



Radio Controlled
Soaring Digest

March 2023

Vol. 38, No. 3

The New RC Soaring Digest

March, 2023
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In The Air



Dad, jumping at the first of the evening light just after the clocks were turned forward for the summer.

Spring forward.

Where I live, Daylight Saving Time was first enacted in 1918, ostensibly as a means of increasing production during the First World War. It was abandoned after hostilities ended but then reinstated again for World War II. Canada remained 'sprung forward' year 'round for these latter war years. Since then it has remained as a twice-yearly ritual for most jurisdictions in this country and in many places around the world, albeit reversed in southern climes of course.

Over the years the dates have been tweaked backwards and forwards a bit, and there are routinely debates about the merits of either retaining or abandoning it. But here we are, nearly 80 years later, yet again on the cusp of that week where many of us Canucks feel a little jet-lagged having missed out on a hour of precious sleep. And just when it was getting light in the morning.

For the record, I'm firmly in favour of retaining it as-is. But for a very selfish and some would say silly and sentimental reason. And certainly one that makes absolutely no sense whatsoever outside my sample size of exactly one. Me.

I like the annual rite of spring because it reminds me of my dad.

The Monday after the Sunday – weather permitting – was when I would get a call from Dad to say he was going to be at the playing fields near his home in Richmond, British Columbia, Canada.

“Meet you there?” he would say, cheerily and hopefully. After a long, wet, west coast winter the fields were a soupy, super-humid, muddy mess but it never deterred him. Having a bite to eat and then grabbing the glider and transmitter and heading out to catch the last of the fading evening light was his priority number one in the late winter as it drifted into spring.



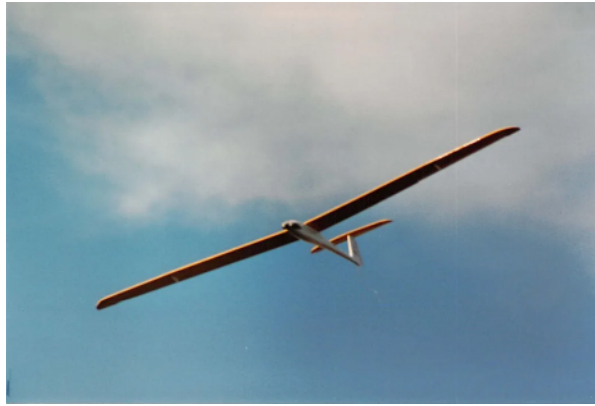


The brushed motor maven.

Dad was an early adopter of electric technology back in the pre-brushless days. That brushed motor in that battered, dewey frankenglider would have been handily out-climbed by Lindbergh on the way to Paris. For him, it just seemed like a recurring, predictable miracle that **climbing** without the aid of a cantankerous, whiny Cox .020 or .049 was even an option.

Later, he bought and flew a very sporty *Sunfly* for his evening flying adventures. That may have actually been one of the first generation brushless motors but paired with an undoubtedly clapped-out nickel-cadmium battery pack. However the odd time I got out to see him fly its performance, while not a patch on anything of today's generation of aircraft, was pretty amazing for its time.





Left: My father with his bouffant, flat-brimmed trucker hat — he was also ahead of his time on that score, as well — and me wearing my mom jeans and still with a full head of hair. It provides some hint of how long ago this really was. Right: The Sunfly flew very well and Dad was really proud of mastering the slippery airframe. It's still a nice-looking glider.

After the sun was well and truly down, Dad and I would sometimes return to my folks home on Williams Road and Mum would make some tea and often have something home-baked to eat. We'd catch up on nothing in particular.

To say my father was an RC glider enthusiast understates the case by a wide margin. He was slightly obsessed — but in a good way, of course. It's what made me a little obsessed, too — it was one of the many gifts he gave me.

Unfortunately he did not live long enough to see me edit and publish the New RC Soaring Digest but I'd like to think he would have been a reader.

In addition, for both my mother and father there was no letter to the editor of the Richmond News — or barring that some somnolent government official — which went unwritten. I therefore suspect that one or both would have found some reason to be contributors to RCSD's monthly Letters to the Editor, as well. (Oh, remind me to tell you the story one day of how they wrote one of their signature letters to Queen Elizabeth II. **And received a reply.**)

When you lose your parents — particularly if you're close to them, as I was — one thing you'll miss a lot, as I do, is the absolutely and utterly

unconditional attaboys they always had at the ready. I didn't often deserve them, if ever, but that doesn't mean I don't wish I could still get one from them every once in a while, even today. It's because nothing – absolutely nothing – ever quite replaces that unassailable encouragement. But despite not having access to their unwavering support – at least down here on Earth – I hope the work I'm doing on this humble journal would make them both proud.

So it's at this time of year, with the clock about to spring forward I think a lot about my dad and I think a lot about my mum and I think about those happy evenings in Richmond with them. It almost goes without saying that I now deeply regret all the times I said I was 'busy' and would have to miss spending some time chasing planes around those soggy fields. What's sad in retrospect is I have absolutely no clue what occupied my time such that I was not able to meet him for an evening flight. Nothing I can remember, of course.

Now I would give just about anything to be able to do it *just one more time*, sometime 'round this time of year.

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Resources

- [*The History of Daylight Saving Time*](#) from the University Canada West website.
- [*Champion of Something*](#) by Terence C. Gannon. – “On a whim in the summer of 1976 – no doubt in part because he wanted to drive his shiny silver Alfa Romeo on the twisty and dangerous road through the mountains – my father suggested I have a stab at the Model Aeronautics Association of Canada National Championships held that year in Calgary...”
- [*A Torrey Pines Puzzle*](#) by Terence C. Gannon. – “Undoubtedly inspired by its cameo in Disney's *The Boy Who Flew With Condors*, [Dad] must have ditched one of the scintillating but undoubtedly

stuffy seminars on noise-induced hearing loss ... [i]n his suddenly free afternoon, he must have then sneaked out to Torrey Pines..."

- [Mike Shellim's Instagram](#) – The source of this month's beautiful cover photo – see immediately below for a further explanation.

Cover photo: *This month it comes to us by way of Mike Shellim, who captured Kevin Newton giving Alvaro Silgado's Fox some prime motivation off the south face of La Muela, Spain in 2019.*

For those for whom Mike's name is not immediately familiar, we have featured his superior work in the New RC Soaring Digest on numerous occasions. However, what caught our attention recently is Mike's revamped Instagram feed (see Resources, above) which has adopted as its theme a series of beautiful, spare, black and white photographs which "are a celebration of the wonderful world of F3F, and of my fellow pilots." Mike's feed is unique and we strongly encourage you to check it out and give it a follow.

You are welcome to download the March 2023 cover in a resolution suitable for computer monitor wallpaper. ([2560x1440](#)).

Disclaimer: *While all reasonable care is taken in the preparation of the contents of the New RC Soaring Digest, the publishers are not legally responsible for errors in its contents or for any loss arising from such errors, including loss resulting from the negligence of our staff or any of its contributors. Reliance placed upon the contents of the New RC Soaring Digest is solely at the readers' own risk.*

All photos from the Gannon family photo album. Here's the [first article](#) in the March, 2023 issue. Or go to the [table of contents](#) for all the other great articles. A PDF version of this edition of In The Air, or the entire issue, is available [upon request](#).

Letters to the Editor



As usual we have added one more stamp to our montage – can you spot it?

Mark Drela, more flight simulators, another helpful answer and simply a kind word.

Mark Drela's Other Accomplishments

In this era of celebrity it should be mentioned that Mark Drela still holds the world boat man-powered speed record and has for 22 years! 21 mph, 100 meters.

John Vigour

For readers who may have missed the reference, in the first part of Tiberiu Atudorei's Project ALTius series (see Resources, below) the author made reference to Mark Drela's remarkable contributions to the world of RC sailplane design. However thanks for reminding us, John, that Mark's accomplishments are in no way limited to this one discipline. Information on his record-setting Decavitator design is linked below. – Ed.

An Answer to Sanjay's Graupner Mosquito Question

I would strongly advise him to build the model as designed. The plan shows that the steel and brass tube wing joiners are highly integrated into the spar structure and, together with the 'D' box leading edge, this will be adequately strong for the purpose the model was designed for – thermal soaring. A 300W (or so) outrunner will provide adequate power on a 3S LiPo and will be significantly lighter than the original power system. Perfect for summer thermalling with the sun shining through transparent film on the open structure wings!

Mike Goulette
United Kingdom

Sanjay's letter from last month is linked below. Mike is an experienced, expert builder and he seems to have offered some great advice. – Ed.

More Simulators!

I see there's a new ongoing series *Condor Corner* starting up in which Scott Manley is going to talk about the full-size *Condor* soaring simulator. I'm looking forward to reading more in the coming months.

But how about featuring some content on other RC flight simulators, specifically ones that work well simulating RC soaring? I have been a fan of *PicaSim* for a while now, but then found out that Michael Selig had released his *FS One* simulator last year and I really like it too.

Perhaps the authors of each sim would be willing to publish an article each with some history and insights on how each of their sims came about, and what their plans are for the future? Thanks!

Bill Tsang

Bill—thanks so much for that positive feedback. Almost everything in the New RCSD starts off with an experiment and in this case, it seems to have panned out. We actually had a great article by Chip Kaye about PicaSim a while back. Also, our Cool New Stuff section last month featured the upcoming Yawman flight sim controller. Both articles are linked below. We see this area as one of real growth for the New RCSD — your idea of having all the sim makers weigh in is a great one! Thanks again for your note. — Ed.

It's Simple — Insomnia Is Our Friend

I don't know how you guys do it, but you somehow manage to make each month's issue, excitingly new and shiney! The February edition is no exception and comes in like a breath of fresh air!

Lyle Jeakins,
Hamilton, Ontario


To be entirely candid, Lyle, this month was a rough one for the New RCSD team. However when we receive letters like yours, it makes it all worthwhile. Every bit of it. Thanks so much for passing this kind thoughts along. We'll keep writing if you promise to keep reading. — Ed.

Resources

- [*Project ALTius / Part I: A simpler approach to high-performance glider development using CAD/CAM.*](#) — The first part of Tiberiu Atudorei's series. The second part appears in this month's issue.
- [*Decavitator Human-Powered Hydrofoil*](#) — "On 27 October 1991, Mark Drela pedalled the human-powered hydrofoil, *Decavitator*, to a world-record speed of 18.5 knots (9.53 meters/second) over a 100 meter race course on the Charles River in Boston, Massachusetts..."
- [*A Question about a Graupner Classic*](#) — "I was wondering if anyone had any tips on a wing joiner arrangement. The one shown in the

plans is just 3+3" long and about 3/16" (5mm) diameter of unspecified material. Lots of doubts there..."

- [*J'Adore PicaSim! | A superb – and free – flight simulator for slope soaring.*](#) – "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..."
- [*FS One*](#) – "can work with practically any USB simulator controller. After your download, follow the setup instructions in the online user manual to get going..."
- [*Cool New Stuff | Gaming Controller Designed for Flight Simulators*](#) – "The Yawman Arrow is a new type of hand-held gaming controller ... [it] combines all the traditional flight controls of an aircraft..."

Send your letter via email to NewRCSoaringDigest@gmail.com with the subject "Letters to the Editor". Alternatively, you can leave a reply in the Responses section below (that's the little ). We are not obliged to publish any letter we receive and we reserve the right to edit your letter as we see fit to make it suitable for publication. We do not publish letters where the real identity of the author cannot be clearly established.

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

Cool New Stuff



The magnificent brand-new 4.1m AS-33-Me from Composite RC Gliders of Würselen, Germany.

A little (or not so little) something for every interest and budget.

4.1m AS-33-Me

Authentic scale looks, stand out performance and impressive size combine in Composite RC Gliders' latest tour-de-force.

The *AS-33* is a single-seat glider manufactured by the German glider manufacturer Alexander Schleicher. It can be used with different outer wings in the FAI 18m class and FAI 15m class.

Using this beautiful aircraft as a subject, Composite RC Gliders's brand-new *AS-33-Me* is a semi-scale glider modelled at 1:4.4-scale with a wingspan of 4.1m and a take-off weight of around 4.6kg. It has a high degree of prefabrication including cockpit, seat pan and fully installed FES (front end sustainer) and retractable landing gear (click any picture for more detail):



If you have ever heard the saying “if it looks good it should fly well”, it truly seems to apply here: the *AS-33-Me* is also designed with a strong thermal profile which ensures a stable turning circle and excellent climb. At the same time it’s no ‘hangar queen’ with robust construction sufficient to withstand hard use. Equipped with both large spoilers and flaps, the *AS-33-Me* can be slowed down very nicely on the approach.

Additional information about the *4.1m AS-33-Me* is available directly from [Composite RC Gliders](#).

Dripless Glue Bottle

You will never spill Titebond on your Thermic 50 plans again.



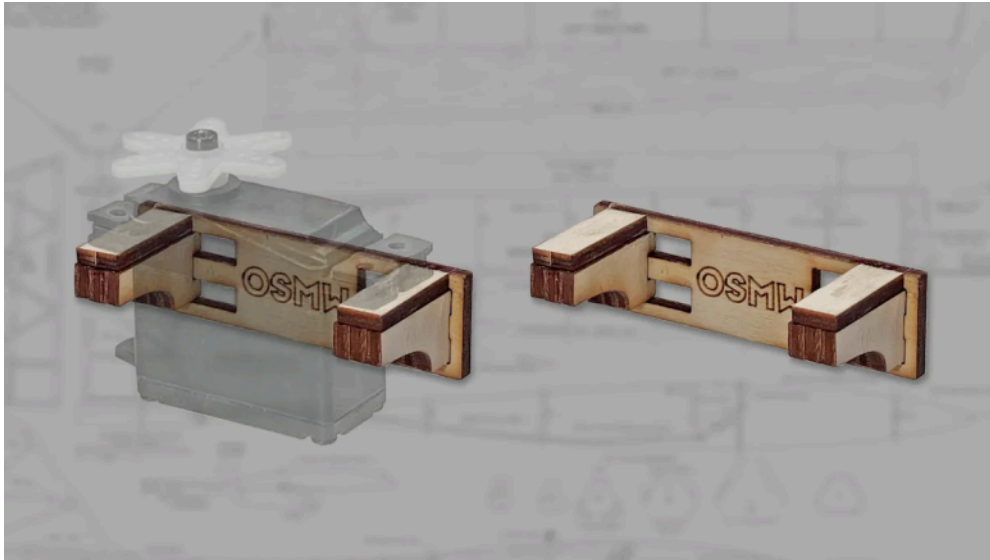
With Lee Valley's *Dripless Glue Bottle*, a gentle squeeze forces the glue through a channel at the bottom of the airtight reservoir and up the spout. Release the pressure and the sides of the reservoir return to their original shape, creating a suction that draws excess glue from the spout, preventing drips. A simple, brilliant idea! Now glue stains on your irreplaceable 'golden age of RC gliders' plan are now a thing of the past.

Available in three sizes, each with two tips: flat for dispensing a strip of adhesive and conical for beads. The replaceable tips can be trimmed to suit whatever your job requires, and the tethered cap won't go walkabout while you are busy gluing in all those ribs and shear webs or during the seemingly endless drying time. Thankfully, should the unthinkable happen Lee Valley also sells the accessory kits of replacement tips and caps.

More information available directly from [Lee Valley](#).

Multi-Size Servo Mounts

A simple solution to a problem which can take hours to solve.



Old School Model Works new laser-cut servo mounts have several advantages over others on the market:

- They're designed with a slotted baseplate which accommodates mounting beams where needed and enabling a perfect match to the size of the servo's case. Each mount fits servos from .875in through 1.6in in length.
- The thicker mounting beams give the servo's mounting screws more purchase and less chance of stripping out compared to mounts with just a thin 1/8" ply sheet.
- Each mount is laser-cut from aircraft-quality lite-ply and weighs in at just 2.5g when fully assembled.

These mounts are sold in sets of four making them very cost-efficient. More information is available directly from [Old School Model Works](#).

New RCSD Logo Peaked Cap

Finally, the accessory for which so many have been asking.



This beautiful chino cotton *New RCSD Logo Peaked Cap* comes in eleven colors (including camo!) to match your inimitable personal style. Thanks to the adjustable strap it is one-size-fits-all for both men and women. It features the New RCSD logo on the front and on the back you'll find the classic RC Soaring Digest sailplane motif (inset, bottom right) which appeared starting with the the very first issue from January of 1984.

You can obtain more information directly from the [The RCSD Shop](#).

Say you saw it in the New RC Soaring Digest.

***The Fine Print** All product descriptions in Cool New Stuff are prepared in collaboration with the product's manufacturer and/or distributor which is/are entirely responsible for ensuring the accuracy of their product's descriptive text and images contained herein. Note also the New in Cool New Stuff can sometimes mean 'new to us' – the French nouvelle as opposed to neuf.*

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A Homemade 5m ASW-28



The 5m ASW-28 in flight – what a beauty!

A lavishly detailed article on this unique, FES-equipped glider intended for mountain flying and GPS triangle racing.

While this article appears under my byline I must emphasise the text was co-authored with Jean-Luc Foucher and the beautiful pictures were a collaboration with Frédéric Hours. My deepest thanks to them for their participation in the creation of this article. – PR

Introduction

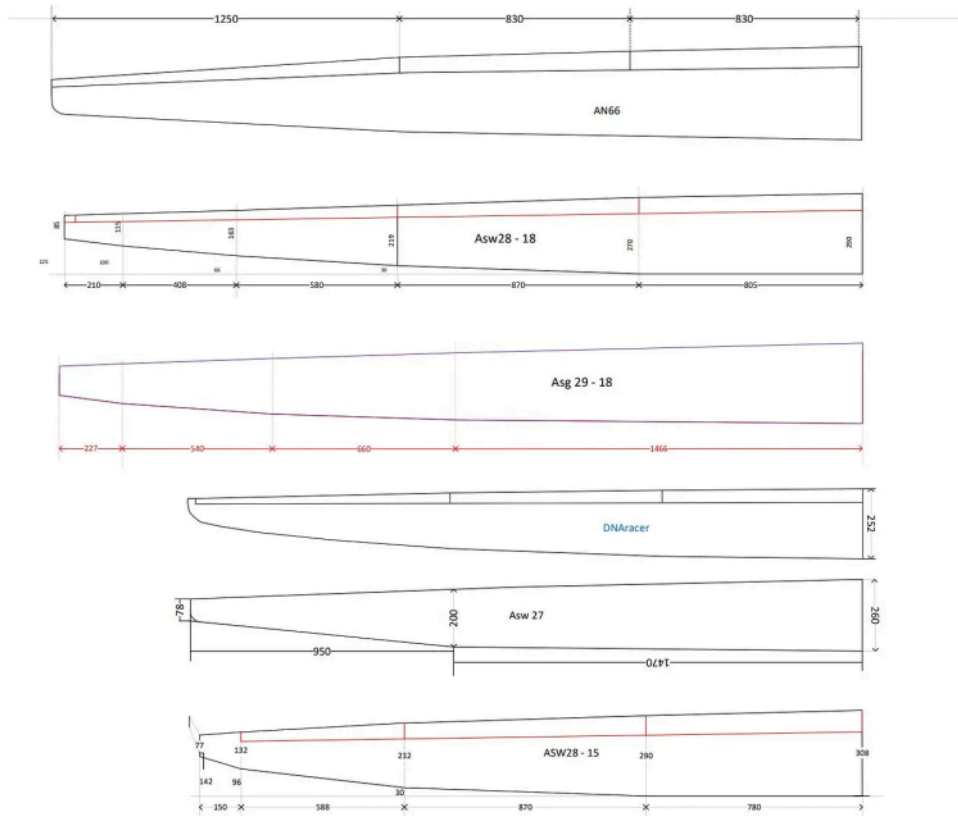
I am taking my pen today to tell you about a nice project led by two longtime friends, Frédéric Hours and Joël Carlin who are both F3F competition pilots. This project was born three years ago and the first flight – I was lucky enough to attend – was made at the end of May 2020, at the end of the first lockdown. But let's not rush the steps and let's start by talking a little about the genesis of this glider.

A Simple Yet Ambitious Idea

The initial idea was to design and build a large, electrified F3F glider with a 5m wingspan and a semi-scale look. Intended for slope and mountain flying and eventually a little GPS triangle racing (GPSTR), it will be equipped with a motor in the nose – a front electric self-launch (FES) system. While being discrete it will enable going up in case of weak air. This is a key point in my opinion if you want to fully enjoy this kind of glider without risking it. Elevation in the mountains is sometimes important and it is not rare to go down low and fast without necessarily having the possibility of landing safely. The motor is beneficial as it allows to push the search for the lift a little further or a little longer.

The wings will be built from a vacuum laminated core while the fuselage would be constructed using an existing homemade mold, to be determined later in the process.

It remained to define which model specifically. The type of construction of the wings imposed a multi-panel wing requirement. Joel and Frédéric reviewed the different models on the RC glider market such as the *Diana 2*, or the *AN66* GPSTR type or the large gliders such as the *ASG-29* and *ASW-27* for which it is quite easy to find a 1/3-scale mold. The choice was quickly made for the *ASW-28* in its 15m version. It offers the possibility of a wing with a reasonable aspect ratio of 19.5 while also allowing the use of a thin airfoil. It also employed the geometry of trapezoids to approach an elliptical lift distribution while remaining close to the wing shape of the full-size glider. Note however that the model has six wide chord control surfaces and not just ailerons and airbrakes as found on the full-size aircraft.

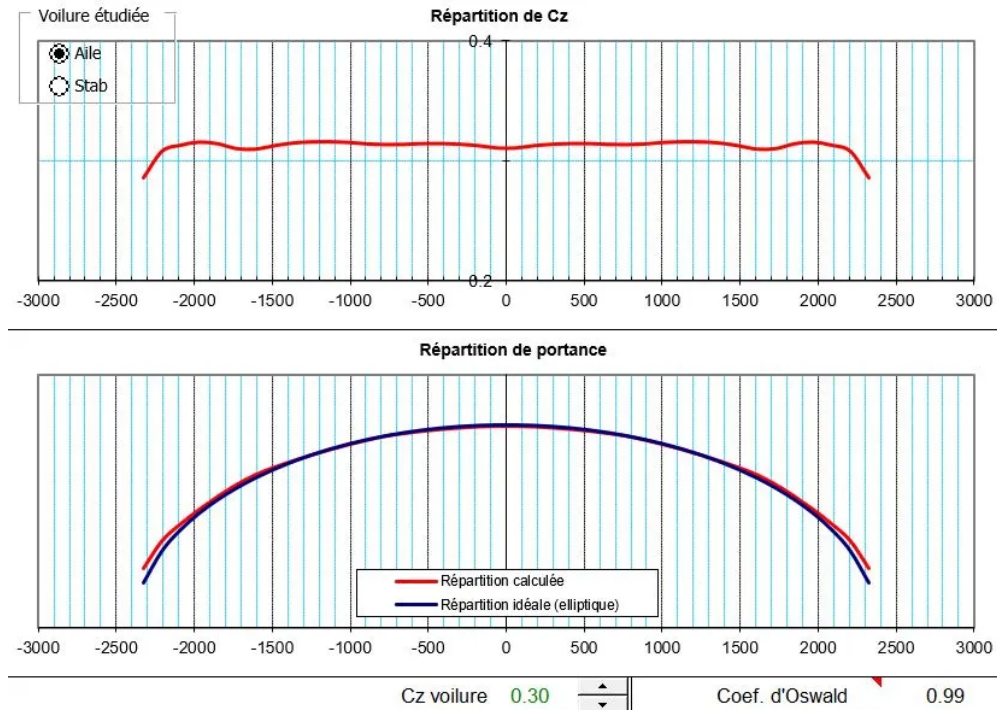


Some wing geometries of well-know RC gliders of the same wingspan and type.

Once the geometry of the wing was defined, our two friends called upon Jean-Luc Foucher – the father of the *Alliaj HM*, but also of the *Prodiij HM* by Aeromod, the *Pingouin F3F* and the *Cosmos F3F* – to design the airfoils of this new 5m glider. Jean-Luc accepted the challenge and what better way than to tell us about it himself, so I'll pass him the pen.

Aerodynamics (Jean-Luc Foucher)

Aerodynamics is just an exciting hobby for me and is treated as any other physics topic. I employ my experience in fluid dynamics related to various topics such as: F3F, dynamic soaring, 3D helicopter blades, racers and windfoils. By experience we address three main phases: objectives/constraints, flight mechanics/specs and airfoil computation.



Lift and C_z repartition along the wing.

Objectives and Constraints

The first objective is to achieve an '*F3F-like*' behavior. This means maneuverability, acceleration, turn efficiency and a wide range of speed. This also means a speed range from 15m/s to 50m/s, and the highest turn C_l/C_d ratio. The second objective is to increase the overall soaring capability compared to F3F. One constraint is to have very 'friendly' behavior with no hard stall so that it can be used by non-expert pilots. The second constraint is to keep the *ASW-28* shape leading to an airfoil chord (from 77mm to 308mm), mass range from 9kg to 13kg and wing area of 117dm². And finally, the third constraint is to have at least 11% of airfoil thickness at the wing root for mechanical strength.

Flight Mechanics and Technical Specifications

For this purpose general aerodynamic equations are used: one output is that airfoils along the wingspan will have to be analyzed over a wide Re range – from $1e5$ to $1e6$. Another output is a C_l range between 0 and around 0.7 all over Re range. For soaring we have to focus on C_l

up to 0.8 for lower Re , optimizing $C_l^{1.5} / C_d$ for various speeds and flap configurations.

Airfoil and Wing Computations

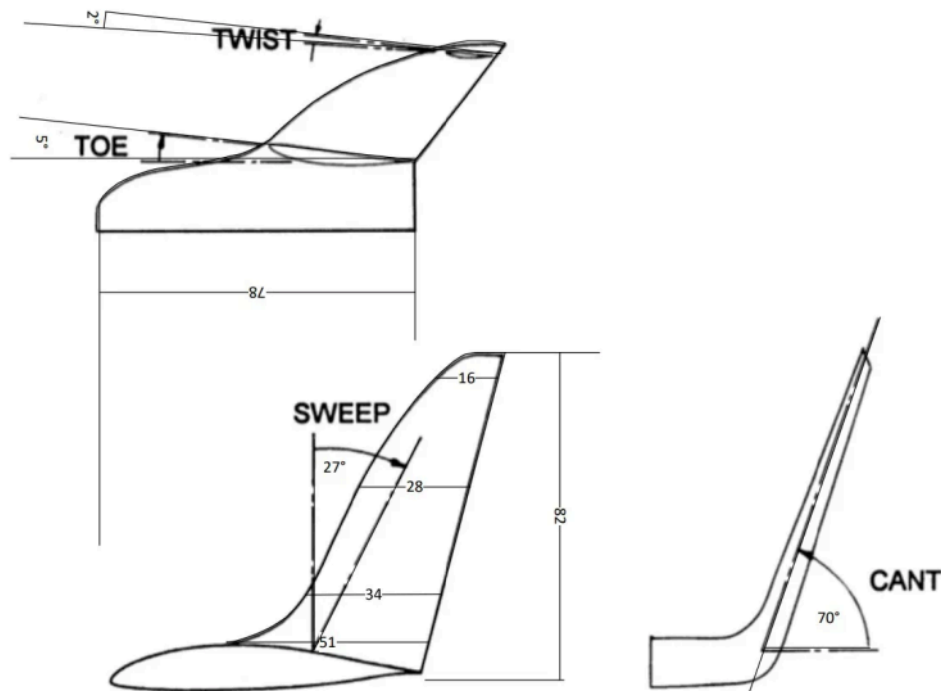
Software used was *Profili* for 2D design, then *XFLR5* for the 2.5D design mainly to check targets are achieved. Work has been performed starting from F3F airfoils, as ranges of C_z and Re are comparable. Then thickness at root has been increased to 11% and enhanced for soaring purposes including the use of adequate flaps. Then airfoil adequacy along the wingspan is computed taking into account: Re distribution, elliptical shape of C_l at high wing lift with flap and efficiency of ailerons for roll axis. To achieve the desired friendly behavior, one important point is to get a smooth C_l / C_d curve, even with flaps, to be more forgiving to wind and pitch changes.

Airfoil Comparison with A7026 Series

Finally, we compare these airfoils to existing airfoils such as the very popular A7026 series; both airfoils being set at 11% for comparison purposes. A few simulations show that these A7026 series are very efficient over a wide speed range. Optimization looks to be performed around $C_l = 0.4$ and can be extended to lower C_l using negative flaps. This means that A7026 series seems optimized for rather big and loaded scaled airplanes. A7026-1 has a 2.55% camber as our camber is 2%. The two airfoil polar curves are comparable when putting -3° flap at 25% to A7026, with a small advantage to our airfoil as it has been optimized in lower C_l range. Putting a few degrees flap to our airfoil, we stick to A7026 polar curves. Nevertheless, with some positive flap to A7026 series, it becomes more efficient above $C_l = 0.8$ which is falling outside our objectives.

In conclusion, despite the differences between these two airfoils concerning camber and C_l area of optimization, I would guess there is not so much difference in flight behavior: of course, using adequate flap (and wing/fuselage angle setting) for the desired flight domain and taking into account fuselage and tail drag, as well as induced

drag for high Cz. So again, the actual need and technical spec is of great importance in the design process!



The winglets geometry used, and 3D-printed on the ASW-28.

Few Words about the Construction (Pierre Rondel)

I take the pen back to continue on the construction chapter, starting with the wings.

This is a laminated core and vacuum construction with a spar. The first step was to do some tests to determine the best skin layup. Initially, Frédéric did some tests with a single layer of 200g/m² triaxial carbon fabric under the 50g/m² fiberglass finishing fabric, but the weave always stood out, despite several tests at different vacuum pressures.

This approach was therefore finally abandoned, and the following solution was chosen: one layer finishing fabric of 50g/m² fiberglass, then two layers of 160g/m² from HP-Textiles (see *Resources*, below) positioned at 45° for better torsional rigidity. In practice, in order to optimize the use of the fabric which was 1.50m wide, the fiber is in

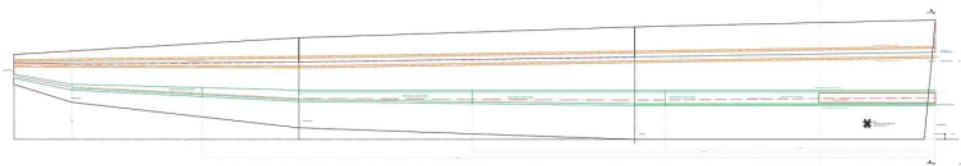
fact at 38° on the 2.50m of the wing, to avoid the joins which are always seen under vacuum, what the tests confirmed.

To avoid deformations on the top surface of the wing, the lamination is done in several steps, the first one being to laminate the top surface on the raw core, without any insert, and using a mylar sheet (also bought from HP-Textiles) for a nice surface finish. The core is simply a Knauf 'small ball' polystyrene.

Frédéric then removed the material on the spar area to put six layers of 220g/m² unidirectional carbon fabric on the top surface and four layers on the bottom surface decreasing in thickness and length.

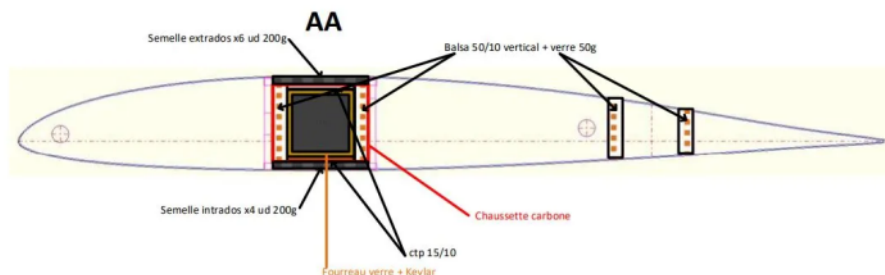
Carbon works less well in compression, so you have to use a little more.

The spar is prepared separately and calculated according to an Excel spreadsheet created in 2003 by Jean-Luc Delort and available on a French website *Les Grands Planeurs RC* (see *Resources*). The spar is calculated to support acceleration up to 10G to 15G for a glider of about 10kg.



In green, the spar.

The spar, composed of two carbon soles joined by a composite made of two 50/10 balsa planks, vertically oriented fiber, then reinforced with vertical fiberglass, with a foam core in the middle.

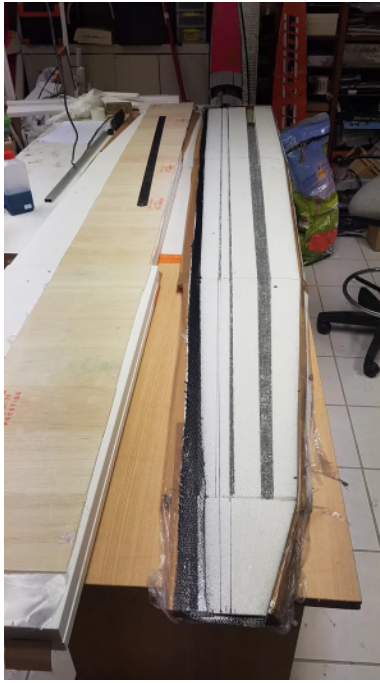


The structure of the wing root, with the joiner box terminating the spar.

The wing joiner is a square section of 25mm x 25mm in carbon, with dihedral. The joiner box is made of fiberglass plus Kevlar strands, with a 1.5mm plywood cap on top and bottom. The complete spar and joiner box is then inserted in a carbon sock, dry before installation and lamination 'in situ' in the wing. Note that the gluing of the spar is not done under vacuum pressure, just a little weight to press on it during the curing to avoid any deformation of the top surface.















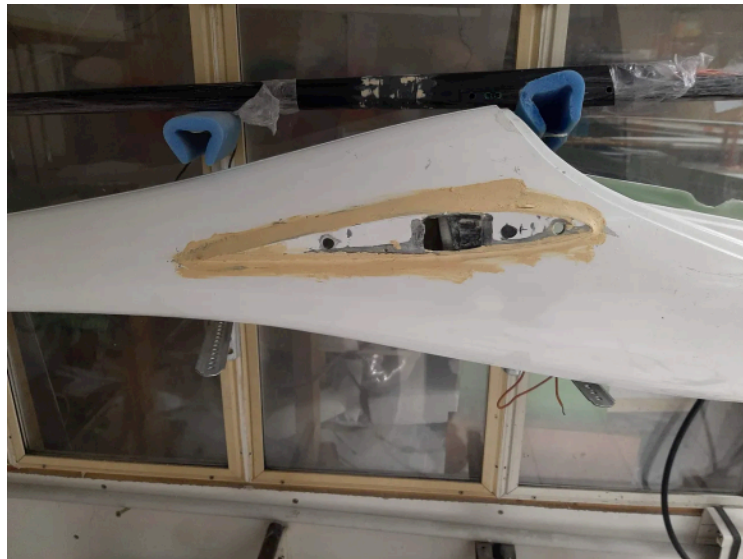
A few pictures of the construction of the wings.

The wing and control surface spars are also made of 50/10 vertical fiber balsa and fibreglassed on both sides. There is no spar on the last tip panel, because its dimensions are too small to fabricate something correctly.

Once cured we fabricated the bottom surface reinforcement, composed of four layers 220g/m² unidirectional carbon fabric, and we finish with the bottom surface skin. The leading edge is reinforced with a little micro balloons filler and silica.

The fuselage comes from a homemade mold. However, the fuselage wing root had to be modified to fit the wing section. The canopy was bought from Ulmer (link in *Resources*). The winglets are simply 3D-printed, modelled on the *ASW-28s Maughmer* tip.







Work on the tailplane and on the fuselage, mainly the wing root to adapt to the wing airfoil.

The tail, which uses a TP29 profile at 10% to accommodate a 10mm servo, uses the same manufacturing process, but this time using a TeXtreme 110g/m² carbon fabric (see *Resources*) laid at 45° and a 50g/m² fiberglass surface layer. A spar with balsa board 50/10 vertical fiber and 50g/m² fiberglass is employed to make the connection between the underside and the upperside.

The locking of the wings in flight is made with a threaded rod of 6mm in the wing to which we mate in the fuselage with 3D-printed nuts.

The wings finally came out around 1900g the half wing, the tail is 182g, so the weight estimate is within the limits for a target of 9kg to 11kg empty with the possibility to go up to 13kg to 15kg ballasted.

Motor Setup

It is the most standard, using a direct drive motor for simplicity and avoid maintenance :

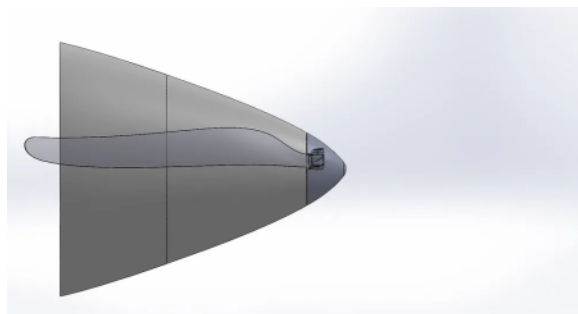
Motor	e-Flite <i>Power 60</i> Brushless Outrunner
Controller	Castle <i>Talon 90</i>
Propeller	16x10 GM scale
Spinner	GM scale 50mm (diameter) x 25mm (length)
Batteries	Two 6S 3000mAh mounted in parallel for a total capacity of 6000mAh.

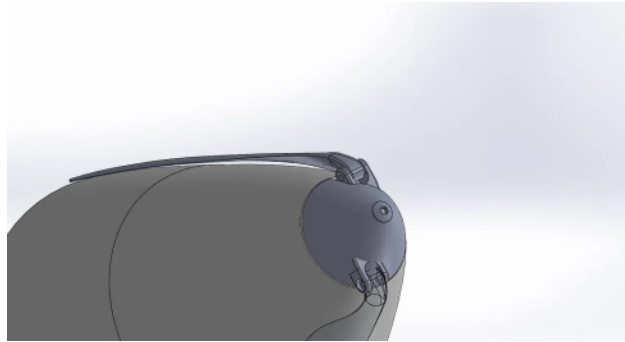
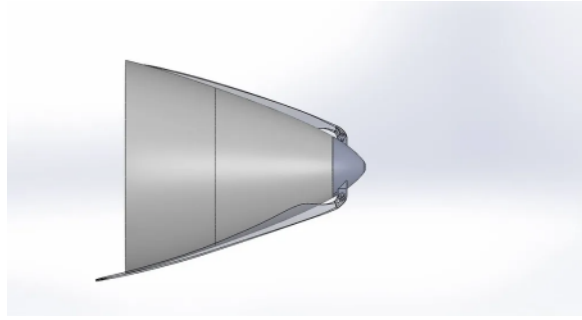


A last motor test, just in case of poor lift – but that didn't happen!

This configuration certainly does not allow climbing vertically but it is not the goal! The objective is to have a climbing rate around 7m/s and to aim for three or four climbs of 200m, which allows you to get out of a bad situation in the mountains and save the glider.

For the spinner, Frédéric and Joël contacted Georgi Mirov of GM Propellers (see *Resources*), who kindly did some 3D simulations to select the best available spinner for the shape of the *ASW-28* nose. The result is quite impressive as you can see in the sketches and on the pictures.

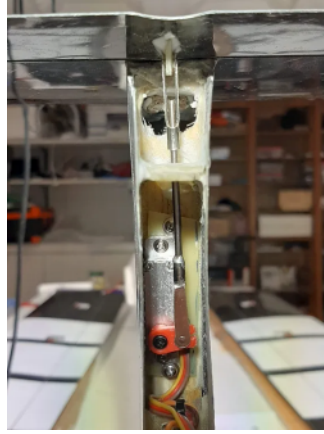




Propeller simulation and in real life to compare the accuracy of the simulation.

Radio Installation

Not much to report except for the dual reception with each half wing connected to a receiver, each receiver having its dedicated 7.4v Li-ion battery (2S format 18650), while the elevator and rudder are in redundant mode, i.e. connected to both receivers through the use of *JETI ENlink 2RS plus* modules (see *Resources*). This module then provides the highest voltage and best signal to the servo for optimum safety. The elevator servo is 10mm with direct drive. Same for the rudder servo, both mounted in the fin. Three servos per half-wing to avoid having a rudder longer than 1m for obvious torsional rigidity problems and also to relieve the servos. Moreover, this enables more complex mixes, for example in 'butterfly' mode for landing.



Radio installation in the fin and fuselage (lot of place), and radio settings in the workshop before driving to the slope.

In Flight

I was able to attend the first flight which took place on the beautiful slope of Corps, south of Grenoble. The flight went perfectly, the CG was immediately correct. The geometry of the glider was entered on *PredimRC* (see *Resources*) beforehand to calculate the CG using a static margin of 2%.



Joël Carlin ready to launch Fred's ASW-28.

Despite its 5m wingspan and 8.5kg, the glider seems light and agile in flight, responding like an F3F glider to the pilot's commands, with the inertia and responsiveness of a larger and heavier model. The stability is excellent, the glider is like it's on a rail in flight and is very precise.







Few pictures in flight to appreciate the result of this nice project!

Acceleration is excellent, and the energy retention in turns and other manoeuvres is incredible!

Elementary aerobatics are performed with ease and elegance. The six control surfaces allow the glider to slow down on landing, making you forget the size. The rigidity of the wings is satisfactory both in bending and in torsion.

Finally, the presence in the air of the glider with its large fuselage and the curve of the forward part is superb.

During another flight session, I was able to take the radio transmitter and fly this fantastic glider. The feeling on the sticks is excellent, a mix of lightness, precision and agility which is unusual on a glider of this size. A beautiful machine!

To finish, here are two videos you should be sure to watch. The first one is of the first flight in 2020 :

The second one is with an onboard camera which will allow you to appreciate the rigidity of the wing:

Conclusion

At the end of the day, it is safe to say this project has been a success, with all objectives met or exceeded. The satisfaction brought by this model makes the builders forget the hours spent in the workshop during the construction or in front of the computer for the design and the calculations. I can easily imagine that Joël Carlin is now impatiently waiting for his model, so that we can film or photograph the patrol flights of **two** 5m *ASW-28s*!



The ASW28 and the Obiou mountain in background, a 2789m high summit

I hope that sharing these few lines on this project will have brought you some information and will give you the desire to launch yourself in this kind of construction!

Finally, a new French craftsman should emerge in the next few months with the ambition of marketing a glider of similar size using the series of profiles developed for this *ASW-28* and working in close

collaboration with Jean-Luc Foucher. *And we'll be happy to bring that news to you when it does!* – Ed.



Big smile on Fred's face after the successful maiden flight!

Resources

- [GM Propellers](#) on Facebook. – “High performance carbon propellers for hobby and competition...”
- [HP-Textiles GmbH](#) – “Since the company was founded in 2004, HP-Textiles GmbH has stood for the development and distribution of fibre composites...”
- [JETI ENlink 2RS plus](#) – “a device for increasing safety and reliability of radio controlled models to the highest level ... parallel connection of systems that are detached maximally leads to the significant increase in reliability...”
- [Knauf Insulation](#) – “Our mission is to challenge conventional thinking, create innovative insulation solutions that shape the way we live and build in the future...”
- [Les Grands Planeurs RC](#) (Large Scale RC Gliders) – The home of the spar calculation Excel spreadsheet created in 2003 by Jean-Luc Delort.
- [PredimRC](#) – “an aerodynamic analysis and simulation tool for aircraft models ... for designers but also for pilots anxious to adjust correctly their device or to improve its behavior or performance...”

- [Profili](#) – “This new version can assist you in: · Searching for the right airfoil for your application · Creating new airfoils · Analyzing the airfoil aerodynamic...”
- [TeXstreme](#) – “spread tow reinforcements are a uniquely adaptable, safe and ultra light supportive solution for your carbon fiber composites...”
- [ULMER Kunststoffteile GmbH](#) – “We see ourselves as a competent solution partner in the development and production of high-quality and technically high-quality plastic products in vacuum thermoforming technology and hot forming...”
- [XFLR5](#) – “an analysis tool for airfoils, wings and planes operating at low Reynolds Numbers...”

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What is F3L?



Two Yellow Jacket 2M Competition GS models ready for contest flying.

New provisional FAI class for rudder/elevator/spoiler models launched via hi-starts.

The F3L class — previously known as F3RES — is a new provisional, international soaring competition for models limited to two meter wingspan. This class of plane uses only rudder, elevator, and spoiler controls (RES) and they are constructed mostly of wood. Over the past eight years or so, German RC competitors developed a set of rules that largely were used to form the current provisional rule set. F3L was recently added to the *FAI Sporting Code* and the 2023 rules can be found starting on page 56 of *Volume F3 Radio Control Soaring Model Aircraft*. I have linked the document and page in the *Resources* section below.

F3L kits typically cost somewhere between \$200 to \$400 making for a much lower than most other RC soaring formats cost of entry class of contest flying. Many modern F3L kits can be built in 40–60 hours or

so. This author built his most recent F3L kit, a *Yellow Jacket 2M Competition GS* (again, see *Resources*) in a little under two months without making too much of an effort to rush.

F3L models need to be made mostly of wood. Carbon/fiberglass parts can be used for spars, leading edges, joiners, and pushrods. The fuselage can have a carbon/fiberglass tailboom as long as the boom doesn't extend beyond the last 1/3 of the wing cord but the pod must be made from wood although 1/3 of it can be reinforced with glass/carbon. The pilot doesn't have to build the model flown and ARFs are allowed.



The author's Yellow Jacket 2M Competition GS under construction.

F3L planes are launched into the air using relatively low-strength high-starts also sometimes called bungees. F3L hi-starts are composed of about 15m of rubber/surgical tubing and about 100m of kite or fishing line. In a contest setting, the hi-starts are provided by the contest organizer and are matched to provide a fairly equal pull when stretched to a common length. The hi-start's pull distance/strength is specified in the rules. Launches are generally fairly gentle.

F3L models launching in an F3L contest.

The objective of an F3L competition flight is to fly as close to six minutes duration and land the model with the nose close to a predetermined spot on the ground. Competitors are given nine

minutes of 'working time' where they and other pilots in their flight group must launch their model and try to fly for as close to six minutes as possible. Pilots may make as many flights in the nine minute window as they want but only the last flight's in the nine minute window is scored. The landing task is fairly generous with 100 points being scored for landing within 0.2m of the landing spot and beyond that points are distributed based the following table:

5.L.11.2 Scoring of the Landing

A landing bonus will be awarded in accordance with distance from the assigned landing spot, according to the following tabulation:

Distance from spot up to m(metres)	points	Distance from spot up to m(metres)	points
0.2	100	5	80
0.4	99	6	75
0.6	98	7	70
0.8	97	8	65
1.0	96	9	60
1.2	95	10	55
1.4	94	11	50
1.6	93	12	45
1.8	92	13	40
2.0	91	14	35
3.0	90	15	30
4.0	85	over 15	0

(credit: FAI)

This short video provides a couple of examples of landing techniques which would have qualified for points under the F3L rules.

F3L competition landings.

F3L entrants compete as part of a team where pilots take turns flying, serving as air reader/timer/helper for a teammate that is flying, and returning the launch lines for in case the pilot that is flying needs to re-launch within the round and prevent line crosses from launch lines of other teams. The team format is ideal for beginners because every contestant in an F3L contest will be put on a team. This means every contestant in an F3L contest will have designated team members to help the new contestant launch the model (if desired), time for the new contestant and other housekeeping tasks.

F3L is a great competition format for new pilots or experienced pilots that would like a relaxed format that rewards building a well flying 2m

RES model. This author thinks it is a great format for club or regional RC soaring competition and hopes that this format gains traction regionally and around the world and serves as an entry point for RC glider pilots to try out competition.

Thanks for reading and see you in the launch line-up!

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Resources

- [*FAI Sporting Code – Volume F3 Radio Control Soaring Model Aircraft*](#) – The F3L rules start on page 56 and this link will automatically open the document to this specific page.
- [*Yellow Jacket 2M Competition GS*](#) by Sonoran Laser Art. – This is the aircraft mentioned above. From the website: “The *Competition GS* wing has a new planform as its more elliptical, lower EDA, with longer mid and short tip panels...”
- [*F3RES Resources*](#) on RCGroups. – An F3L discussion and resources with information on models, hi-starts and other subject.
- [*DJ Aerotech*](#) – Another source of F3L kits but also importantly a source of good quality F3L rubber to make hi-starts.

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Twist Distributions for Swept Wings



Jeff Vrba launching Curtis Suter's 'Tinamou' flying wing at the Alpine Soaring Adventure held at Joseph, Oregon. (credit: Curtis Suter)

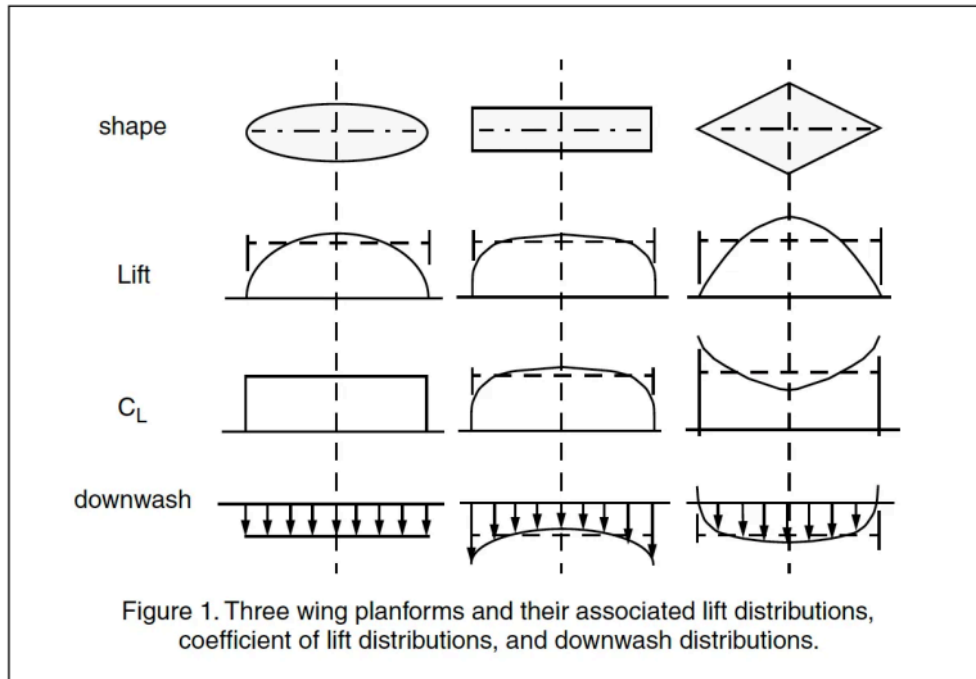
Part 2: The stalling patterns of untwisted and twisted wings.

Readers who have not already done so may want to read [Part 1](#) of this five part series before proceeding with the following. – Ed.

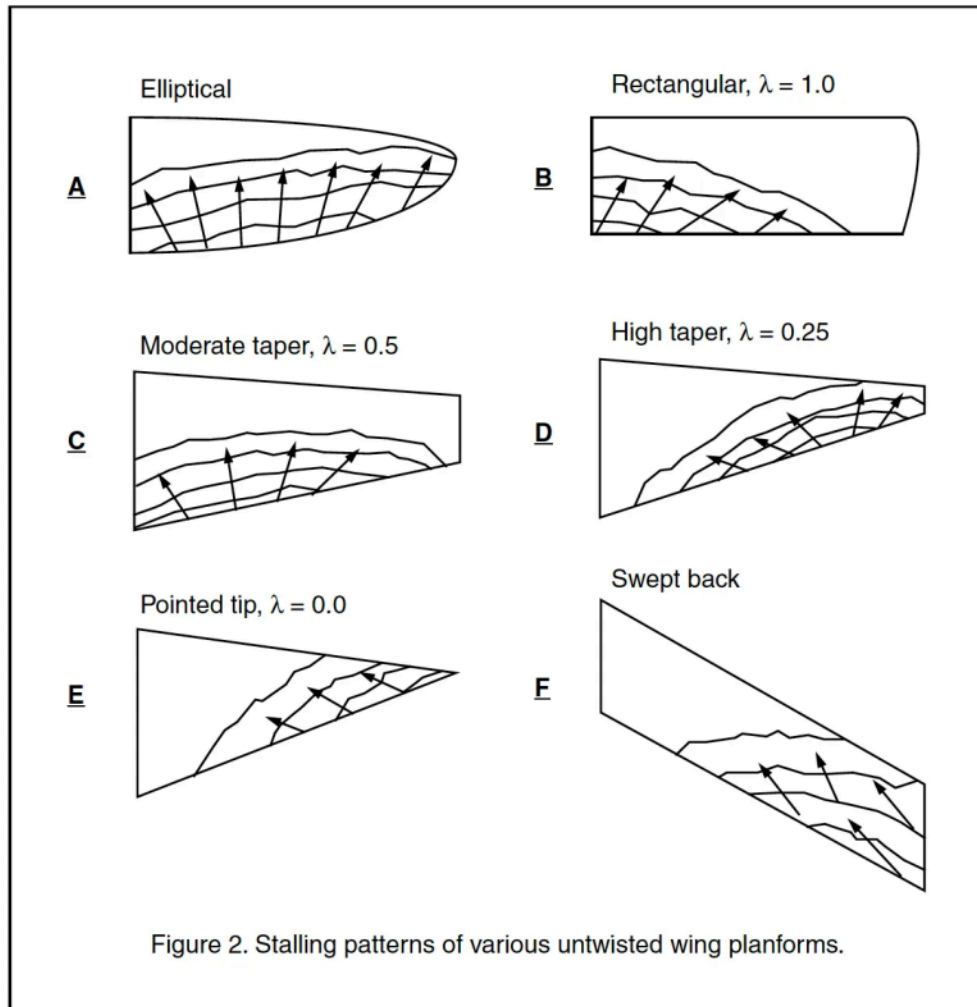
Having defined and provided examples of lift distributions in Part 1, we now move on to describing the stalling patterns of untwisted and twisted wings, determining the angle of attack as from the location of the stagnation point, and how wing sweep affects the angle of attack across the semi-span.

Stalling Patterns for Untwisted Wings

The lift generated by any wing segment is a product of the local coefficient of lift and the local chord length. Referring to Figure 1 (a reprint of Figure 4 from Part 1) we can see the results of this formula as applied to three wing planforms.



The ideal lift distribution is the elliptical as shown in the left column. Note the local coefficient of lift (c_l) is identical across the entire span, as is the downwash. While the elliptical wing planform is efficient, it is difficult to build and, because the c_l is the same across the span, all segments of the wing are equally susceptible to stalling. See Figure 2A.



The rectangular wing, with its constant chord, Figure 2B, tends to stall at the root first. This is because the local coefficient of lift progressively decreases for those wing segments nearer the tip. This takes some of the load off them, inhibiting stalling. Note also from the middle column of Figure 1 that the rectangular wing tip vortex is quite large, indicating substantial outward flow across the lower surface, and substantial inward flow across the upper surface.

The diamond planform (right column Figure 1 and Figure 2E), unless in a vertical dive ($c_l = 0$) is stalled to some extent at all times. Note that although the local coefficient of lift at the wing tip tends to be infinite, the actual amount of lift generated is very low because of the diminishing chord, and the downwash in the tip region tends to zero. The stalling pattern for this wing planform grows inward from the trailing edge of the wing tip and toward the leading edge. From this information, it does not seem like a delta wing would be useful, but

the airflow over a severely swept wing, which a delta is, is far different from the airflow over the straight wing described in this instance.

Wings with large to moderate taper ratios, $\lambda = \sim 0.4$, have stalling patterns approaching that shown in Figure 2C and tending toward that of the rectangular wing planform (Figure 2B). Wings with small taper ratios, $\lambda = <\sim 0.4$, have stalling patterns approaching that of the highly tapered planform shown in Figure 2D and tending toward that of the diamond wing planform, Figure 2E.

The most interesting stalling pattern, however, is that of the swept back wing, as depicted in Figure 2F. Although the wing tip has the same chord as the root, the stalling pattern is entirely different than that of the unswept rectangular wing.

Lift Distributions and Stalling Patterns of Swept Wings

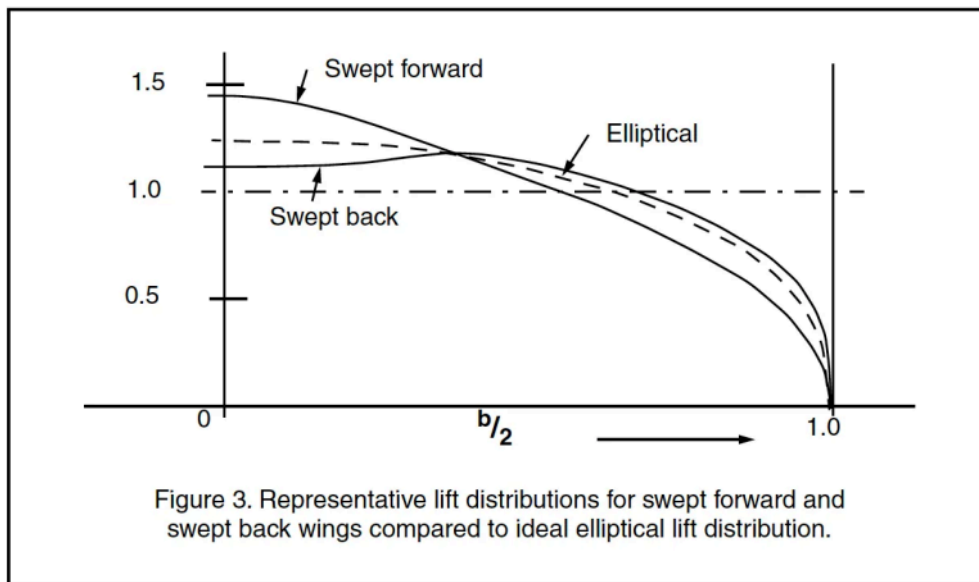
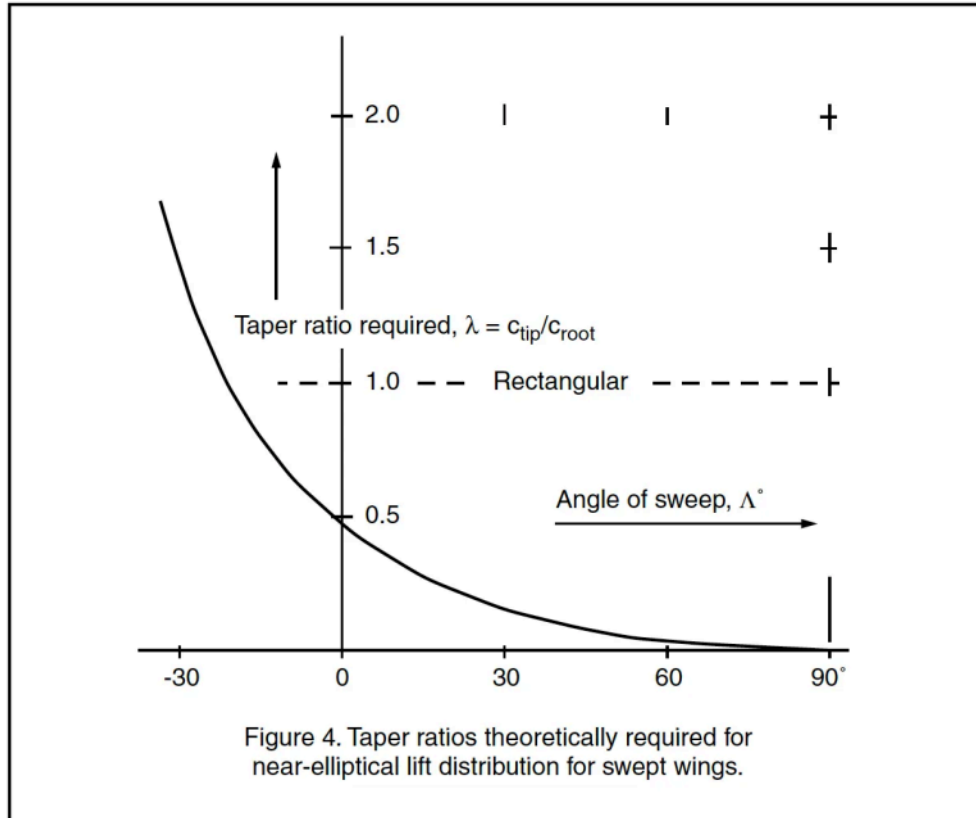
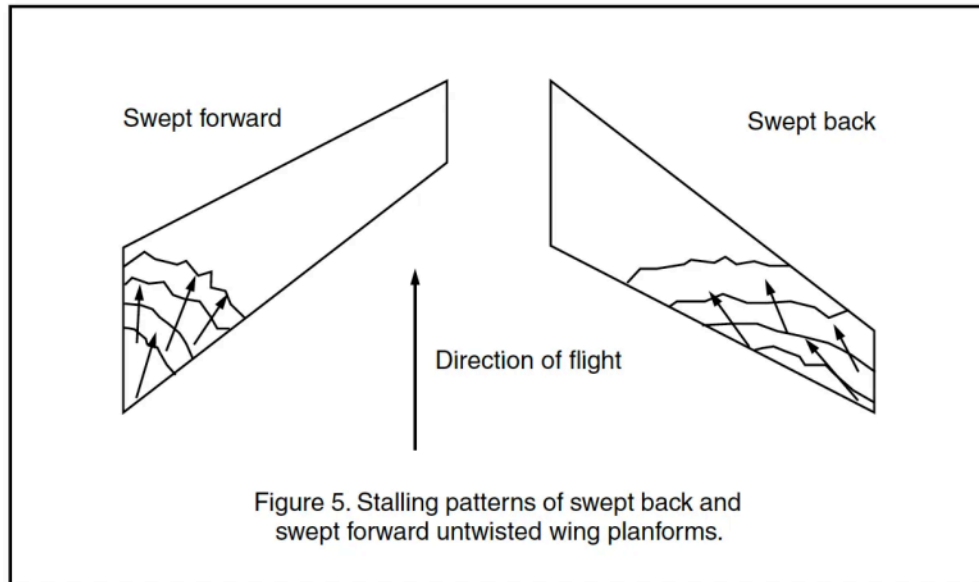


Figure 3 compares the elliptical lift distribution with representative lift distributions for swept forward and swept rearward wings. The swept back wing shows an increase of lift near the wing tips and a noticeable depression of lift near the wing root. The swept forward wing shows an increase in lift near the wing root, and depressed lift near the wing tip.

Before speaking to why this is so, it should be mentioned that we can attempt to tailor the lift distribution of swept wings to closely approximate the lift distribution of the elliptical planform by modifying the taper ratio. Figure 4 shows in graphical terms the taper ratios required for this approximation as based on the sweep angle.



While we can modify the lift distribution to more closely match the elliptical ideal by adjusting the taper ratio, the stalling pattern does not appreciably improve. The stalling pattern still tends to grow inboard from the wing tip. This is seen in Figure 5.



The swept back wing, when stalled, tends to pitch up into a deeper stall as the center of lift moves forward when the rear of the wing is stalled. As the (elevon) control surfaces are normally placed outboard, they are in a stalled region of the wing. A swept forward wing will suffer from a somewhat similar malady. When the root of a swept forward wing stalls, the wing tips remain unstalled and the center of lift moves forward, pitching the nose up. Aileron control is maintained, but at the expense of a possible severe pitch up and deep stall.

Despite having identical root and tip chords and sharing what some would consider dangerous stall behavior, we bring up these two cases as an example of how sweep can effect the air flow over the wing. The two swept wings in this example have different stall patterns caused by the imparted sweep.

Sweep and angle of attack

An airfoil which is creating lift demonstrates three important characteristics:

- The air going over the top of the section accelerates, the air going along the bottom decelerates. If the smoke stream is pulsed, these velocity differences are easily seen.

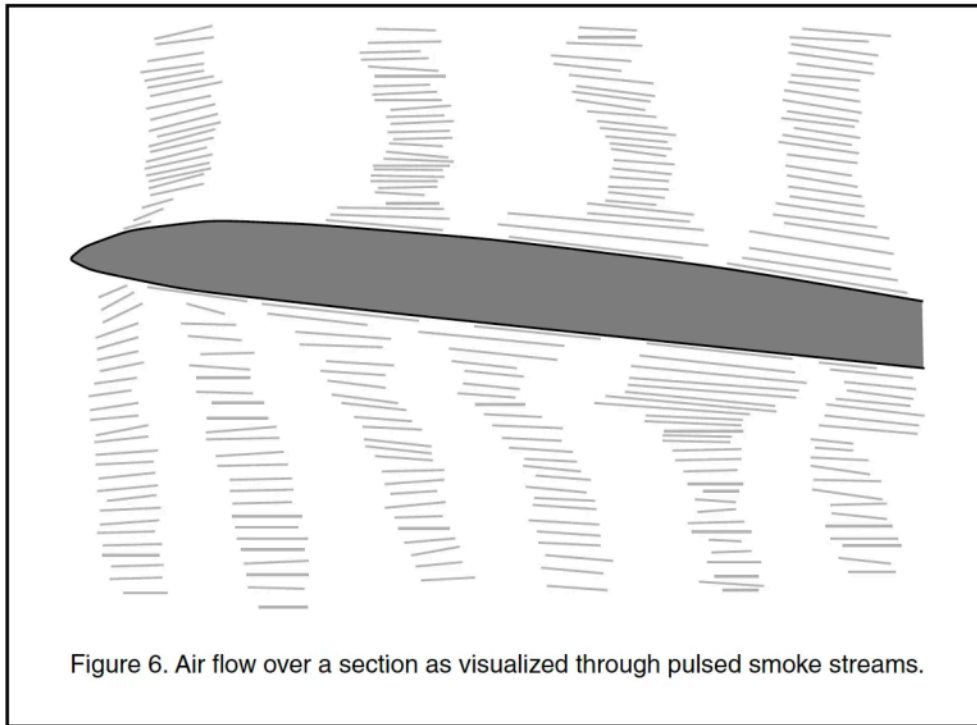
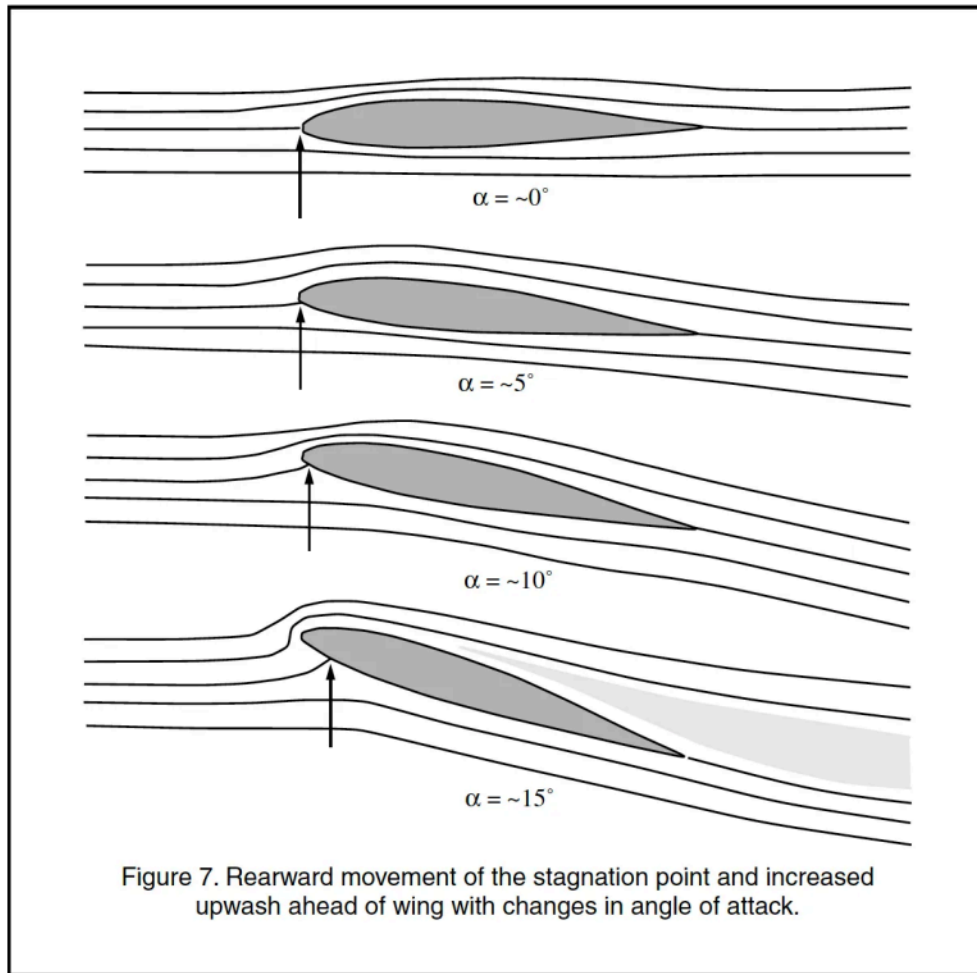


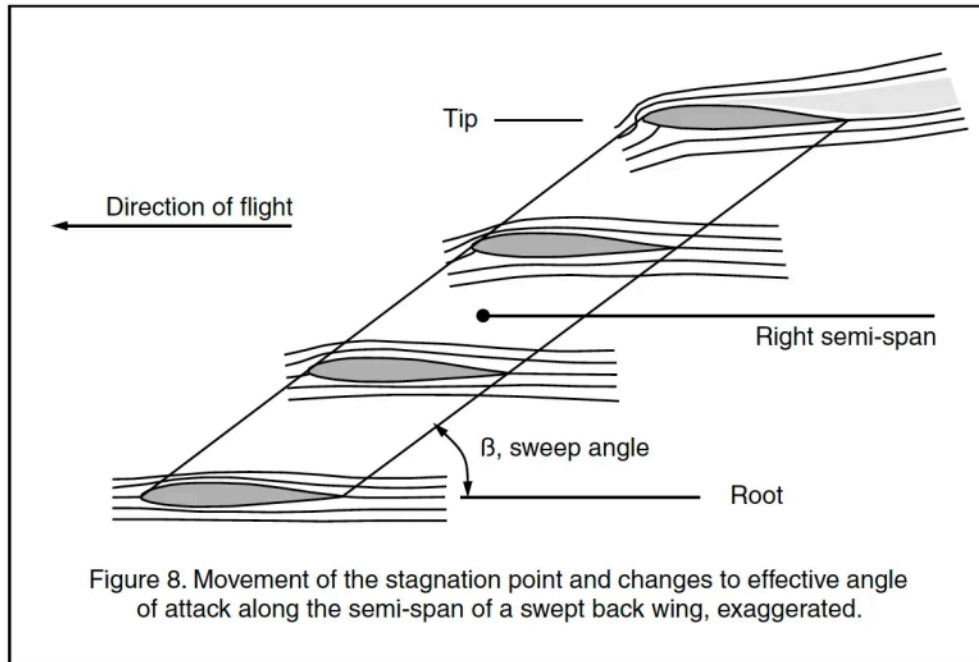
Figure 6 was derived from a smoke tunnel photograph using this methodology. The acceleration differential is seen in the varying size of the pulses and the varying distances between them. (Some mixing of the smoke with clear air takes place because of turbulence caused by the boundary layer interfacing with air which is moving more rapidly.)

- The air rises toward the section as it approaches the leading edge. This is seen in Figure 6 as well. This portion of the air flow is called the 'upwash'.
- The air is deflected downward aft of the airfoil section. The section acts as a vane, turning the air stream downward. Termed 'downwash', this flow is an important consideration in the design of conventional tailed aircraft as it influences the size and placement of the horizontal stabilizer.

Going back to the second characteristic, there is a point near the leading edge where an air molecule actually comes to rest at the airfoil surface. This point is termed the stagnation point, and its location can be used to determine the section angle of attack (α). As the angle of attack increases from the zero lift angle, the stagnation point moves further aft along the bottom of the airfoil. See Figure 7.



The air flow around a straight wing with an elliptical lift distribution is such that the location of the stagnation point remains consistent across the semi-span. On a swept back wing, we find any segment of the wing has an effect on the upwash of the section immediately downstream and hence outboard from it. The stagnation point thus moves rearward along the bottom of the lower surface, indicating an increasing angle of attack toward the wing tip. Figure 8 provides an exaggerated illustration of this behavior on an untwisted wing.



Because of wing sweep, the effective angle of attack at the wing tip is greater than the effective angle of attack at the wing root. It's little wonder the wing tips are proportionally overloaded and subject to stalling. To maintain a constant angle of attack across the entire span, some amount of washout (leading edge down) must be imparted to the outer portion of the wing. This will reduce the tendency of the wing tips to stall first.

A Note about Washout

On a conventional tailed sailplane, it is common practice to place some amount of washout in the outer wing panel(s) to assist in reducing the tendency to 'tip stall'. The problem with this methodology when used on a straight wing is that each spanwise wing segment is seeing the air approaching at the same angle, and the local angle of attack as defined by the location of the stagnation point is entirely dependent upon the segment angle of incidence. When the entire wing is called upon to generate very small coefficients of lift the root is flying at a relatively small angle of attack, and the wing tips may be flying at an angle of attack which is below the zero lift angle. The wing tip then generates lift in the downward direction. In the 1920's and 1930's, when sailplane designers were

building wooden sailplanes with higher and higher aspect ratios, wings with insufficient torsional strength were destroyed by the aerodynamic forces generated by excessive wing twist.

On a swept back wing, the angle of attack as seen by each wing segment increases toward the wing tip. For a specific coefficient of lift, washout can therefore be used to correlate the angle of attack of the wing tip with the angle of attack of the wing root. At some particular speed (C) the entire wing will be operating at the same local coefficient of lift (c_l) across the entire span. This is not quite as good as the lift distribution of an elliptical wing, which remains elliptical over a very large range of speeds, but it is a definite improvement over an untwisted swept wing. So long as the root is developing lift, the outboard segments will continue to see an increasing upwash. While required torsional strength is dictated by both sweep and twist, it is handled well with modern design and construction materials and methods.

Are Swept Wings Worth the Effort?

From what we've said thus far, it would seem like getting a swept wing to perform in a fashion similar to the elliptical lift distribution, with its accompanying efficiency, would require a major effort. After all, the lift distribution is now dependent upon three variables – sweep, taper and twist – rather than simply taper and twist alone as with a straight planform. The addition of sweep to the design environment magnifies the number of complex computations required. At this point in our discussion, it would appear the only clear advantages to be derived from a tailless swept wing planform would come from either drag levels lower than those of a conventional tailed airplane or improved handling characteristics, both of which have the potential to significantly improve performance.

Whether the gains to be achieved are worth the time and effort involved in obtaining them has always been open to question. A synthesis of concepts and technology may change that balance in the

future. There are avenues of approach, first presented decades ago, which now look quite promising. The advent of low cost supercomputers which are able to quickly run the sophisticated software required to handle exceptionally complex iterative processes is bringing recent advancements in computational fluid dynamics to creative individuals outside the formal aircraft industry.

What's Next?

As we mentioned in Part 1, there are three major hurdles to be overcome in order to design an efficient swept wing: (1) achieve and hopefully surpass the low induced drag as exemplified by the elliptical lift distribution without creating untoward stall characteristics; (2) reduce the adverse yaw created by aileron deflection without adversely affecting the aircraft in pitch; (3) maintain an acceptable weight to strength ratio.

This column has focused on the first of these difficulties, and it would appear there may be acceptable solutions available. However, it would be quite valuable to not only achieve the high efficiency of the elliptical lift distribution, but to surpass it. Surprisingly, achieving that elusive goal may be one of the results of solving the second problem, the topic of the next installment.

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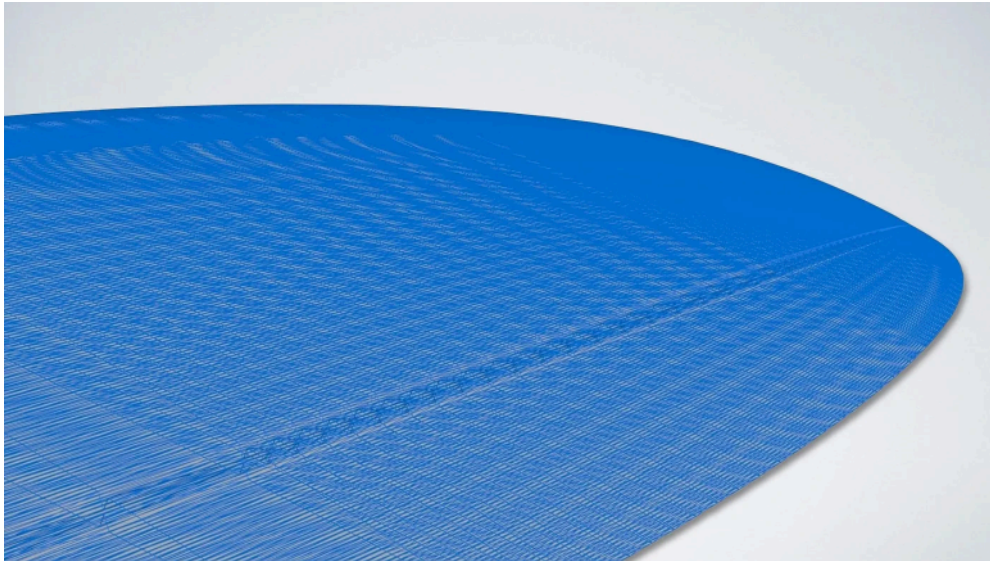
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Resources

- [*Twist Distributions for Swept Wings, Part 2*](#) by Bill Kuhlman. — The original version of this article, exactly as it appeared in the June, 2002 issue of the legacy RC Soaring Digest.
- [*Tinamou: Revisiting and refreshing an RC Soaring Digest classic from 2008.*](#) by Curtis Suter. — “I’ve always been intrigued by flying wings, especially swept flying wings. Six years ago I happened upon an article about a flying wing built and flown by Herk Stokely. See *On The Wing: A Comparison of Two Tailless RC-HLGs...*”

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Project ALTius



A wingtip wireframe.

Part 2: Getting our feet wet with 2D and 3D software workflows.

In the [first part of this series](#) the author described performance glider projects as quite complex with a lot of repetitive and complex operations. He went on to explain how CAD software can be automated in standalone separate SAD (software assisted design) apps and manufacturing can be simplified with homemade HAM (hardware assisted manufacturing) devices. With that knowledge in hand, he now proceeds with examples of how these tools are used. — Ed.

**CAD ➔ CAM has evolved to SAD ➔ CAD ➔
CAM ➔ HAM**

At the moment my collection of SAD apps is quite small. I plan to release these via my *ALT3dRC* GitHub repo — see *Software Referenced in This Series* below. My SAD apps are:

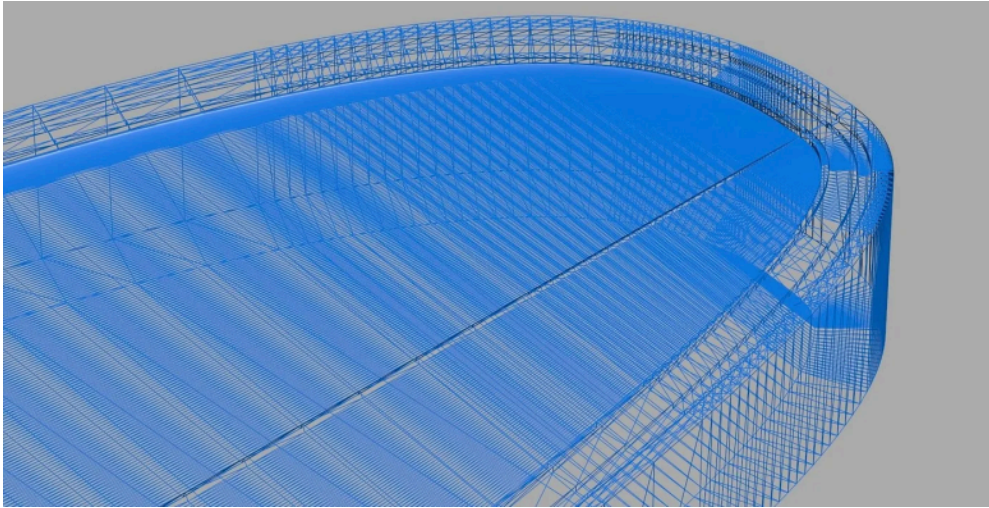
1. `3dat2dxf` – an app for drawing ribs and other wing elements such as spars, leading and trailing edges and D-boxes for a Drela-type wing. It currently supports three airfoils: center, joiner and tip.
2. `arrow` – an app for drawing ribs and other wing elements for a flying wing with a low drag and bell-shaped lift distribution based on *Prandtl-D* project from NASA.
3. `geodetic` – an app for drawing normal and geodetic ribs for a Taylor-type wing with 3D model computed by `xflrwing` immediately below.
4. `xflrwing` – an app for 3D models of wings, molds and plug segments for a Taylor-type wing. This app can currently be found in my GitHub repo.
5. `fuselage` – an app for 3D modelling for a F5J-type fuselage.

One clarification is necessary: these ‘apps’ are not your iOS or Android phone apps you can download from Apple or Google stores. Rather, they are programs written in the C programming language with a very simple, text-only interface. You can run them on any computer with a GCC compiler: a cheap Raspberry Pi / Orange PI, Windows laptop / desktop or a Mac with Intel or ARM processor.

I usually test my programs on four different platforms: Linux/ARM (RaspberryPi and a TV Box with Linux), Windows/X64 (a MacBook Pro with Bootcamp laptop and a desktop), MacOS/X64 (a MacBook Pro with Intel) and MacOS/ARM (a MacMini with M1). I started writing these programs in Windows but the goal was to be able to use these programs from a cheap SBC (single board computer) or the latest MacBook Pro or Mac Pro – with a 100x-200x price tag compared to the humble SBC! In other words I wanted to cover as much as possible from the ‘90% Windows – 9% MacOS – 1% Linux’ mix of computer users today. So don’t worry, whatever computer you have can run my SAD apps.

In the `xflrwing` repository there is a short `README` file with brief instructions how to get the GCC compiler for Windows (*MinGW*) and for MacOS (*Xcode*) and how to compile (`g++ xflrwing.cpp -o`

[xflrwing.exe](#)). For a detailed tutorial on using xflrwing please refer to the topic in the RC Groups thread linked in *Resources* below.



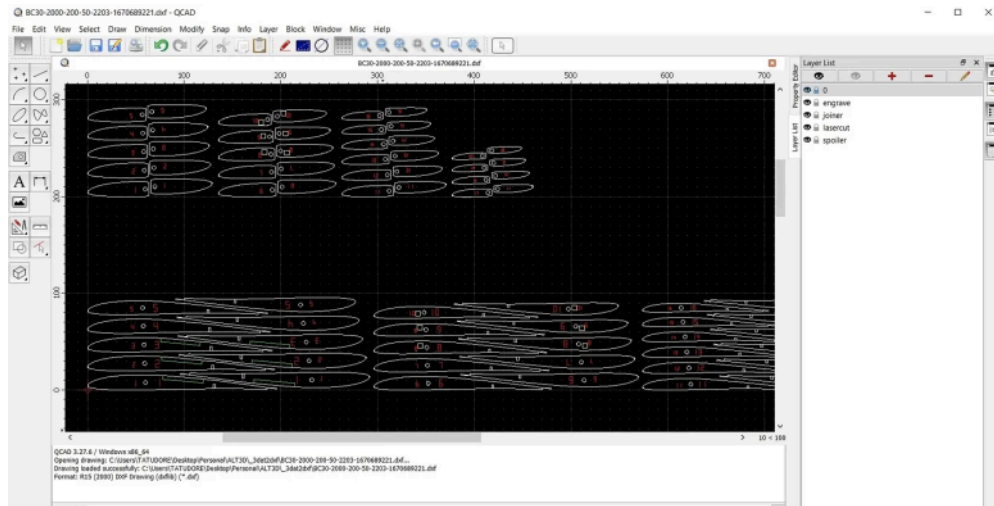
Tip of the wing in mold – notice the finer vertices on the leading edge and at the tip. Click this or any image in the article for a more detailed view.

Essential CAD / CAM programs

I have provided a hyperlinked list of all the software used or mentioned in this series: see *Software Referenced in This Series* at the end of this and future articles.

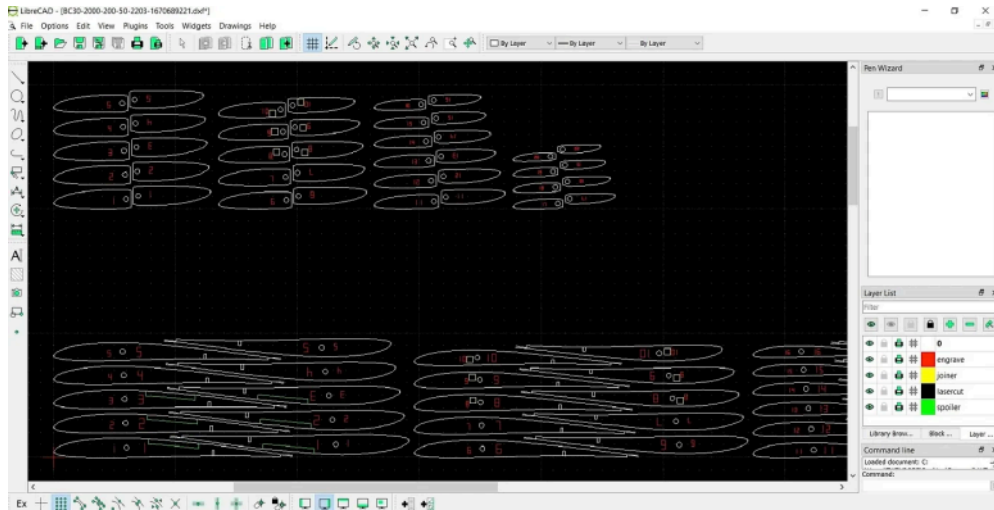
The good news is that these programs are available for free. Most of them are open source or at least you can use them for free or in some case you can pay an optional small fee. The not so good news is that it's not my intention to provide a tutorial on how to use these 3rd-party programs. You will find enough tutorials in their web pages or on YouTube and I will provide some tips and tricks for some apps in order to make your life easier.

QCAD / LibreCAD and the Typical 2D Workflow



3dat2dxf output opened in QCAD.

The main 2D CAD program is *QCAD* for creating drawings in `.dxf` format. You can download the trial program and on the first run it will ask you to do some selections. In the `Trial` sub-window on the right you can press the `Remove` button and the program will instruct you to delete some files from the `plugins` folder in order to remove the *QCAD Pro Trial* functionality and convert it to *QCAD Community Edition*. It's not limited in time and free to use. After you delete those files you will have only three files in the `plugins` folder but that's all we need. Right hand on the mouse – for selecting lines / circles with left click or deselecting with right click – eyes on the screen, left hand on keyboard ready to enter two-letters commands for lines (`LI/LA/LH/LV/LB`), circles (`CI/CR/CA/CD/C2/C3`), ellipses (`EP/EA/EA/ED`), arcs (`AR/AD/A2/A3`), splines (`SP`) then move (`MV`), rotate (`RO`), resize (`SZ`), mirror (`MI`), flip horizontal (`FH`), flip vertical (`FV`), offset (`OF`), chamfer (`CH`), round (`RN`), measure distances (`IP`) or angles (`IA`). Just explore `Draw`, `Modify` and `Info` in the menu. I'm pretty sure you will love this program and soon you will be quite proficient in *QCAD*.



The same file opened in LibreCAD.

LibreCAD has almost the same functionality but the two-letter commands are not available and you will need to get the same results with a lot more clicks of the menu. *LibreCAD* is available for some platforms where *QCAD* is not like Linux / ARM on Raspberry Pi / Orange Pi / TV box with Linux.

A typical 2D balsa project workflow:

1. `3dat2dxf` / `arrow` / `geodetic` – For drawing the ribs and other wing elements.
2. *QCAD* / *LibreCAD* – For validating / cleaning up / divide on individual balsa sheets.
3. *DXF2Gcode* / *Estlcam* – For generating the G-code for the laser cutter.
4. *LaserGRBL* / *K40 Whisperer* – For sending the G-code to the laser cutter.

Again, you can find all of these in the *Software* section below. Please note that in the case you have a K40 CO2 laser cutter you don't need step 3, above. *K40 Whisperer* will read the `.dxf` file resulted in step 2 and generate the code used in K40 controller.

OpenSCAD and NetFabb and the Typical 3D Workflow

My favourite 3D CAD app is *OpenSCAD*. It's a script-based modeller for 3D solids – in other words you can 'program' your model. With just a few lines you can define very complex 3D models by using some building blocks like `sphere()`, `cube()` and `cylinder()`. You can `scale()`, `translate()`, `rotate()` and also do `intersection()`, `union()` and `difference()` between objects. And of course you can `import()` some drawings (`.dxf` and `.svg`) or 3D objects (`.stl`/`.off`/`.3mf`) and `linear_extrude()` or `rotate_extrude()` some elements.

A typical 3D project workflow:

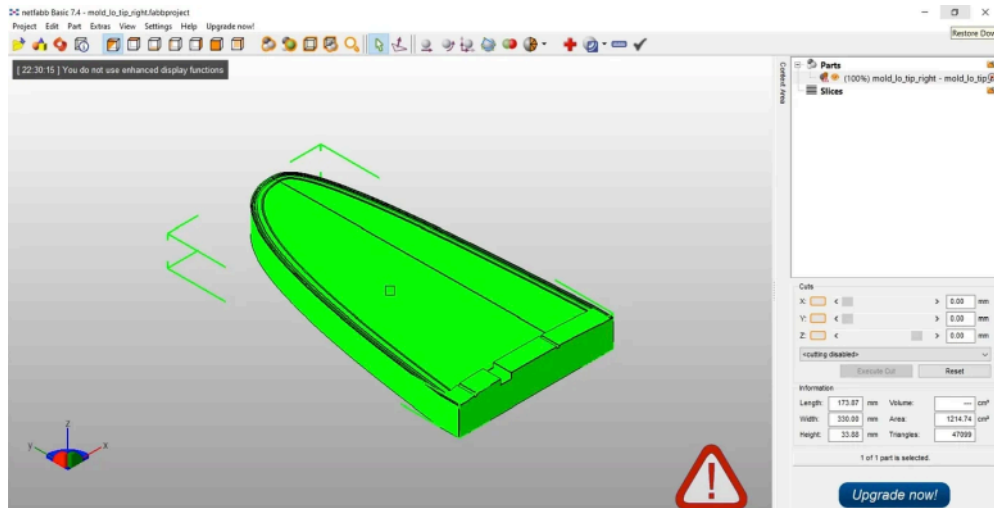
1. `xflrwing` / `fuselage` – For generating the 3D models of wing mold and plug segments.
2. *STLviewer* – For initial visualization of results.
3. *NetFabb* – For validation and repairing the 3D model.
4. *STLviewer* – For a follow-up visualization of results.
5. *OpenSCAD* – For additional changes in the model.
6. *Estlcam* or *UltiMaker Cura* (or other slicer) – For generation of G-code for subtractive manufacturing (that is, CNC) or additive manufacturing (that is, a 3D printer).
7. A G-code sender to transmit the results of the previous step to CNC or 3D printer. It may be a Java app or a simple Python script or be included in the slicer.

NetFabb – A Tool for 'Patching' 3D Models

The 3D models of wing segments, molds and plugs are extremely complex, there are a lot of fine details and very small surfaces. Sometimes for certain conditions the 3D model seems to be fine in *STLviewer* but the slicer complains that model needs small repairs. These are minor changes – 'patching' a very small hole in the 3D model, for example. It's entirely probable that in the future versions of the program there will be no need for this step. For repairing a 3D STL model in *NetFabb*.

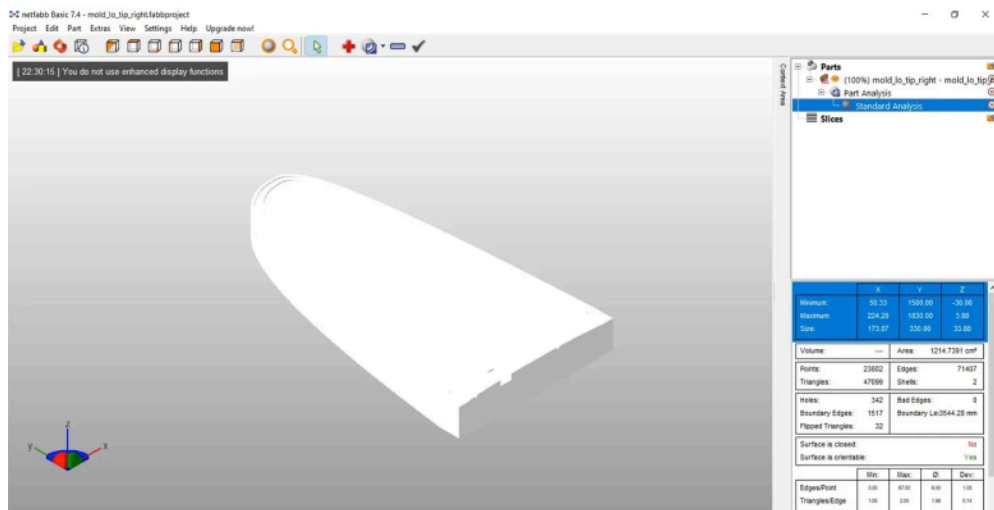
NetFabb > I accept the terms of usage...

Project > Open or Add part > select the STL file you want to repair:



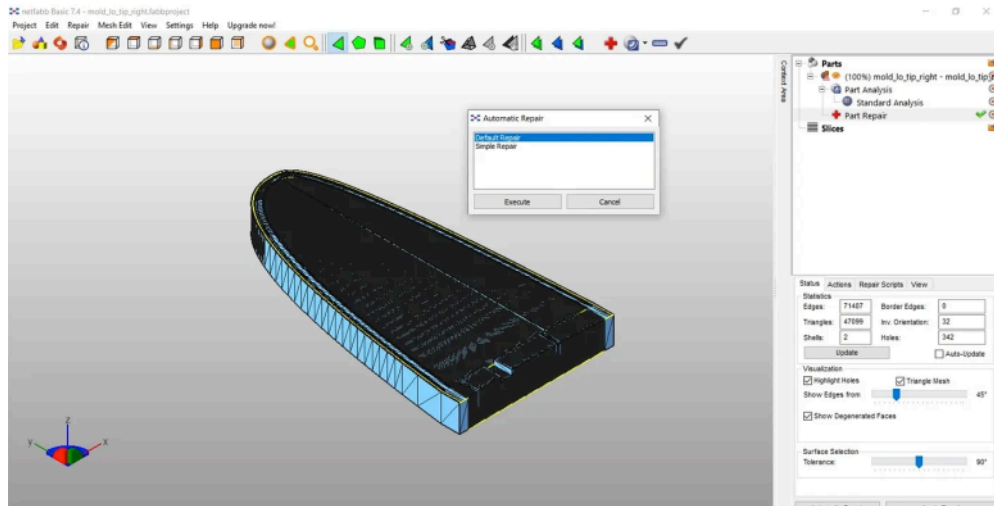
Step 1: Import part.

Extras > New Analysis > Standard analysis | In the right panel look for the surface is closed value (Yes with green, No with red)...if No then:



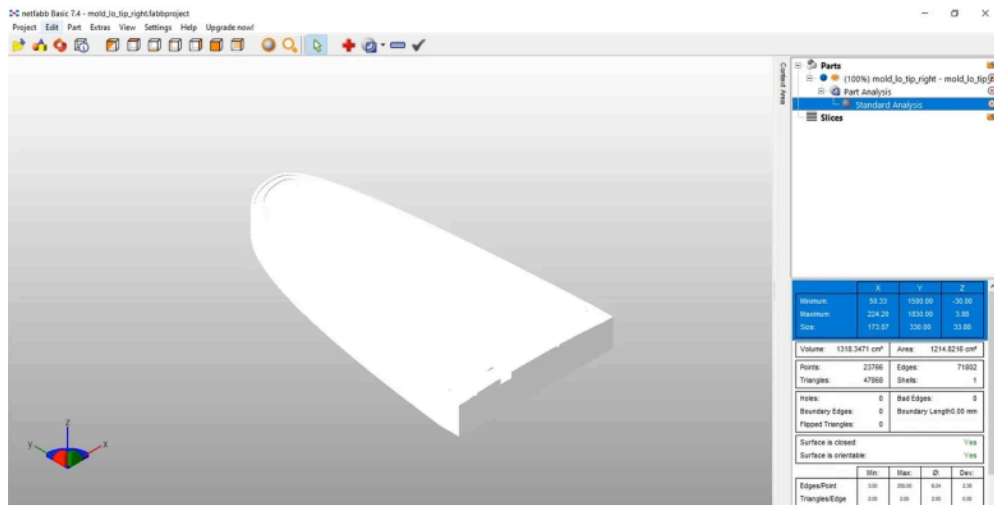
Step 2: Analysis.

Repair part > Automatic repair > Default repair > Execute > Apply repair > Remove old part



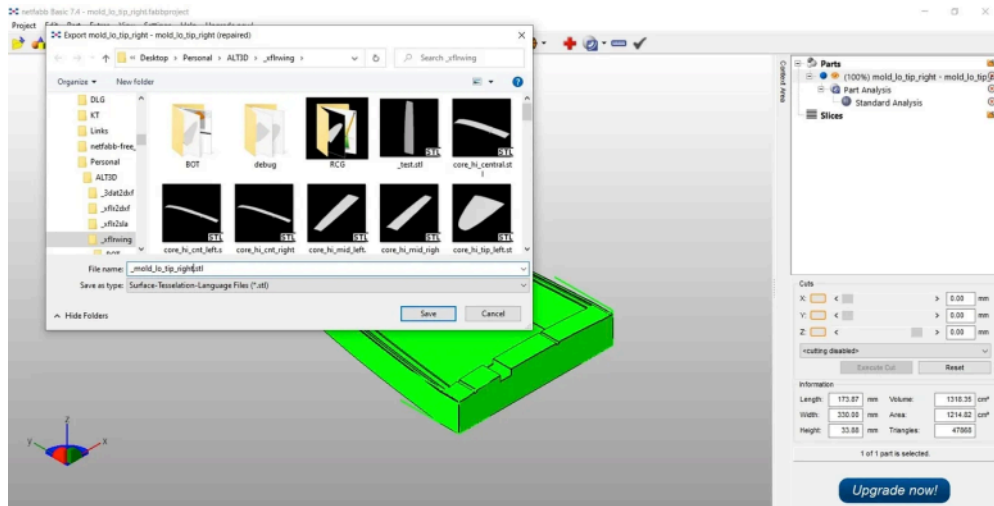
Step 3: Repair.

Extras > **New Analysis** > **Standard analysis** | In the right panel look for the **surface is closed** value. Now you should have a **Yes** part.



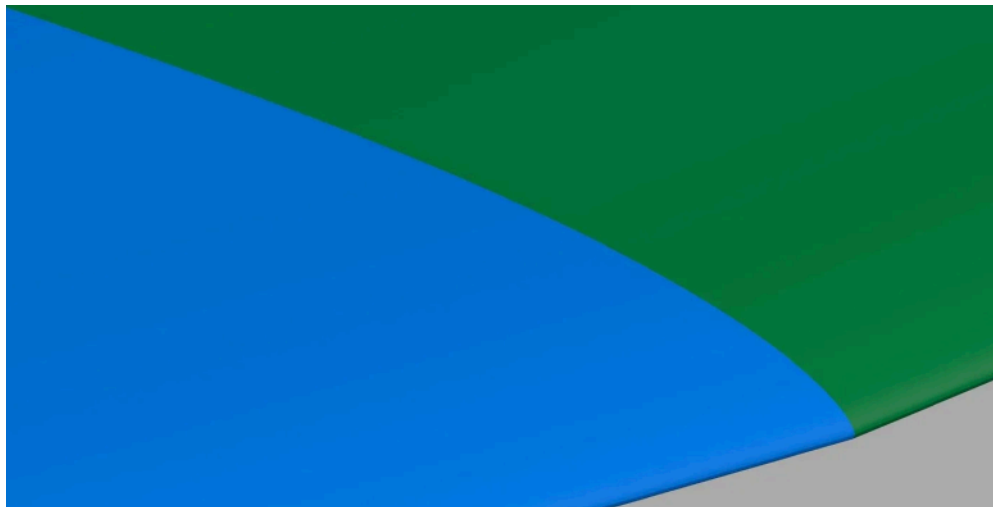
Step 4: Verify.

Export part > **as STL** | Give it a new name (I usually keep the old name and insert a_ at the start),



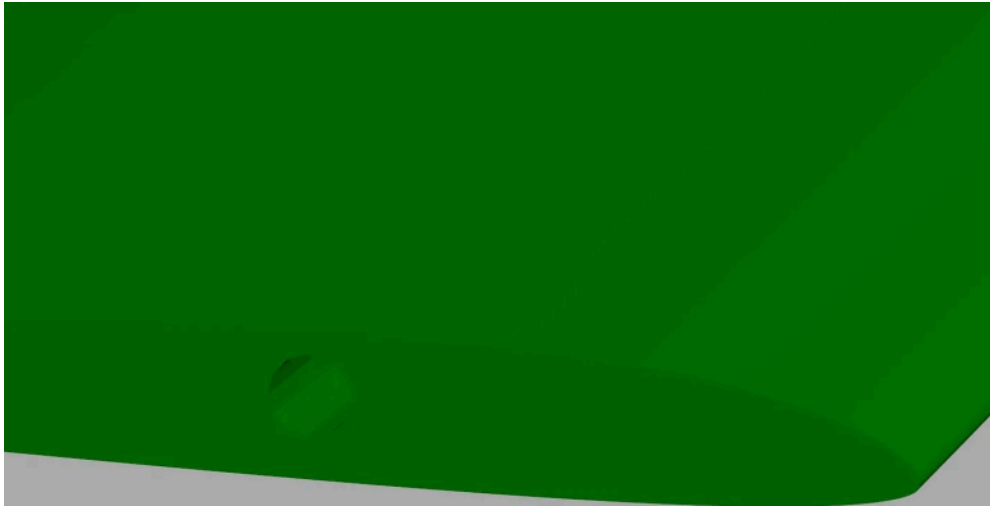
Step 5: Export model.

OpenSCAD Advanced Scripted Processing of 3D Models



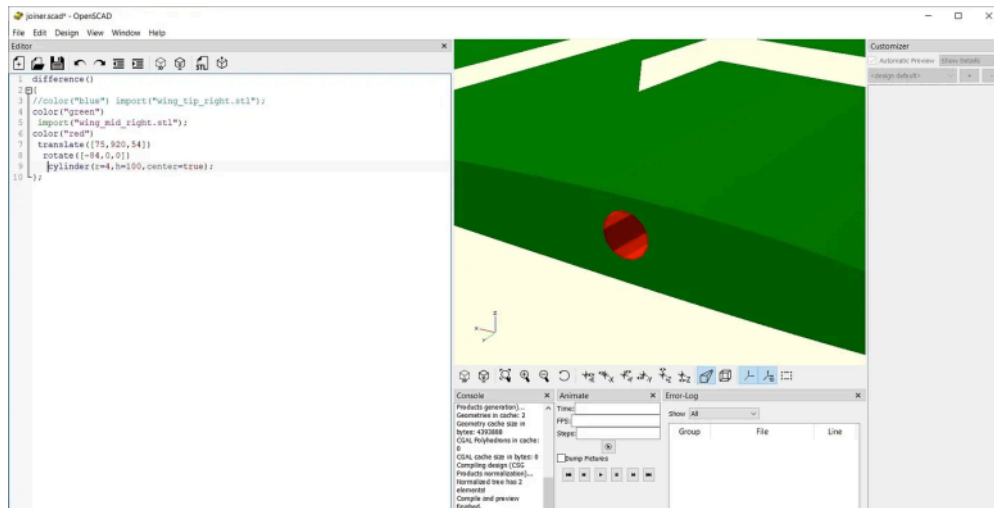
Wing segments.

The *OpenSCAD* step is needed for another reason: in my app I do not use complex binary operations between solids like intersections, differences and unions. `xflrwing` is just computing 3D coordinates and writing the STL for the wing surface and some standard mold or plug contour around the surface. Even if I do not use a complex 3D solid math, the program is quite large – around 3000 lines of code. If we want to progress from this design / CAD phase to manufacture / CAM we will definitely need these complex 3D binary operations such as intersections, unions and differences.



Wing segment with a joiner tube

For instance: we need joiners between wing segments and the simplest joiner we can use is a carbon rod which is cylinder. If a wing segment has no dihedral angle (it's horizontal) and the next segment has a 4° dihedral the simplest model for the joiner is a cylinder with a 2° inclination long enough to be able to sustain the load and short enough to be enclosed in the wing. It enters the wing closer to the upper surface and the tip of the joiner is closer to the lower surface of the wing. We need to 'carve' inside the wing segments the necessary space for this joiner. This is done by defining a simple cylinder with the good dimensions, rotate it, translate it in the area between wing segments and finally subtracting this cylinder from the wing segments. This is done very simply in *OpenSCAD* with a program of several lines. The joiner is an 80mm cylinder with a 6mm diameter rotated by $90 - 2 = 88$ degrees and translated with 30mm on the X-axis and 900mm on Y-axis and 5mm on Z-axis to get it in the right position:

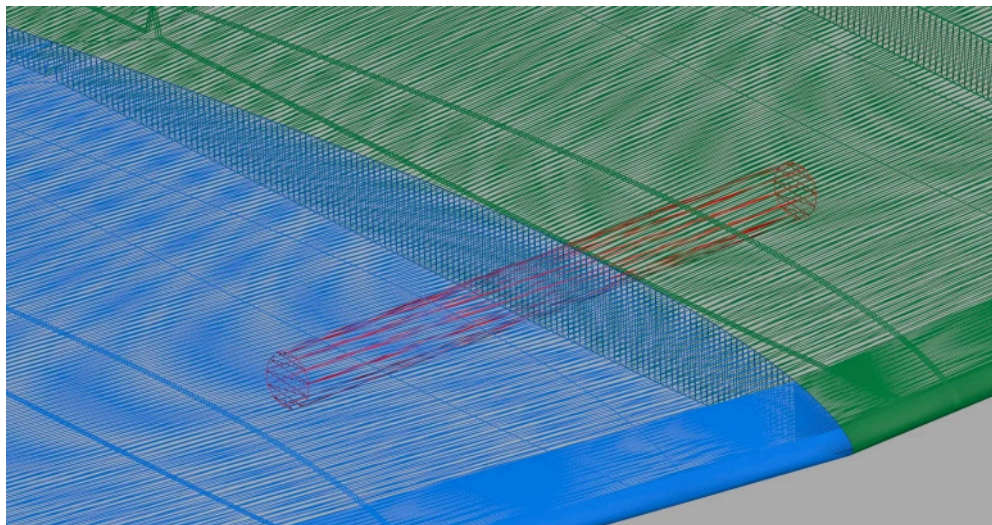


OpenSCAD – Wing segment with a joiner tube.

```

difference()
{
  import("wing_segment.stl");
  translate([30,900,5])
  rotate([88,0,0])
  cylinder(h=80,r=3,center=true);
};

```



Joiner between wing segments using low resolution ply for better visualization.

Another typical use of *OpenSCAD* is for further segmentation of a wing segment, mold or plug in a 3D object with dimensions suitable for your CNC or 3D printer:

```
intersection()  
{  
  import("mold_segment.stl");  
  translate([126,900,0])  
  cube(250,center=true);  
};
```


A Little Bit Of Homework

Beside these joiners we will need some additional 'carving' in the wing for some very usefull features like servo wire channels and maybe whatever you call that piece connecting the servo arm to the control surface. Try to write the code and see what you get.

Some advice: before a complex function like `difference()` and `intersection()` try to visualize all the components inside the function – just comment out with `//` the `difference{}` and then `{` and finally the `};`. Save the small program (click on the floppy icon), then `Preview` (the dotted cube with fast forward), then `Render` (the cube with the hour-glass) and assuming you want to save the result as an STL file, press the paper with STL.

On more trick: in the above examples `translate()` and `rotate()` are modifiers for `cylinder()` and `cube()` and the order is important. For a better view of the components you can use different colors beside the default yellow like `color("red")` or `color("blue")`.

What's Next

Once you get a pretty good set of STL files you can start planning the manufacturing. For that, you'll have to wait until next month. Between now and then, if you have any questions feel free to add them in the *Responses* section. You get there by clicking the little  below.

Thanks for reading. Until next time, best of luck with your project.

Software Referenced in This Series (alphabetical)

- [ALT3dRC](#) – The author’s GitHub repository. Currently it contains *xflrwing* with plans to upload his other SAD apps in the near future.
- [AutoCAD](#) – “2D and 3D CAD software trusted by millions to draft, engineer, and automate designs anywhere, anytime...”
- [DraftSight](#) – “The Ultimate Editor for DWG and DXF Files From The Makers of SOLIDWORKS...”
- [DXF2GCode](#) – “a tool for converting 2D (dxf, pdf, ps) drawings to CNC machine compatible GCode...”
- [Estlcam](#) – “easy-to-use software that converts both 2D and 3D designs into CNC programs...”
- [Fusion 360](#) – “Unified CAD, CAM, and PCB software...”
- [K40 Whisperer](#) – “reads SVG and DXF files, interprets the data and sends commands to the K40 controller to move the laser head and control the laser accordingly...”
- [LaserGRBL](#) – “it is specifically developed for use with hobbyist laser cutter and engraver and could be a good free and easy alternative to [other programs] for who don’t need more than a simple and effective tool...”
- [LibreCAD](#) – “LibreCAD started as a project to build CAM capabilities into the community version of QCad for use with a Mechmate CNC router...”
- [MeshLab](#) – “open source system for processing and editing 3D triangular meshes. It provides a set of tools for editing, cleaning, healing, inspecting, rendering, texturing and converting meshes...”
- [MinGW](#) – “a native Windows port of the GNU Compiler Collection (GCC), with freely distributable import libraries and header files for building native Windows applications...”
- [NetFabb](#) – “a free ... software for 3D Printing and the STL file format...”

- [OpenSCAD](#) – “software for creating solid 3D CAD models. It is free software...”
- [QCAD](#) – “a free, open source application for computer aided drafting (CAD) in two dimensions (2D)...”
- [SolidWorks](#) – “SOLIDWORKS® and the 3DEXPERIENCE® Works portfolio unite your entire ecosystem...”
- [STL Viewer](#) – “simple application to view STL files...”
- [XFLR5](#) – “an analysis tool for airfoils, wings and planes operating at low Reynolds Numbers...”
- [UltiMaker Cura](#) – “prepare prints with a few clicks, integrate with CAD software for an easier workflow, or dive into custom settings for in-depth control...”
- [Xcode](#) – “includes everything you need to develop, test, and distribute apps across all Apple platforms...”
- [xflrwing](#) – “STL generator for an XFLR project wing...”
- [XFOIL](#) – “an interactive program for the design and analysis of subsonic isolated airfoils...”

Resources

- [G-code](#) on Wikipedia. – “the most widely-used computer numerical control (CNC) programming language. It is used mainly in computer-aided manufacturing to control automated machine tools, as well as from a 3D-printing slicer app...”
- [Project ALTius / Part I: A simpler approach to high-performance glider development using CAD/CAM.](#) – “altius, citius, fortius – sounds familiar? That’s the Olympic motto where ‘altius’ means ‘higher’. But the spelling (ALTius) is related also to my initials – Atudorei Lucian Tiberiu...”
- [Prandtl-D](#) – “the aircraft features a new method for determining the shape of the wing with a twist that could lead to an 11-percent reduction in drag...”
- [Project ALTius](#) on RCGroups. – “altius, citius, fortius – sounds familiar? That’s the Olympic motto where ‘altius’ means ‘higher’.

But the spelling (ALTIus) is related also to my initials – Atudorei
Lucian Tiberiu...”

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](#).

Disposable Gloves



(credit: Gougeon Brothers Inc. | Proto INSA Club)

Don't overlook the importance of this humble piece of PPE.

Kicking off this month, we are delighted to present selected articles from Gougeon Brothers, Inc. excellent in-house publication Epoxyworks. We afford ourselves the luxury of a printed edition, which is cause for celebration every time it lands on our doorstep. See Resources for how you, too, can subscribe which we highly recommend. Heartfelt thanks to Logan Gougeon for her tireless efforts in setting this up. — Ed.

Most epoxy systems can cause skin irritation or allergic skin reactions. Hardeners can be particularly severe skin irritants and sometimes can even be moderately corrosive to skin tissue. Consequently, you should always protect your skin from epoxy with protective clothing and gloves.

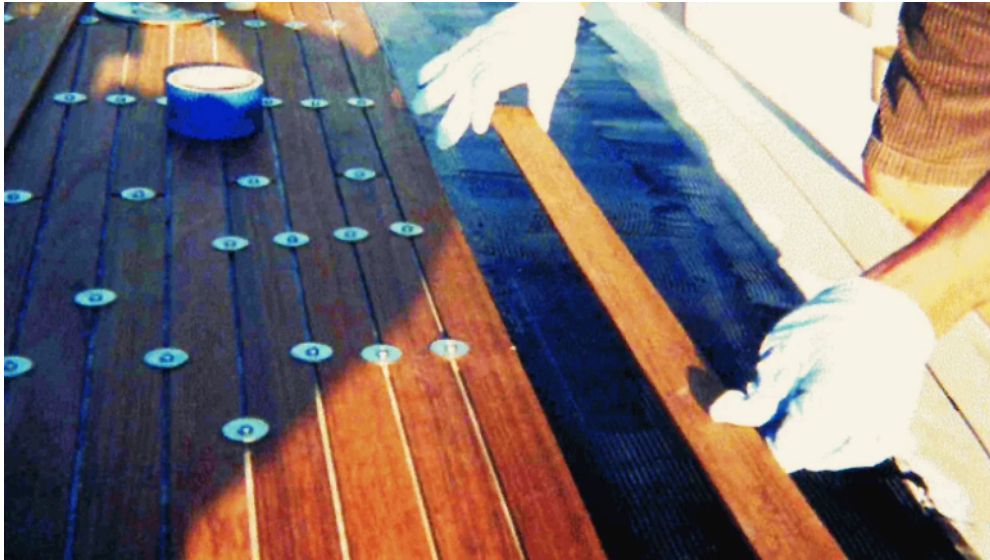
Disposable gloves are the most convenient and economical hand protection for use with epoxy, but they do have limitations. One

challenge is finding the right disposable glove that will stand up to the chemicals in both the resin (Part-A) and the hardener (Part-B). Both resins and hardeners have components that attack glove materials differently and at different rates.

Your typical 4–6 mil thick disposable nitrile, neoprene, butyl rubber, natural rubber, or latex glove can withstand up to 30 minutes of working with epoxy before it degrades. When the gloves begin to degrade, epoxy chemicals can permeate the membrane and reach your skin. For longer jobs, replace used gloves with a new set before the 30-minute mark. These types of gloves offer the suggested protection for general epoxy use, based on tests and data provided by chemical and glove manufacturers. WEST SYSTEM® offers a neoprene 4-mil disposable glove, part numbers 832–4 and 832–50, that works well for these quick jobs. Other disposable glove materials, such as vinyl and polyvinyl chloride (PVC), degrade faster when exposed to epoxy and allow chemical breakthrough to occur quickly.

In addition to material, breakthrough rates are determined by the thickness of the glove. The thicker the glove, the longer it will take for breakthrough to occur. Keep in mind that breakthrough and degradation can occur with the recommended glove materials, but it will take longer to occur. To date, there is no 'all-purpose' disposable glove that will withstand exposure to a wide range of chemicals, be durable enough to last a long time, and still be thin enough to provide the desired dexterity.

By knowing what to look for in proper hand protection, and using these guidelines to wearing gloves effectively, you will be able to work safely with epoxy.




Guidelines

The following can be used to provide the best hand protection while using disposable gloves:

1. Use a **protective barrier** cream underneath the disposable glove to provide secondary protection in case a glove should tear or puncture. You should not depend on the barrier cream to provide primary hand protection by itself.
2. **Double layer** your disposable gloves. This will ensure you always have an uncontaminated pair underneath. Periodically (every 20–30 mins.) replace the top glove before it degrades or gets damaged. You can use cotton liners under liquid-proof gloves to absorb sweat and add comfort.
3. **Replace gloves** carefully. Carelessly removing and re-donning gloves can cause additional, unnecessary epoxy exposure. The most common technique is to peel the gloves off inside out, one at a time, being careful not to contact the wrist area with a contaminated glove.
4. **Dexterity & Sensitivity**. Disposable gloves are favorable for projects where dexterity and fingertip sensitivity are necessary. Conversely, for longer projects, where gloves may be immersed for an extended period of time, and where dexterity is not as crucial, a

thicker glove may be the right choice. This is especially true if you can't change your gloves frequently.

5. **Try Different Materials.** It is well known that materials used in manufacturing latex gloves can cause allergic reactions in certain individuals. If this affects you, try using a nitrile, neoprene, butyl rubber, or natural rubber disposable glove instead.

Thanks for reading and if you have any questions, you can add it to the *Responses* section below (click the  below) and contact information can also be found in the *Resources* section that follows.

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Resources

- [Epoxyworks](#) – The excellent quarterly magazine published by Gougeon Brothers, Inc. of Bay City, Michigan which produces the WEST SYSTEM® and PRO-SET® lines of epoxies. You can sign up for your own free subscription with this link.
- [Disposable Gloves](#) – This article as it originally appeared in *Epoxyworks* magazine.
- [WEST SYSTEM® and PRO-SET®](#) – While these likely need no introduction to RCSD readers, these are “marine-grade epoxies used around the world in the commercial, marine, aerospace and industrial composite markets.”

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KAVAN Twin Shark 304TS



Blue sky and a nice looking plane!

A nice-looking, semi-scale EPO glider with performance similar to its full-size cousin.

While this article appears under my byline, note the excellent pictures were a collaboration with Joël Marin to whom I offer my thanks for helping to create this article. – PR

Introduction

KAVAN, a well-known manufacturer in the world of aeromodelling, has been offering for a few years a range of EPO (expanded polyolefin) foam kits, planes and motor gliders. New for 2022 is a pretty cute baby of 2.7m wingspan, a semi-scale model of the Czech company HpH's *Twin Shark 304TS* full-size glider, a modern two-seater. This is the review of this new kid on the block.



The look of this Twin Shark is really nice.

A Few Words about the Full-Size Glider

The design of the *Twin Shark 304TS* started with the idea of creating a tandem glider as attractive and performing as well as a single-seater glider *and* capable of competing in the FAI *20m Multi-Seat* class. The aerodynamic performance of the *Twin Shark* is the result of extensive aerodynamic studies and wind tunnel tests. It is based on the experience acquired on the single-seater *Shark* model. The optimal elliptical leading edge and winglets are made possible by CNC machining. Additional performance is achieved by the downward tailplane tips. The spacious cockpit with a one-piece, side-opening canopy provides exceptional visibility for both pilots. The main cockpit features that made the *Shark* cockpit popular have been retained in the *Twin Shark*. The full-size *Twin Shark* is available in a powered version – employing a retractable pylon and soon in a version with a small and retractable jet engine – a ‘jet sustainer’.



Nice resemblance between the full-size model (bottom left) and the scale model shown in the other photos.

The RC Model from Kavan

KAVAN's model is very similar with a high aspect ratio wing with very thin winglets, a very similar fuselage shape and the same canopy shape with the small recess at the rear end. Only the tailplane is a little bit different with a bit more surface, but it still has the

characteristic downward tips of the full-size glider. The vertical stabilizer also has a bit more surface. It should be noted the kit is manufactured under official license as indicated on the box. Kavan has even gone to the detail of providing a flyer of the full-size glider, should you wish to change the RC model for the real 20m version!



The advertising brochure of the full-scale glider provided in the kit.

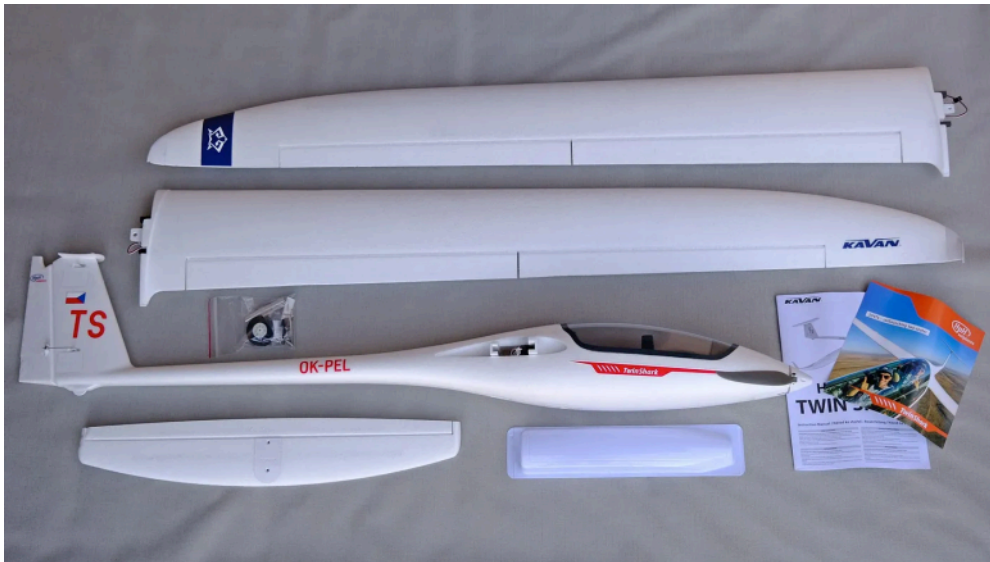
A Very Complete Kit

Now let's take a closer look at the contents of the box. The kit arrives in a large cardboard/polystyrene box, very well designed, but very bulky which will nevertheless remain perfect to store the model or to transport it even if it takes up a lot of space in the boot of the car. The *Twin Shark* is only offered in an ARTF (almost ready to fly) version. Only the propulsion battery and the receiver are missing. No options either, everything is in the box!



The bulky cardboard box which hosts the Twin Shark kit.

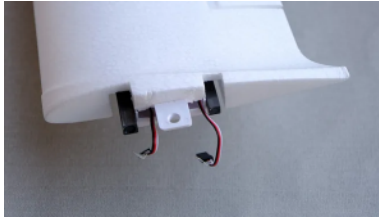
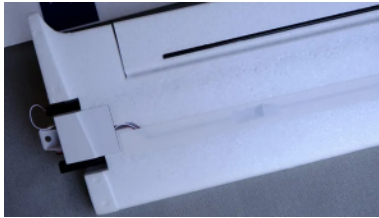
The high aspect ratio wings are of beautiful workmanship, the surface is very beautiful and without visible extraction holes. Wing tip ends with a very thin and pronounced winglet in plastic glued permanently. They are not removable, which will make transport more complicated once the glider is dismantled.



The kit, complete, ARTF and nicely assembled. Just missing the receiver and the propulsion battery.

The double carbon spars of different lengths can be seen with the natural transparency of the wing. The main spar – a square section of 10mm x 10mm – runs quite far on the wing. The second spar – smaller at 8mm x 8mm – stops at the aileron servo. Their presence presages good rigidity in bending and in torsion. These same spars protrude from the root of the wing and act as wing joiners. They come nested in an aluminum profile located in the fuselage, a part which gives the dihedral and maintains the wings laterally.





Detailed pictures of the wings out of the box.

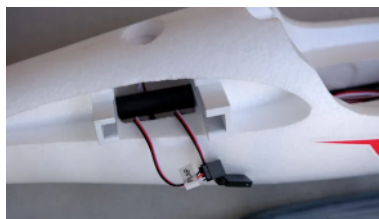
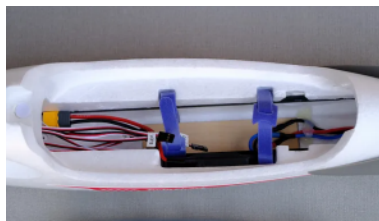
The flaps and ailerons are rigidified by a carbon rod or tube of 3mm of diameter on 80 to 90 % of their length. The plastic horns with central 'domino' already have a different angle of attack between the flap and the aileron in order to obtain mechanically the right differential. The servos and extension leads are of course installed and connected. The cut-outs are then masked with white vinyl.

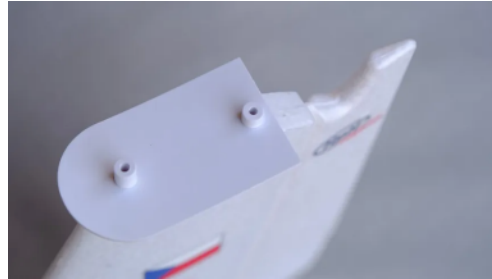
The tailplane is built in the same way, with a spar and a carbon tube or rod insert in the elevator flap to give rigidity.





The fuselage is molded around a large carbon tube that runs to the vertical stabilizer and provides stiffness. The rudder and elevator servos are respectively housed in the rudder foot and at the top. They are in direct attachment by means of a piano wire. The horns are of the same type as on the wings, with a central rotary 'domino' and removable, which will be convenient to remove the stab at the end of the flight session. At the front, once the canopy is removed (without pilot, too bad!), we discover a large volume which will allow the use of a large variety of propulsion batteries. By the way, I find that the canopy magnet is not strong enough for good retention.





Some details of the fuselage. Under the canopy there is a lot of space.

The KAVAN *C3548-750* brushless motor and its 11x8" folding propeller, as well as the 50A KAVAN *R-50SB* controller with SBEC (switching battery eliminator circuit), capable of powering the six servos are in place and do not encroach on the inner volume. You will just have to find or buy a 4S LiPo battery 14.8V 2600–3300 mAh (at least 30C) to provide the watts to your *Twin Shark*.



The Twin Shark needs a 4S battery – here of 2600mAh capacity which already give a long flying time.

The locking of the wings on the fuselage is done by a big plastic screw which is at the top of the fuselage. It is simple and effective.

All the assemblies are of good quality and the decoration is done. In short, all that remains is to connect a five or seven channel receiver and a propulsion battery. I forgot to mention the accessory pocket which allows you to install a fixed wheel quickly, and a plastic landing skid to cut and glue under the fuselage to protect it from scratches. The wheel and the skid can easily cohabit. For my part, I only put on the skid, glued with Loctite *60 Sec. Universal Glue* (see *Resources*), a kind of cyanoacrylate gel and slow curing that offers a good bonding in the end.



The accessories with the optional wheel and a few Allen wrench tools allowing to disassemble the tailplane or do some maintenance if needed. On the right the skid, provided.

I found it surprising that the flap servos are with plastic gears while the aileron servos are with metal gears, which is a guarantee of a better lifetime. But for me, the most annoying thing is the Y-cable harness provided by default for the ailerons and flaps. This limits the mixing possibilities and restricts the flight range. However, I

understand the logic behind this choice, which is indicated in the manual that comes with the kit. So, if you want to 'open the chakras' of your *Twin Shark* and thus benefit from a real 'quadroflap', 'butterfly', or variable camber then plan the purchase of four male-female extension leads of 20cm to 30cm in length – it should not ruin you financially.

In Flight, Very like a Much Larger Glider!

On a glider with high aspect ratio wings, performance and behavior are most often dictated by this geometry, and this is verified with the *Twin Shark*.



The author with smile and not worried before the first flight

Before talking about the flight behavior, a short word about the motorization. The climb rate is very good, thanks to the use of a 4S battery. The climbs are decisive with a rather steep angle – more than 45° – and enables the glider to reach a comfortable altitude quickly. That's ideal in the mountains to get out of a bad situation or at a flat field to go up sufficiently high to hunt thermals. This also means a good autonomy, because we can hope to get a significant number of climbs from a single battery. During my flying sessions, certainly on the slope but sometimes in light conditions as well, I never managed to go to the end of the battery. At the field, this good point is more

appreciated. After this side consideration, let's turn off the engine and see how the glider behaves.

The first flights were done in the factory configuration – the ailerons on one channel and the flaps on another – which does not allow to move up the two ailerons at the same time during the landing phase or to have the flaps acting on the opposite in quadroflap mode. In this configuration, the glider is quite usable and functional, the flight is pleasant, the ailerons are sufficiently precise, the landing is not problematic with the flaps down to the maximum, even if it lengthens a little more. But the limit is felt at high angles and when you try to do aerobatics and you need more efficiency in roll.





A superb look and a flight behavior rather dynamic makes of the Twin Shark a pleasant glider, but aimed at pilots already have a first experience with three-axis piloting.

For the rest of the flight tests, let's go to the ideal configuration by replacing the two Y-cables with the four male-female extensions of 20cm to 30cm.



Flyby!

In flight, the glider has a rather fast cruising speed, it covers the distances with ease. It accelerates well, can transit at sustained speed and recovers well when you release the stick. This is interesting to explore the flight volume with efficiency.

The spiral must be worked with the rudder, with the ailerons at the opposite. If the lift is rather strong, you can put a little flap to increase the rate of climb. On the other hand, you can't tighten the spiral as you could do with an F5J or a more 'specialized' glider, here the spiral remains of a larger diameter.



Action!

Overall, I found the wing section more efficient when it is neutral with no deflection. Remain also at low speed and at high angles, the small wing chord reminding you of its limits at first nicely, but if you ignore the message, then more frankly.

The *Twin Shark* has a real presence in the air and remains a pleasure for the eyes with its shape and thin wings. You can't get enough of making flybys over and over again to enjoy its very sexy look!

Let's move on to aerobatics: with such a high aspect ratio, the *Twin Shark* is not really made for this exercise, at least on paper. However, the basic aerobatics are not a problem. The roll must be 'worked' to be true in axis. One can help a little with the rudder in the last quarter. In any case, you need to have enough speed before starting the maneuver. The reversal goes perfectly with a sufficient efficiency of

the rudder. We kick a little before the glider stops, which favors the bite of the vertical stabilizer. Eventually you can 'cheat' a little on the ailerons in case the glider does not come out on the right axis, or does not tip over fast enough.

Looping is easy with a little bit of speed at the entrance. If the glider is well positioned in relation to the wind, it will remain well-oriented. If not, a small aileron correction will put it back on the right trajectory.

The stiffness of the glider's airframe is quite good, it bends a little under stress, but this remains acceptable and adds to the realism of the flight.



Some onboard pictures.

Finally inverted flight – with the CG at the rear limit of the manufacturer's CG range – holds but when the conditions are rather good. We don't wait too long for the speed to decrease to put it back on the level in order to always have efficiency on the ailerons.



A nice place to fly in the heart of the French Alps!

Finally, the landing is a simple formality with the butterfly mix. With the elevator compensation trim set correctly, the approach at low speed and the final landing are done without worries, and you can easily control the descent slope with the elevator.

Before concluding, I'm sharing two videos of the model. The first being from the ground:

and the second from onboard:

It's Time to Leave!

The *Twin Shark* from KAVAN is a semi-scale model with a particularly nice look and close to the full-size glider. It offers good performance in flight and a rather dynamic behavior for a very reasonable price compared to the competition. The assembly is of high quality and allows the modeler in a hurry to fly in a few minutes. The *Twin Shark* is clearly positioned as a formidable outsider to the market leader. Just like its competitor, it is not aimed at beginners but at three-axis pilots sided able to combine ailerons and rudder. Happy landings!



Resources

- [KAVAN Twin Shark 304TS](#) – “now you can enjoy flying with our 2700mm wingspan semi-scale model of this beautiful sailplane powered by a brushless motor...”
- [HpH 304 Twin Shark](#) – The full-size version of the aircraft presented in this article.
- [Loctite 60 Sec. Universal Glue](#) – “the first all-purpose glue that bonds in only 60 seconds. No more waiting and no more clamping! It quickly forms strong bonds...”

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](#).

Science for Model Flyers



“Captured this most beautiful eagle stretching his wings.” But mostly, just look at those eyes. (quoted caption/photo: [Shraga Kopstein](#) via [Unsplash](#))

Part V: Evolution and Visual Acuity

Although by no means is it a prerequisite, you may want to read the [preceding parts of this series](#) before reading this final instalment. – Ed.

Our bodies are wonderful machines. The story of how they evolved over time is a fascinating one. The drive in nature to breed selectively those random ‘favourable variations’ that improve survival to reproduction age have resulted in very ingenious but sometimes imperfect devices, a good example being our eyes. Jim Smith wrote an excellent article in a the December 1994 edition of the RC Soaring Digest, which I have inset below. Don’t forget that there are great articles in the legacy RC Soaring Digest archive dating back to 1984 (see *Resources*). But before I get to Jim’s article here is an explanation of how our eyes work.

People with all kinds of disabilities can enjoy our hobby. There is one that rules it out and that is poor eyesight. Fortunately science now enables us to correct or cure many minor faults. If I take on a trainee one of the first things we talk about is vision. It pays therefore to know about the eye. As you will see, even if you have excellent eyesight there are still traps you can fall into.

So far in this series of articles we have talked about reflection and diffraction. For understanding our eyesight we now need a new term, refraction.

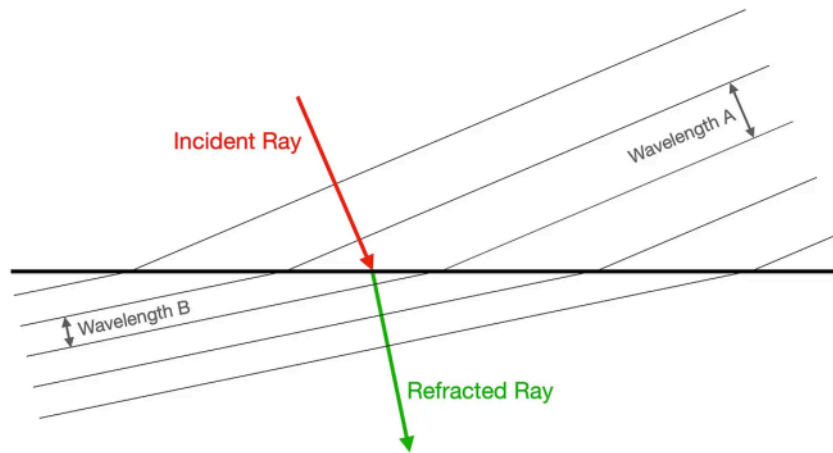
Refraction

In a vacuum light always travels at about 300 million metres per second (m/s). In other transparent media such as air, plastic, diamond, water and glass it goes more slowly depending on density. Its frequency can't change or else its colour would. The only thing in the equation $c = f \lambda$ that can change is the last term lambda λ , which as you now know is wavelength. So when light slows down its wavelength drops, called refraction.

Why does refraction matter to us as flyers? Because it is how we see our models clearly and how we take sharp pictures and videos of them.

A new type of diagram was devised by Christiaan Huygens in 1678. He drew lines representing the peaks of a series of waves that he called wavefronts. You might have watched similar waves in a ripple tank in a science lesson at school. Wavefront diagrams allow us to see waves in two dimensions.

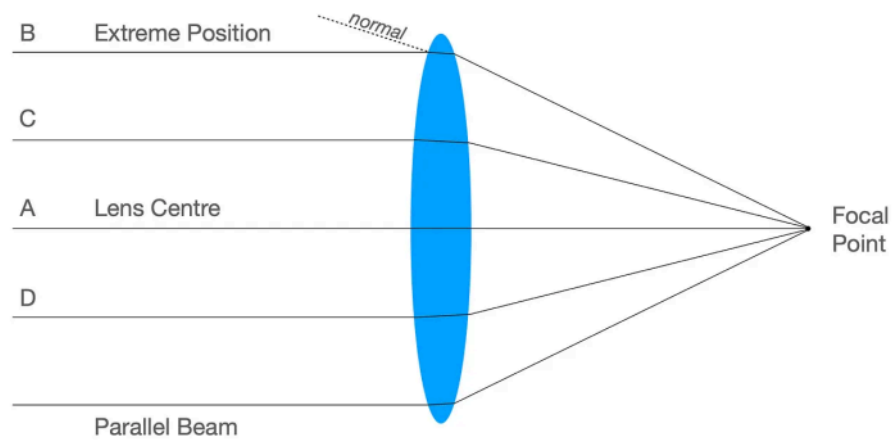
In Picture 1 you see the wavefront peaks hitting the surface at an angle between the air (above) and glass (below). They slow down and simple geometry shows us that the reduction in wavelength gaps between the peaks from A to B causes the waves to change direction. The greater the angle at which the incident rays hit the surface the greater the change in angle.



Picture 1: A simplified notion of refraction.

Refraction is how lenses work and diamonds sparkle. It is also why a prism produces a spectrum of colours, as different colours with different wavelengths change angles differently. Incidentally take a look at the the sleeve of the *Pink Floyd* album *Dark Side of the Moon*. One day, out of the blue my boss asked me to stay after work to help a photographer take a picture of optics in my lab. Turned out that's what it was for.

Let us look at the shape of a lens in Picture 2. As you see, a parallel beam of light hits a curved lens surface at different angles in different places. At the lens centre it does not change direction at all. At the extreme position it has maximum deflection – the line labelled *normal* is at right angles to the surface at that point. The curved surface will cause the straight wavefronts to become curved. A parallel beam will come to a single point called a focus if the surfaces are curved accurately. Faults in a lens' curvature are called spherical aberration. The ability of a lens to change the direction of light is called its optical power, usually measured in dioptres. You take the dioptre number, say four, and divide one metre by it. That gives the distance from the lens centre to the point at which the lens can focus a parallel beam of light. In the case the focal point will be 250mm away.



Picture 2: A lens used to concentrate 'beams' of light at a point.

As I mentioned above different densities of media cause differing deflections. That is why equally powerful lenses will have differing thicknesses depending on the type of plastic or glass they are made from. And of course the best, 'high refractive index' ones cost a lot more don't they? When I lived in London I used to visit the *Design Centre* to see the latest clever designs. They were expensive. I wondered then why good looking objects had to cost more. After all they were all mass produced using similar techniques and materials. So naive!

Christiaan Huygens (1629–1695)

Huygens was born on 14 April 1629 in The Hague in the Netherlands, into a rich and influential Dutch family. Christiaan was educated at home until the age of sixteen, and from a young age liked to play with miniatures of mills and other machines. From his father Constantijn he received a liberal education including languages, music, history, geography, logic and rhetoric, alongside dancing, fencing, and horse riding. He corresponded with intellectuals across Europe; his friends included Galileo and Descartes.

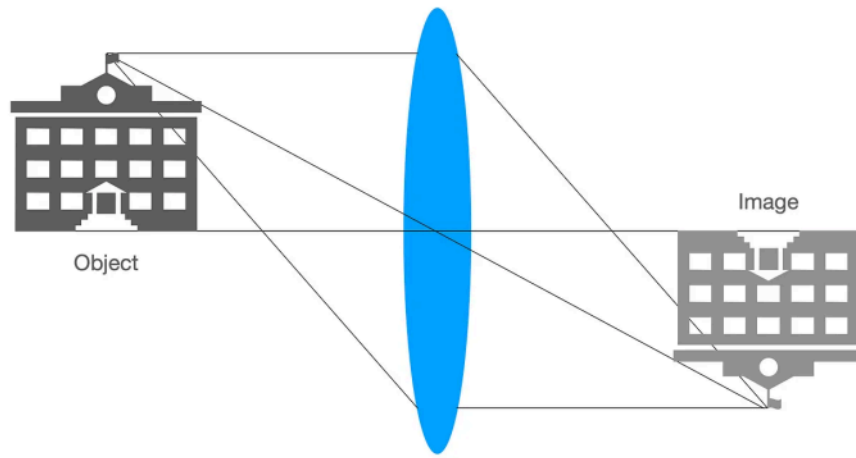
He was a mathematician, physicist, engineer, astronomer and inventor, and regarded as one of the most important figures in the scientific revolution. In physics, Huygens made seminal contributions to optics and mechanics, while as an astronomer he

is chiefly known for his studies of the rings of Saturn and the discovery of its moon Titan. As an engineer and inventor, he improved the design of telescopes and invented the pendulum clock, a breakthrough in timekeeping, remaining the most accurate timekeeper for almost 300 years. An exceptionally talented mathematician and physicist, he was amongst the first to use mathematical methods to explain phenomena. As a result, he has been called the first theoretical physicist.

Huygens is especially remembered in optics for his wave theory of light, which he first communicated in 1678 to the Académie des Sciences in Paris. Huygens' theory was published in 1690 under the title *Treatise on Light*. It posits light as radiating wavefronts, at right angles to the actual light rays. Propagation of the wavefronts is then explained as the result of spherical waves being emitted at every point along the wave front (known today as the Huygens–Fresnel principle). This was the basis for the advancement of physical optics, explaining all aspects of light propagation until Maxwell's electromagnetic theory that resulted in quantum mechanics and the discovery of the photon.

Two Other New Words Are Object and Image

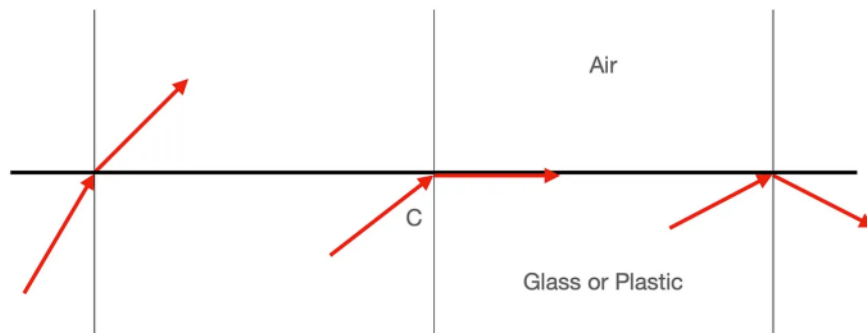
In Picture 3 we see three 'rays' of light going from the top of the object being viewed through various parts of the lens. This changes their directions and brings them together to form an image that might be different in size depending on the 'power' of the lens. This image might be on the retina or the sensor in a camera. Notice the light from each part of the object goes through every part of the lens. As you cover part of the lens it just reduces the brightness not the image size or sharpness.



Picture 3: Various 'rays' of light passing through a lens.

Total Internal Reflection

This is important to you for two reasons. First it explains how you receive this magazine, through fibre optics, all or part of the way from the data centre. Secondly it can cause strange optical effects when there are warm and cold air layers that might conceal a model or make it appear to be in the wrong place, and it can cause mirages.



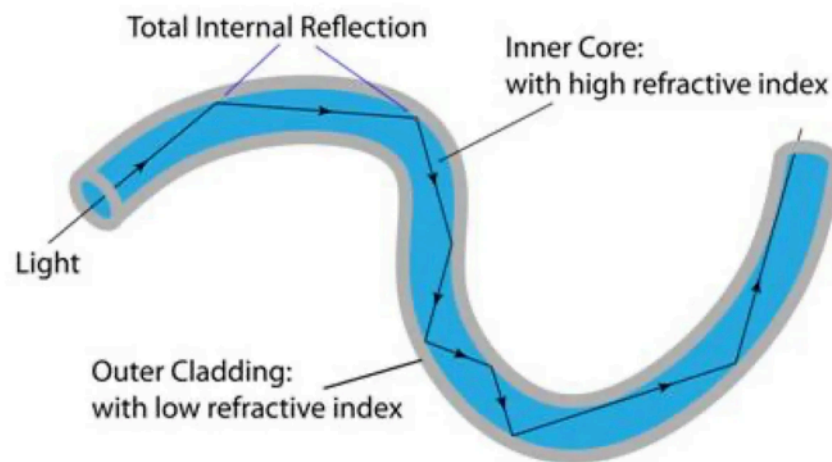
Picture 4: The effect of the critical C as compared the effect at lower and greater angles.

In Picture 4 you see three different situations. In the one on the left light is leaving glass or plastic into air at a small angle to the right angle *normal* line. If the angle increases the refracted ray's angle does too. Eventually, as in the middle case, the light moves along the interface and does not leave the heavier medium at all. Angle C is called the critical angle and depends on density and other things. Increase the angle further as shown on the right and the light reflects back at the same angle as it hits. This is called total internal

reflection. The value for C is around 45° for most materials but for diamond it is 24° . This means that light will bounce around inside a diamond a great deal before it is able to leave it at less than 24° . That is why a diamond sparkles and why the angles at which the many faces are cut are important.

Fibre Optic Cable

In Picture 5 you see light being internally reflected along a transparent fibre. The fourth reflection is at quite a steep angle but not quite enough for the light to break out of the cable. Fibre cables should not given very sharp bends.



Picture 5: Light moving through a fibre optic cable. (credit: one-school.net)

Faults and Their Correction

What faults do we flyers and trainers have to watch out for? Some can be fixed but not all. Here are the fixable faults:

- Lenses become stiffened with age and don't change shape so well, causing blurring that needs corrective glasses.
- The muscles that stretch the lens become weaker, also needing corrective glasses, though some say exercise can help.
- Have you noticed how a long day looking into the distance when flying can counteract the effect of aching eyes due to lots of close work?

- Lenses can become cloudy, also called cataract, which is usually due to exposure to ultraviolet from the sun. Always get your glasses and sunglasses treated with a UV coating. The operation for cataract is almost miraculous according to friends I know who have had it. The lens is then fixed in shape so you have to choose between needing glasses for reading or for distant vision.
- Laser treatment is available to reshape the eye lens permanently to correct faults.

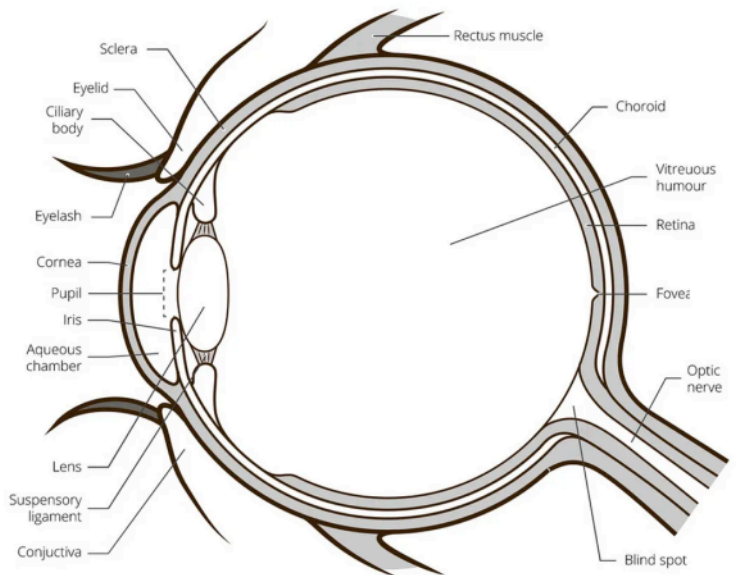
These two faults are currently not easily curable:

- The high resolution part around the fovea called the macular, degenerates.
- The retina becomes detached and blindness results. There have been attempts to refix it with a laser.

For a modest fee (£10 in the UK) opticians (optometrists) will now do a 3D scan of your eyes to check for problems with the macula, which is the high resolution part around the fovea, and with the retina in general. I was amazed at how useful and clear it was when I had the first one a few months ago.

Our Eyes

Picture 6 illustrates how light is focussed by the lens onto the sensitive layer at the back of the eye called the retina.

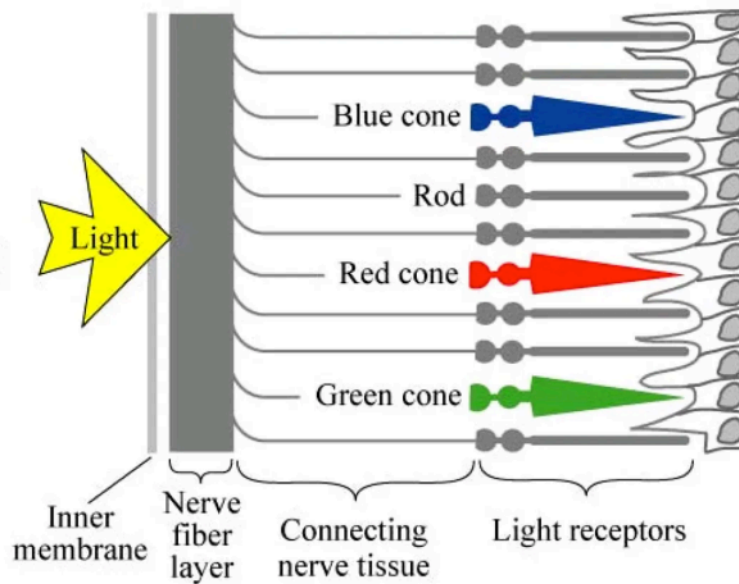


Picture 6: The structure of the human eye. (credit: vectorstock.com)

The iris surrounding the pupil opens and closes to let varying amounts of light in. When the surroundings are bright it is small and uses only the almost parallel-sided centre of the lens. This gives the fewest distortions so gives the sharpest image and focusses on the greatest range of distances. It's one reason why squinting can sometimes sharpen your sight. It's a sort of second iris. If you use a proper single lens reflex camera you will know that focus and depth of focus become better at smaller iris settings, such as $f/16$. It's a good way to blur backgrounds too. Use a small f -setting, for example $f/2.8$ that produces a large iris, and a short exposure. Phone cameras are great but you still can't beat a large diameter lens SLR for flexibility.

The eye lens is made thicker or thinner by the ciliary muscles to focus distant or close objects sharply on the retina. As mentioned above, lenses stiffen and muscles weaken with age so you might need glasses (spectacles) to help. Picture 7 of a cross-section of the retina shows us that it contains cells that detect brightness and colour. The small, brightness ones called rods are more tightly packed and give better resolution while the three types of colour cells called cones are less sensitive to light and are larger. The three detect red, green or blue light. Their low sensitivity is why in low light you only see grey through the rods. You must bear in mind that your vision will be

poorer in low light levels. If we didn't have colour vision our eyesight would be very much sharper.



Picture 7: Cross-section of the retina. (credit: sas.upenn.edu)

Picture 7 of the retina also shows you what I meant above about bits of our bodies being rarely perfect. The ability to see is a key to survival and reproduction so it evolved vigorously, though not always optimally. Our eyes work well but one part is poor. The light has to go through two layers of retinal tissue before it reaches the rods and cones, so loses energy. The evolution of different types of sight in various animals is a fascinating story. Wallace and Darwin didn't tackle vision, being forced by lack of technology to study larger scale evidence. My favourite Darwin joke is a spoof quote of his, "Finches? Seen one seen 'em all." To find out why it is funny read the next verbal thumbnail and the Wikipedia link in *Resources*. Even some plants are sensitive to light and turn to follow the sun or close up at dusk. It is after all why the Spanish for sunflower is girasol – sun turner.

Charles Darwin (1809–1882)

Darwin came from a wealthy and religious family and had the illustrious grandfathers Erasmus Darwin and Josiah Wedgwood. His intelligence and curiosity led him to become a natural scientist. Key to that was joining a round-the-world voyage of exploration on the *Beagle* starting in 1831. Evidence piled up in the form of

geology, fossils and living specimens, with the key work being in the Pacific Galapagos Islands. Here he studied how related species changed to adapt to the environment on the different islands, particularly finches, hence the joke. He was very slow to publish his findings, partly due to the fact that they clashed with his religious ideas. He anticipated a backlash from the churches and got it. Contact with Wallace convinced him of the need to publish and their relationship was remarkably amicable and co-operative, unlike some bitter scientific disputes over priority. His book, *On The Origin Of Species* published in 1859, gave the central role to what he called natural selection.

Alfred Russell Wallace (1823–1913)

Wallace was born in Wales in a large but gradually less well-off family. They claimed the Scots revolutionary William Wallace as a predecessor. He conceived the notion of evolution through natural selection independently of, and in parallel with, Darwin. He was also a social reform campaigner, particularly against the malign effect of the rich and powerful on working people. Like Darwin he was a traveller and collector. Unlike Darwin he was keen to publish. His book *The Malay Archipelago* (1869) was widely acclaimed and earned him much needed money.

Don't get me wrong. Despite its faults, the human body is an amazing thing. After all it took over four thousand million years to get to it. As Mike Skinner wrote in 2008 in his song *On the Edge of a Cliff* for his group *The Streets*:

*For billions of years since the outset of time
Every single one of your ancestors survived
Every single person on your mum and dad's side
Successfully looked after and passed onto you life
What are the chances of that, like?*

That sums it all up, or should I say 'raps' it up? I imagine it will be available on streaming sites. We need to bear in mind the limitations

of our sight when flying. By the way, Mike's hero was not on the cliff to do some soaring.

Experiment

Here is an experiment that you can try. Note from Picture 6 that the eye has a blind spot where the optic nerve goes through the retina. Get a piece of paper and write a 10mm high letter **L** on the right and a similar **R** on the left about 100mm away. Close your right eye and look at the **L**. Move your head backward and forward about 300mm away and at the correct distance the **R** will disappear. Do the same for the left eye looking at **R** this time. Normally one eye fills in the blind spot from the other. The lesson is don't close one eye when trying to spot your model, and of course it could cause a problem for someone with only one working eye.

There is a further complication. Science has now discovered that our brains don't create pictures based only on the signals from our eyes. The image processing involved is so onerous that, to save effort and time, our brains make up parts of the picture based on assumptions and past experience. That's why few people see the gorilla in the background of the classic video *The Invisible Gorilla* (see *Resources*) that tests our perception and why we quite often miss things or see them differently from reality. So as well as Jim Smith's very sound ideas (below) we have to add that as a further warning. Remember that you now know that the gorilla will be there 'cos I told you so. But you could try it on someone else who hasn't seen it before.

20/20? or Where Did That Airplane Go?

Jim Smith's article as it originally appeared in the legacy RC Soaring Digest. A link to a clean, easy-to-read version of this article is linked in *Resources*, below.

**20 / 20 ? or
Where, Did That Airplane Go?
...by Jim Smith**

I have been considering writing an article on sailplane visibility for some time. The graph of "Index of Visibility" (color) in the May issue of "Looking Up" forced me to action.

What is good vision, anyway? On the familiar Snellen eye chart, the one your doctor uses to check your eye sight, 20/20 vision equates to the ability to identify letters that fill a visual angle of 5 minutes (.08 degrees) of arc. Of course, your sailplane is not a letter of the alphabet. When it is "specked out", you only have to see the speck. You don't have to be able to identify it as a "T" shape (conventional airplane) or a "V" shape (flying wing), you just have to see something!

A 1966 study by Lockheed says, in part, "The smallest image that can be perceived at the fovea (the spot on the retina where vision is most acute) ranges from .5 to 1.0 minutes of arc, with a mean value of .7 minutes of arc." That's roughly .01 degree. However, the same study revealed that when the target moves as little as 20 degrees from straight ahead, the minimum detection angle rises to 10 minutes of angle. That's more than a ten fold increase!

In recent years, the National Transportation Safety Board (NTSB) has come to the more reasonable conclusion that the probability of sighting other aircraft (in a potential airborne collision situation) is about 12 minutes (.2 degree). (The diameter of the full moon is .5 degree.)

How does this relate to flying your model? Obviously, the wing's the thing! From our vantage point, the stabilizer and fuselage will disappear before the wing. So, let's consider the wing alone. A two meter wing will reach the .7 minute size at a distance of about 34,000 feet. But

wait a second! We must consider the wing chord, not the span! A telephone line stretches for miles, but we can not see it beyond a certain distance because it has a very small "chord"!

Okay then! Let us consider the 10 inch chord on that two meter plane. That dimension reaches the .7 minute size at 4200 feet. And don't forget that's straight ahead. If you look aside the 20 degrees noted above, you could lose sight of your plane at less than 500 feet! Of course, at that altitude it still appears quite large, and is easy to find! At higher altitudes, as the airplane becomes smaller, it is much more difficult to re acquire if you look away momentarily!

So! At about 4000 feet, it is virtually impossible to see a model with a ten inch chord, unless you're Chuck Yeager, who states in his autobiography in reference to on coming Luftwaffe fighters, "Andy (Clarence E. "Bud" Anderson) and I were the first to see them coming; at fifty miles or more..."

Referring back to the Snellen chart, have you ever had your eyes checked on a chart having colored letters? Certainly not! Because maximum contrast gives the best results! The same holds for sailplanes. Colors may have some relevance for power flyers, who operate up close to their planes, but glider guiders need contrast! Give me black wing bottoms every time. You can't get more contrast with clouds or bright sky than you can with black. Since I've been flying with "blue blocker" sunglasses, I use dark blue under surfaces which look black through the orange lenses.

Paint 'em or cover 'em as you wish on the top, but I think dark below is a must. This from a fellow who has had two brightly colored transparent covered two meter airplanes go "out-of-sight". ■

It's not just me then. The above shows why, if you take your eyes off a completely visible model, you can't pick it up again when you look back. So bring your model close before you look around.

Afterthought

The British Broadcasting Corporation is very good over its coverage of science. On the BBC World Service there are three excellent programmes: *Science In Action*, *Crowd Science* and *The Science Hour*. All are available anywhere in the world as podcasts unless of course your government blocks such things. *Crowd Science* invites people to send in questions and then spends time investigating and reporting. It could be you.

Thanks for reading!

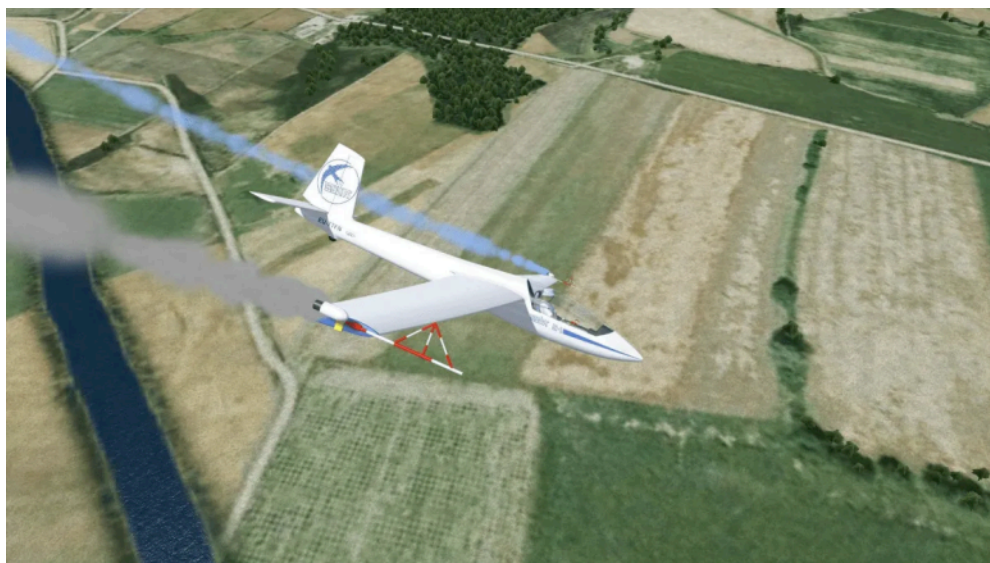
Resources

- *On The Shoulders of Giants* – The Wikipedia links for those historical figures mentioned in this article and on which the short, italicised bios are based: [Christiaan Huygens](#), [Charles Darwin](#) and [Alfred Russell Wallace](#)
- [20/20? or Where Did That Airplane Go?](#) – A link to an OCR'd, cleaned up version of this great article by Jim Smith, provided in PDF format.
- [The RC Soaring Digest Legacy Index](#) – A link to PDFs of every issue of the legacy RC Soaring Digest from January of 1984 through December of 2018.
- *Popular Science on the BBC* – Here's where you can find the shows mentioned in the article: [Science In Action](#), [Crowd Science](#) and [The Science Hour](#).
- [On the Edge of a Cliff](#) by *The Streets* on Apple Music.
- [The Invisible Gorilla](#) – “At some point, a gorilla strolls into the middle of the action, faces the camera and thumps its chest, and then leaves, spending nine seconds on screen. Would you see the gorilla?”

Erratum: In my previous article Part IV: Aerials I made a mistake over the first picture that I am sure you noticed. I replaced the original with one that showed one and half waves rather than the two in the text but didn't change the words. Well spotted all of you. – PS

All images are by the author unless otherwise credited. 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](#).

Condor Corner



An MDM-1 Fox performing its smoke-traced aerobatic routine in a Condor simulator session. (credit: Condor)

Using glider simulator training to thrive under adverse conditions.

This is the second of this series to appear in the New RC Soaring Digest. The original version of this article first appeared in the March 2022 issue of Soaring magazine. — Ed.

Prologue

In the introductory article for *Condor Corner* in the New RC Soaring Digest (see *Resources*, below), I invited SSA members, clubs, and commercial operations to contribute to the article by submitting narratives of their positive experiences using glider flight simulation. The following account was provided by John Duke, an active member and recent past president of the Texas Soaring Association (TSA). I had the pleasure of working with John on his initial private pilot glider certificate, providing him with the simulation-based flight training that

set the stage for his aircraft-based training and certificate completion at a commercial glider operation.

How Condor Helped Our Soaring Community Thrive During COVID

As the COVID-19 pandemic continued to disrupt normal operations at the TSA (see *Resources*, below), we began 'mutating' to adapt to this new reality.

At first, we were most concerned with the safety and well-being of our club members. As time passed, we also became more aware of and involved with our community neighborhood.

We were not alone in suffering reduced operations and the economic effects of this pandemic. One of our neighbors, the Salvation Army's *Camp Hoblitzelle* (see *Resources*) was having a tough time as well. The camp is the Salvation Army's largest, offering summer day camp and other year-round event services to their community. Their program focus is educational and restorative events for youth, including archery, fishing, horseback riding, team building and similar activities

Like TSA, the pandemic had vastly altered the Camp's capacity and revenue, and they too were searching for ways to adapt. One of those adaptive measures was an agreement with an area home school co-op program to provide activities for students of middle and high school age.

TSA shares a property line with *Camp Hoblitzelle*, and while meeting with camp director Casey Bilbrey and his staff on other issues, we began sharing how our respective organizations were not only coping with the effects of the COVID-19 pandemic, but in fact fighting back against it to continue our missions successfully and safely.

As our conversation continued, the topic of STEM (Science, Technology, Engineering, Math) education came up, as the Camp's

staff had begun to see a role in providing these types of programs to their community. We mentioned the growing need within the larger aviation industry for professionals with STEM expertise and how that might fit into their developing vision. This line of thought led to a suggestion that our two organizations work together to develop an aviation-related course that would accomplish the Camp's goal of exploring STEM-related courses and TSA's goal of introducing soaring to a youthful audience. As you know, the soaring community has been concerned with this objective for quite some time as the average age of soaring pilots increases and participation in the sport dwindles.

The new course would be a semester-long adaptation of Scott Manley's well-developed simulation-based glider flight training curriculum. Having done all my initial flight training using this system, I knew this offering would not only be what *Camp Hoblitzelle* needed, but also represented an opportunity for young adults to pursue an interest in aviation through soaring, and quite possibly entice them to become youth members of our club.

The TSA board approved the idea, and I went about recruiting several interested and talented volunteers who, despite many of them having little or no experience with *Condor*, offered to teach sessions of the course weekly over the semester. My hat is off to them for mustering the enthusiasm and bravery to face a group of teenagers in a classroom environment.

There were several obstacles to overcome. Neither of our organizations had the resources to purchase the equipment and materials needed. There were technical issues that needed to be solved with the computers and video equipment. Course instructors needed to arrange their professional work schedules to be available on the days they would teach. We needed instructional space, and the training itself had to comply with Salvation Army policies and procedures to protect the kids and the teachers. Each of these challenges was met with enthusiasm and good will.

At our request, Scott Manley provided advice and direction regarding course content and arranged for the use of four glider simulation workstations (laptop computer, joystick, rudder pedals) available from the SSA for exactly this type of training.

We recently completed our first semester-long course. Working with an initial cohort of four students (thinking big, starting small) helped us understand how to scale up the program, and we are now committing to class sizes of 8–12 students per semester. *Camp Hoblitzelle* is enthusiastically behind our efforts and is now offering the course as part of their regular curriculum.

The course concluded with a field trip to our club during which our graduates received recognition for their accomplishments, including completion the Civil Air Patrol Wing Runner Course and mastery of the knowledge and skills required to make a complete simulation-based flight in a glider, that is takeoff, aerotow, free flight, traffic pattern, and landing. After learning to preflight the *ASK-21* and observing ground handling operations, the graduation event culminated with each student receiving a demonstration flight.

Another really interesting note: one of the kids in the first class at *Camp Hoblitzelle* is currently interviewing for college with the ambition of becoming a professional pilot as a *direct result of the course*. What an accomplishment!





Shown above, all geared up and ready for flight, are graduates Nathan Magar and Brason Salinas. (credit: Ron McIntosh, TSA)

Our initial experience has taught this observer a few important things. Willing partners and club members are critical to the success of such a program. There is not only a compelling need for this type of program but a real appetite for it as well. When well supported, this initiative will not only meet the goals of both *Camp Hoblitzelle* and TSA, but as importantly promises to provide scores of young people with an immersive, hands-on, cost-effective, and positive introduction to aviation through soaring.

I am deeply indebted to the following for their very significant contributions to the successful implementation of this program. Scott Manley for his guidance and curriculum support, the Soaring Society of America for its support and generosity, *Camp Hoblitzelle* Director Casey Bilbrey and his staff for their support and encouragement, and the Board of Directors of the Texas Soaring Association. Last, but certainly not least, my gratitude to the TSA members who taught the course. Their efforts not only made the course possible but ensured its success. They are Colin Agor, Dan Porter, Steve Penca, Jan Martin, Robert Grimm, Jacob Fairbairn, and Greg Carr.

Next Month

Once again I want to offer my thanks to John Duke for such a compelling description of the program. Next month, I return with the story of three generations of simulator pilots – all from the same

family. It's an interesting and inspiring story you're absolutely going to want to read. Until next time!

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Resources

- [Condor Corner: Introduction](#) – The first article in this series as it appeared in the New RC Soaring Digest.
- [Texas Soaring Association](#) – “Founded in 1947, TSA promotes the sport of soaring and a love of aviation in the Dallas / Fort Worth, Texas area. We currently have more than 150 members, making us one of the largest glider clubs in the US...”
- [Camp Hoblitzelle](#) – “Located just south of the Dallas-Fort Worth Metroplex, *Camp Hoblitzelle* provides quality services and facilities for retreats and conferences in a peaceful setting that fosters unique opportunities for fun, learning, adventure, inspiration and fellowship...”
- [Simulation-based Glider Flight Education](#), the author's website. – “to provide you with the information and resources you need to self-manage the flight training and aeronautical knowledge development required to qualify for a Private Pilot Certificate with a Glider Category...”
- [Condor](#) – “simulates the complete gliding experience on your computer. With it you can learn to fly gliders and progress up to a high level of competition skill. The core of the simulator is the state of the art physics model and advanced weather model aimed at soaring flight.”
- [Soaring Magazine](#), the official publication of the Soaring Society of America. – “each issue brings you the latest developments on safety issues, delightful accounts of individual soaring accomplishments, a sharing of ideas and experiences, tips from the great soaring pilots of our times, and...”

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the entire issue, is available [upon request](#).

Soaring the Sky Podcast



E089: Soaring In The Philippines with Rolf Dunder

Our tenth instalment of this ongoing series where we select and present episodes from Chuck Fulton's highly regarded soaring podcast. See Resources, below, for links where you can find Soaring the Sky, or simply click the green play button below to start listening.
— Ed.

On this episode of the podcast Chuck heads to the Philippines to talk with Rolf Dunder. He originally learned to fly in Hamm-Lippewiesen, Germany but is currently the only glider pilot soaring in the Philippines. Rolf started soaring in 1979 and soloed in 1980 at the age of 15. He received his PPL in gliders in 1982 and his CFIG in 1989. In 2000 he picked up his Ultralight rating and in 2001 his Paraglider as well as his Single Engine in 2002.

In 2008 he moved to the Philippines where he started glider operations in Nampicuan and now Tuy. Rolf has flown many gliders including the ASK-13, Ka-8, Ka-6, K-7, Twin III, ASK-21, DG-505, ASW-

15b, ASW-19b, LS-4, Standard Libelle, IS-28, Schweitzer 2–33, Puchatek, Duo Discus, SZD-55, and the Nimbus 4DM (whew!)

Rolf has also experienced soaring all over the world and will share some of these exciting adventures with us. He has flown in Japan, France, Australia, Italy, Spain, the United States and even had the pleasure to be a guest on a 985 km triangle flight in a *Nimbus 4DM* in Kuruman, South Africa. Ralf has logged over 900 hours in gliders over 2,500 flights. He also has over 100 hours in single-engine aircraft with 300 hours in ultralights and 100 hours paragliding.

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Resources

- [No Engine Airplane! Glider Experience | Filipina Pilot Chezka](#) on YouTube featuring Rolf Dunder. — “Not in my original bucket list but I added it right away and checked it! Thank you Lord for letting me experience this! You see ... life is short, so whenever an opportunity comes knocking at your door...”
- [Soaring the Sky](#) — “an aviation podcast all about the adventures of flying sailplanes. Join host Chuck Fulton as he talks with other aviators around the globe”. You can also find Chuck’s podcast on [Instagram](#), [Facebook](#) and [Twitter](#)

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

Stamps That Tell a Story



This series issued by Antigua on March 28, 1978 celebrated the 75th anniversary of the Wright's first powered flight at Kitty Hawk.

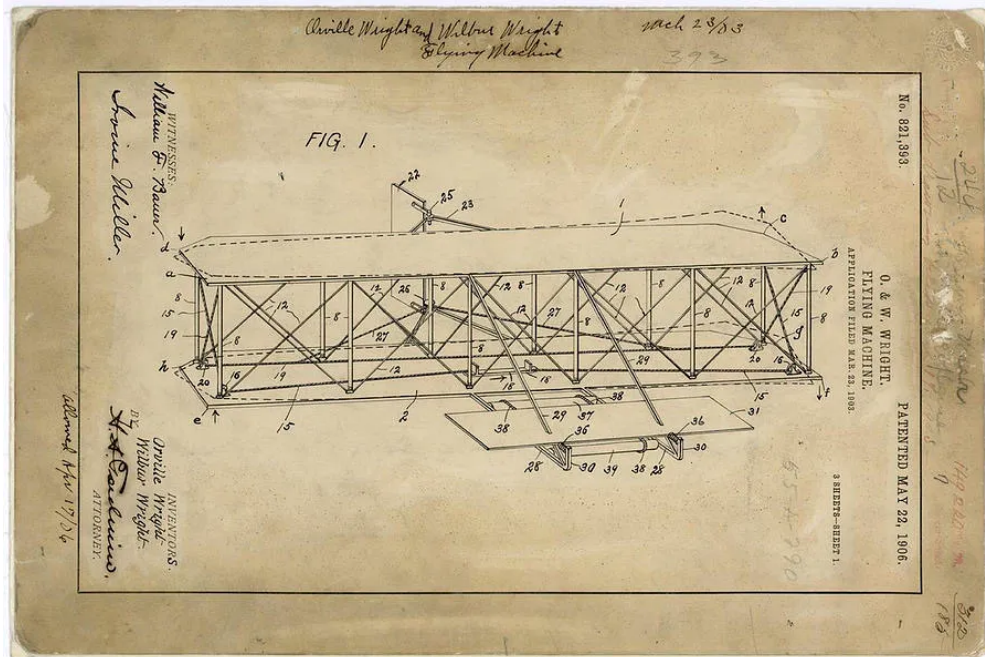
A series from Antigua celebrating the achievements of the Wrights.

This article first appeared in the October, 2002 issue of Gliding magazine. The relative temporal references (eg. "exactly one hundred years ago") have been retained as they were originally written by the author. – Ed.

The Postal Service of Antigua issued a set of seven postage stamps plus a souvenir sheet in honour of the first powered flight by the Wright brothers in 1903. One of the stamps (top left in the montage above) shows their 1902 glider in flight.

Much has been written about the first powered flight and more than one hundred postage stamps have been issued world-wide on this thematic subject. Most likely there will be significantly more material coming in 2003, the centenary of their first sustained, controlled, powered flight.

But the soaring community is vastly interested in the gliding experiments which the two brothers did between 1899 and 1902. Because the glider, which was flown so successfully late in 1902, became the basis for their patent, it was also the basis of the powered machine.



The Wright patent, based on the 1902 glider. It became the basis for their 1903 “motorglider”. (credit: Library of Congress)

There are far fewer stamps on this subject. These Antigua stamps are probably the nicest rendering.

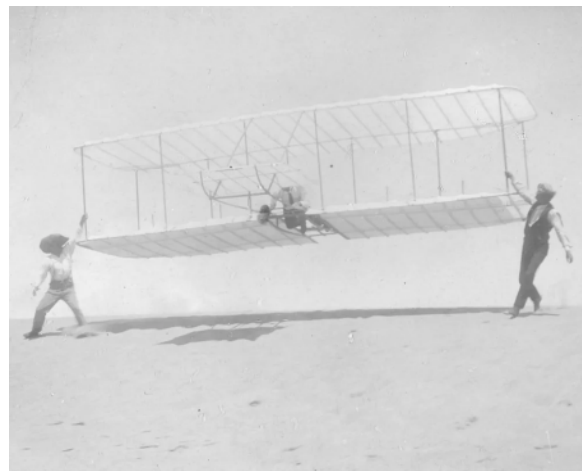
In May of 1899, Wilbur Wright wrote to the Smithsonian Institution and asked for information on flying machines. They spent \$5.50 and received among other publications, Octave Chanute’s book *Progress in Flying Machines*, published in 1894 (and linked below).

A year later, they made contact with Chanute (see last month’s article) who at that time was a well-known, respected engineer and the leading authority on almost anything aviation related.

To the growing aeronautical community, Chanute was a clearing house and he always took the time to reply to letters from budding aeronautical engineers, giving input and criticism.

Many letters were exchanged between them, and Chanute became a good friend and mentor, always encouraging the brothers in their efforts. This correspondence often helped them during times of difficulty and frustration and it built their confidence in what they were doing.

Chanute was asked to join the Wrights at Kitty Hawk during their flying season in 1901 which was not very successful. He was happy to oblige. Several of the photos he took with his camera are now frequently used to document the Wright brothers' achievements.



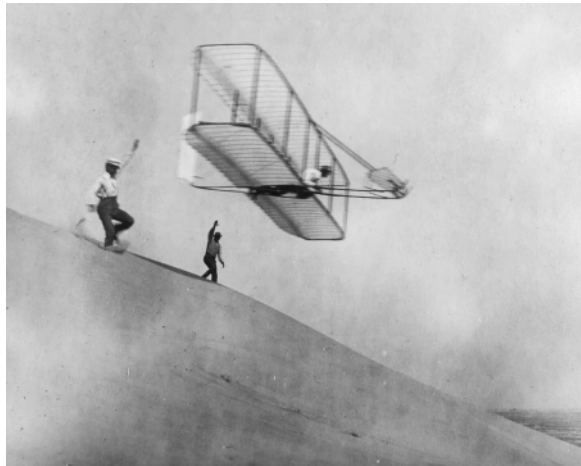
The Wright camp in 1901. The left shows several visitors to the Wright camp and was probably taken with Chanute's camera. Chanute is sitting in the front and Wilbur Wright beside him. The photo on the right shows the 1901 glider being launched. (credit: Library of Congress)

The following year, Chanute was again asked to visit their camp. On October 18, 1902, their machine was launched from N^o2 hill, into an easterly wind.

The longest flight on that day was made by Wilbur Wright, a distance of 552ft and almost 25 seconds in duration.

A few 'adjustments' were made and then, on October 23, Wilbur made the best gliding flights ever, flying 622.5ft with a 26 second duration.

The groundspeed was calculated as 24ft/s.



On the left is the 1902 machine being launched on October 18st and flown possibly on October 23rd during the 26 second flight. (credit: Library of Congress)

This well known photo on the right, above, may have been taken of this 26 second flight. It seems to be the photo used for the design of the postage stamp for Antigua. This flight was flown exactly one hundred years ago, which is reason to celebrate.

A few days later, the Wrights broke camp and went back to Dayton. The events of the 1903 flying season changed the world forever.

Resources

- [*Progress in Flying Machines*](#) by Octave Chanute, published in 1894.
– The Library of Congress (LOC) has the complete volume available for PDF download. Once you start poking around the treasure trove of aviation-related items at the LOC be prepared to clear your calendar for the day (or week!)
- [*Stamps That Tell a Story: The Series*](#) – Catch up on your missing instalments of this excellent, informative series of articles presented previously in the New RCSD and of which this article is the final part. Of particular interest may be last month's article on philatelic tributes to [Octave Chanute](#).
- [*First Flight Society*](#) – “The FFS was founded in 1927. This non profit organization celebrates the accomplishments of the Wright Brothers and helps educate the world about aviation! Join us in our mission...”
- [*The Air Force Historical Research Agency*](#) – “the repository for Air Force historical documents. The Agency's collection, begun in Washington, DC, during World War II, moved in 1949 to Maxwell Air Force Base ... to provide research facilities for professional military education students, the faculty, visiting scholars, and the general public...”
- [*To Fly is Everything*](#) – If the invention of the aeroplane and other aviation pioneers is of interest to you, Gary Bradshaw's website is worth a visit.
- [*The Wright Brothers' Aeroplane Company*](#) – “a virtual museum of pioneer aviation...”

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

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the entire issue, is available [upon request](#).

A History of Gliding and Soaring in the Inland Empire (1930–1940)



An 1894 topographic map of the Inland Empire region.

A look back at the early days of soaring in southern California.

This article originally appeared in the Summer 2022 edition of the National Soaring Museum Historical Journal (see Resources, below) and is republished here with their kind permission and our thanks. — Ed.

As soaring became increasingly popular in the 1930s, many locations in southern California were adopted as regional “glider bases.” These included the well-known Point Loma and Torrey Pines in San Diego, and locations such as Hollywood Riviera and Long Beach in the Los Angeles basin among many others. The majority of sites were coastal as the cliffs and afternoon sea breezes offer ample opportunity for ridge soaring and knowledge of thermal soaring was only in its infancy. However, as gliding blossomed, aviation-minded folks in inland communities within southern California such as San

Bernardino, Redlands, and Riverside also expressed interest in trying the sport. This region, known collectively as the “Inland Empire” has its own important role in regional gliding history that has largely been forgotten. One important location was Little Mountain, a site that is still popular for RC soaring. This article reviews the early history of Little Mountain and its more than 90-year connection to motorless flight.

The San Bernardino Glider Club

In late March and early April of 1930, speed record holder Frank Hawks made a well-publicized multi-day transcontinental aerotow across the United States using the Franklin P-S-2 “Eaglet.” Each stop from San Diego to New York City was used to promote the sport of gliding nationally. Given this and other popularized gliding activity in southern California, the manager of the local California Theatre in San Bernardino, Mr. M. F. Williams, decided it was time to form the “San Bernardino Glider Club” (SBGC) to convert local model airplane club enthusiasts into manned glider enthusiasts. The local Exchange Club sponsored the new club and news spread quickly. The SBGC wished to purchase a Franklin P-S-2 just like the one Hawks had used for his flight but during the Great Depression, they could hardly afford it. Supervised by Dr. L. W. Ayers, a member of the Exchange Club interested in aviation, the SBGC managed to collect \$203 in donations (roughly the equivalent of \$3,500 in 2023), most of these as individual \$1 donations from members in the community, with \$20 from the California Milk Producers Association, and \$30 from the California Theatre operated by the Fox Film Corporation. On Saturday April 12, 1930, the midnight showing of the aviation-minded movie “Young Eagles” at the California Theatre was used as a fundraiser and upped the total to \$300.¹⁻⁴ Franklin gliders were difficult to obtain at the time, and so interest shifted towards the purchase of a Bowlus sailplane instead for a total of \$460, still just slightly out of reach for the club. A member of the U.S. Army Air Corps by the name of Gordon Corwin volunteered to serve as the club glider instructor and took glider

lessons from Al Hastings at the Bowlus Glider School at Mines Field (now Los Angeles International Airport).⁵



Figure 1. The movie “Young Eagles” about a World War I aviator helped launch the fledgling San Bernardino Glider Club in 1930. It played at the California Theatre at 562 West 4th Street in San Bernardino which is still in use today. (theatre credit: City of San Bernardino)

Although interest remained high, few if any in San Bernardino had actually seen a glider in action before. Victor “Vic” Evans of the Redondo Beach Glider Club (RBGC) came to the area on June 1, 1930 to make a demonstration of his all-metal primary gliders at Ontario Airport.⁶⁻⁷ Soon thereafter, Alan Richard “Dick” Essery and other members of the Western Flyers Glider Club from San Diego arrived to

provide a gliding demonstration to the SBGC. This event featured a primary glider flown by Essery on July 1, 1930 from the top of the Shandin Hills (Little Mountain) to the flats below, the first recorded glider flight from the location.⁸ Primary gliders were also being constructed by local high school students. For instance, armed with the knowledge that Little Mountain was now considered good for gliding, Colton High School student Noel Sharp announced that he would soar in his primary glider from Little Mountain south all the way to Colton, over the town of San Bernardino. He noted, "I'm going to take off and then pray for air currents to take me across the valley. I don't have the least idea where I'll land. That's why I'm making the trip, to see how the air currents are off Little Mountain. If I have some luck I'm going to go out for some real records."⁹ Needless to say there are no reports of his success – it's a long way for a primary glider from Little Mountain to Colton.



Figure 2. A topographic map from 1894 shows the location of Little Mountain (circled in red) to the north of San Bernardino with Colton pictured even further to the south. Afternoon winds in this area are often from the WSW however in Santa Ana wind events the winds shift to being out of the NNW as the winds come down through the Cajon Pass.

Unable to secure funds for their own glider, Dr. Ayers reorganized the SBGC on August 1, 1930 at the Anderson Building in San Bernardino.¹⁰

Eager to attract even more interest in gliding, Dr. Ayers met with Bowlus at the dedication of the Santa Paula Airport in Ventura County. There he convinced Bowlus to provide a glider demonstration for the SBGC sometime in the latter half of August.¹¹ Armed with this news, Ayers returned to the SBGC, organized a larger set of members on August 13, re-connected with Gordon Corwin as the club instructor, and pushed for success.¹²⁻¹³ Corwin was elected President, Ayers Vice President, Carlyle Eikleman as Treasurer/Secretary. Unfortunately, Bowlus's plans changed as he travelled to the east coast and he was never able to address the SBGC.¹⁴

Other Regional Glider Clubs

In parallel to the SBGC, employees of the San Bernardino Post Office formed their own glider club in April 1930 including P. H. Scheppers, R. E. Barnette, N. K. Jelinek, H. E. Hunt, T. E. Cleveland, Wayne Stadtman, Joe Clapp, A. C. Yeates, Walter Herkelrath, W. E. Schroeder, William A. Leffen, Jr., and Stanley McClellan.¹⁵ Little is known about the success of this venture. In August 1930, the local San Bernardino YMCA announced an affiliation with the national non-profit American Model Aircraft Club (AMAC) to inspire young boys and girls to take up model aviation and gliding. Dr. Ayers was also involved with this direction.¹⁶ Despite all the interest, the pressures of the Depression made it difficult for clubs to survive, and interest in gliding waned through the latter half of 1930 and into early 1931. The SBGC continued but fell back into a dormant mode.

Things were slightly different in Monterey Park to the west of San Bernardino. There, the Monterey Park Glider Club (MPGC) had a strong core group of fliers, eager to fly their primary gliders from various hillsides. By June 7, 1931, the MPGC had learned of Little Mountain and started flying there. Members of the Riverside Glider Club (RGC) including William "Bill" Atwood also attended these events.¹⁷ Take offs were made by shock cord from the top of the mountain near a lookout tower operated by the U.S. Forestry Service for the prevention of brush fires. Milton Jackson, the fireman

stationed at the lookout was impressed with the efforts of the young glider pilots. (Being stationed in a fire lookout tower on the top of a mountain was a lonely job, being in the company of glider-minded folks, clearly much more fun!) The following week the glider guiders returned and without any experience whatsoever, Milton Jackson agreed to be launched from the mountain in one of the primary gliders. During his landing, the left wingtip caught on a clump of brush and swung the glider around with considerable force, damaging the glider but without injury to Jackson. Remaining flights that day were called off.¹⁸ Given the MPGC primary glider was now being repaired, Bill Atwood launched in his new sailplane on July 12, 1931 at Little Mountain and managed to soar for 12 minutes. His flight ended abruptly when he came just a bit too close to the mountain itself and a sudden downdraft caused an unanticipated forced landing, resulting in minor damage to the glider but no injuries to Atwood.¹⁹ This flight caused a local stir in the press and Atwood announced that as a part of repairs he would return in two weeks with a larger rudder and soar for an even longer period of time. Given these activities were happening in their backyard, Dr. Ayers yet again to invigorate the SBGC and the club moved its secondary glider closer to Little Mountain. News of the inland soaring location spread throughout southern California. Members of the Redondo Beach Glider Club (RBGC) and the Time Glider Club of Los Angeles traveled to use Little Mountain.²⁰ Finally Little Mountain was on the soaring map.

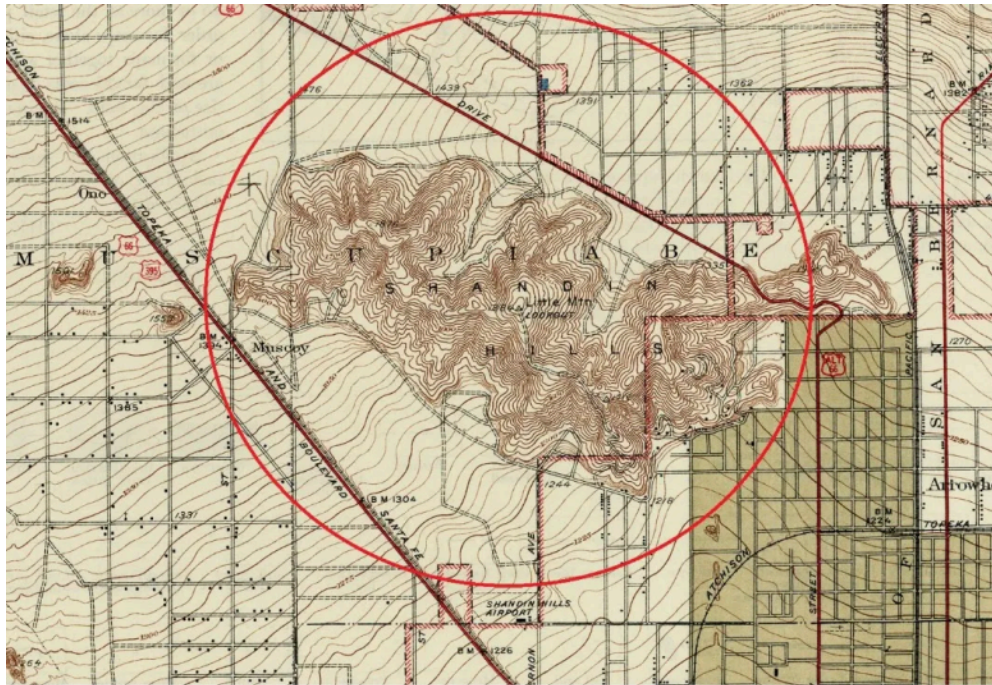


Figure 3. A topo map from 1936 presents a more detailed view of the Shandin Hills with the lookout tower on the top of Little Mountain at the center. Note that the hills are oriented largely towards the WSW flow, however the north end of the hills could be used during Santa Ana events. Access to the top of Little Mountain was made via the dirt road at the south end of the hills. The Shandin Hills are roughly 300–500 feet above the surrounding terrain.



Figure 4. A view of Little Mountain today from the same dirt road used in the 1930s, with microwave relay towers where the fire lookout tower once stood. Launches were made to the left (west) from near the towers. The hillside is now largely surrounded by homes and freeways. (credit: Jim Duvall / Peakery)



Figure 5. Members of the Monterey Park Glider Club (MPGC) with their primary glider, likely at a location near Monterey Park and not at Little Mountain but from the same time frame. Fred Chambers, a leader of the MPGC is shown in the pilot's seat. (credit: Monterey Park Bruggemeyer Library / Calisphere)

Soaring at Little Mountain

On August 1, 1931 Gordon Corwin, SBGC President and Instructor, launched at Little Mountain in the club's silver-winged secondary glider via shock cord at 4:30 p.m. He stayed aloft 57 minutes, setting a new site duration record. The SBGC secondary glider was designed by Arthur Campbell of Riverside, an aeronautical engineer and graduate of Caltech, and built by Vic Evans and his Evans Glider Company. It was becoming clear to many that Little Mountain was a special place as it faced the prevailing westerly afternoon winds but also allowed for soaring in stronger northerly Santa Ana winds.²¹ Corwin returned on August 2nd and made another flight, climbing to over 400 feet above the mountain in a 25-minute flight, which was considered a new site record for altitude.²²

With so many glider clubs active at the site on the weekends, it was natural for someone to propose a glider meet. This was arranged for Labor Day weekend, September 1931 and sponsored by Milton

Jackson and Vic Evans with Dr. Ayers serving as Meet Coordinator. Through connections in the Forestry Service, Jackson began researching the weather in the area to predict when winds would be favorable. Meanwhile, Evans considered this meet as the first of a larger series of "Glider Goodwill Meets" to be held at different locations throughout California once a quarter to foster fun competition.²³ Dr. Ayers hoped for between 6 and 12 gliders for the glider meet. The U.S. Forestry Service even went so far as to provide equipment for a camp on the top of the mountain to house the 25 participants that were expected. In preparation for the glider meet, 6 SBGC members completed their glider license at Tri-City Airport in Colton on August 24th. The licenses required no written exam, only a test of their ability to maneuver the club's secondary glider following an auto-tow, banking, and then landing successfully.²⁴⁻²⁵

Corwin once again returned to Little Mountain on Sunday August 9 to try to break his site records for endurance and altitude, however insufficient winds had other plans and he landed after scratching for just 5 minutes.²⁶ John Pierce, a Pasadena resident and founding member of the Long Beach Glider Club, also stopped by to see the activities and noted that he too would have his sailplane at the Labor Day glider meet.²⁷ Corwin returned with the SBGC secondary glider on August 22. Fortunately, that day a solid 13–18kt wind was blowing. He launched in the late afternoon, with Milton Jackson serving as official timer. 1 hour and 20 minutes later the winds subsided and Corwin landed at the base of the mountain having established not only the first 1-hour flight at the site but a new site record of 700 feet in altitude.²⁸ On Sunday August 23, members of the Pasadena Glider Club came to Little Mountain to test out their primary glider. The longest flight was just 2 and half minutes. But this was only because the gusty winds in the afternoon were so strong that flying a primary glider was considered too dangerous.



Figure 6. John Pierce during the construction of his sailplane prior to the Labor Day meet. (credit: California Institute of Technology / Calisphere)

Quickly it was realized that there was so much interest in the Labor Day glider meet and so little time left to organize that the meet needed to be postponed. Local papers noted, “popularity of Little Mountain as a glider rendezvous is increasing rapidly due to the fame the location has received this summer. This coupled with excellent flying conditions and the ever growing number of glidermen visiting the spot from all parts of the Southland makes a test of skill and endurance imminent, observers assert.”²⁹

Despite the postponement, glider guiders showed up anyway on Labor Day weekend to enjoy soaring. On Saturday Sept 5, 1931 John Pierce brought his large 43-foot wingspan sailplane, with test flights made to get the feel of the site.³⁰ The following day, 15-year-old E. G. “Guy” Rowell, Jr. of Redondo Beach soared in an Evans secondary glider for 1 hour and 18 minutes at Little Mountain at an altitude of 400–450 feet above the summit. It was his first experience at soaring and at times the very gusty wind caused his glider to move erratically, so much so that spectators were convinced he would crash. But each time, he managed to bring the glider back under his control. “On one occasion the wind failed and forced the light ship below the summit

of the mountain on the north side. Taking advantage of a breath of light air the youthful pilot gained enough altitude to set the craft down on the summit of the mountain near his point of take-off without a mishap.” Using a similar type of Evans secondary glider, Gordon Corwin soared for 1 hour and 57 minutes the same day. Members of the MPGC and RBGC camped on the hill.³¹ Meanwhile, members of the Santa Maria Glider Club on California’s central coast drove all the way with their primary glider in tow just to visit Little Mountain and see what the fuss was about.³²



Figure 7. Gordon Winthrop Corwin later became a California State Assemblyman between 1934–1941. He also became enamored with large-scale model steam locomotives later in life. (credit: Highland News)

Unfortunately, during in the Fall of 1931 and into early 1932 tragedy struck the local southern California. Over the cliffs of Redondo Beach,

the wings came off a glider that Vic Evans was piloting and he was killed in the resulting crash.³³⁻³⁵ In January, 1932, another glider pilot Frank Slaughter was killed at Redondo Beach when the tail came off his primary glider.³⁶ With the deaths of these two popular local glider pilots, once again interest in gliding waned in the region, until the summer of 1932, the same summer that brought the Olympic Games to Los Angeles for the first time and a renewed interest in sports of all types.

On June 19, 1932, Burchard Wilson of Burbank managed to soar in a glider for 1 hour 28 minutes at Little Mountain. He flew as far west as Cajon Road (later known as a part of Route 66) and south of the mountain by nearly a mile. Adverse winds forced him to land at the base of the mountain. That same day two other gliders were flown by Lester Fuller and Frank Wolcott, both of the Glendale Glider Club. A bad landing caused sufficient damage to Fuller's glider that he was unable to fly in the afternoon.³⁷ While glider pilots would return on some weekends to the site, their flights no longer made local headlines as gliding was now considered more commonplace.

By the spring of 1933, the Redlands Glider Club announced that Little Mountain would become the base for their operations. As a member of this club, Charles D. Wilcox operated a primary glider with a nacelle for drag reduction. The new Shandin Hills Airport located just to the south of Little Mountain also gained popularity by hosting an air show on April 23, 1933 completed with stunt flying and parachute jumping. The airport and its proximity to Little Mountain once again revived interest in gliding in the area.³⁸

On May 26, 1935 two flights were made at Little Mountain, each more than one hour in duration. Don Stevens soared in his Franklin P-S-2 secondary glider for 1 hour and 10 minutes and Harland Ross soared for 1 hour. At the time Stevens and Ross were associated with the Bowlus-DuPont company of San Fernando. Wallace Neugent of Glendale was present as well as other members of the Riverside

Glider Club. Milton Jackson, who was still maintaining the forestry lookout tower served as a timer and witness for the flights.³⁹

On May 30, 1935, "Little Joe" Stasneck and a passenger flew in the RGC's large 50-foot wingspan 2-place glider for 1 hour and 18 minutes and to a height of 1,000 feet above Little Mountain. This flight established new site records for 2-place gliders. Other RGC members Morris Slack, George Ferrell, Frank Ferrell, Carson Shade, Meredith Shade and Jesse Veach attended. "Those at the field claimed it was one of the best [sites] they had ever used." Arrangements were made for newsreel cameras to take pictures of the soaring planned for the following weekend June 8–9.⁴⁰

On Sunday June 9, 1935 Stasneck once again returned to Little Mountain and soared for 1 hour 37 minutes in his homebuilt glider, setting a new site record. On June 16, a variety of glider enthusiasts converged on Little Mountain including Don Stevens with his Franklin P-S-2, Franklin Wolcott of Glendale with his Spillane secondary glider, and Joe Stanseck. They noted to the press that, "plans are being made for the future charting of Little Mountain and the regions north extending to the big mountain range. The work will be done by Mr. Stanseck, assisted by Milton Jackson, fire dispatcher and observer at the Little Mountain lookout. The charting will indicate where favorable air currents are and will further opportunities in making cross country altitude and endurance glider records, it was stated. As a value of the air currents in the hills, in a recent contest a rubber band model remained in the air 31 minutes. The world record for glider models is 14 minutes. However, the record-breaking time was unofficial. Mr. Stevens believes that glider supremacy may soon be centered at San Bernardino instead of at Elmira, N.Y., present glider center of the world, where records are made and competition is staged constantly."⁴¹

The manager of the nearby Shandin Hills Airport, Gwin Cook, noted that new hangars should be constructed at the airport for use by glider pilots. "This port is the only one in the country with a glider

take-off so close, and the surrounding land is so flat there are always ample opportunities for safe landings.”⁴¹ (If one looks carefully at Figure 3, the Shandin Hills Airport can be found just near the bottom of the red circle in the middle of the image). Plans were announced for a July 4th glider contest arranged under the auspices of the American Glider Association. Fred Barnes, Robert “Bob” Stanley, and Bud Hugill of Los Angeles visited the site in late June, 1935 and flew the 2-place 52-foot wingspan Buxton “Transporter” and a similarly large open cockpit sailplane (perhaps the “Sloanlo”) to evaluate the merits of the site. Despite this, no records of a July 4, 1935 meet can be found. However, soaring continued at Little Mountain into the late 1930s with exhibitions for newsreels etc. largely arranged by Don Stevens.⁴² In 1938 and 1939, the Shandin Hills Airport was used more routinely for glider testing by Frank Wolcott, Bob Heidemann and other members of the newly formed Southern California Soaring Association (SCSA), a club that continues to exist today.⁴³⁻⁴⁴ On June 16, 1939, the famous German glider pilot Peter Riedel was launched in a sailplane via auto-tow from the Shandin Hills Airport. Encountering a thermal he rose to over 6,000 feet above San Bernardino before heading to the east for his goal of Palm Springs. However, encountering the strong winds in the San Gorgonio Pass, Riedel was forced to land 1 mile northeast of Banning on the Morongo Indian Reservation after soaring for three hours. The following day he was able to soar over Mt. San Jacinto on a flight from Palm Springs.⁴⁵⁻⁴⁶ Interestingly in the late 1930s the Shandin Hills Airport became very popular with model airplane enthusiasts who scheduled several competitions. One of these included Reginald Denny, the Hollywood movie actor who would later play a pivotal role in the development of the Radioplane target drone in World War II.⁴⁷

Conclusions

Many in the RC soaring community of southern California are familiar with Little Mountain for its great slope soaring since the 1970s. However, few realize that the site has its own association with gliding

back to 1930. This places Little Mountain in the same context as Torrey Pines or Redondo Beach as one of the earliest locations for gliding in the region and now in its 93rd year. We are fortunate that with all of the development in the surrounding area, Little Mountain still remains, complete with dirt roads that lead to the top of the mountain and its radio towers where a lookout tower once existed. Unfortunately, the nearby Shandin Hills Airport closed in about the time of World War II and is now covered by the I-15 freeway and homes. The California Theatre, where the San Bernardino Glider Club first started still remains today as the California Theatre for the Performing Arts and is listed on the U.S. National Register of Historic Places.⁴⁸

Few if any photos of the early gliding activities at Little Mountain remain, however those familiar with the history of aeromodelling and soaring will have already recognized some important names. Bill Atwood later became well known for his many model airplane engine designs as a part of Cox Hobbies. He was inducted into the Academy of Model Aeronautics Hall of Fame in 1982.⁴⁹ John Pierce later became an important figure in the field of communications theory and became a co-inventor of pulse code modulation (PCM) that was featured in RC transmitters in the 1980s and 1990s,⁵⁰ Harland Ross was the designer of the first 20:1, 30:1, and 40:1 sailplanes in United States history and was inducted into the Soaring Hall of Fame in 1959.⁵¹ Others like Don Stevens helped popularize gliding through the motion picture industry. Joe Stasneck continued soaring at a wide variety of locations in southern California, passing away in 2008. And of course, there is a whole other history associated with RC gliding at the site, one that also is poorly recorded. Sites like these are critical to the future of soaring not only to help interpret the past but preserve the future for forms of motorless flight. Little Mountain needs to continue as a location for RC soaring for many years to come.

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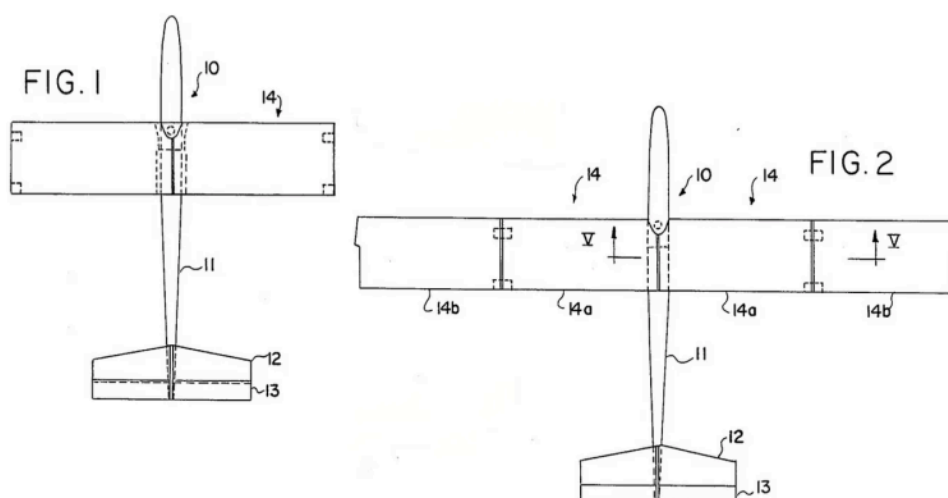
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- [***Albert E. Hastings / America's First National Glider Champion***](#) by Gary B. Fogel in the New RC Soaring Digest. — “The period of 1929–1931 was particularly important to the growth of soaring in the United States. Inspired by the success of Lindbergh’s Atlantic crossing...”
- [***The 2022 International Hand Launch Glider Festival***](#) by Gary B. Fogel in the New RC Soaring Digest. — “In October of 1994 the TPG established the first two-day contest for javelin-launched gliders, including various unique tasks...”
- [***A History of Gliding and Soaring in the Inland Empire \(1930–1940\)***](#) by Gary B. Fogel in the National Soaring Museum Journal, Summer 2022 edition.

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***](#).

Glider Patents



US 4759736 A: Folding Wing Glider

This is the ninth in our series of glider-related selections from the files of the US Patent and Trademark Office (see Resources, below). They are presented purely for the interest and entertainment of our readers. They are not edited in any way, other than to intersperse the drawings throughout the text. Disclaimers: a) Inclusion of a given patent in this series does not constitute an expression of any opinion about the patent itself. b) This document has no legal standing whatsoever; for that, please refer to the original document on the USPTO website. – Ed.

- [54] **FOLDING WING GLIDER**
- [75] **Inventor:** Paul Carlson, Urbana, Ill.
- [73] **Assignee:** Off The Ground Models, Inc., Lawrenceville, Ill.
- [21] **Appl. No.:** 828,619
- [22] **Filed:** Feb. 11, 1986
- [51] **Int. Cl.⁴** A63H 27/00
- [52] **U.S. Cl.** 446/62
- [58] **Field of Search** 446/62, 61, 63, 64, 446/66, 67, 68

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Primary Examiner—Robert A. Hafer
Assistant Examiner—D. Neal Muir
Attorney, Agent, or Firm—Tilton, Fallon, Lungmus & Chestnut

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Abstract

A folding wing hand launch glider having two modes of operation is disclosed. In one mode of operation a portion of the wings are retracted and so produce a reduced air resistance and lift, while in the other mode of operation the wings are fully outstretched so that the airplane glides. The first mode of operation is used for launching the glider and the second mode of operation represents normal flight. The outer tip portions of the wing is hinged and said portions are released to their fully outstretched positions, such as by command from radio control means after the glider is launched.

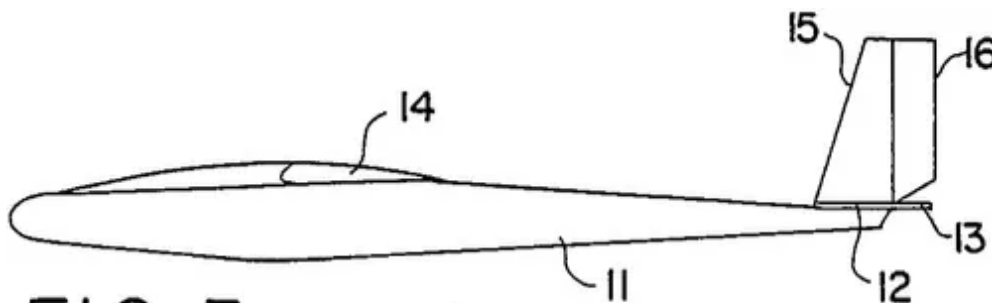


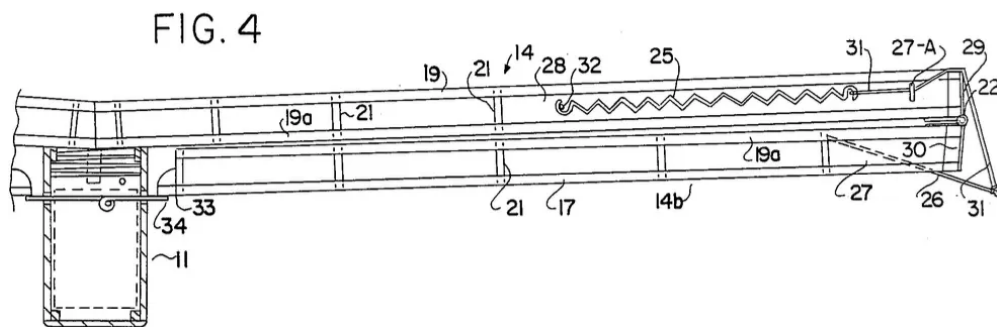
FIG. 3

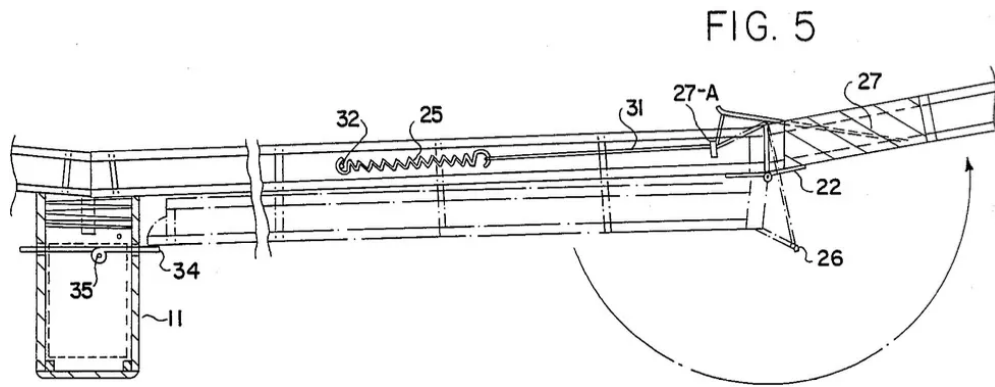
Background of the Invention

The concept of the folding wing hand launch glider was devised in an attempt to overcome the problems associated with launching small gliders. The gliders have to be kept as light in weight as possible to fly well, but designers have found that by building the planes stronger and thus heavier they were able to launch the planes with a greater force which gave the plane more altitude and oftentimes longer flights.

When a conventional fixed wing hand launch glider is thrown hard in an attempt to gain more altitude from the launch, the wings produce much more lift than the plane needs. Since the lift of a wing increases to the square of the velocity, increased velocity at launch means more lift which tends to cause the glider to loop in the air. To keep the glider on the desired launch path, the elevator must be applied downwardly to counteract the extra lift of the wing. The resulting configuration of the flying surfaces produces a large amount of drag which slows the aircraft and wastes a large amount of the kinetic energy transferred to the plane during the launch. Not only is extra drag produced, but the wings are stressed much more than normal. In order for the wings to survive such stressful launches they have to be made stronger which in turn means the gliders are going to be heavier.

There is a definite need for a lightweight hand launch glider having reduced drag during launch and also having the capability of being launched with great force without causing unwanted looping.





Summary of the Invention

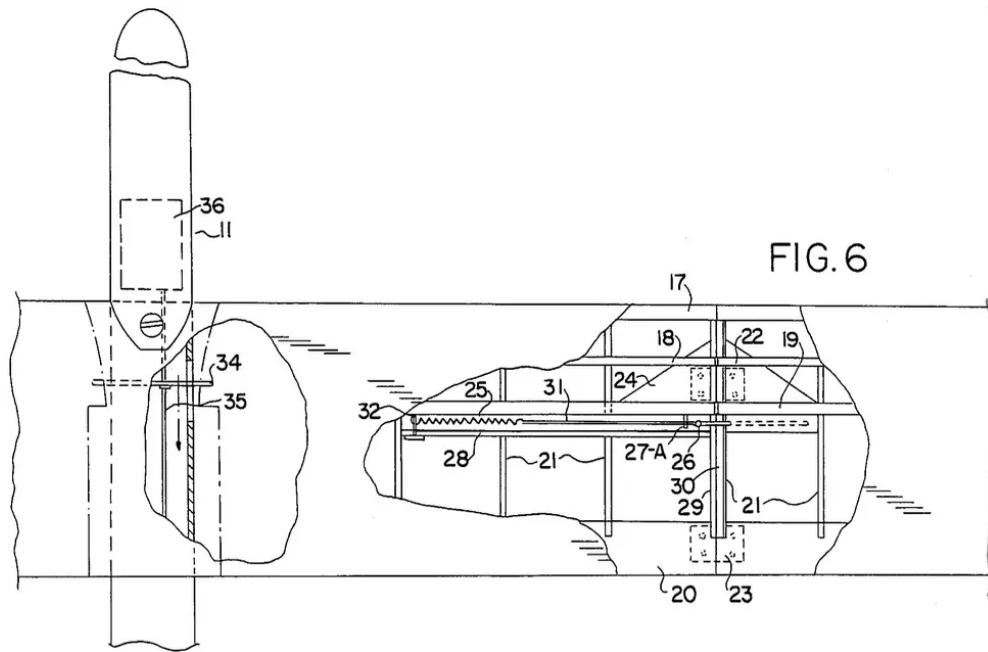
It is an object of this invention to produce a lightweight model glider than can withstand a great force when launched and will not tend to loop in the air during launch.

Another object of the present invention is to provide a hand launch glider which has flying surfaces which do not produce a large amount of drag during launch.

Yet another object of the present invention is to produce a folding wing hand launch glider in which upon launching, portions of the wing are retracted and after launching said portions may be released by radio control means to fully extend the wings for normal flight.

The present invention relates to a folding wing hand launch glider or sail plane which overcomes the traditional problems associated with launching model gliders while gaining higher altitudes upon launching. The folding wing hand launch glider comprises a fuselage, a plurality of wings, each of said wings having outboard wing panels and inboard wing panels, the outboard wing panels capable of being folded underneath the inboard wing panels by hinge means, and with the outboard wing panels being held in place by a releasable pin. With this configuration, the flyer may launch the glider with great force without stressing the wings or looping the plane. Before the apex of the launch, the flyer may release the outward wing panels by radio control means to fully extend the wings thereby converting the remaining speed into extra height. At this point, the glider is free to

perform as a conventional hand launch glider but would do so starting at a much higher altitude thereby resulting in longer times of flight.



Description of the Drawings

FIG. 1 shows a top plan view of the folding wing hand launch glider of the present invention with outboard wing panels retracted, i.e. folded underneath the inboard wing panels.

FIG. 2 shows a top plan view of the folding wing hand launch glider with the outboard wing panels extended.

FIG. 3 shows a side elevational view of the folding wing hand launch glider of FIG. 2.

FIG. 4 shows a detailed rear section view of a wing, with the outboard wing panel folded underneath the inboard wing panel, but otherwise similar to FIG. 5.

FIG. 5 shows a rear section view taken at line 5-5 of FIG. 2 of a wing exhibiting the releasing means of the outboard wing panel from the inboard wing panel.

FIG. 6 shows a top sectional view of a wing disclosing hinging means and release means for the outboard wing panel.

FIG. 7 shows the respective angles of the wing sections off horizontal.

FIG. 8 shows a front sectional view of a wing disclosing alternate releasing means.

FIG. 9 shows a side elevational view from the end of a folded wing showing the outboard wing panel folded underneath the inboard wing panel.

FIG. 10 shows a side elevational view of the tip end of a fully extended wing.

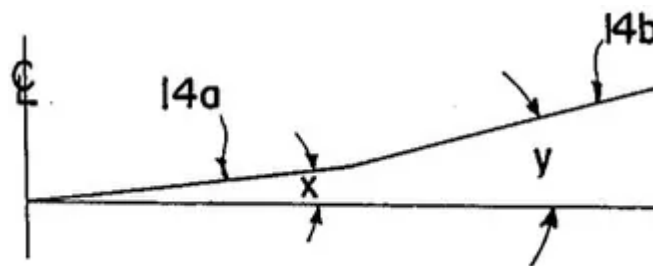


FIG. 7

Detailed Description of the Invention

Referring initially to FIG. 2, the numeral 10 refers generally to the model glider of this invention. The glider 10 has fuselage 11, stabilizer 12, elevator 13 and wings 14. Each wing comprises an inboard panel 14a and outboard panel 14b. The glider 10 may be constructed of balsa wood in a well known manner and covered with any suitable flexible sheet material. Of course, other lightweight materials may be utilized for the structure and covering depending upon the preference of the model builder.

While FIG. 2 shows the outboard wing panels 14b fully extended for normal flight, i.e. placed in the flight position, FIG. 1 shows a top plan view of glider 10 in the launch position in which the outboard wing

panels **14b** are folded underneath the respective inboard wing panels **14a**. The wings **14** thus may be folded for purposes of launching the glider **10** by hand or other means or for purposes of storage, transportation, etc. The wings **14** in the folded or retracted position are generally referred to as being in the launch position.

FIG. **3** shows a side elevational view of glider **11** disclosing fin **15** and rudder **16**.

The preferred embodiment of the folding wings **14** is shown in FIGS. **4, 5** and **6**. Front strut **17** runs parallel to other structural strut members **18, 19** and **20** in the wing. All parallel structural members abut and are rigidly connected to spar plate members **21** to provide rigid support for wing **14**. Front strut **17** is adjacent the forward or leading edge of wing **14**, structural member **18** is located near the top center of the wing, structural member **19** provides support at the top center of the wing, structural member **19a** (see FIG. **4**) provides support at the bottom center of the wing, directly underneath member **19**. Structural member **20** secures the back sides of spar members **21** to provide support to wing **14**, and provide the customary trailing knife edge shape to wing **14**. Pairs of hinges **22** and **23** connect inboard wing panel **14a** with outboard wing panel **14b** at abutting end spar plates **29, 30**. The front hinges **22** are mounted on respective support blocks **24**. The wings panels **14a** and **14b** are so connected (through hinges **22, 23** and abutting spar plates **29, 30**) as to form a polyhedral joint connection (see FIGS. **5** and **7**), in which angle "X" is preferably, approximately 5 degrees and angle "Y" is approximately 10 degrees.

Wing panels **14a** and **14b** are further connected by releasable locking means to allow folding and unfolding of the wing panels. Extension spring **25** is connected via a flexible wire or thread **31** to a hooked pin **26** which is embedded in block **27** which in turn is secured between structural members **19** and **19a**. Further, a spring support pin **32** is embedded into a shortened, parallel structural member **28** which abuts the ends of certain of the spar members **21** and extends to end

plate **29** of inboard wing panel **14(a)**. The spring wire **31** connects the spring **25** with hook **26** and passes through support eyelet **27a**.

As shown in FIG. 4, when outboard wing panel **14b** is folded, outer striker tab **33** engages a release pin **34** carried in the fuselage **11**. Release pin **34** is secured to the moveable cable **35** which controls movement of elevator **13** by radio control means **36** in the fuselage **11** of glider **10**. Accordingly, in the launch position the outboard wing panels **14b** are folded on the glider and the combined wing panels **14a, 14b** offer minimal air resistance and little lift force so that the glider can be projected into the air at a great force. Preferably the glider is hand launched at an angle of 60 degrees off horizontal. Slightly before the glider **10** reaches the apex of its ascent or launch, the flyer may signal through his radio control means a command to move the elevator upwardly to sustain flight. With this command which rearwardly moves cable **35**, the release pin **34** would disengage the striker tabs **33** of the outboard wing panel **14b** so that the springs **25** would tighten and thread **31** would pull the outboard panels **14b** to their fully extended flight position to allow the glider to sail. Upon landing, the wing panels **14b** can be easily retracted into the launch position for another take off. Wing panels **14b** are simply folded downwardly until the tabs **33** securely engage release pins **34**. The glider **10** is then ready for another hand launch.

FIG. 8 shows an alternate embodiment wherein the connecting hook pin **26** is embedded in block **27**, within the confines of the wing **14b**, i.e. pin **26'** does not extend outwardly from the upper surface of wing panel **14b** as does pin **26** in the preferred embodiment (see FIG. 5). Otherwise, pin **26'** is connected via wire **31** to spring **25** and operates wing panel **14b** in a similar fashion.

It will be understood that the above description of the present invention is susceptible to various modifications, changes and adaptations.

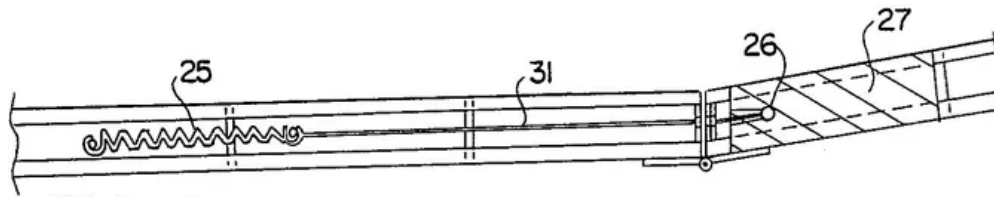


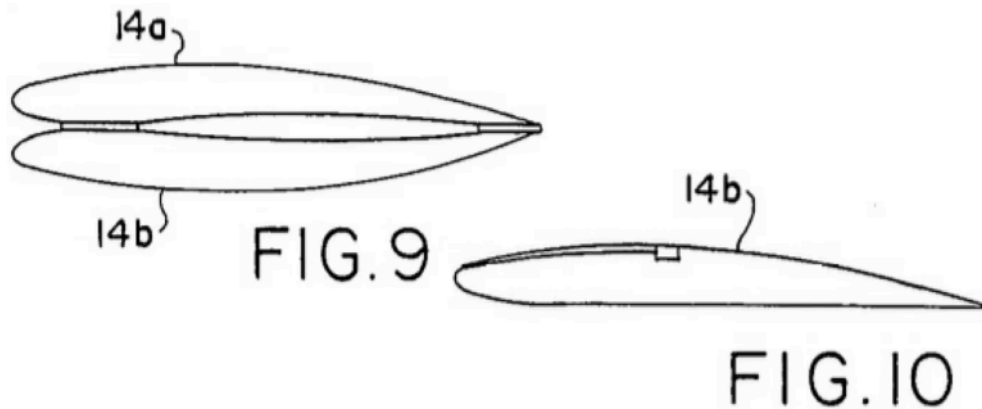
FIG. 8

Claims

What is claimed is:

1. A folding wing glider comprising in combination: ¶ a fuselage having a length; ¶ a plurality of wings attached to said fuselage, each of said wings having an upper surface, each of said wings including an inboard wing panel and an outboard wing panel of generally equal size connected thereto said outboard wing panels foldable downwardly away from said upper surface of said inboard wing panel and underneath the respective said inboard wing panels to thereby be placed in a locked launch position, said folding with respect to a hinge axis, said hinge axis being generally parallel to said fuselage length; and ¶ releasable locking means to controllably release said outboard wing panels from said folded launch position into an extended flight position.
2. The folding wing glider as described in claim 1 wherein each said outboard wing panel is hingedly mounted on said inboard wing panel.
3. The folding wing glider as described in claim 2 wherein each flexible connector means and spring means cooperate with said hingedly mounted outboard wing panel to extend the same from a locked position downward and in direct alignment underneath said inboard wing panel.
4. The folding wing glider described in claim 3 wherein, when said outboard wing panel is folded downwardly and locked underneath said inboard wing panel, said spring means is stretched, and further, upon a controlled release of said outboard wing panel said spring means and said flexible connector means urge said outboard wing panels into said extended flight portion.

5. The folding wing glider of claim 1, wherein said releasable locking means comprises movable pin means engageable with the outer tips of said outboard wing panels when foldably placed in said launch position, said movable pin means operable to be controllably moved as desired to effect release of said outboard wing panels.



Resources

- [US Patent and Trademark Office](#) (USPTO) – The USPTO provides an outstanding search engine which enables digging through (seemingly) every patent in their archive. Proceed with caution – you could easily spend **days** of your time digging through their utterly fascinating files.
- [US 4759736 A](#) – A PDF of the original patent as downloaded from the USPTO website, on which this article is based.
- [Glider Patents](#) in the New RC Soaring Digest. – The complete compendium of articles appearing in this series.

Thanks to Editorial Assistant

for her invaluable assistance in preparing 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](#).

The Trailing Edge



"DG-1000 at sunset." (credit: Sébastien via Flickr and all rights are reserved. It is used here with permission)

We're glad you brought up the subject of deadlines.

Yeah, we know you didn't but they're much on our minds this month so we're going to talk about them anyway.

In his near insatiable desire to bring you, the reader, an incredible volume of great stories each month, *The Ed* can sometimes be — shall we say — a bit 'enthusiastic'. We don't spend a lot of time making hay about it but your stories really are lavished with our attention when they arrive. They're worth it. We always think it's going to be a few minutes but it always ends up being at least a couple of hours to do justice to each story, and in some difficult cases, as much as a day or two. So a word to the wise when *The Ed* says "sure, you have plenty of time...just get it in as quickly as you can!" What he's really saying is that **he** has plenty of time because it's not really his time for which he is making a commitment. It's ours.

Please don't get us wrong – we love the stories we're asked to edit. But if you can possibly get them in by the **end-of-the-day on the 15th** two great things happen: first, the issue has a fighting chance of getting out on time. Although we know that February is three days short of a real month, having to work until the third day of any new month to get an issue out isn't exactly our goal. The other good thing that happens is that we're not pulling all-nighters trying to get all these great stories out to you. And we can't begin to tell you how much we thank you for that.

If you miss the 15th, the absolute worst case scenario is that your story will get bumped to the next issue. Not the end of the world, of course, but disappointing for you if you spent a ton of time telling your tale and you're now anxious for the world to read it.

So thank you so much for your help. And we can just keep this between us. That way when *The Ed* gives you his "sure!" spiel, we'll both know what it really means. Thanks to each and every one of you, we really appreciate it!

New in the RCSD Shop



Featured on the March 2023 *Cover Photo T-Shirt* is this beautiful, 60s-vibe black and white image taken by Mike Shellim. Mike captured

Kevin Newton giving Alvaro Silgado's *Fox* some prime motivation off the south face of La Muela, Spain in 2019.

Also, in the spirit of this month's black and white cover photo, the sleeve art is also featured in monochrome and appropriately the shirt is only available in black and white. [Order yours today.](#)

All items in the Shop are made especially for you as soon as you place an order, which is why they are fairly priced and it takes us a bit longer to deliver them to you. Making products on demand instead of in bulk helps reduce overproduction and waste. Everybody wins. Thank you for making thoughtful purchasing decisions!

Make Sure You Don't Miss the New Issue

You really don't want to miss the April, 2023 issue of the New RC Soaring Digest when it's out – we always have some exciting things in the works. Make sure you connect with us on [Facebook](#), [Instagram](#), [Twitter](#), [LinkedIn](#) and [Post News](#) or simply subscribe to our [Groups.io](#) mailing list. Please share the New RCSD with your friends – we would love to have them as readers, too.

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

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Resources

- The key photo for this article was taken by [Sébastien](#). He describes the photo simply as the "DG-1000 is coming back from the airfield after some nice aerotowing." The photo was taken on June 26, 2011. Thanks so much for the opportunity to present this beautiful photo the pages of the New RCSD.

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