these arrangements. — Ed.

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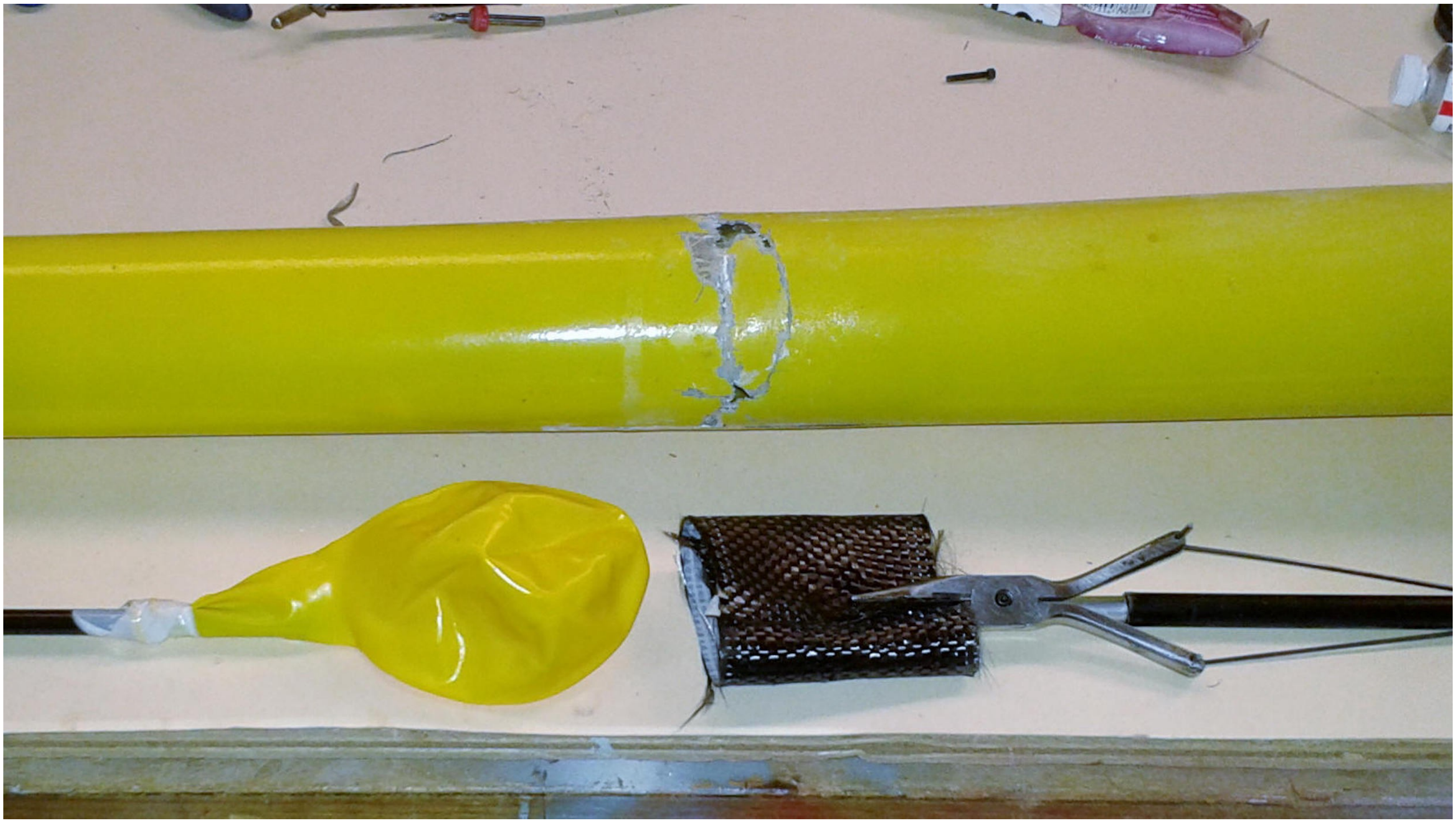


Photo 1: The Extra Long Reach Pliers in action, fixing a wayward Aquila XL fuselage.

Extra Long Reach Pliers

The perfect tool for repairing that long, skinny fuselage.

Tom Broeski Follow
Jul 7 · 3 min read

I have a couple of long reach tools, but none long enough for what I was working on. I've had a need for something that could open and close and get way down in a fuse. Soooo… I needed to make something…

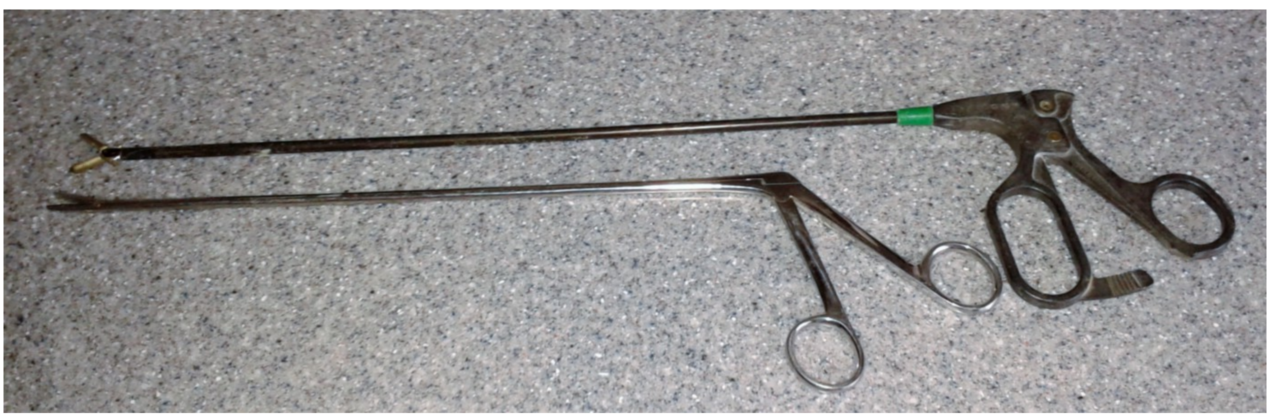


Photo 2: There are a number of types of long reach tools available. Here are a couple of mine — they get a lot of use.


Photos 3 and 4: The first thing I did was look around at what I had extra of. I had an old set from Harbor Freight that cost $5, so I picked out one that was not to long and not too short.

Photo 5: I grabbed a 3ft fiberglass tube (carbon will work fine also) from my stock. This one looked good.

Photo 6: I marked where they should be cut off.

Photo 7: I was thinking of keeping the springs, but later found them unnecessary.

Photo 8: After cutting and grinding, I drilled a couple of holes for the pushrods.

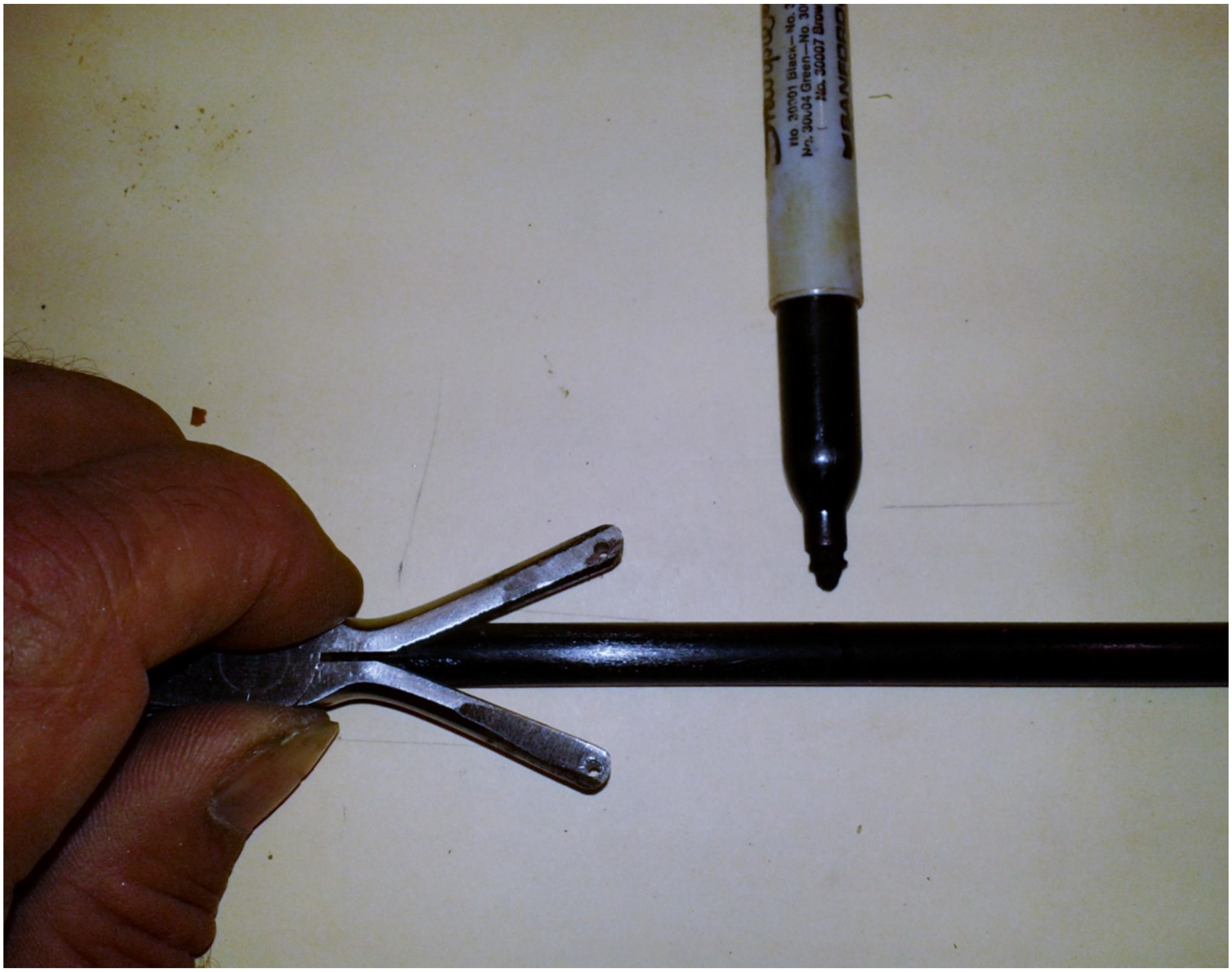


Photo 9: I marked a place that look reasonable for the pushrods to exit.

Photos 10 and 11: I cut a slot in each side of the tube about 3/4 in long.

Photo 12: I drilled through the center of the pliers, took a piece of aluminum rod, turned down one end to fit the tube, drilled and tapped it for a tiny socket head cap screw. You could just as easily fill the rod with epoxy or a dowel and put the pliers right on the rod. Just account for that when making the slots.

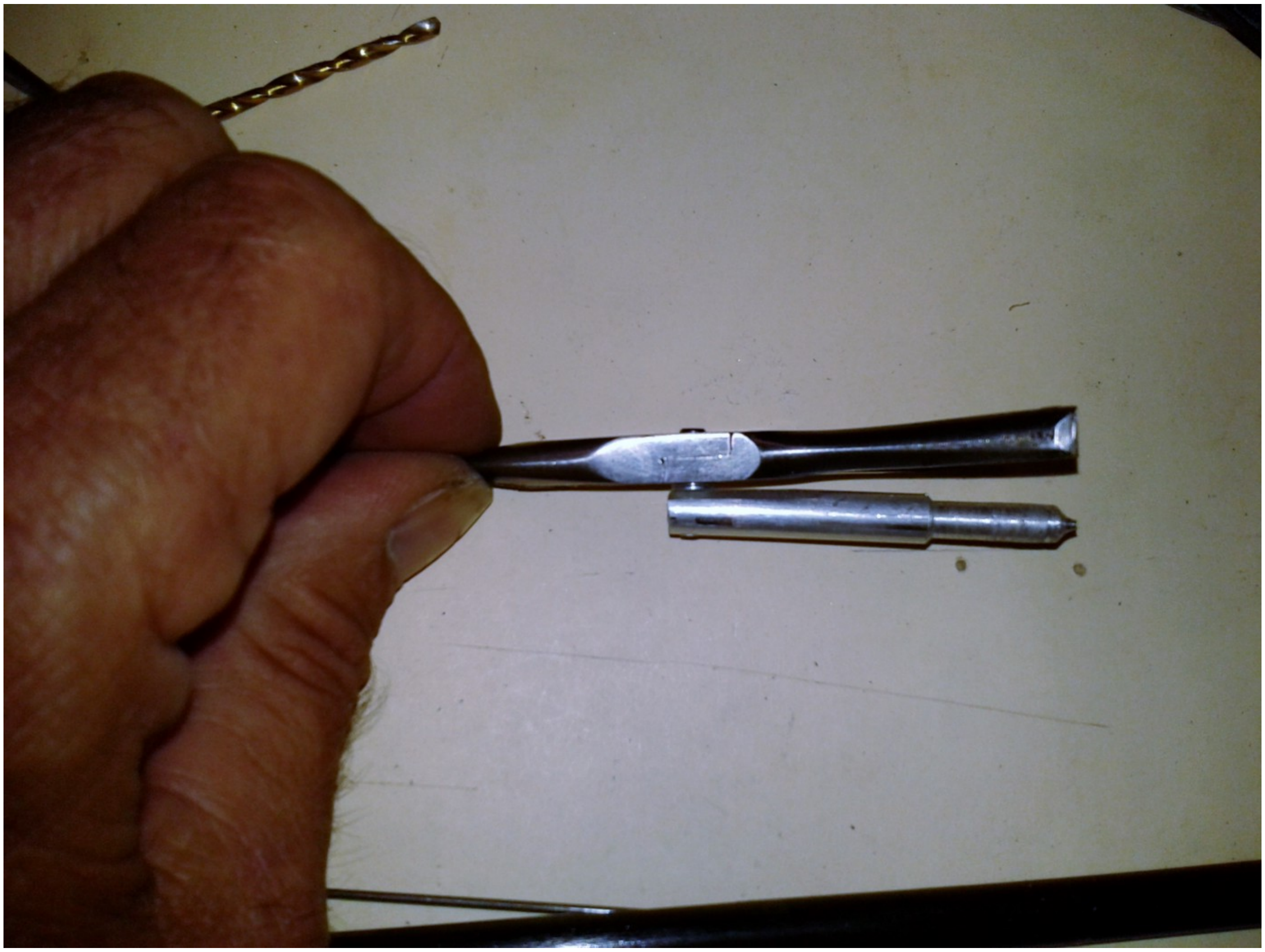


Photo 13: I added the washers as spacers and screwed it together.

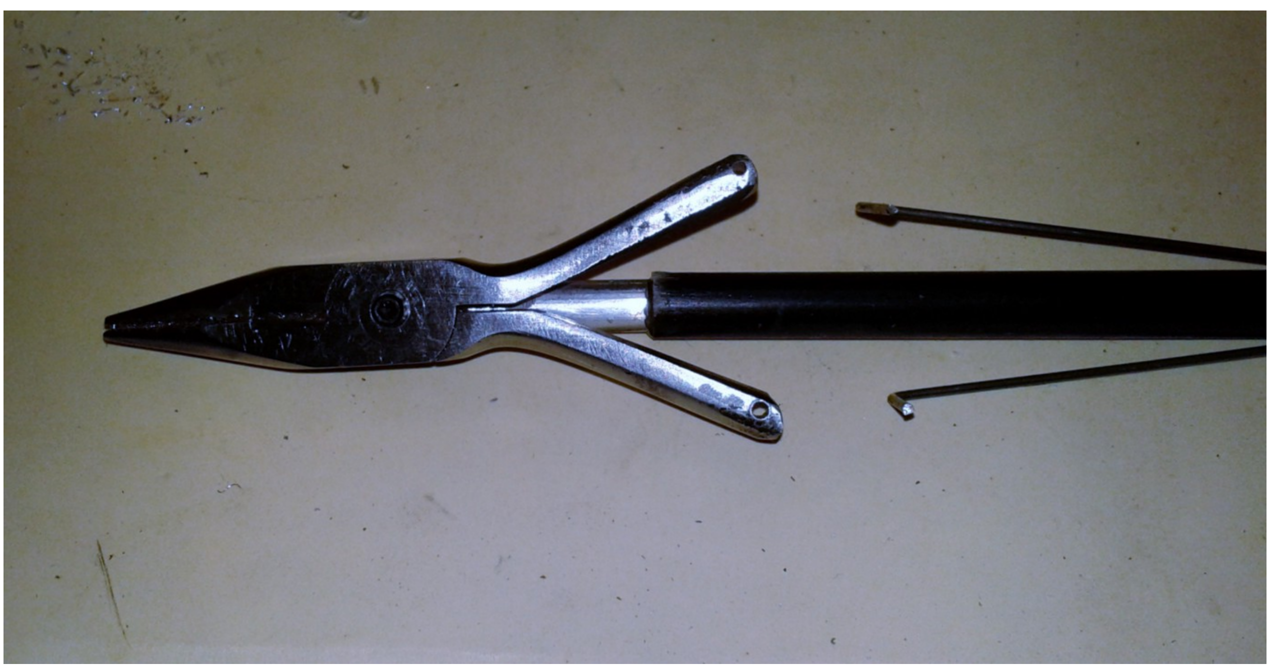


Photo 14: Glued it in the tube. Then I inserted some music wire into the slots in the tube and bent the ends at 90 degrees.

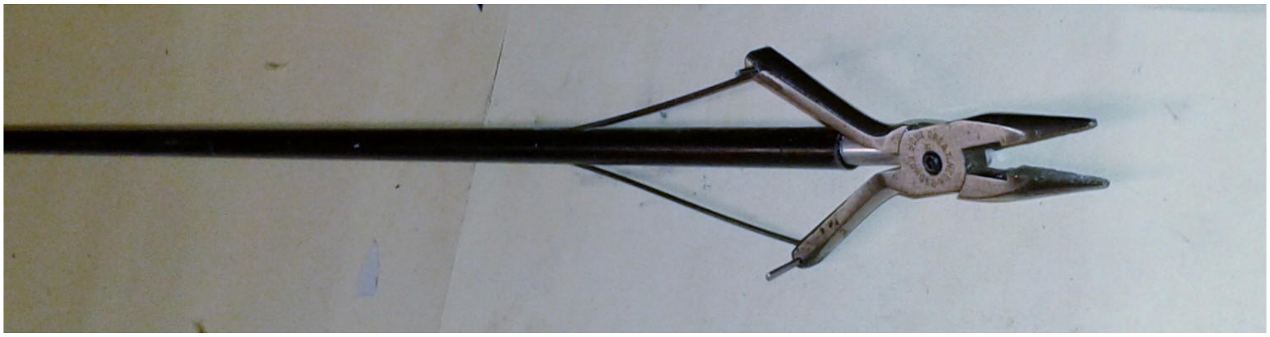
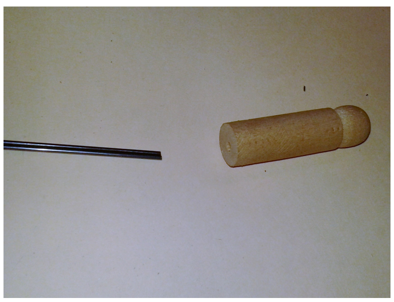


Photo 15: Put the rods into the holes in the handle and…



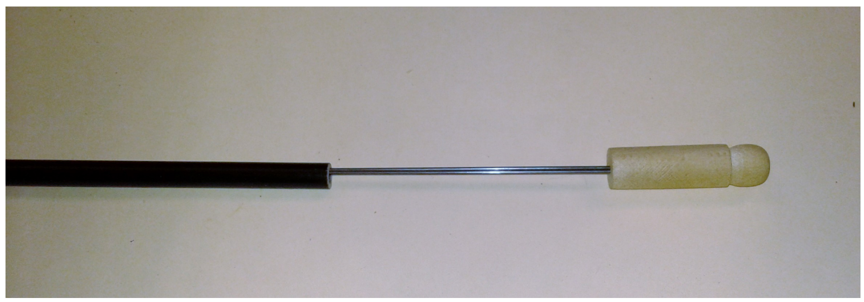


Photo 16 and 17: …went way down to the other end and made a simple handle out of a dowel and…

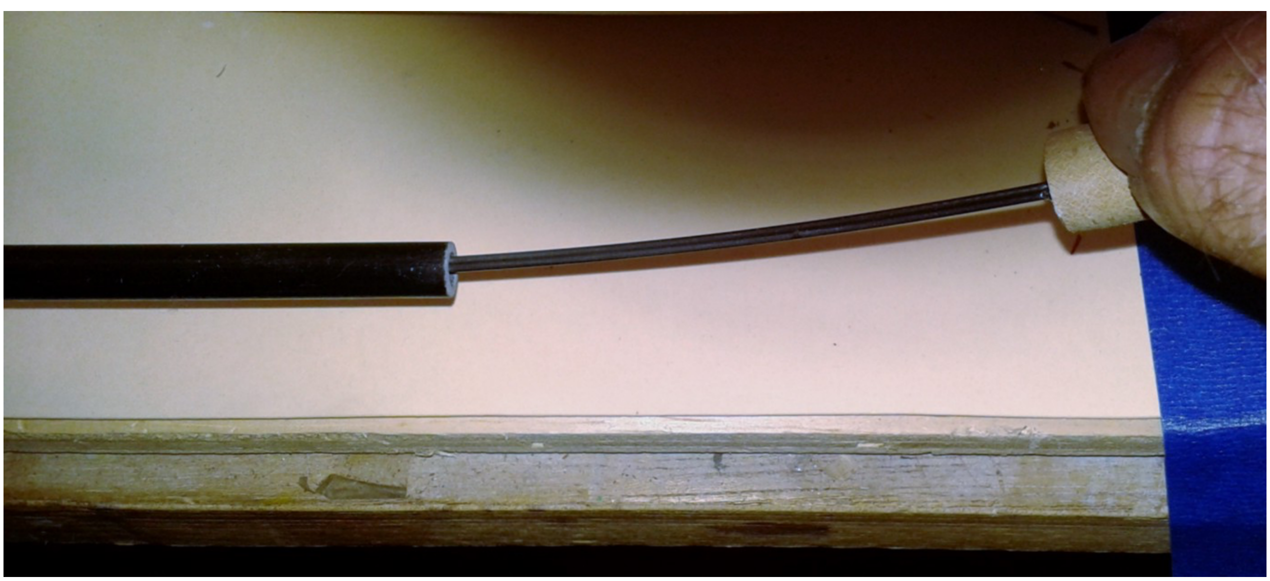


Photo 18: …glued it on.

Photo 19: Left plenty of rod out the end so it could flex if necessary.

And there it is. It worked amazingly well. 45 minutes work — that I wish I had spent years ago when I was building (and repairing) a lot of planes. Here's how I used it to repair an Aquila XL fuse.

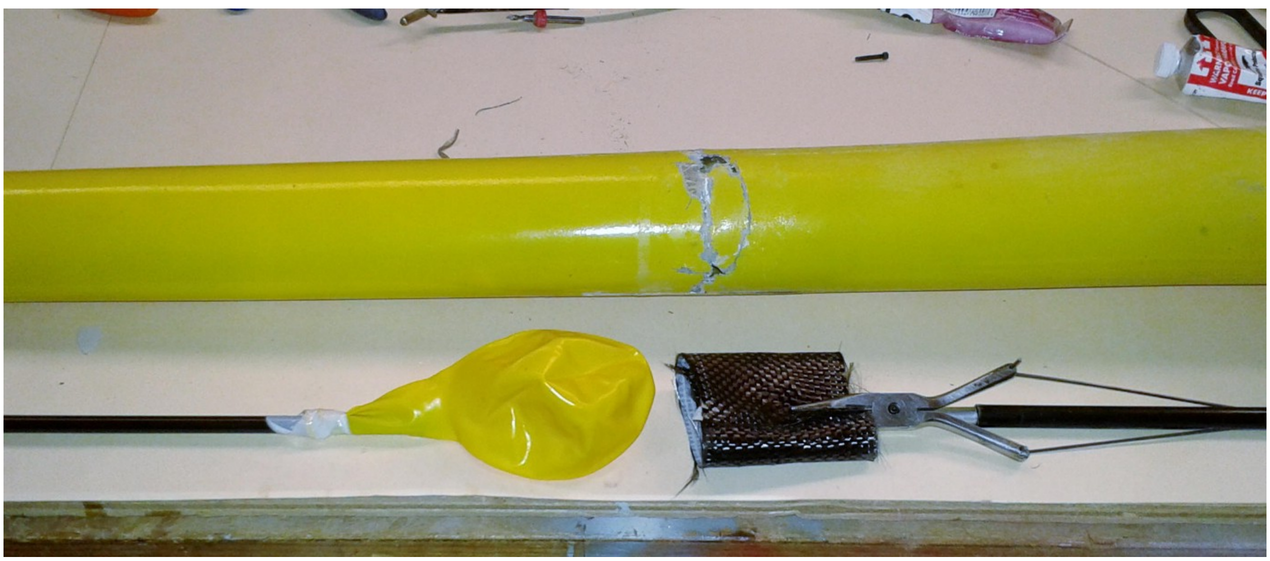


Photo 20: Long reach pliers and a tube with a balloon.

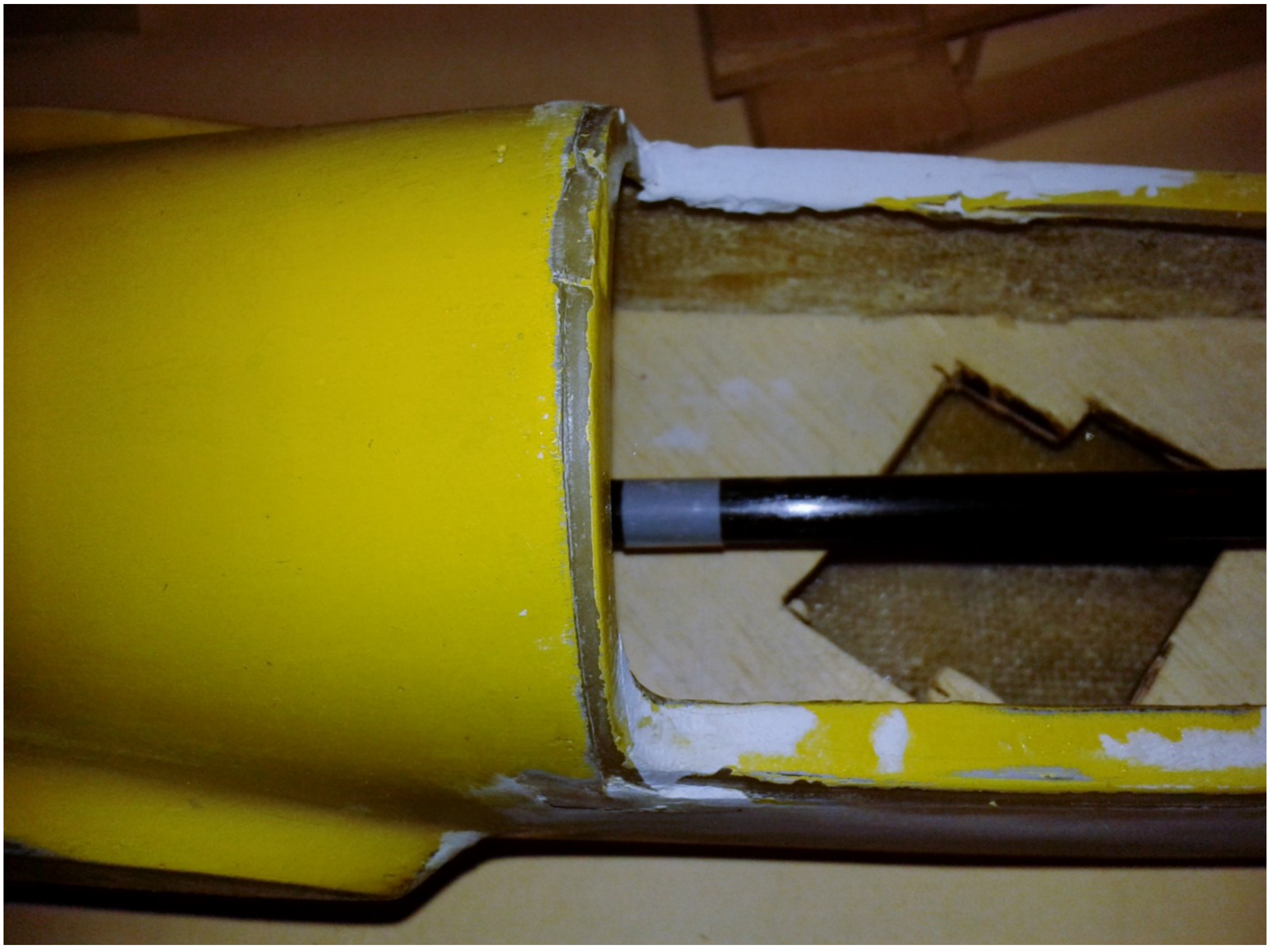


Photo 21: Marked where the pliers and cloth should end up.

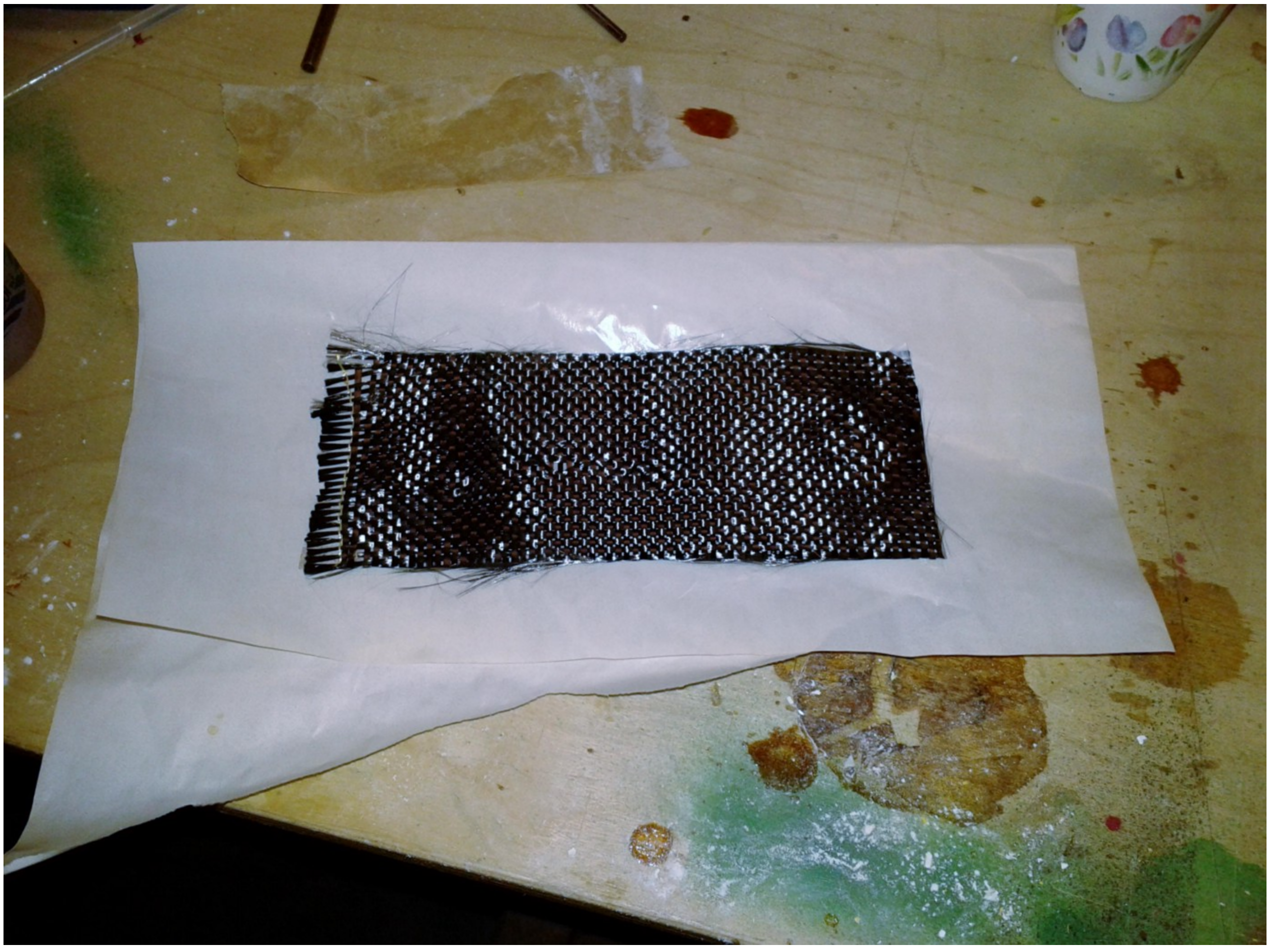


Photo 22: Cut and wet out a piece of carbon cloth.

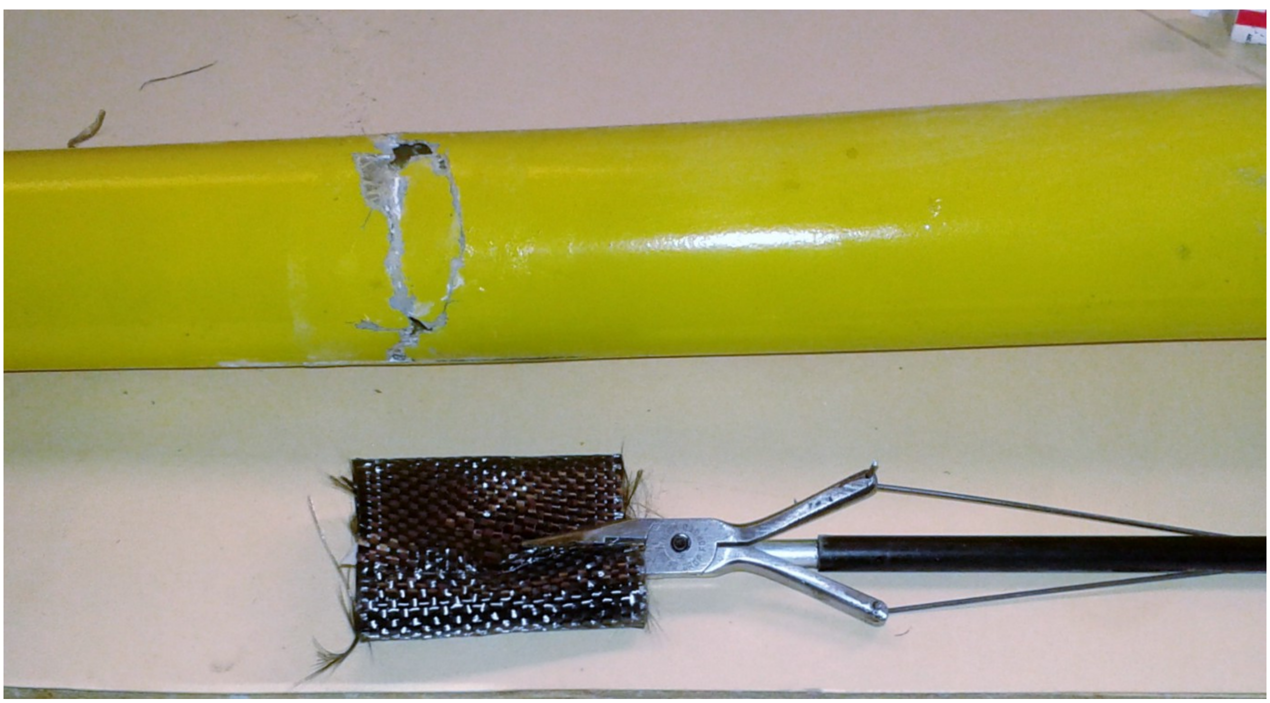


Photo 23: Rolled it and grabbed it with the Extra Long Reach Pliers.

Photo 24: Stuck it down in the fuse and released it.

Photo 25: Put a little extra epoxy in the big holes. I had dripped in some extra epoxy before running the cloth in also.

Photo 26: Ran the balloon in to the right spot and blew it up gently. Then blew hard to pop it and pulled it out. I did it again with a surgical glove since I ran out of balloons. I left it in until the epoxy got tacky and then blew until it popped and pulled it out.

Photo 27: The nose on this Aquila was fuse totally demolished, but I managed to put Humpty Dumpty back together again. After some sanding and filling, the fuse came out great.

’Til next month!

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

In-Flight Setting of a Multi-Point Trim Curve for Crow Brakes

A Lua app for JETI transmitters inspired by Mike Shellim's recent RCSD article.

Harry Curzon

The JETI DS-24. (image: JETI model s.r.o.)

In the April 2021 issue of the NEW RC Soaring Digest, I was delighted to see the article *I've Got the Power: OpenTX* by Mike Shellim (see *Resources*, below) in which he describes his crow aware trim Lua application. At the time, Dave McQueeney and I were finishing the development of a Lua app for JETI transmitters which was inspired by Mike's work. We published it on May 22nd, 2021 along with a YouTube training video. The app will do the setting for you of a multi-point curve of elevator trim compensation for crow brake/flaps/spoilers, whilst in flight, without you needing to take your eyes off the model or your fingers off the sticks. This saves you from the many iterations of fly, land, adjust, fly, land, adjust, to set a trim compensation.

The app takes Mike Shellim's wonderful idea and develops it further, so that instead of taking your fingers off the sticks to press the trim button, it uses the movement of the elevator stick itself to adjust the relevant point on a trim compensation curve. JETI users will be familiar with this concept, from the *Auto-Trim* feature. The result is that all you need to do is slowly open the crow brake/flaps/spoilers, just keep flying the model to the attitude that you want, and keep going until you have the brakes fully open. As you do this the app chooses the correct point along the trim compensation curve, and the elevator stick moves that point to the required up or down trim. Within one or two flypasts you can get a perfect trim over the entire movement of the brake. You can do it on a maiden flight so that your first landing does not suffer from wild pitching up and down as you operate the brakes or flaps.

Photo 2 shows a graph of a seven point curve created by the app on the transmitter home screen, demonstrating the non-linear nature of the elevator trim compensation required with crow brakes.

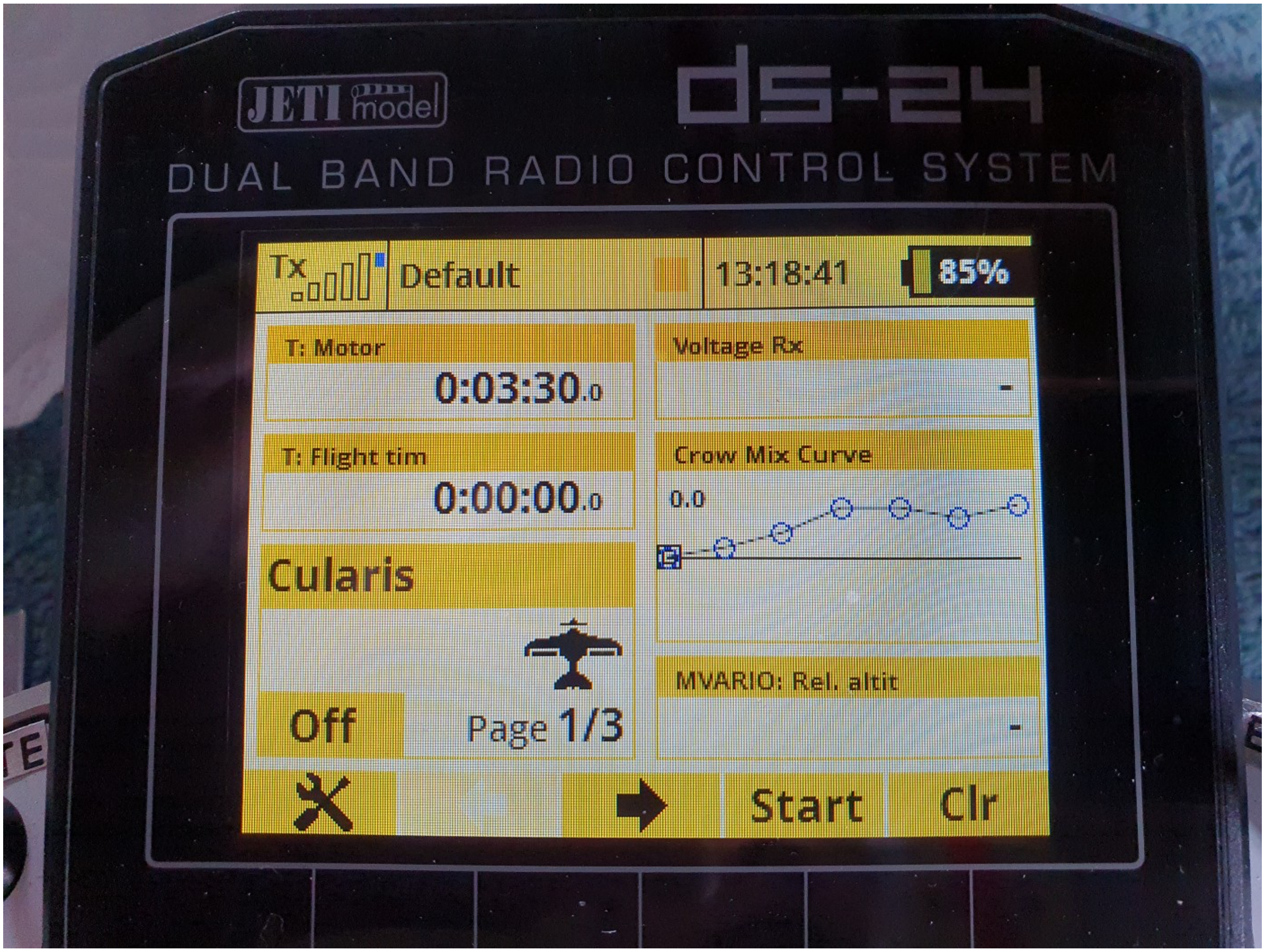


Photo 2: A seven point curve created by the app.

Photo 3 shows the choices available in the app settings menu.

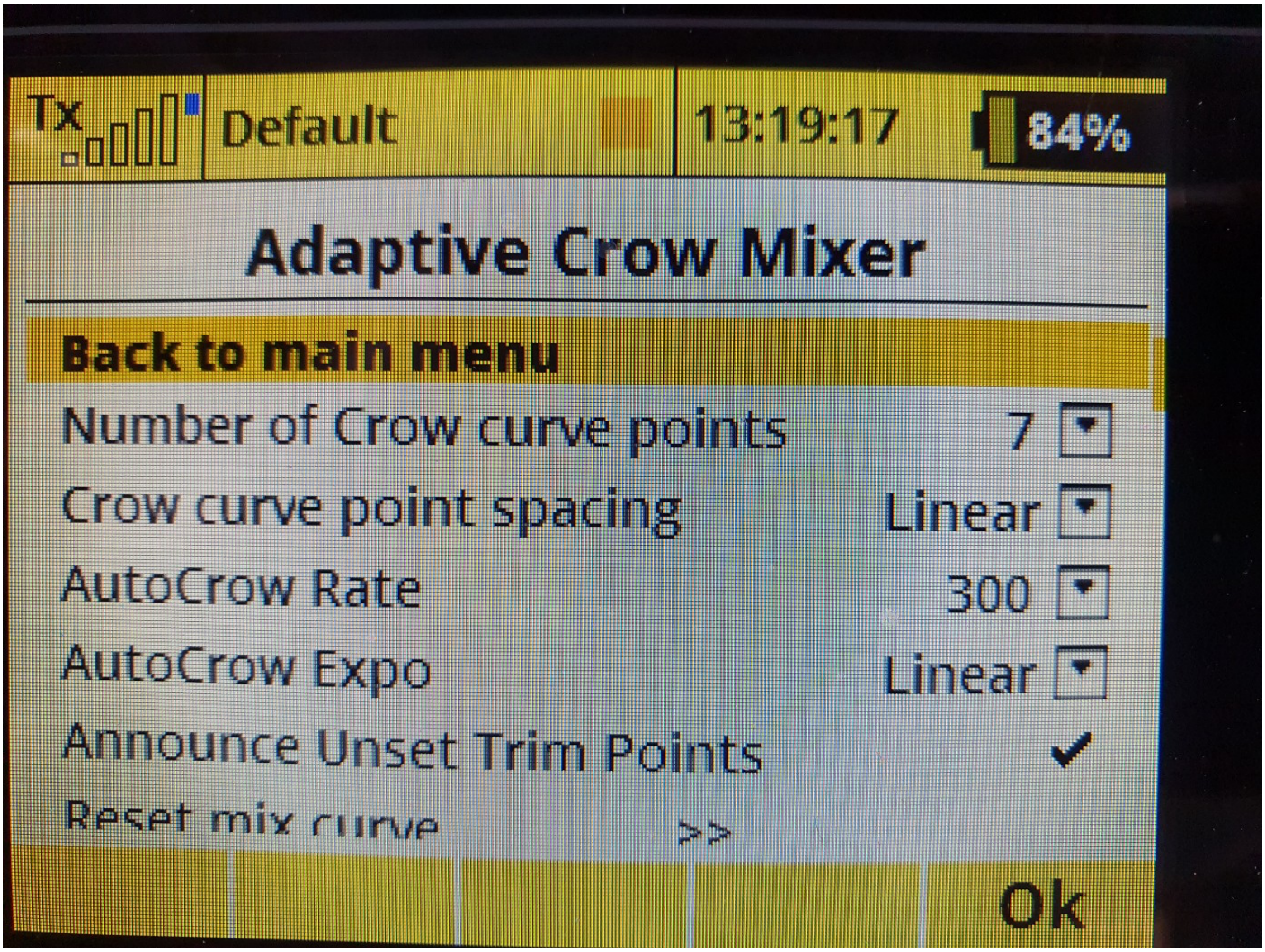
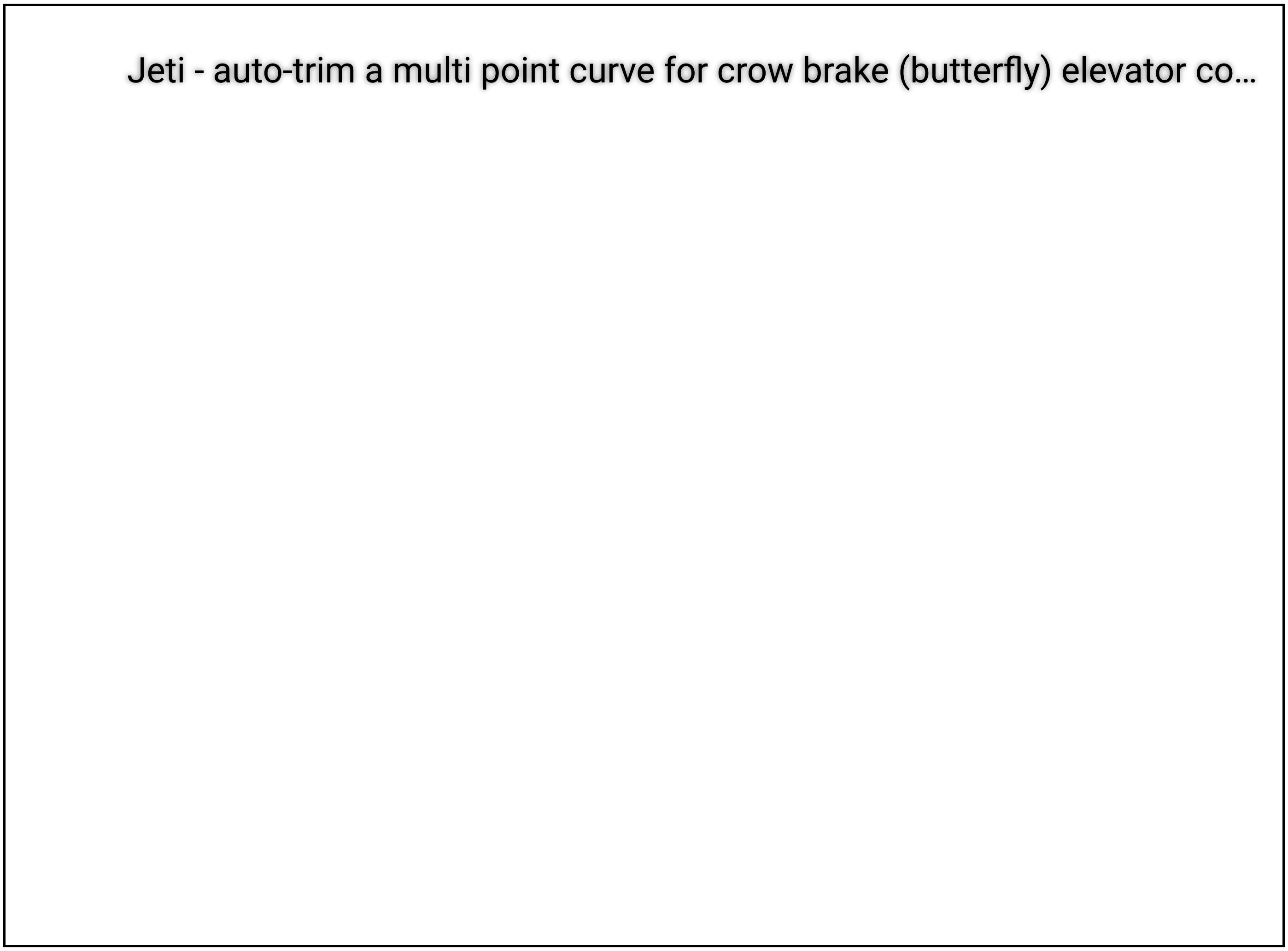


Photo 3: Adaptive Crow Mixer settings menu.

The app, which works on all the JETI transmitters, is available from JETI Studio but you will need to watch the training video to see how to enable that feature in Studio.



Video 4: *JETI — Auto-Trim a Multi Point Curve for Crow Brake.*

Note that the video above is in English, but if you switch on subtitles and then use options you can select it to auto-translate the subtitles into most languages.

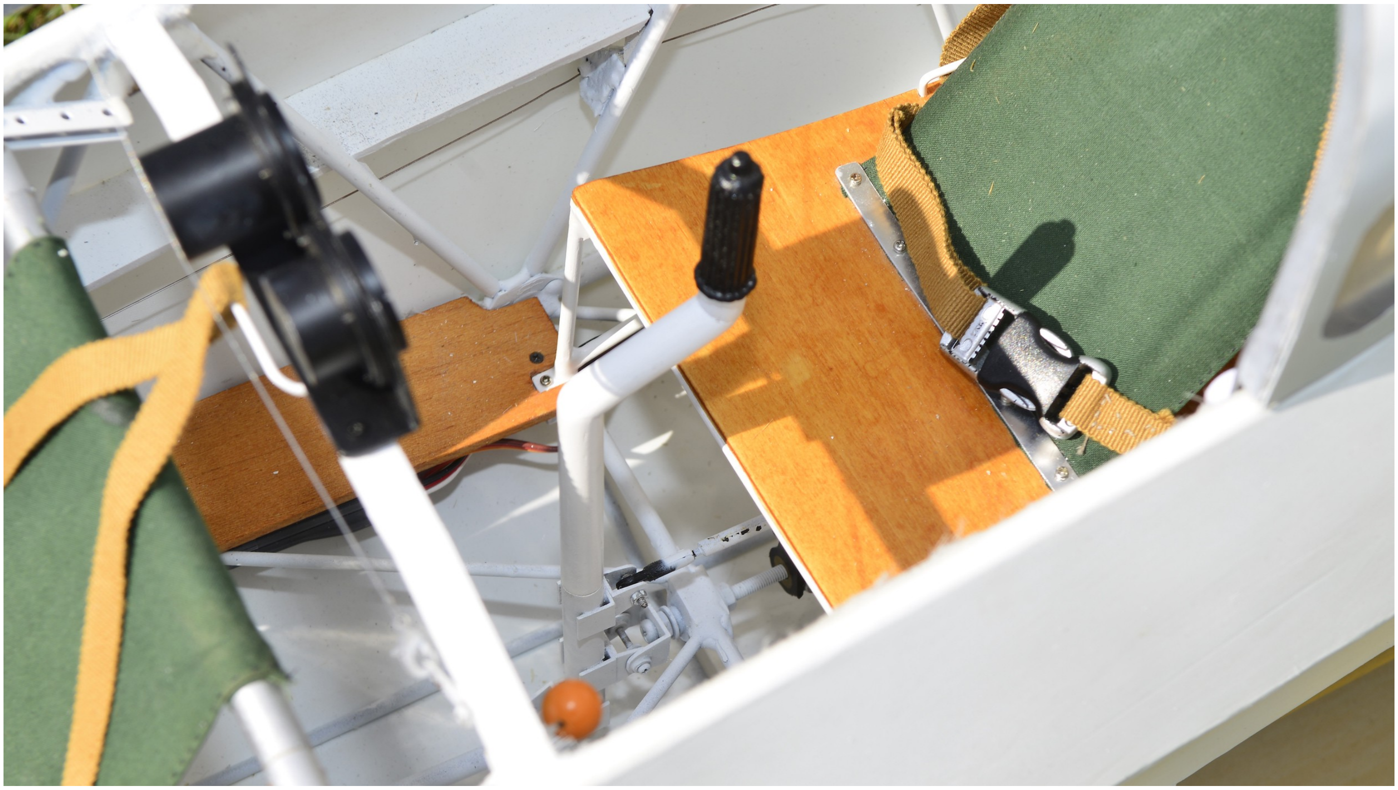
Resources

- *I've Got the Power: OpenTX* (article by Mike Shellim)
- *JETI for Gliders* (video series)
- *Lua Programming Language* (Wikipedia article)

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

1/3rd Scale Mita Type 3 Production Notes

Norimichi Kawakami



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

Fabrication Part 11: Wingtip

Wingtip of the real aircraft

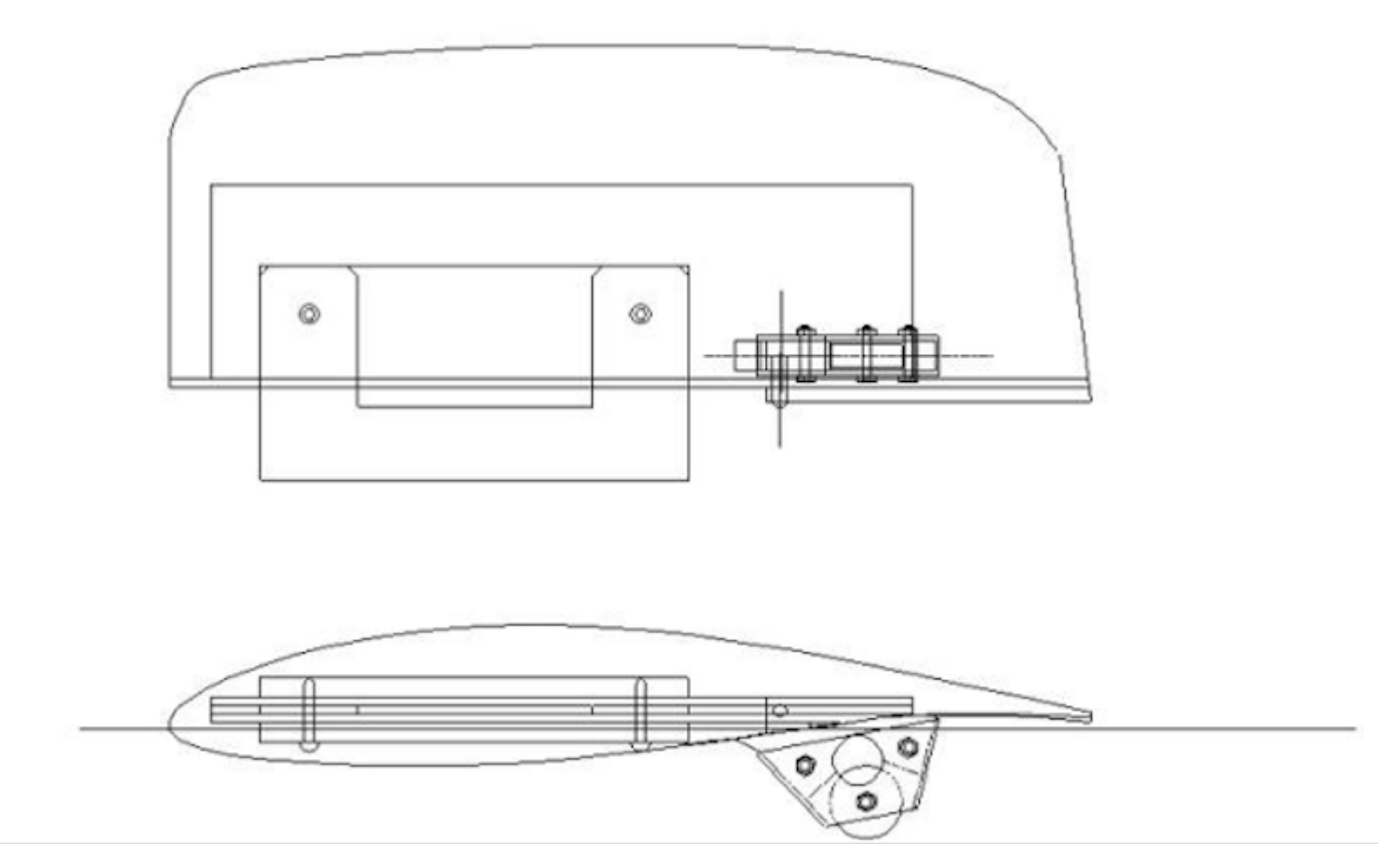
Since the main wheel of the real aircraft is single-wheeled, one of the left or right wingtips always touches the ground at low speed. Therefore, a small auxiliary wheel is attached to the wing tip:

Photo 58: Wingtip of the real aircraft.

I made this wingtip with a wheel in 1/3 scale.

Drawing

The first step is to make the drawing. The wingtips of the real model are not removable, but in the 1/3 model, the ailerons are fitted from the outside, so the wingtips are designed to be removable. Drawing 20 is what I made. A 2mm thick aluminum fitting attached to the outer wing is inserted into the wingtip and screwed tightly. The auxiliary wheel is a small one with a diameter of 15 mm. Its attachment mechanism is also designed to be similar to the actual one:



Drawing 20: Drawing of wingtip.

Parts Fabrication

Photo 59 shows the parts fabricated based on the drawing:

Photo 59: Wingtip parts (one side).

The part where aluminum fitting is inserted is constructed by sandwiching 2mm balsa between two sheets of 1.6mm plywood. For the part where the screws are to be fastened, 4mm-thick plywood is applied as a support. Several balsa sheets are overlapped to the thickness of the wing around them. I cut out quite a few sheets of balsa because the wing thickness is quite large even at the wing tip. If I had used thicker balsa, the number of sheets would have been less, but since I used scrap balsa, I ended up with more than 10 sheets for a wing. The parts in the photo above are for one wing tip. The part for attaching the auxiliary wheel is made of 5.5 mm thick plywood and sandwiched between two pieces of 0.5 mm thick brass to attach the wheel.

Rough Cut Wingtips

Balsa sheets were laminated together and rough-cutted to the shape of the wingtip, and the auxiliary wheel was temporarily attached:

Photo 60: Rough cut wingtips.

I finished sanding the wingtips while they were less than 1mm thicker than the final shape. This is because I plan to attach them to the outer wings when the planking are completed, and sand them together so that the whole shape is smoothly connected.

I had wanted a thicker rubber wheel, but I couldn't find a suitable one with a diameter of 15 mm, so I ended up with this one, but the shape of the wingtip is similar to the actual one.

Completion of Wingtips

The wingtips were shaped later when the outer wings were finished. After that, putty was applied to the recesses for final shaping, sanding sealer was applied, and after drying, fine sandpaper was used to clean the surface. After repeating this process twice, I sprayed the wingtips with 1000-grit surfacer and then painted them with red acrylic paint to complete the wingtips.

The weight of each wingtip was 58g including the screws for attaching to the outer wing.

Photo 61: Finished wingtips.

Change of Policy

In the Basic Concept №1, I had decided on the fuselage and wing division method, taking consideration of its transportation by my car, but after checking the actual loading with the completed fuselage so far, I decided to change the patition of the main wing.

Car Loading Check

Now that the skeleton of the main wing and the rear part of the fuselage were completed, I checked them by actually loading them into my car. First, the outer wings. As you can see in Photo 62, I confirmed that the wings can be installed without folding down the passenger seat:

Photo 62: Checking the installation of the outer wings in my car.

Next is the fuselage. Both horizontal and vertical tails can be removed from the fuselage. The rear fuselage is surprisingly thin, so it won't get in the way even if it jumps out between the driver and the front passenger seats. Then I actually loaded it in my car:

Photo 63: Fuselage mountability check in my car.

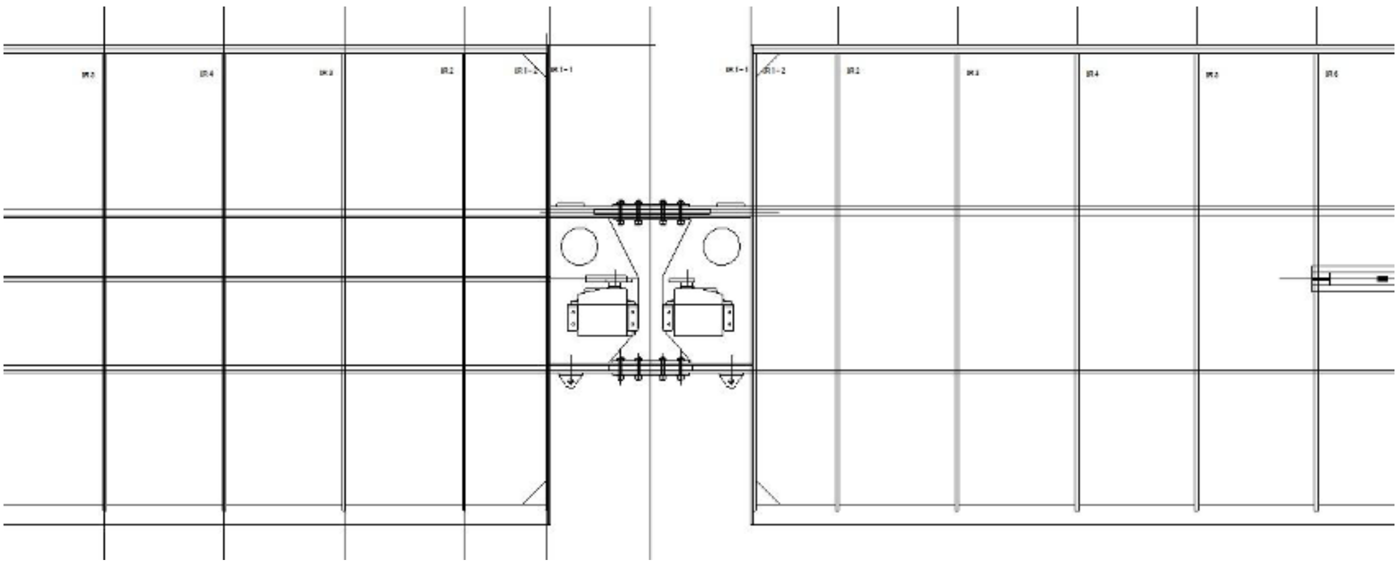
The rear fuselage is exactly half of the total length of the fuselage, so it is loaded in the luggage compartment of the car leaving a reasonable length. I confirmed that it is not a hindrance for driving, although it is a hindrance for accessing the cupholders and the radio.

Change Of the Main Wing Partition

The most troublesome part is the center wing which is 2m long. If I split it into two pieces, I can easily pack it into the luggage compartment of the car without folding the front passenger seat. Fortunately, the center wing was made in two pieces for the convenience of fabrication and has not been joined yet, so I decided to split it into two pieces. In other words, the main wing was divided into four parts, two center wings and the right and left outer wings.

Drawing of the split/joint parts

This is the drawing for a structure to split for transport and connect for flight:



Drawing 21: Dividing/connecting structure of the center wing.

The carbon flanges of both front and rear spars have 4mm inner diameter round holes, then 4mm pins are inserted into them for positioning. A 1.6t web of plywood extending in the wing span direction is originally attached to the rear surface of the upper and lower flanges, and the same plywood web is added to the front surface. The gap between the two webs is filled with thick plywood to create a solid structure. These are bonded together with epoxy adhesive. This solid spar is sandwiched between two 2mm thick aluminum plates and are fastened together with 3mm bolts.

This change affects the target weight. Originally one servo mounted at the wing center used to operate the left and right spoilers, but now two separate servos are required that will increase the weight. In addition, the weight of the joint structure must be added. The total delta weight will be about 120g.

This means that the target weight of the center wing will increase from 1,600g to 1,720g, and the target overall weight in normal flight will also increase from 7,600g to 7,720g.

Fabrication of the Joint Structure

I immediately made the joint structure of the center wing. Photo 64 shows the locating pins, which are 3mm carbon rods threaded through 4mm brass pipes:

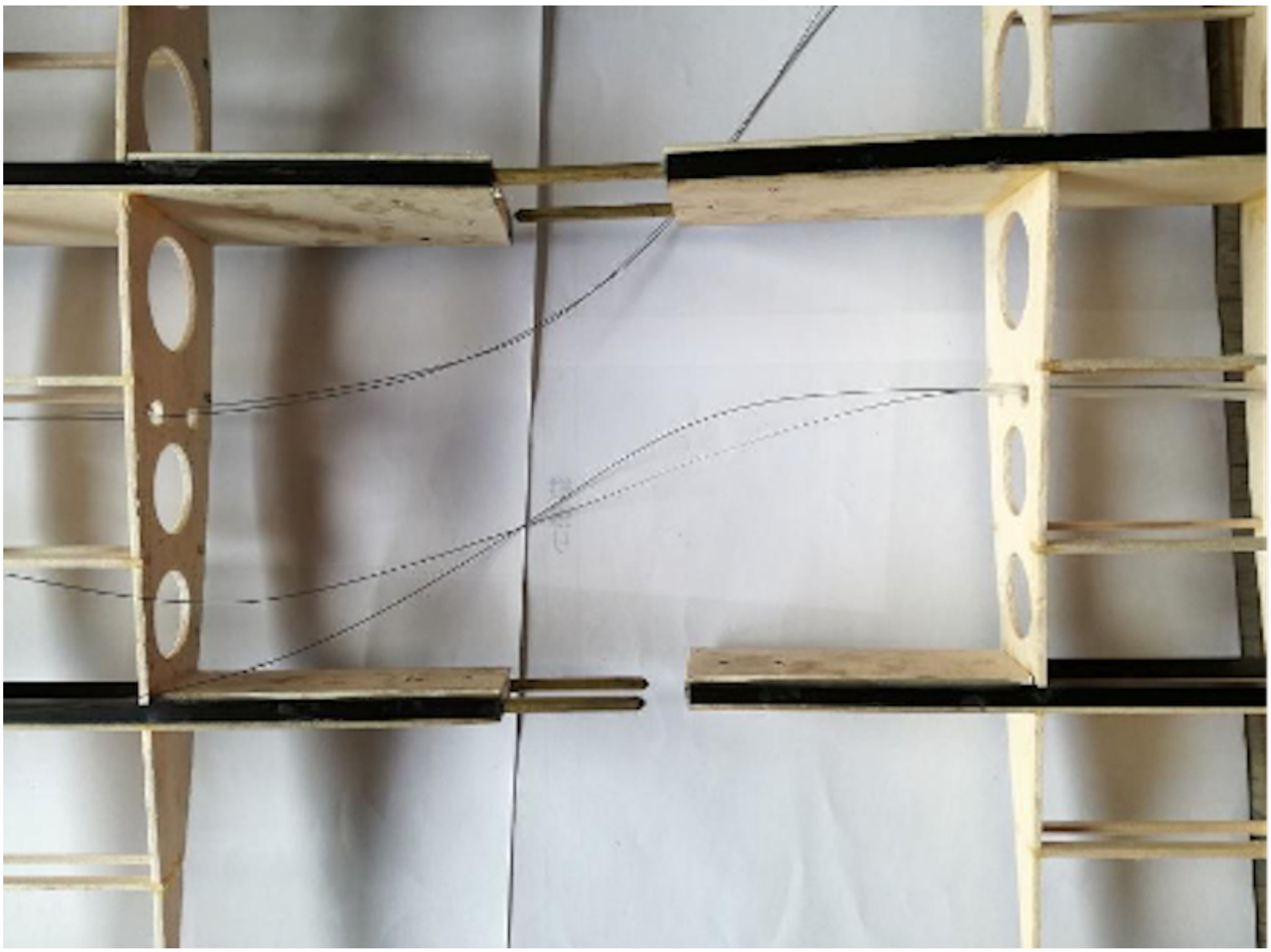


Photo 64 Positioning pins for center wing joint.

Photo 65 shows the left and right sides are connected for testing:

Photo 65: Testing the left and right connection.

Both sides could be joined quite tightly. Photo 66 shows the spoiler servo beds:

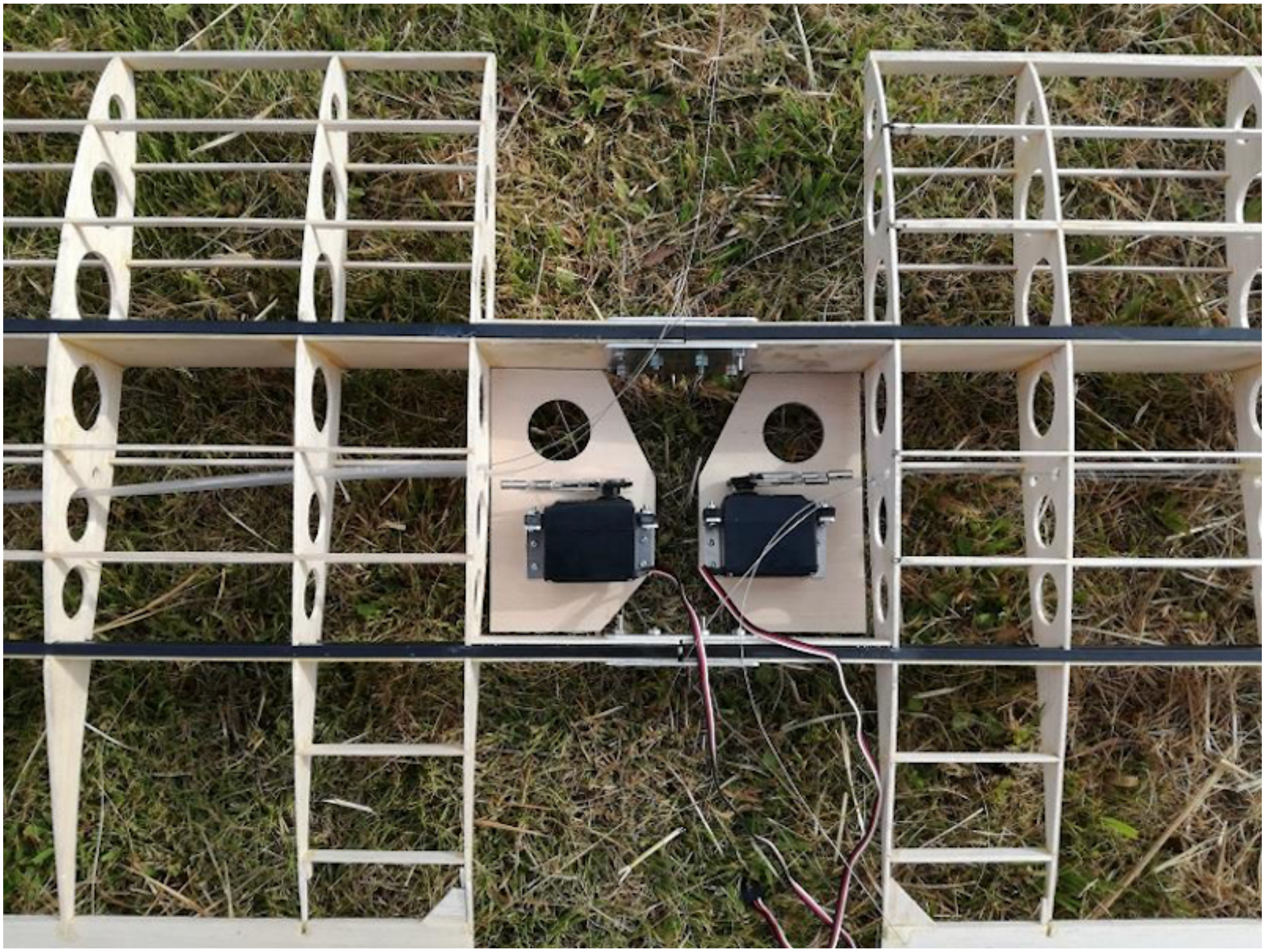


Photo 66: Spoiler servo beds.

Weight Check

Here, the weight of the center wing is actually measured to predict the finished weight. The weight measurement results were as follows.

Left center wing	400 g
Right center wing	398 g
Connecting brackets	53 g
Center/outer wing connecting tube	158 g
Spoiler servos	129 g
Total:	1,138 g

The estimated weights for the remaining items are:

Planking	400 g
Inner end rib reinforcement	20 g
Outer end rib reinforcement	10 g
Covering	190 g
Mounting brackets	50 g
Aileron servo extension cords	40 g
Painting and marking	30 g
Total	740 g

Therefore, the estimated completion weight of the center wing is 1,878g, which is 158g (9.2%) over the target weight of 1,720g.

I had weighed the wing when the framework was completed last time, and had expected it to be almost within the target weight. After that, a glass cloth was applied with a lot of epoxy resin to reinforce the connecting pipe supports and the connection pins to the outer wing and the measures to prevent the outer wing from slipping were added. Because of these works the weight increased significantly. I also forgot to count the weight of the aileron servo extension cords and underestimated the weight of the spoiler servo by 50g. The weight of the servo itself is 40g, but the weight of the servo bed and the spoiler cable length adjustment brackets turned out to be too much. As a result, the weight was 9.2% over the target, which was a bit embarrassing.

5th Calculation of Weight and Balance

Based on these data, the fifth estimation of weight and balance was checked in the chart below (the fourth was omitted):

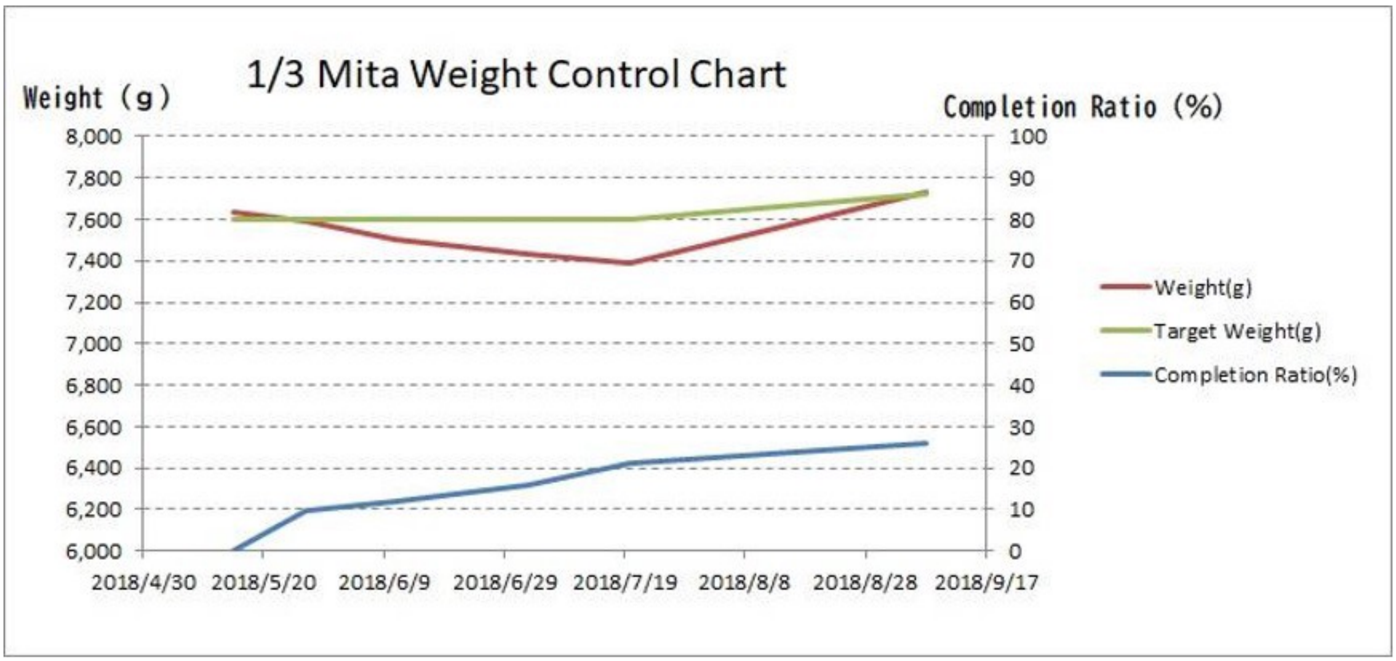


Table 5: 5th calculation of weight and balance.

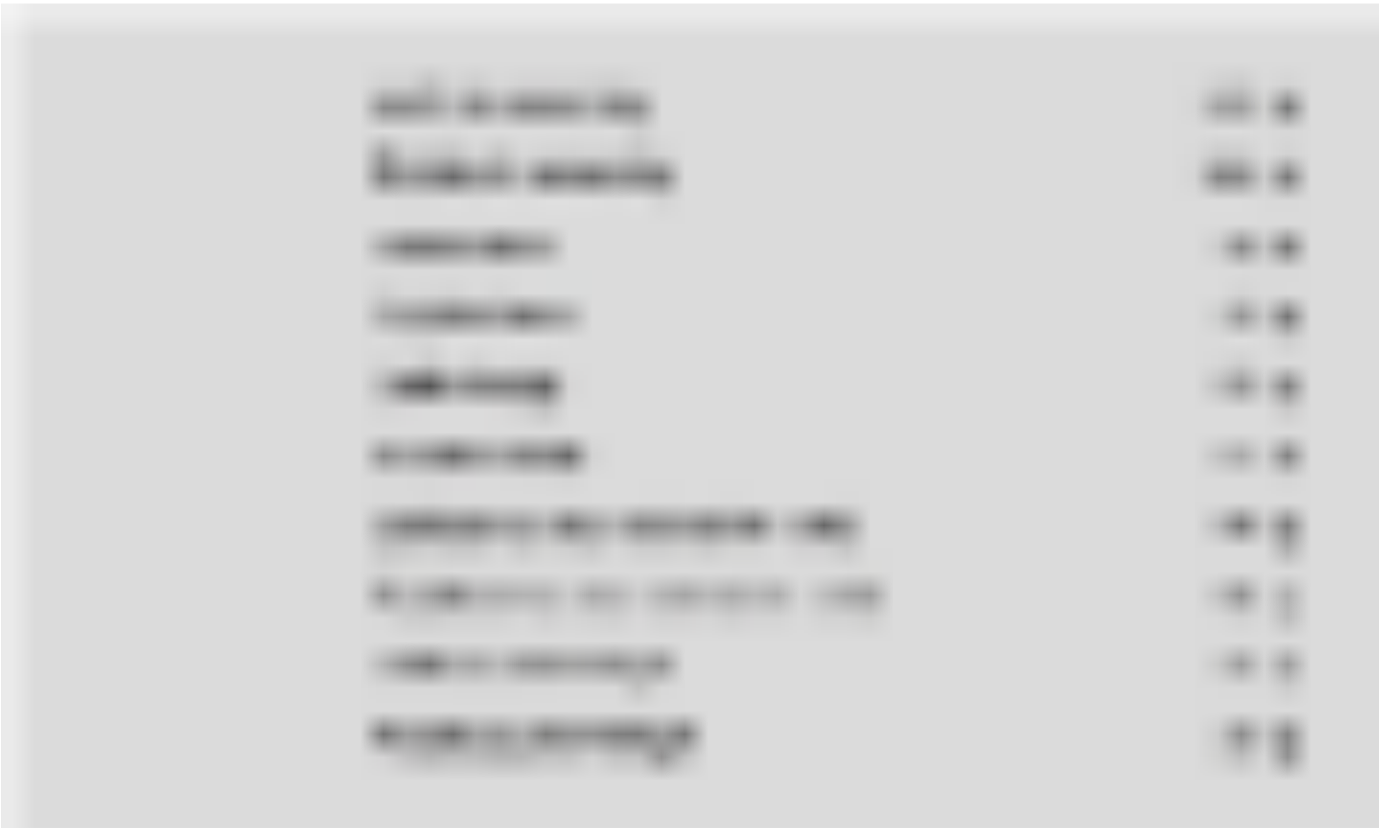
The total weight in normal flight condition seems to be 10g over the target value of 7,720g.

Significant Overweight Was Found After Measuring the Outer Wing Skeleton Weight

Because the outer wing components (rib assembly, aileron, wingtip, servo assembly and counterweight) were completed, I measured their weights. As a result, it was found that the weight far exceeded the target weight.

Weight Measurement and Finished Weight Prediction

The measured weights are as follows:



In total, the current weight of the left outer wing is 569g and the right is 563g. Table 6 shows a prediction of the finished weight of the outer wing from this state:

Table 6: Predicted weight of completed outer wing.

The weight of the outer wing is expected to exceed 1,000g per wing. The target weight was 700g per wing, so the weight of both wings will exceed 630g (45%). I may have overestimated the plank weight a little based on my experience of making tail wings, but I think I need to be prepared for 1 kg per wing.

> ***Mistake №7****: Outer wing weight greatly exceeds the target*

Causes of Overweight and Reflection

Initially, I was surprised and disappointed by this reality, but when I became calm and tried to find the cause, I found out the reason. The reason is that there is a big difference between the way the outer wing is actually made and the way that was implicitly assumed when the target weight was set.

The target weight was set by multiplying the weight by the square of the scale ratio based on the weight data of the 1/5 model. Initially, I was going to multiply the weight by the third power, but since the thickness of the main components such as the plank material and the covering of Oracova is almost the same, I decided to multiply it by the second power.

This implicitly assumes that the 1/3 model will be made in the same way as the 1/5 model. However, the 1/3 model is quite different from the 1/5 model in order to make it look more realistic and to ensure strength. For example:

1. Single spar in 1/5 model, but double spars in 1/3 model.
2. Spar webs are changed from balsa to plywood.
3. 2.5 mm (or 3 mm in some cases) thick ribs are used in 1/3, while 2 mm in 1/5.
4. The aileron of 1/5 is a simple type, but 1/3 has a frise type.
5. Hinges are also changed from seat type to removable pin type.
6. Wingtip auxiliary wheels and aileron counterweights are installed, which are not found on the 1/5.

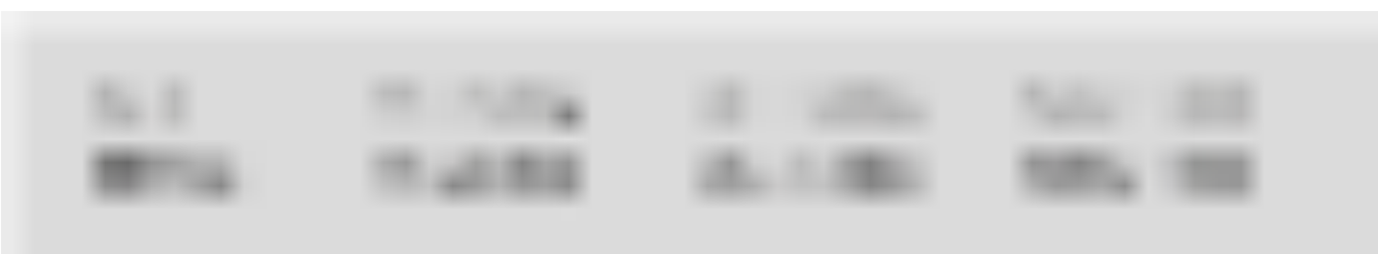
These are all factors that increase weight. In other words, the target weight that was set without considering these factors of weight increase was unreasonable.

6th Calculation of Weight and Balance

Based on this data, I immediately calculated the sixth weight and center of gravity (Table 7). The weight in normal flight condition is expected to be 8,377g, which is close to the expected maximum full weight of 8,700g. The fact that the target weight is unreasonable will again apply to the front fuselage that I am going to make next. In the 1/5 model, the landing gear is attached simply to the fuselage with a short carbon rod, while the 1/3 model has the elaborately built rubber shock absorbers just like the actual model. In addition, as the control mechanisms and seats are planned to be incorporated in the 1/3 model, the target weight of the front fuselage estimated from the 1/5 model without them is sure to be underestimated.

It seems that the assumed maximum overall weight will be the weight in normal flight condition. Since the strength study and the selection of the power unit are based on the maximum overall weight, flight is possible, but I am wondering how much it will affect the glide performance. I will confirm this point later by calculating the performance.

By the way, the weight of the Ka-8 and Minimoa sold by Thermal Studio in 1/5 scale and 1/3 scale, according to the data on the website, are as follows:



I took the median for the weights, which varied depending on the production. If I use this ratio to predict the weight of 1/3 from the 1/5 Mita, the weight of 1/5 is 2,765g, so the ratio 3.33 results in 9,210g, and 3.90 results in 10,800g. These 1/3 scale models from Thermal Studio also do not have a cockpit control system, and the landing gears are simple. Considering these factors, it is expected to be difficult to complete the model with the maximum overall weight of 8,700g. I regret that I should have made such a wide consideration when setting the target weight.

> ***Lessons Learned №4:*** *When setting target weights, pay close attention to the differences in construction methods and equipments from the base aircraft.*

6th Weight & Balance	2018/9/15	Completion Ratio		38.15 %			
	Predicted Weight	STA	Moment	Actual Weight	Estimated Remain Weight	Target Weight	Predicted-Target
Outer Wing Left	**1,020**	860	877,200	569	451	700	320
Outer Wing Right	**1,014**	860	872,040	563	451	700	314
Center Wing	**1,878**	890	1,671,420	1,138	740	1,720	158
Forward Fuselage	1,600	630	1,008,000	0		1,600	0
Aft Fuselage	**540**	1,550	837,000	350	190	560	-20
Vertical Tail	**212**	2,450	519,400	162	50	240	-28
Horizontal Tail	**378**	2,270	858,060	268	110	400	-22
Motor	361	100	36,100	0		361	0
Propeller & Hub	50	-10	-500	0		50	0
Battery for Radio	155	200	31,000	0		155	0
LiPo	600	340	204,000	0		600	0
Others	186	600	111,600	0		634	-448
Total	**7,994**	**879**	7,025,320	**3,050**		**7,720**	274
Target CG		**846**					
Weight	383	160	61,200			0	383
Normal Flight Condition	**8,377**	846	7,086,520			**7,720**	657

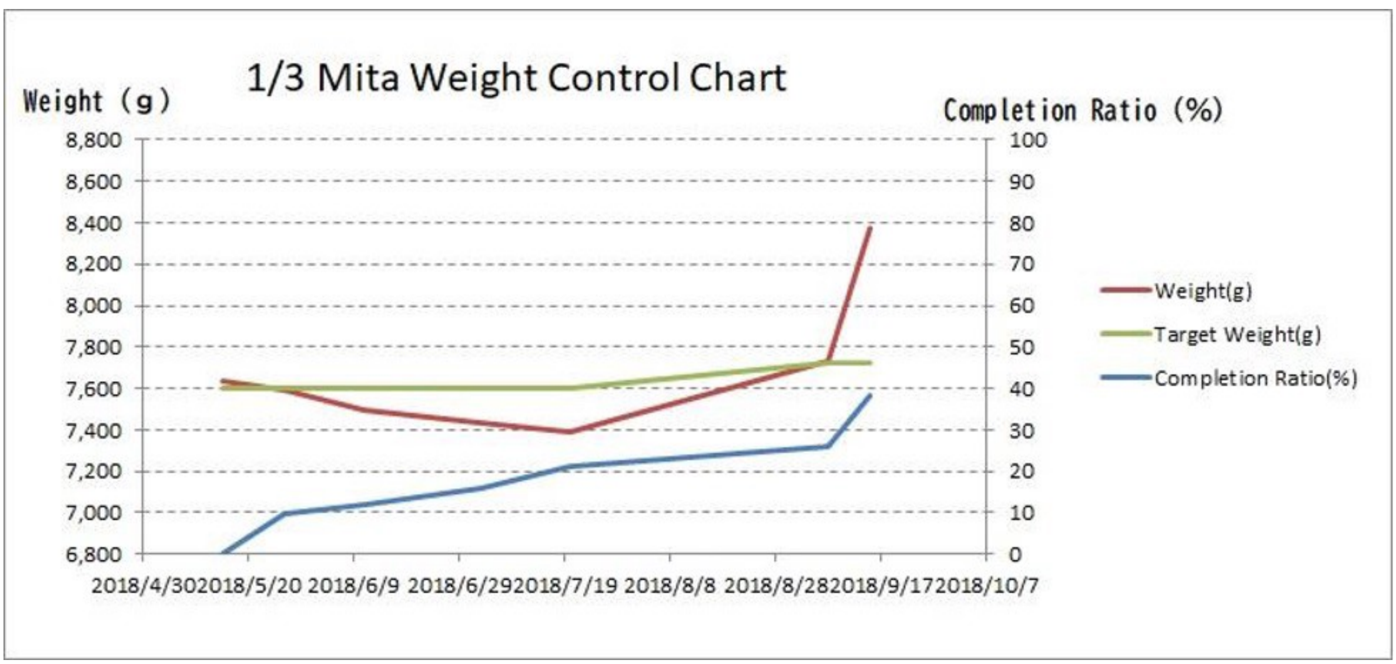


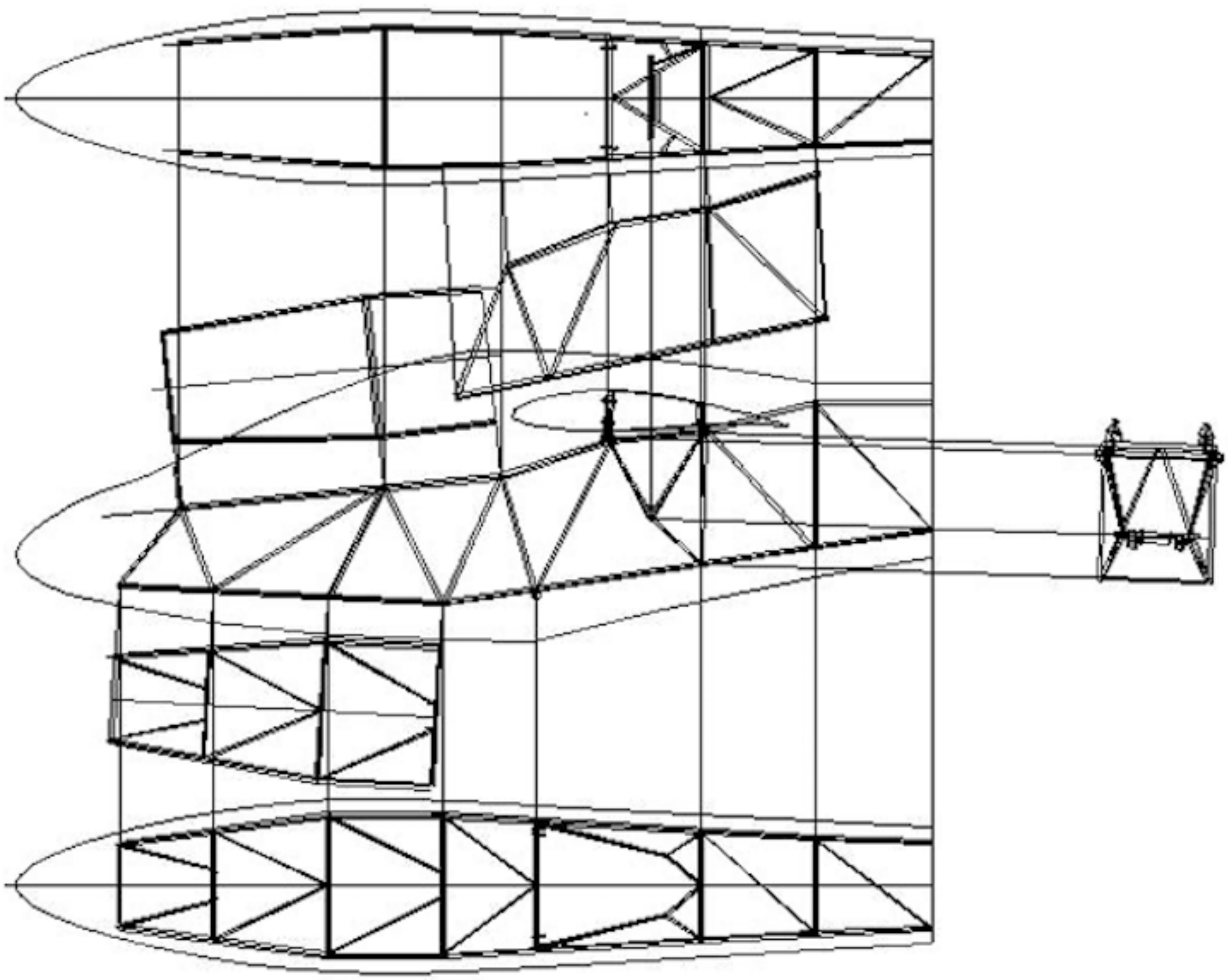
Table 7: 6th weight and center of gravity calculation.

Fabrication Part 12: Main Skeleton of the Front Fuselage

Next, the main skeleton of the front body was fabricated.

Drawing

Drawing 22 is the main skeleton of the front fuselage which is mainly made of carbon tubes:



Drawing 22: Main skeleton of the front fuselage.

If you look at the drawing carefully, you will notice that there are flat areas. These are the left and right panels of the wing attachment area, the cockpit floor and the canopy sill. First, these panel structures are fabricated on a flat board.

Fabrication of Panel Structures

Just as I did when I built the rear fuselage structure, the full-scale drawings of these panels are printed and placed on a flat board. The cypress bars were used to secure the longerons. The lower longeron is straight, so only one Φ7mm pipe is needed, but the upper one is bent twice, so three members are needed to be connected. These members are connected with a 4mm diameter aluminum pipe of 60mm length buried inside the longerons with epoxy adhesive.

Next, cut the 5mm diameter members that connect the upper and lower longitudinal members to the dimensions shown in the drawing, fit them in place, and fix them with CA. I used a diamond file to carefully make a radius at the connection part to match the roundness of the pipe.

Photo 67 shows the process of making the left and right panels of the main wing attachment area:

Photo 67: Making the left and right panels of the main wing attachment area.

The two thin sticks in the center are 1mm thick cypress sticks, which were laid down to ensure accurate stepping when gluing the Φ5mm vertical members to the Φ7mm longitudinal materials.

The cockpit floor panel and the canopy sill were made in the same way (Photo 68):

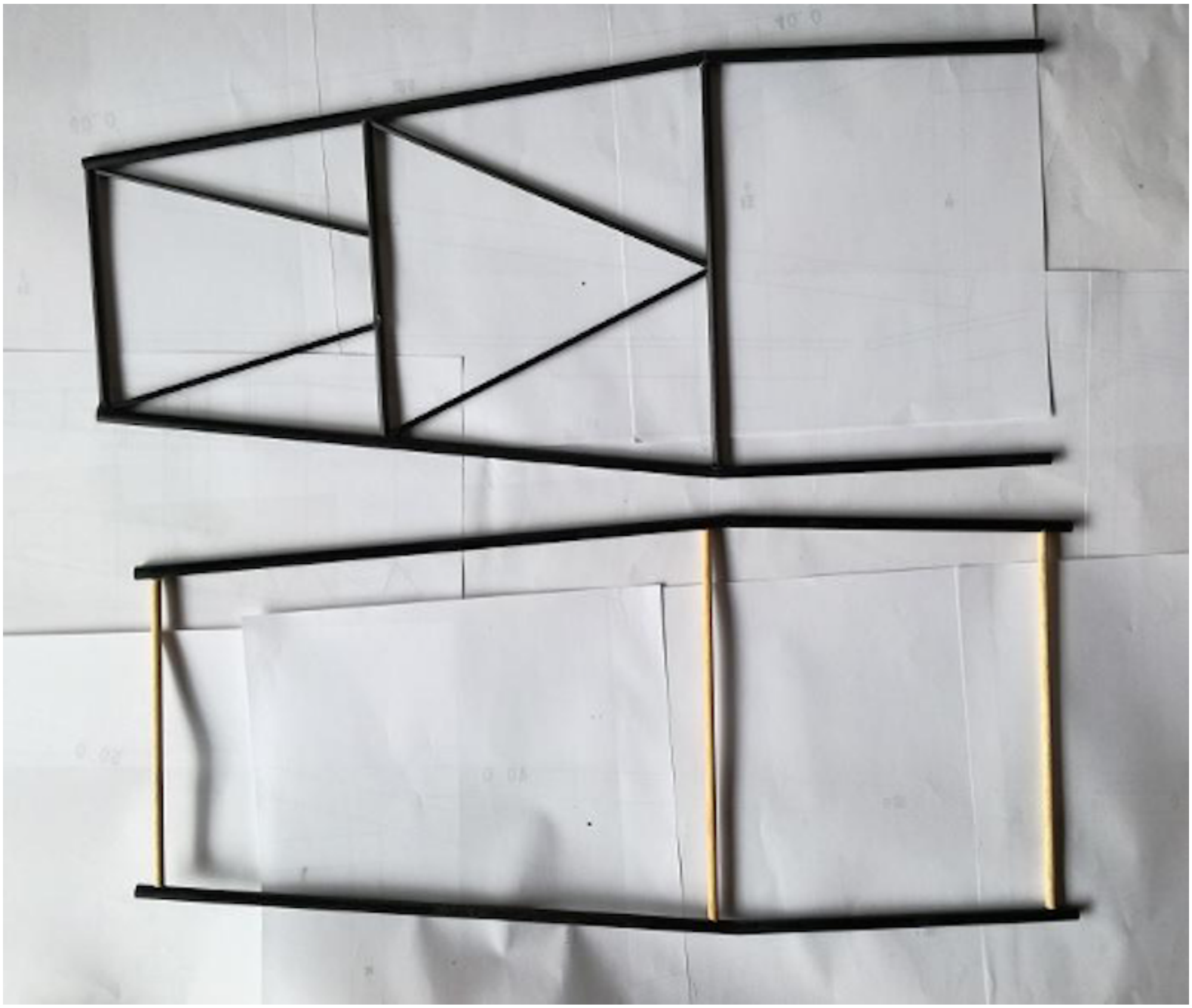


Photo 68: Cockpit floor structure (top) and canopy sill (bottom).

Since there are no parts to connect the left and right longitudinal members of the canopy sill, three temporary connecting members have been installed for the convenience of assembly. These will be removed after assembly is complete.

Making the Main Wing Attachment Section Crossbeams

Two cross beams are attached to the top of the right and left main wing attachment panels to connect them and to which the main wing attaches. These cross beams are made of 10 mm square carbon pipes, and their ends have extremely complicated cutouts to connect to the bent part of the Φ7 diameter longitudinal pipes. I had a hard time finding the right dimensions for this part, but I finally solved the problem as follows.

First, from the drawing of the joint between the crossbeams and the longitudinal pipes, the top, bottom, front and rear development views of the crossbeam are drawn and printed in actual size, then they were cutted out (Photo 69). Although it is not clearly visible in the picture, the development views of the cutout shape are printed on both ends.

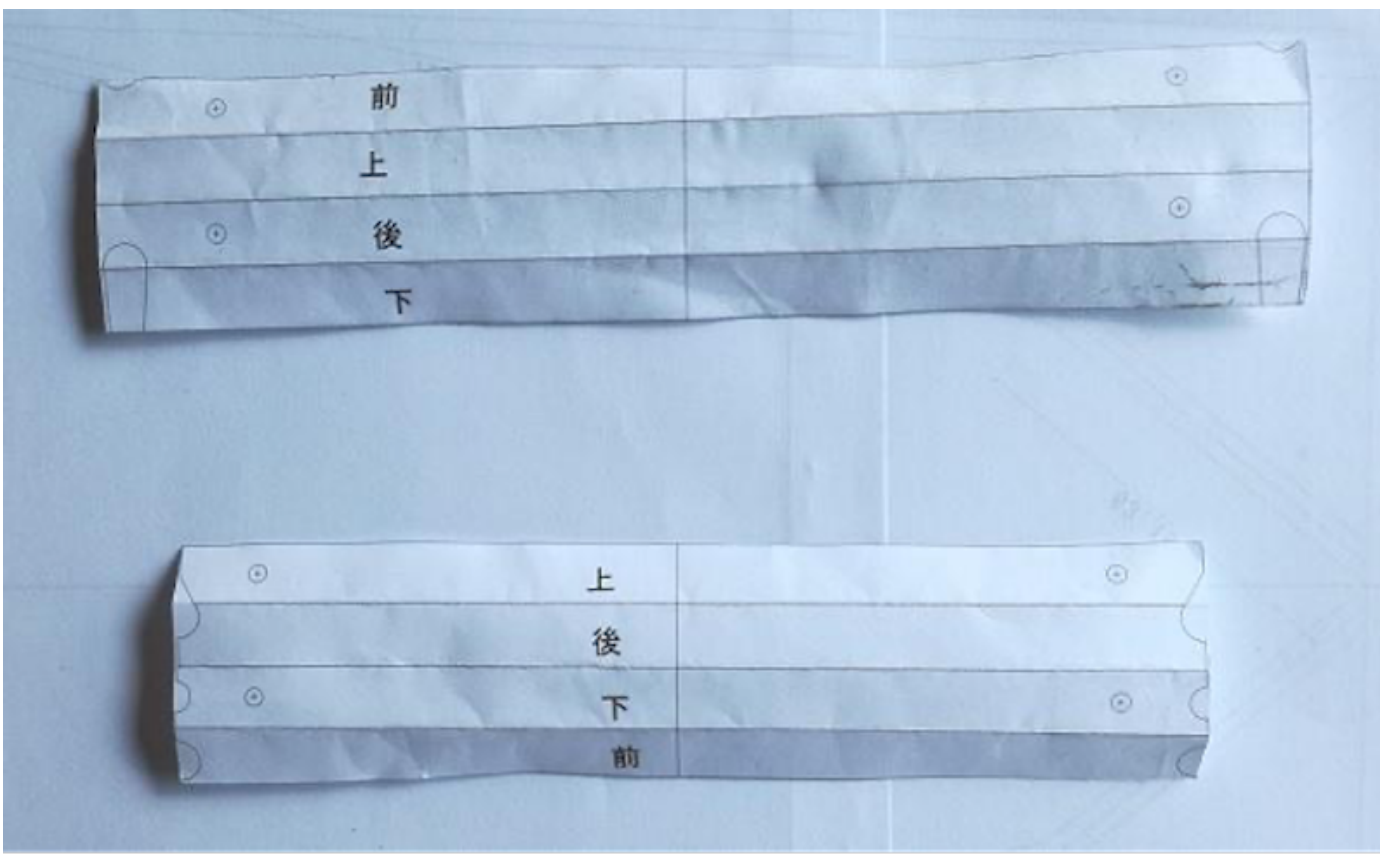


Photo 69: Development view drawings of the main wing attachment crossbeams cut out.

Paste the cut-out development plans around the square pipes. After that, I shaved the pipes with a file along the development drawing to complete the processing of both ends.

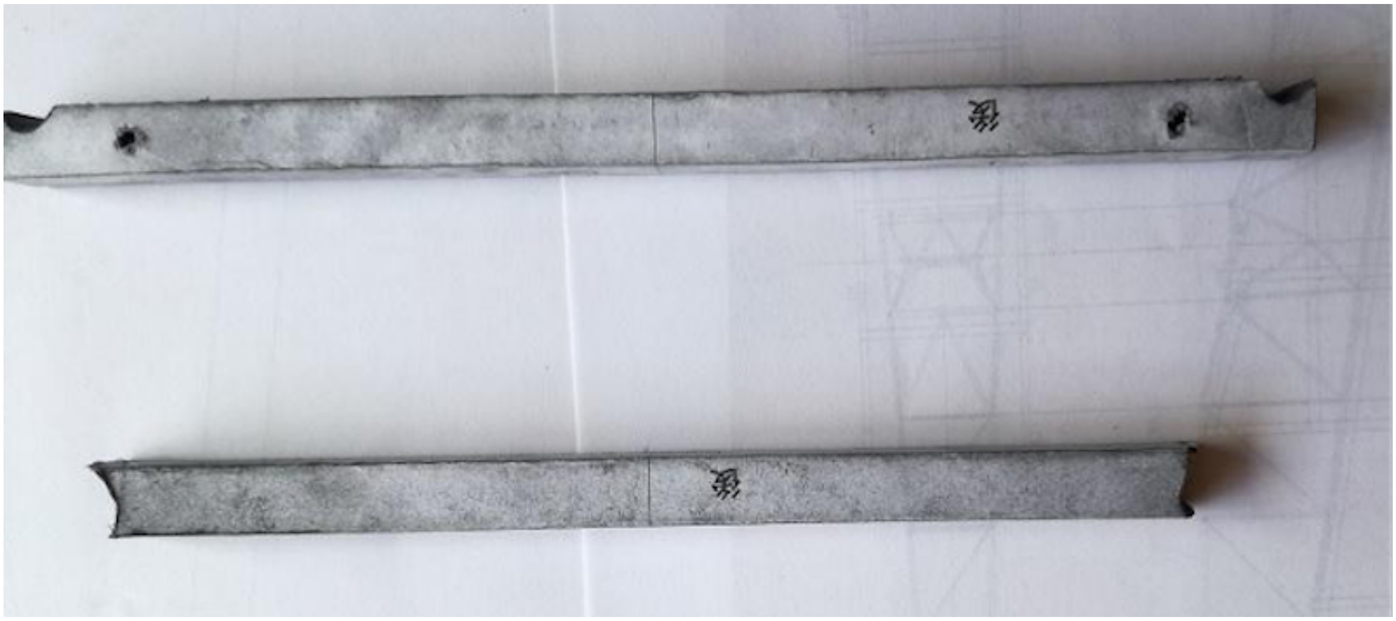
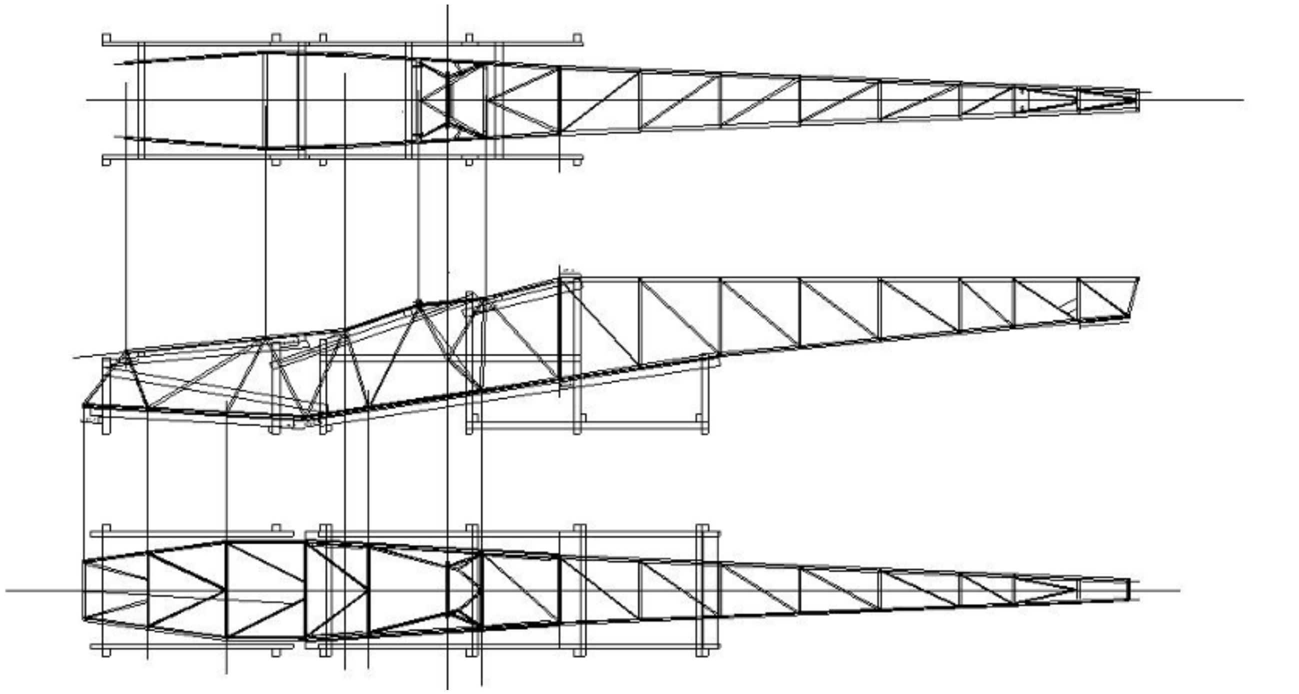


Photo 70: Processing the ends of the main wing attachment crossbeams.

Now that I have finished making the panels and the cross beams for attaching the main wing, the question is how to assemble them. The panels are connected to each other at complex angles, up and down, left and right, and also it is not easy to connect the assembled front fuselage to the already completed rear fuselage. An assembly jig is mandatory.

Drawing

Drawing 23 is for the assembly jig.



Drawing 23: Fuselage assembly jig.

I conceived of various types of jigs, but in the end, I settled on a type similar to the assembly jig used for real small aircraft. A number of relatively thick pillars are built and connected to each other by beams with the same angle as that of the fuselage to be assembled. The part in contact with the floor of the fuselage is covered with 4mm thick plywood boards and the actual size drawing is pasted on the board. Then thin cypress bars which hold the floor longerons are attached on the drawing for positioning accuracy.

The assembly jig for the actual machine is made by cutting and drilling with special precision machines and measuring the position accurately with laser measuring devices, so it is extremely accurate. This jig, however, is cut with a handheld saw and drilled with a hand drill, so accuracy is not expected to be as high. Therefore, the floor panel, which is a flat surface, is made first and then assembled the rest. This is the reason for this type of jig structure.

Assembled Jig

Photo 71 shows the completed fuselage assembly jig:

Photo 71: Completed fuselage assembly jig.

The pillars are made of 15x15 cypress sticks and the beams are made of 15x10 cypress sticks, which are assembled with screws. The actual size drawing is attached to the pillar to determine the exact position where the beam will be attached. When the beams were assembled according to the attached drawings, they were assembled with good accuracy.

I tried to place the completed rear body with front panels on this jig. It seems to work well:

Photo 72: Temporary mounting on the assembly jig.

Fabrication Part 14: Assembling the Main Structure of the Front Fuselage and Joining the Front and Rear Fuselages

Using the fuselage assembly jig, I assembled the front fuselage panels. Initially, I was going to assemble only the front fuselage and join the rear fuselage much later, but it turned out to be easier to assemble the front fuselage together with the rear fuselage.

This is the photo which shows how the assembly is being worked:

Photo 73: Front fuselage being assembled on the assembly jig.

Photo 74 shows the assembly of the trapezoidal truss structure to which the main landing gear will be attached. The assembly parts are held by passing the bamboo string through the holes drilled in the left and right beams of the jig:

Photo 74: Assembly of the truss structure for the main landing gear.

From another angle:

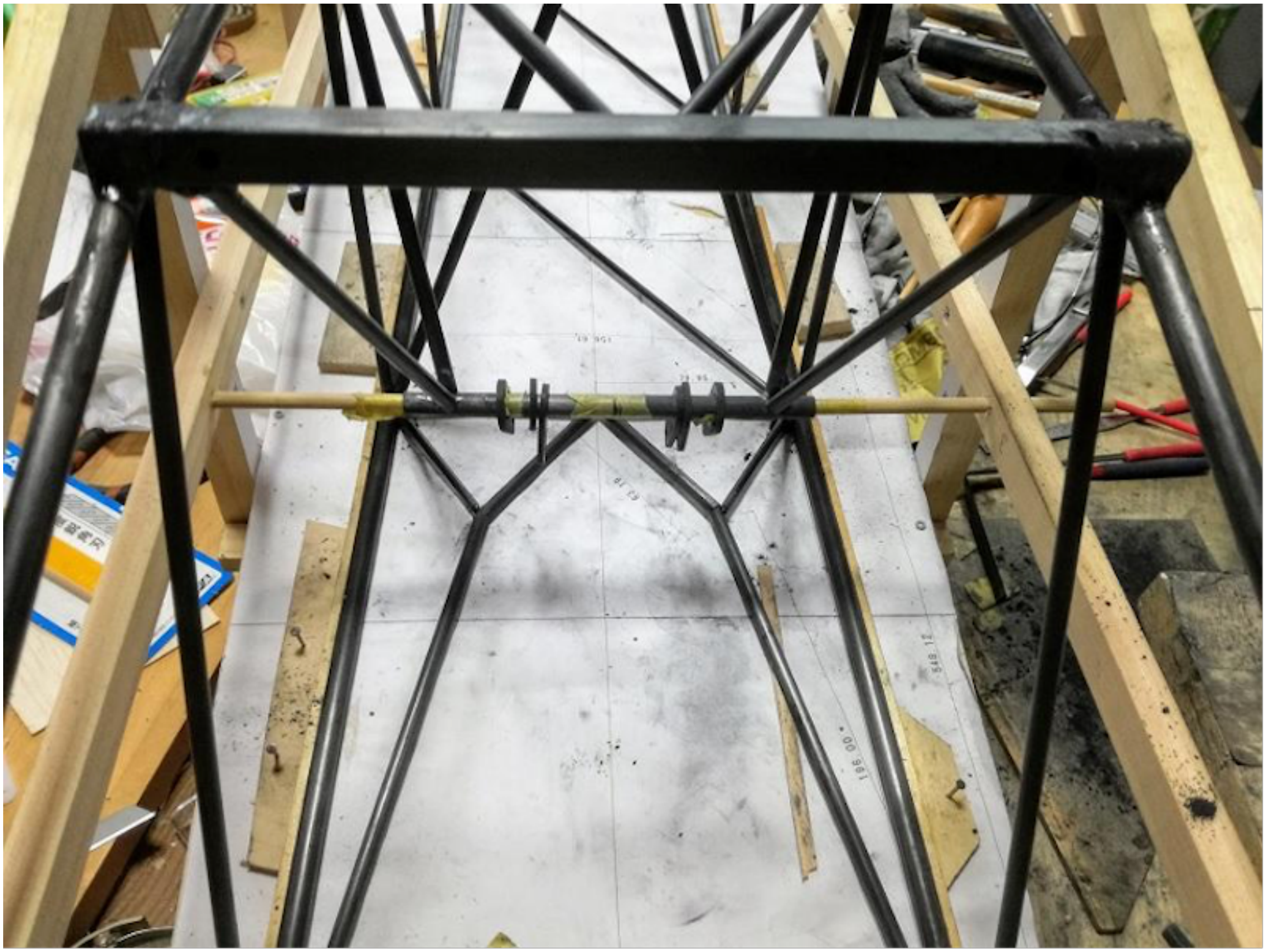


Photo 75: Assembling the truss structure for main landing gear attachment viewed from the front of the fuselage.

The two beams to which the main wing attaches are connected to the longerons at a delicate angle and the distance between the two must be exactly same with that of the front and rear spars of the wing, a simple positioning jig was made as shown in photo 76. This picture was taken after the work was completed, so the braces connecting the beams are in the way and the jig is not set in the correct position, but you can understand how it was.

Photo 76: Positioning jig for main wing attachment beams.

Completed Main Structure of the Fuselage

Fuselage is now assembled and unloaded from the jig. Photo 77 shows the completed main structure of the fuselage. It is made of carbon tubes so it is very light and weighs only 710g in this state:

Photo 77: Main structure of the completed fuselage.

This is the front part of the fuselage, where the cockpit is located:

Photo 78: Structure of the cockpit.

This is the center of the fuselage. The upper two cross beams are the main parts of main wing attachment:

Photo 79: Center of fuselage.

I temporarily attached the main landing gear:

Photo 80: Temporary installation of the main landing gear.

It looks pretty good. When I write this way, you may think that the assembly went smoothly, but in fact it was quite difficult, and some troubles occurred.

There are 165 parts in the truss structure, including the rear body. I had to cut them out from carbon pipes and cut the exact dimensions and process the end faces one by one with a diamond file. This is why my hands turned black for a long time.

The trapezoidal structure to which the main landing gear is attached was found to be slightly skewed only after the gear was attached. When I looked for the cause, I found that the holes drilled in the jig were slightly misaligned on the left and right sides, causing the bamboo string to be attached at an angle. The trapezoidal structure was disassembled, corrected, and reassembled.

The assembly is still in a temporary state using CA, so it will disassemble when subjected to impact. After reinforcing those areas that will be subjected to heavy loads and shocks, epoxy adhesive will be applied to each joint for final bonding.

Fabrication Part 15 — Gimbal Mechanism of Control Sticks

While applying epoxy adhesive to the main fuselage frame, I made the gimbal mechanisms of the control sticks.

Gimbal Mechanism of the Actual Aircraft

Since the Mita Type 3 Revision 1 is a tandem double-seater, there are control sticks in the front and rear seats. The ailerons are operated by tilting them left and right, and the elevator by pushing and pulling them. The control sticks of the front and rear seats are interlocked, and when one of them is operated, the other also moves. In order to make the control sticks move back and forth and left and right, there are gimbal mechanisms underneath. Photo 81 shows the gimbal mechanisms of the actual aircraft.

Photo 81: Gimbal mechanisms of the actual aircraft; left = front seat, right = rear seat.

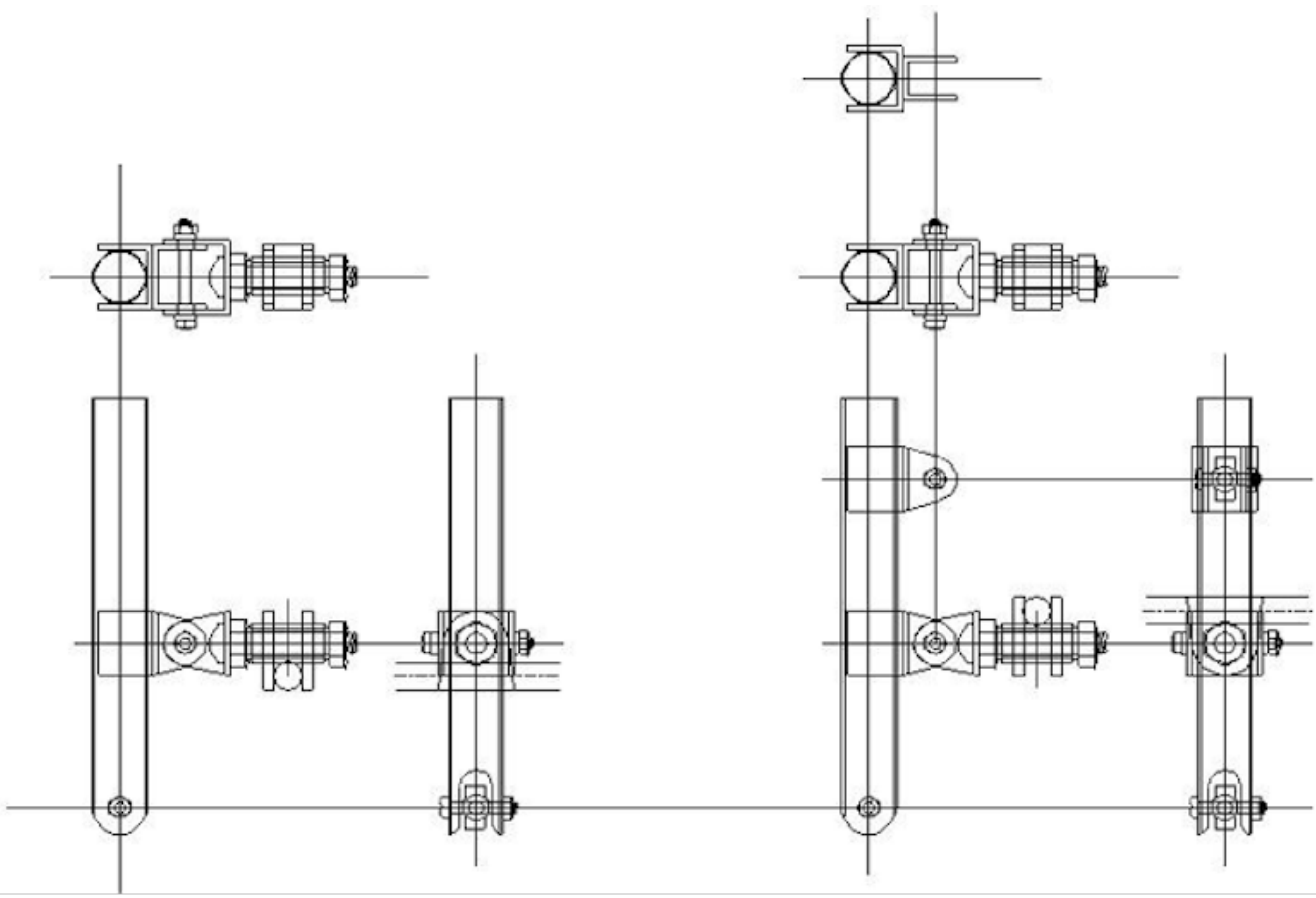
The front stick is mounted on the center of the lower fuselage crossbeam where the front seat is attached. The axle that rotates the control stick left and right for the aileron is attached to the crossbeam, and the axle that rotates the control stick back and forth for the elevator is attached in front of the airelon axle.

The rear stick is mounted under the center of the crossbeam where the rear seat is attached. In order to link the front and rear mechanisms, a connecting rod is attached to the bottom of the control sticks. There is also a link above the rear gimbal that passes under the rear seat and connects to the rear of the fuselage. This is the elevator control link.

Since the front stick is attached to the upper side of the crossbeam and the rear one is attached to the lower side, the connecting rod is attached at an angle. Therefore, the front and rear axles (for ailerons) are also inclined.

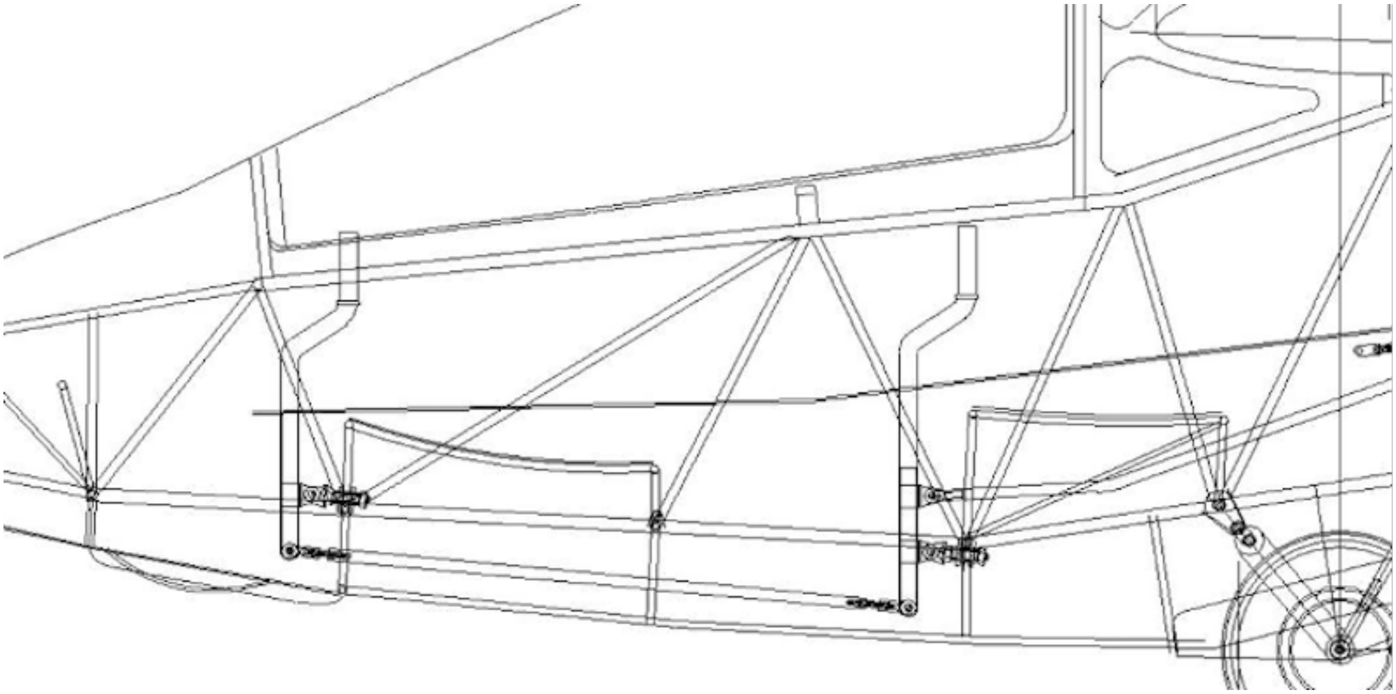
Drawing

This is the drawing of the gimbal mechanisms designed to mimic the mechanism of the actual aircraft:



Drawing 24: Control sticks gimbal mechanisms.

This drawing shows the connection of both gimbal mechanisms:



Drawing 25: Connection diagram of gimbal mechanism.

The aileron axle is made of a short carbon pipe of 7mm O.D. and 5mm I.D., with 4mm I.D. DURACON bushings attached to both ends, through which 4mm bolts pass. At the end of the bolt, a pair of hinges made from a piece of aluminum channel purchased at a home center is attached, and in front of the hinges is an aluminum pipe which was also purchased at a home center. The control stick will be made and inserted into this pipe later.

At the bottom of the aluminum pipe, a rod end with a bearing for the linkage of a large radio-controlled aircraft is attached, and a 6mm diameter carbon rod is used to connect the two gimbols. A 3mm thread is attached to the connecting rod to allow for length adjustment. A rod end is also attached to the top of the rear gimbal pipe and the linkage toward the elevator is attached here.

Fabrication

Here are the parts I made based on the drawing:

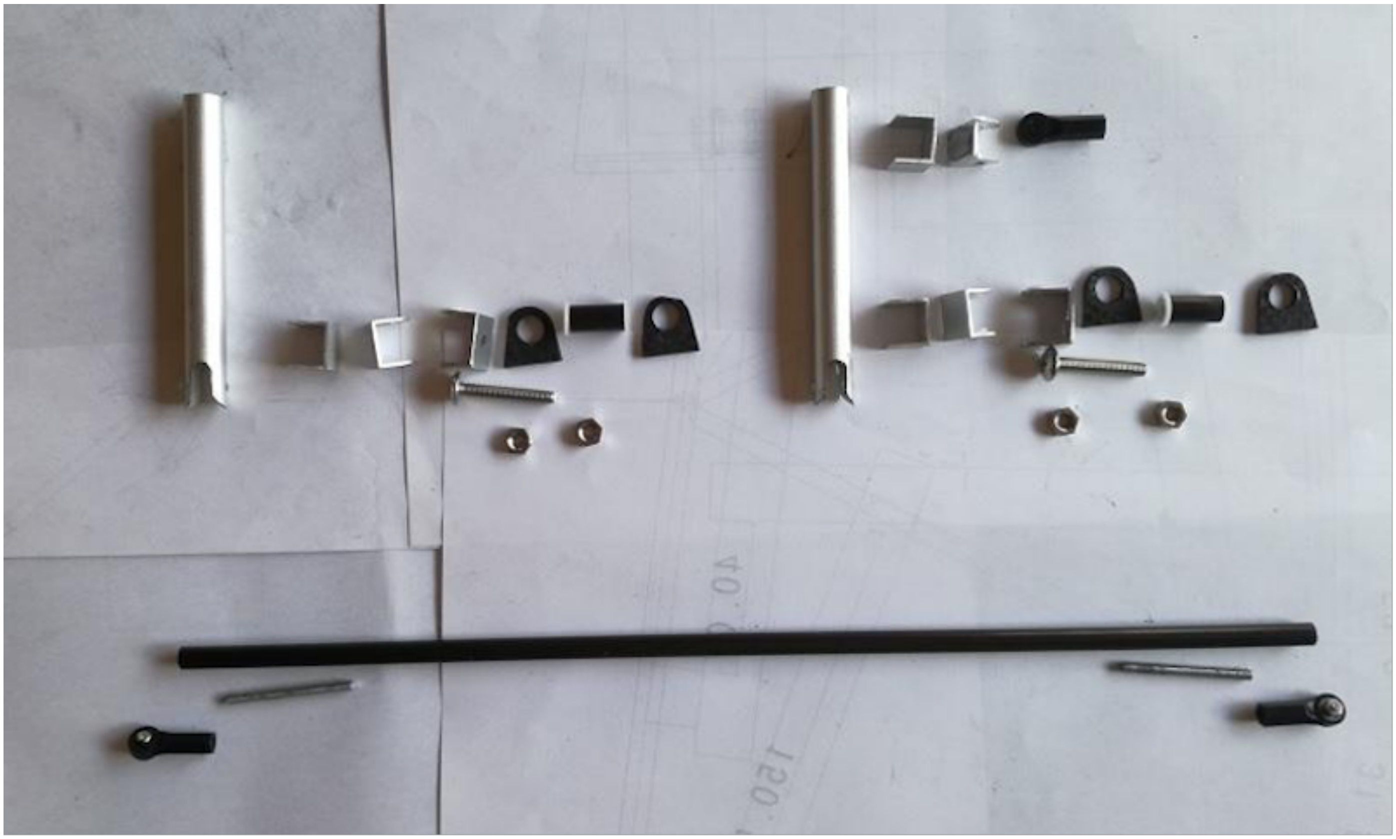


Photo 82: Parts of the gimbal mechanism.

The aileron axle pipes are inserted into two stays cut out of 2mm thick carbon board, and the two stays are attached to the crossbeam of the fuselage.

The Gimbal Parts Assembled

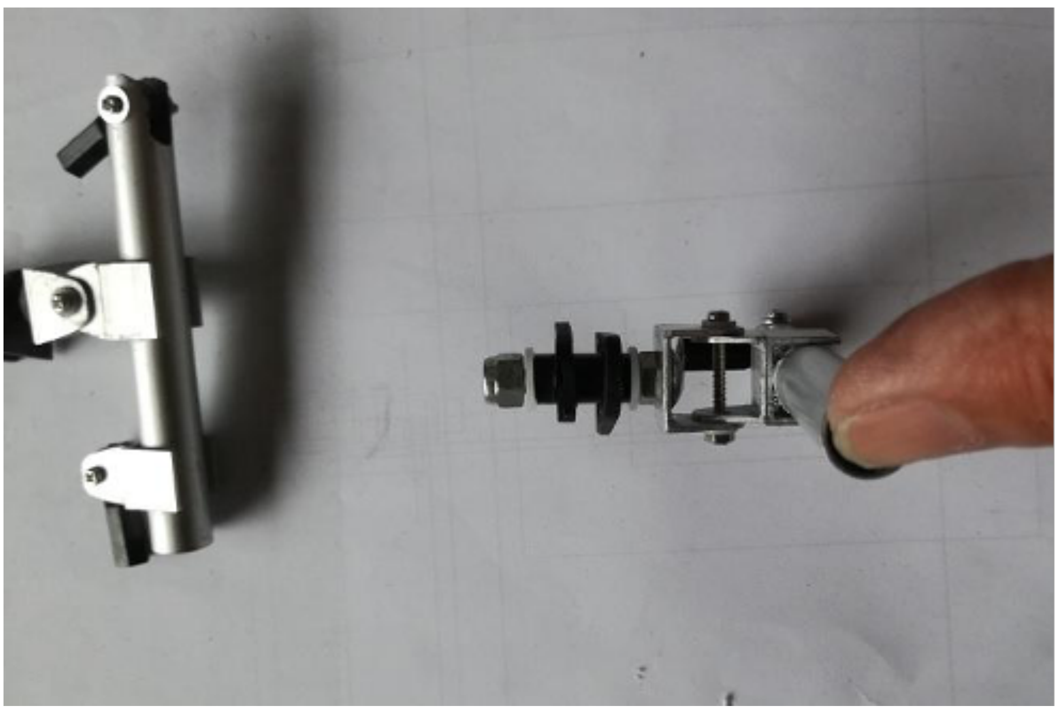


Photo 83: Assembled gimbal mechanism.

This photo shows how front and rear gimbals are connected with a connecting rod:

Photo 84: The connected gimbal mechanism.

Installation on the Fuselage

I immediately installed it on the aircraft.

Photo 85: Installation test of the gimbal mechanism.

Photo 86: Close-up view of the gimbal mechanism.

I was happy to have completed the gimbal mechanism as I had hoped, but I found an unexpected pitfall during the subsequent work on the elevator control system and was forced to modify it.

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

The Trailing Edge

As we wrap up the July issue, we think about how truly fortunate we are.

[The NEW RC Soaring Digest Staff](https://medium.com/rc-soaring-digest)

Pilot Dominique Nivelle puts on a 'Light Painting' show with his Easy-Glyder at Bartres, near Lourdes in France in the summer of 2011. (image: ©2011 Régis Geledan)

The July issue of RCSD was our biggest and most ambitious yet. We are truly fortunate at being able to attract such an immensely talented group of writers who have contributed to this issue and past issues. Furthermore, they are scattered all over the globe including some of the remotest places on the planet. We really think that we may trigger a tourism boom in the Faroe Islands with an unprecedented number of those carrying big, glider-shaped suitcases.

We are also very proud of our record of carrying Japanese-language content and even including a few phrases of French here and there (see below). We hope this trend continues and that each issue will have a balance of languages from all the communities in which RC soaring flourishes. It's amazing how immaterial cultural differences seem when what we all want is to just stretch out that day of soaring just that little bit longer. Maybe even into the night as shown in the beautiful photo which accompanies the photo we selected for *The Trailing Edge* this month. We'll let our good friend and repeat contributor Régis Geledan explain:

> *"Un soir d'été il y a quelques années nous avons eu l'idée d'essayer la technique du light painting. Domique Nivelle, le pilote sur l'image, a totalement modifier son Easy-Glyder avec de nombreux bandeaux LEDs.*
>
> *On a fait de nombreux essais avant de reussir cette image. Il y a un peu de technique et beaucoup de chance car l'appareil photo ne doit pas bouger et il fallait impérativement rentrer dans le cadre.*
>
> *Au final on a surtout passer un super moment comme souvent des que l on vole. Lieu: landes de Bartres près de Lourdes."*

Merci beaucoup, Régis!

Thanks to all those who contributed the great articles for this issue. We can't believe how lucky we are to have you here. Thanks also to you, the reader, for reading them. For those who would like to contribute an article the August deadline is **2021–08–08**. Yes, a little less than a month as we continue our inexorable march to our first-calendar-day-of-the-month target by December of this year.

Please forgive us if we hawk a little merch to help keep the wheels spinning and keep RCSD free. You can help out, if you so choose, with the purchase of one of the soon-to-be-collectable *RCSD Cover Photo T-Shirts*. You can get the January, February, March and April editions now and May, June and July will be out shortly.

Trying to recruit talent for your electric aviation startup or green tech company? There's no better audience for your onboarding message than RCSD readers. We're putting together our *Friends of RCSD* program (previously known as the *Corporate Sponsorships* program). If you feel it might be for you please get in touch.

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

So how did we do? Let us know your thoughts. Thank you all so much for reading and until next time…fair winds and blue skies!

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