RC Soaring Diaries

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

Michael Berends

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.

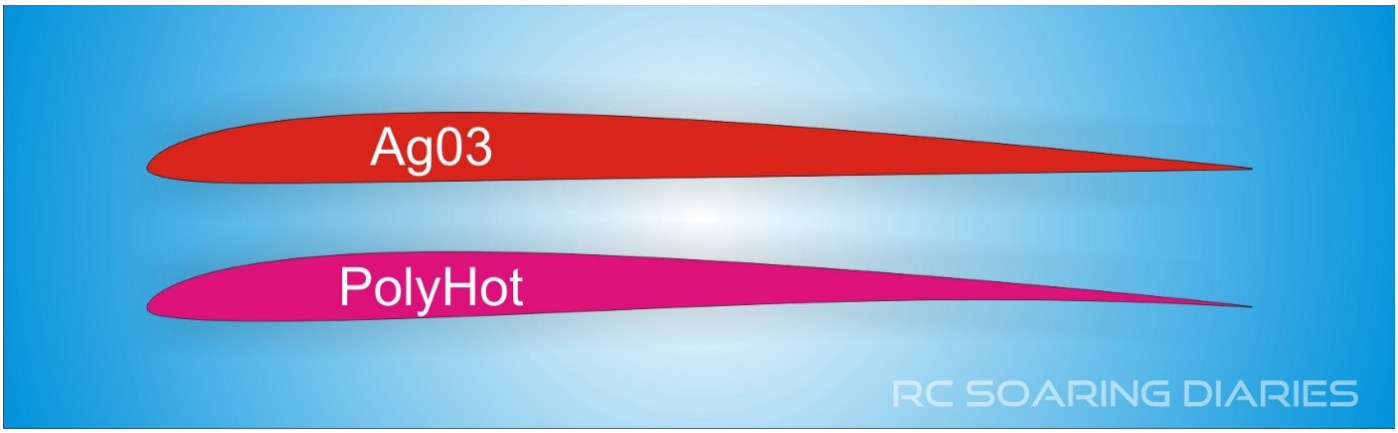
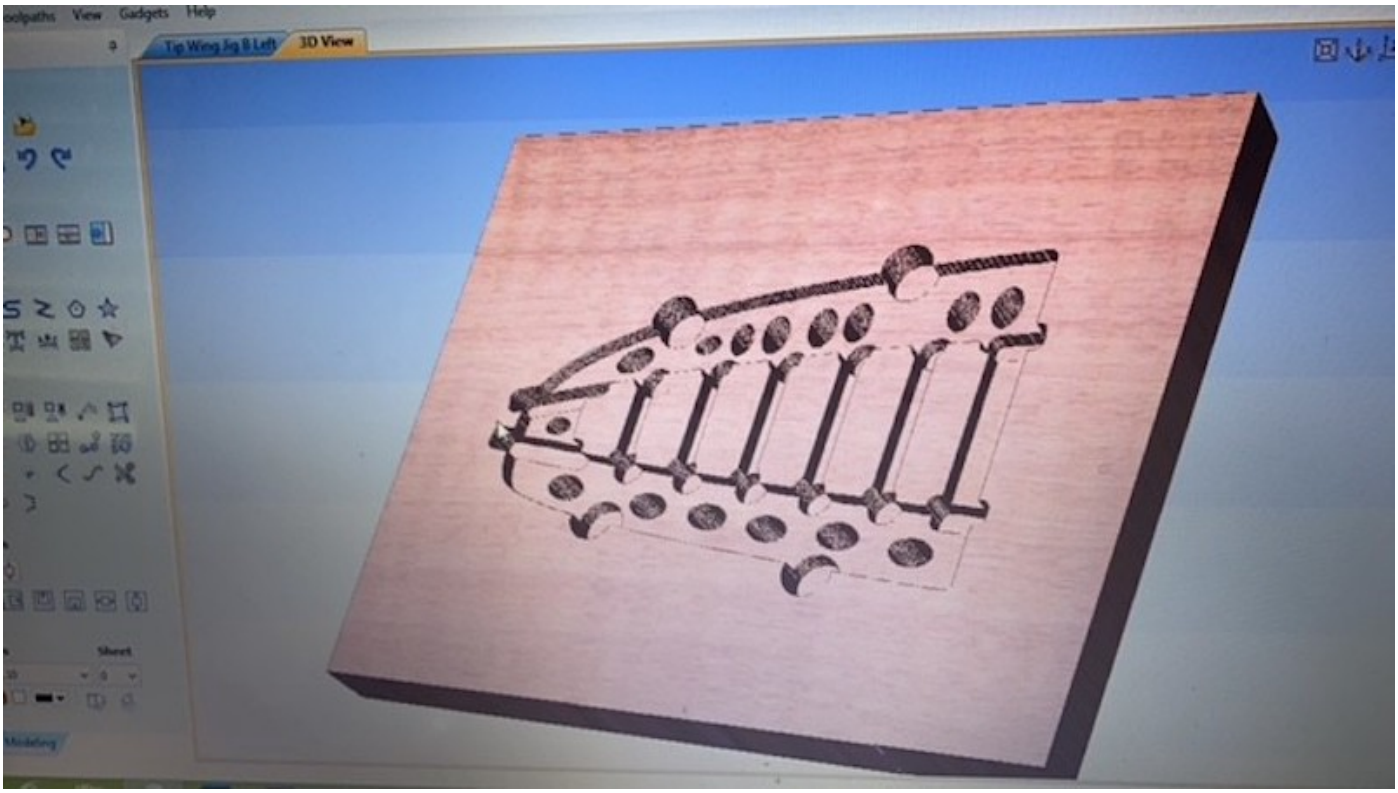


Figure 3: The differences in airfoil shape.

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.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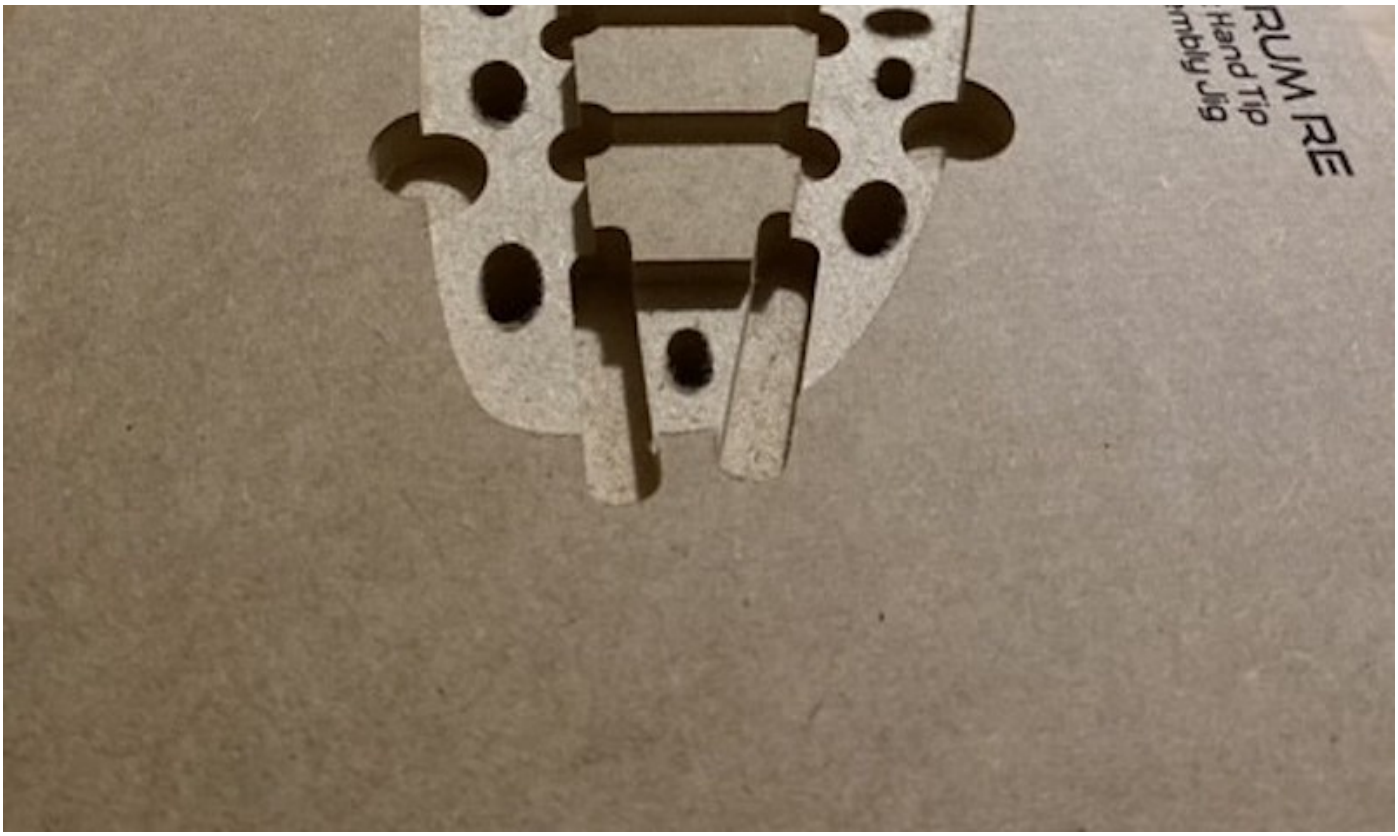
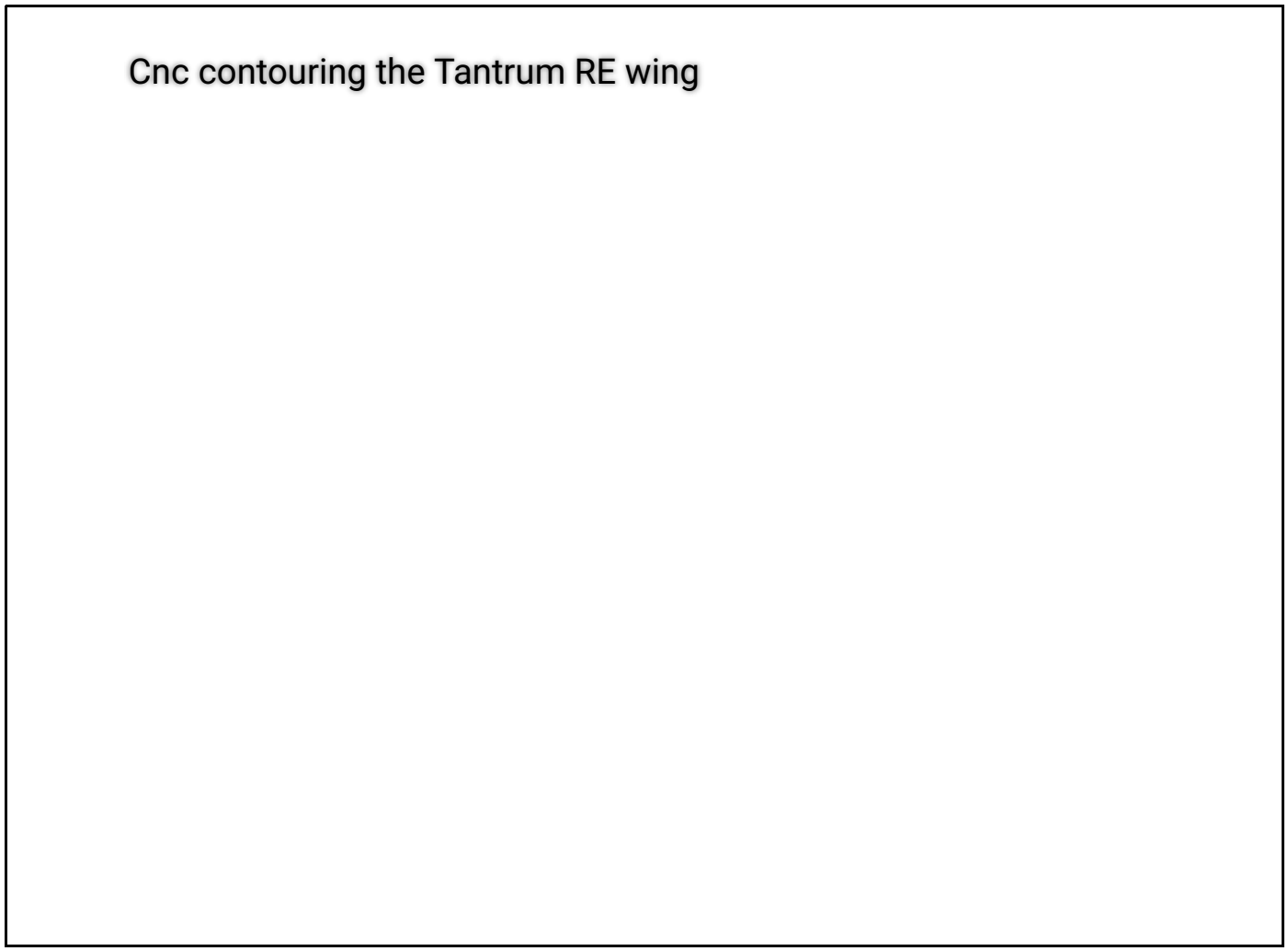


Photo 4 (left)**:** Computer rendering of an assembly jig. **Photo 5** (right): Completed assembly jigs.

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.

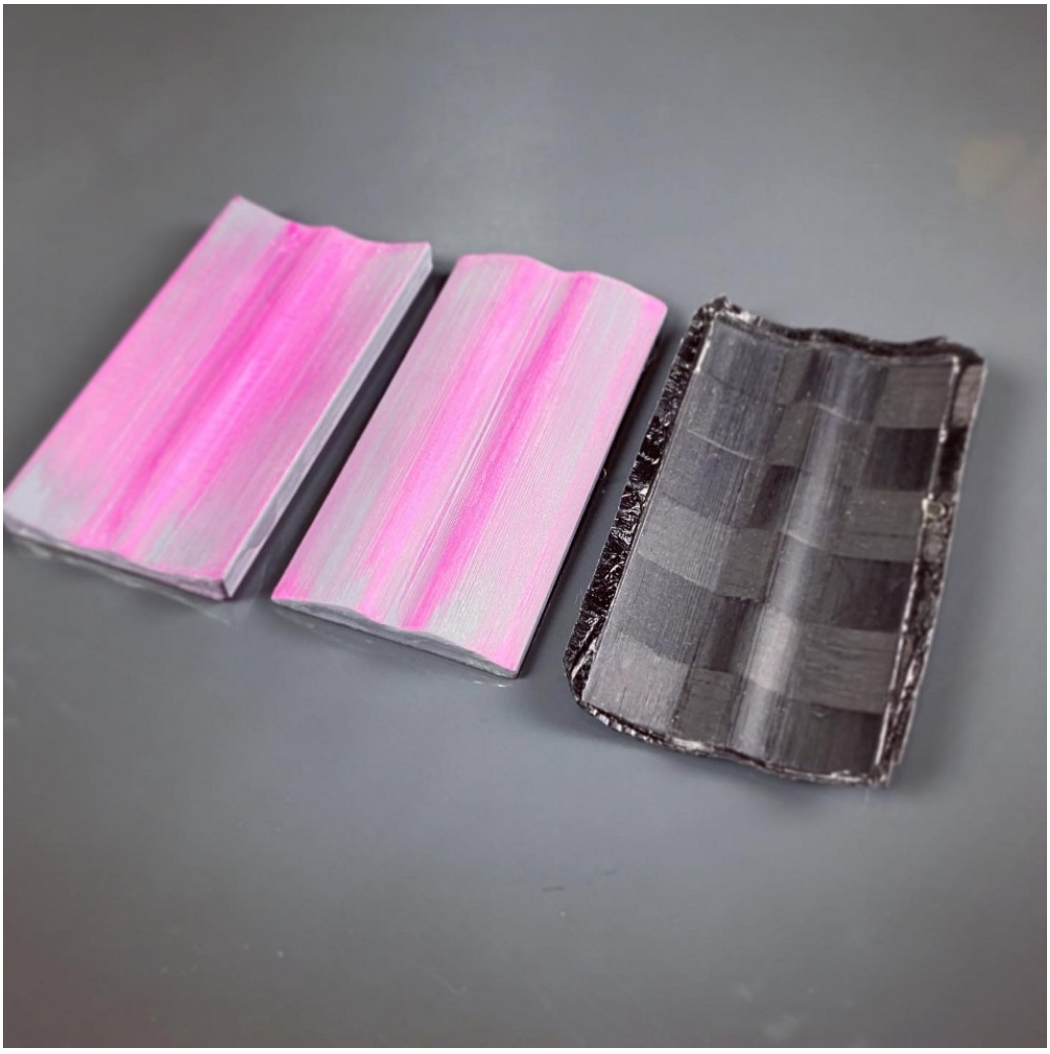


Photo 11: 3D printed molds used for making contoured throwing blades along with the finished carbon fiber piece.

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!

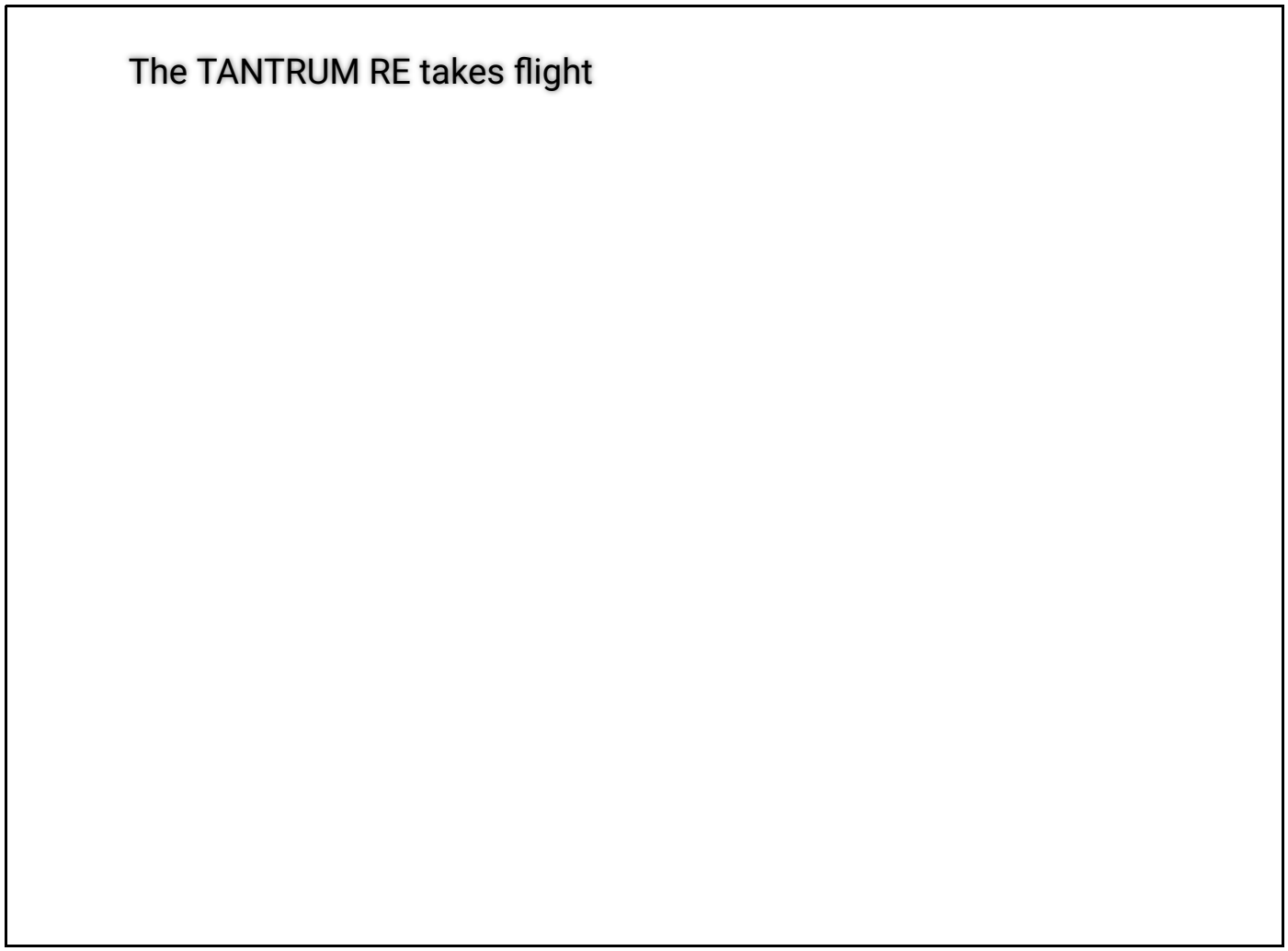
After all the research, work and struggles through the project it was finally time to fly this little machine. Was it going to launch well? Was it going to fly well? Was it going to be strong enough? Did I figure out all my volumes and areas correctly? So many questions run through your head with the 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!

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