Radio Controlled
Soaring Digest
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The New RC Soaring Digest

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Click on any row to go directly to that article.

In The Air

“Flying underway” is the minimalist caption provided by Mike Shellim for his photo taken at the Welsh Open F3F. It took place on September 9th through 11th, 2022 at Bwlch, Wales. Click the image to view Mike’s spectacular still photo in all of its glorious, original resolution.

Great storytelling isn’t always about what you leave in — it’s also about what you leave out.

Many years ago my late, great Aunt Joan told me a story about a flight to the Galapagos Islands she shared, quite by coincidence, with a National Geographic crew. Why my itinerant, enigmatic aunt was on that flight is another story for another day but the NatGeo folks were, of course, going there to snap photos for an article planned for an upcoming issue. In the course of the in-flight conversation with them, dear Aunt Joan managed to glean how many rolls of film they were taking on their expedition — yes, this was back in ‘those days’. Their answer? Jaw-droppingly, the number was **325**. Which is to say well over 11,000 frames from which a handful — maybe ten — would eventually wind up on the pages of the venerated magazine.

Clearly the job of those NatGeo folks was less about what good photos to keep, but rather the 99.91% of them they were going to throw away. Setting aside the whole monkeys/typewriters/Shakespeare thing for a moment, while they were clearly pretty good photographers, their real gift was patient and loving *curation*. In their world, the carefully pruned and sequenced collection of still photos was the primary means of telling the story and, wow, were they great storytellers. Amongst the best. They still are.

Although Mike Shellim will likely blush at the comparison, it was my aunt's serendipitous Galapagos trip which popped to mind when I looked at his F3F-related photo albums on SmugMug, links to which he sent me recently. Why the story of her trip popped to mind was that Mike seems to have a real knack for curation — storytelling through pictures accompanied by the briefest of eloquent captions. Without actually being at the events Mike had photographed, his albums provided the next best thing: a *sense* of being there that not even raw video would have done as well. He makes it look easy. It's not.

Just one sample of Mike's work is the key photo above the title for this story. Click on it if you want to see the panoramic image in all of its original, glorious detail. Mike also provided the great picture for our cover this month as well as the intriguing photo which headlined this month's *Lift over Drag* newsletter. But don't stop there, check out all of Mike's albums at the link I have provided in the *Resources* section below.

Also, if Mike's name seems familiar, it's because he is also a talented educator and writer — his *I've Got the Power: OpenTX* is amongst the most popular stories ever published in the New RCSD. I've linked it below, too. Don't tell anybody else, but a little bird told me that he might also be working on some new articles for RCSD, so pleased stay tuned for that, as well. My fingers and toes are crossed and yours should be too.

However, the bigger concept which Mike's amazing photos brings to light is the yawning chasm that lies between his work and the raw photo and video dumps which proliferate on Facebook, for example. I'm not sure exactly how they do it, but it seems that some posters must ask the spouse to grab the wheel and put a foot on the accelerator on the drive home from the field, just so they can upload their 179 pictures and 68 minutes of unedited video to Facebook — without a word of accompanying explanation — before anybody else, heaven forbid, uploads theirs first. For reasons I am totally unable to fathom, the premium seems to be on *immediacy* rather than the illusive and ephemeral goal of, say, *immortality*?

My best guess is it's a weird by-product of our collectively and pathologically shortened attention spans resulting from endless scrolling on the same social media apps. By the way that, too, is entirely intentional behaviour and designed in from the outset by *les enfants terrible* of social media. Get a death grip on those eyeballs and don't let go. With apologies to Jerry Seinfeld and his bit about men's endless TV channel surfing, it's not about what's **on** Facebook, but rather **what *else*** is on Facebook.

Which, in my very 'around the houses' kind of way, is my pitch for asking you to take a moment — a split second is all I ask — before you hit the `Post` button and ask yourself "can I tell a better story with this stuff?" If the answer is 'no', then by all means post away. On the other hand, if the answer is 'well…maybe' trending toward 'yes' with a hint of 'hell yes!' then why not give it a go? And while you're pondering that, think about what might be a good platform on which to publish that story. It's about now I hope you might consider the New RCSD for that and join the very talented group of dedicated storytellers already here.

As always, thanks to all of our contributors to this month's issue and my deepest thanks to you, the reader, for choosing to spend at least a bit of your valuable time with the New RCSD.

Fair winds and blue skies,

Letters to the Editor

We have added another couple of stamps to our ‘famous’ montage — why not see if you can find them? Hint: they are featured in this month’s edition of ‘Stamps That Tell a Story’. Have a stamp you’d like to contribute? We’d love to hear from you.

We have a couple of real nuggets in the mailbag this month.

Peter Scott on the Value of Life Long Learning

RCSD goes from strength to strength. The mix in the latest September issue is superb.

Like you, I didn’t get on with the formal learning at school even though I went to some gooduns, in London and then a London suburb. It was aeromodelling that got me going on focussed learning — project learning — and around age 14 I started on aerodynamics for my free flight A/2 gliders. That needed drawing and maths and they in turn led to a life in science and engineering. Fortunately I then pretended to be an intellectual just in time to pass my A levels at age 18 and get to university. Uni was in those days free and even carried a cash grant. Only 5% of UK kids went to uni then, now approaching 50%.

In the UK we still lack respect and salaries for engineering in its highest sense of designer, so many clever young men and women think that the only higher education is uni, rather than the on-the-job education of apprenticeships. I ran a youth training company for a few years which got many people started in IT. It was magic to see them develop in just a few months. You will I know keep up the campaign to get young people interested in aeromodelling. It is a great way to start in science and we must hope that CAA/FAA stop their pressure to clear us out of the skies.

Yes you are dead right. We do love to learn. It is after all why we developed such a big brain and why intelligence has at least as much sexual attraction as a fine body. Best to have both if you can of course! One of the great pleasures of writing for RCSD is the rigour. I have to look again at the things I have learned in the past to make sure I understand it. There is nothing better than a public forum for making me ensure it is as correct as I can make it.

All the best,
Peter

Peter —thank you for that and your kind words about the September issue. Also I think this is a great place, what with all the readers assembled, to publically acknowledge and thank you for the yeoman service you have provided since RCSD relaunched. If my count is correct, you've written or curated 28 articles to date, which places you way atop the list of our contributors. Given that each of your articles teaches some new tip, trick or trap of the hobby — explained in some new, interesting and insightful way — it's clear that the readers also love lifelong learning with you as their guide. Thank you so much for all your hard work. I can't begin to tell you how much I appreciate it.— ~TCG

Why Do Those Mouldies Cost So Damn Much?

As a designer and manufacturer, many people ask me this question. Well, here's why: I have done the cottage industry bit, and it has moved on to the large factory which is now being sorted. I'm possibly the most prolific model sailplane designer with more models produced, flown, flying, and in production than any other person on this planet, so I know something about this. Here's a further explanation:

First you have a risk — you need to be a designer who really can back up his design criteria with technical stuff and explanations, because honestly the buyers have a right to it. Can you imagine buying a car and when you ask the salesman "what's the intercooler for?" — he can't tell you?

The most important point is you need to make an honest, good looking, nice flying model that does what it says on the tin, because it's going to be a large investment of your time and your money. If it does not work, well then you are screwed. I know this — I have threads running up and down my back — and 're-curving' other people's stuff will not do either because time has shown that 'me toos' will not last the race.

As examples, look at the RCRCM *Typhoon* and *Sunbird*. Both original designs, now well over a decade old, but still selling well and being enjoyed by the buyers. There is no 'my baby' in this equation, because trust me, you might like your own design but it can be questionable whether others will.

Okay, Let's look at some costs in time and money: Investment: Costs for CAD, CNC and production mould making: around $10,000 USD for a 2~2.5m model like a *Forza* or a *Corsa*. Then, there is what do we have to do and how long does it take to make the model. Here are some typical production processes and times for a 2m moulded model:

- Cutting the glass/carbon kit — 1~1.5hr
- Clean and polish the moulds — 1hr
- Mask and paint the moulds Say 2hr — can be up to 6hr
- Layup the moulds — 8hr but it can be more
- Make the spars/sub spars — 4hr but also can be more
- Join the wing moulds — 1hr
- Oven time — 8hr but this interval *can* be used to cut glass/carbon kits and do other jobs
- De-moulding — 1hr
- Cleaning the moulded parts — 2hr
- Aileron and flaps cutting and wipers — 3hr
- Tailplane cutting and wipers — 1hr
- QC assembly — 0.5hr
- Fitting and small invisible defect rectification — 0.5hr
- Cleaning and packing — 1hr
- General housekeeping — 0.5hr
- Total: (Average) 24~28hr with almost all labour hours *per small model*

In addition add the materials, facilities, utilities, CNC mould and labor costs to this production time. Materials bought in small quantities cost far more than larger purchases, and this is especially true of carbon fabrics, glass fabrics and epoxy resins.

Assuming you do have a great design for a one-man band, it's really hard to produce one model per week at good quality, and it's an eight hours-per-day, seven-day-per-week job where the actual outlay for the materials might be more than the finished model can be sold for.

For a factory, you have to have all of your costs well under control and your processes and SOP well documented and understood by the people working there. Added to that the entire enterprise must be very well supervised because when things go wrong — and they do believe me, corrective and preventative action has to be thorough and rapid. QC is of paramount importance.

Cheers,

Dr. James Hammond

何杰 博士

James — you completely read my mind. As I contemplate another winter building season — I'm still kind of a stick-and-solarfilm, man, I have to admit — I often find myself wondering why I don't just buy the latest and greatest carbonfibre wonder. Then I look at the prices (gulp) and I'm instantly inclined to cyano another stick and heat up the iron. However, your explanation does provide ample objective evidence as to what justifies the price of these beauties. Thank you very much for that.

While I'm at it, this is also a great opportunity, as with my comment to Peter above, to publicly thank you for all your contributions to RCSD since the relaunch. This humble journal would not have been the same without you and I really mean that. And from the sounds of what you've hinted at for down the road, the best is yet to come! — ~TCG.

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2

REVOC Custom's Double Glider Backpack

Finally, I reached the slope after a 20 minute walk. Nice scenery, isn't it?

Premium quality equipment perfect for your hiking and soaring adventures.

Introduction

Slope soaring is a wonderful hobby that enables you to discover beautiful scenery. It has one drawback, however, which is that you sometimes need to walk to reach the slope with all your equipment. REVOC Custom, based in Poland, is now well known for tailor-made plane and glider wing covers, with the possibility to customise them with additional accessories or even to decorate them with your own logo. They recently introduced two universal backpacks, the *Glider Backpack* able to carry one glider, but provided in two sizes, and a *Double Glider Backpack* capable to carry two 3m gliders (F3x type or similar). This is model which is reviewed here.

A Well-Made Online Ordering System

I have to say that the REVOC ordering and follow up procedure looks very professional. Once you have completed your order, selected options and paid, you receive an automatic email to summarise your order. OK, up to know you will tell me this is the same everywhere. The difference is that when your order is ready a few days later, you receive a notification email with professional, studio quality picture(s) of your order. As I said earlier, because of the highly customisable product, this allows you to see and have a good idea of what you are going to receive. Then you receive a second notification mail for the shipment. The bag, protected in a thick transparent plastic, arrives in a second black plastic-wrapped bag parcel, which is fine considering it is not fragile like a glider kit.

The bag at reception, after removing the first black plastic wrapped bag parcel.

Let’s Have a Closer Look

I found it interesting to look at the different bag features because it gives you a good idea about what is possible to carry, and how.

First the bag size: the bag is proposed only in one size with the dimension 157cm x 36cm x 16cm. It is suitable for transporting 3m planes but can adapt to larger planes too. Up to 157cm half wing, you can close the upper bag with the Velcro®.

Lots of interesting details of the REVOC Double Glider Backpack.

But the pleasant surprise is that you can also carry a 4m plane in it by letting the upper side of the bag open. An additional Velcro® strap allows maintaining the wings tight in the bag.

The bag is available in three colours which are red, grey and black. Remember, however, that dark colour will easily become warm under the sun and so everything which is inside. This is the reason why I choose red. That, and it is highly visible.

The entire bag is made of a durable fabric which is used on other wing bags or fuselage bags. This gives a robust bag, but the downside is that the weight of the empty bag is 2.5kg, which is at the upper end if you compare it with usual mountain rucksack weight which starts less than 2kg for the lightest ones.

The only option available is to add more inner pad(s). But the bag comes already with three inner pads so unless you don't have wing covers at all, the provided pads are more than enough. For two gliders with wing covers you'll need in fact only one pad.

The inner pads allow to separate the wings and offer even better protection.

On both sides of the bag there are two adjustable pockets for fuselages. These are interesting because by default they can host easily two F3x fuselages per pocket, but in addition, they can expand by releasing the strap and receive a much larger fuselage like an *Alpina* or an equivalent 4m semi-scale fuselage. An upper strap secures the fuselage boom along the bag. F3x fuselages can be carried with tails in place.

The side pockets in details.

The bag is also equipped with three pockets closed with a zipper on the front. The objective is that you don't need any additional bags.

The first and upper pocket is a flat pocket that covers the entire width of the bag. It is perfect for storing a mobile phone, small tools, your wallet.

The middle pocket is mainly designed for the RC transmitter and has the following dimensions: 30x23x11cm. It easily host any thumbs RC transmitter. For tray transmitters however, you will need to check the size, and possibly move it to the bottom and largest pocket which is 30x36x11cm.

The front zipped pockets.

The bottom pocket is the largest one and is perfect to host a rain jacket, or a softshell, a cap and why not your lunch bag.

Let’s now look at the straps: First the back straps as it is for what the bag has been primarily designed. They are large and well positioned. They can adjust in length. There is also a waist belt to maintain the bag laterally during the walk.

On one side of the bag there is an adjustable shoulder strap to be used occasionally when for example loading your bag in and out of your car, of if you need to walk under some trees, or open a gate to access the slope.

The shoulder straps.

To finish the description, I need to mention the hook and handle: the hook, placed at the top is perfect to hang the bag on a wall to store it: this is convenient. A second hook or more a handle is located at the middle of the height and which can be used to lift the bag when placing it on your back.

The hook and handle.

Overall the manufacturing quality is superb, with only high quality materials and zips. Seams, cuts, adjustments, finish, every detail is nicely done.

Using the Bag

Loading the wings in the ‘tube’ bag is easy. The inside of the bag is made of a slippery and soft fabric that eases the insertion.

The bag is comfortable on the back.

The size of the bag allows to put up to three F3x gliders including three or even four fuselages on the side pockets. However this load means heavy weight on your back which will be fine for a very short walk distance, but will be too much for a longer distance, especially in mountains.

Replacing the F3x gliders by one 4m glider by expanding one side pocket and letting the upper side of the bag opened and you obtain a great bag to carry your *Alpina*, *Excel* or any other 4m class gliders given that the fuselage is not too big/large.

Two F3F gliders can easily fit in the REVOC backpack.

During the walk, I found the bag comfortable on the back but I was missing a chest strap to avoid the shoulder straps moving. I reported it to REVOC who acknowledged the point, so I guess this is now added.

Also I found the waist belt too large for me, even at its minimum size. This is easy to shorten so not critical.

Later, REVOC contacted me back to tell me that they took my feedback into account. First of all, a belt was added between the shoulder pads that is adjustable in length and can be moved up or down for a better fit. The hip pads are now attached to the belt to improve comfort and transfer the weight when walking. The side pockets have been revised and are now partly made of neoprene fabric so that they can deform slightly and fit better to the front of the fuselage.

The enhancements which resulted from the feedback I provided.

Conclusion

Overall, the REVOC *Double Glider Backpack* is a high quality and convenient bag to use, which keeps its promise to be flexible enough and adapt to different needs by offering a high loading volume, multiple pockets. A good addition to your equipment list if, like me, you often hike in the mountains. And the later improvements makes the REVOC *Double Glider Backpack* even more comfortable and convenient to use.

Left: My favorite fence. | Right: Ready to fly.

Thank you for reading and happy landings to all !

Resources

- *REVOC Custom's Double Glider Backpack* — From the website: "The backpack makes it easier to travel with the model on the slopes of the mountains, protects it from damage during transport…"
- *Planet-Soaring* — Author Pierre Rondel's most excellent website dedicated to RC soaring. Well worth checking out.

*All images by the author. Click/tap any image for a higher resolution version. 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**.*

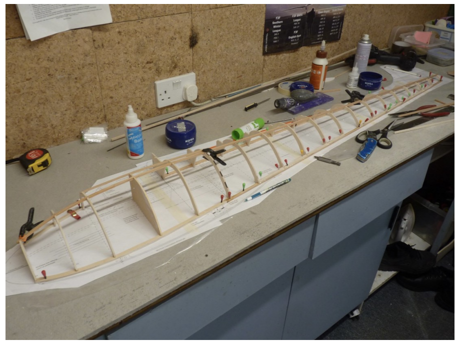
Rhönadler 35

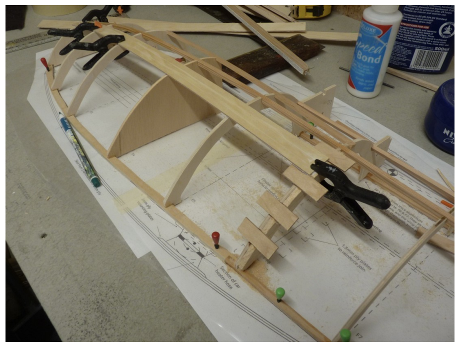
Where it all started: Author with the 1:3.5 scale version of the Rhönadler 35.

Part I: Design and Construction

For those who might be reading this article on a device with a smaller screen (like a phone), the images in this article are going to be really *small. Never fear, though, you can tap on any for a full screen image at which point you can pinch-n-zoom to your heart's content. — Ed.*

The Rhönadler is one of the classic sailplanes from the era of the 1930's, and by 1937 was the most widespread high performance machine of its time. No original examples have survived, although there is a recently constructed replica that now resides in the Wasserkuppe museum. Fred Slingsby based his Type 13 *Petrel* on this design, and you can see that the empennages of the two gliders are almost identical. Back in 2013, I built a 1:3.5-scale version, and it is from this that the new 1:3.9-scale version is derived.



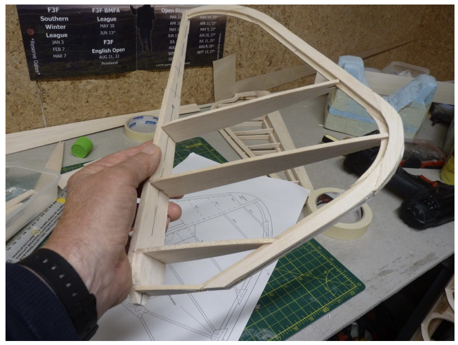


Left: The fuselage is built by the half-shell method, the first half being built over the board. | Centre: Once all the cross bracing at the rear and the majority of planking at the front has been added, the half shell can be removed from the board. | Right: The wing joiner box mount is reinforced with a bracket bolted to a doubled-up former.

The fuselage is built by the half-shell method, whereby the first side is built directly over the plan, before being removed and the second side added directly to it. In order to keep the whole thing straight it's necessary to 1) apply as much of the ply planking to the front as possible and 2) add enough diagonals and doublers to the fuselage rear to render it as rigid as it can be. This is a quick and reliable way to build monocoque type fuselages without all the fuss and extra work needed when using a jig — although sometimes, you don't have a choice!

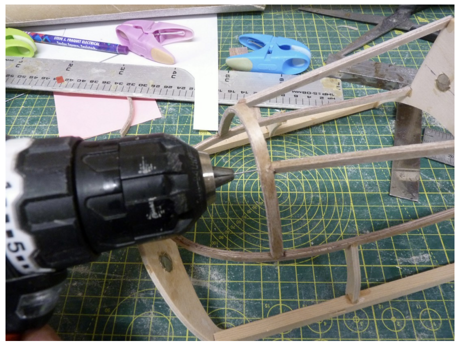
Left: Adding the top pylon facing. | Centre: Finishing off the ply planking at the front. | Right: Lead added as far forward as possible before adding the filler that will constitute the nose block.

The most important thing learned from the bigger version, when the wings parted company with the fuselage during a hastily contrived crosswind landing, was that the wing joiner box needed to be robustly attached to the fuselage. To this end, an aluminium bracket is bolted to a beefed-up former underneath to top surface of the wing mounting pylon, allowing the wing joiner box to be bolted to it. The ply planking at the front is smoothed over with body filler, and the temporary liteply formers inside are removed and the interior glassed with polyester resin and wing joining tape. The nose block is made up from three or four applications of filler.



Left: Planking and filling completed, with the temporary formers in the cockpit removed and the interior glassed. | Centre: The rudder is built ‘in the hand’. | Right: The complete tail unit prior to fitting.

The wings are a departure from my usual choice of airfoil, featuring a scale thickness at the root in order to capture the essence of the full size. This then transitions to my favourite HQ35–12 section at the tip, something I couldn’t have done without the services of *CompuFoil*, the wing plotting app (see *Resources*, below).



Left: Checking the alignment of the empennage relative to the top of the pylon. | Centre: Setting up the canopy framework. | Right: Inserting piano wire pins into the framework joins.

The spruce spars, 5x5mm in dimension seems too small for the task to the enquiring eye, but once the ply webbing plates have been added to the front of the spar, a secondary 5x5mm spar is dropped in front of the web plates to form a strong and very light I-beam.

Left: Early stage of wing construction: fitting the sub spars to form an I-beam. | Centre: Details of the wing joiner box. | Right: Making up the inter-wing fairing.

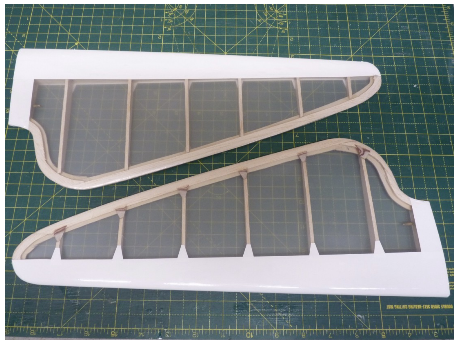
The fuselage is covered with *Solartex* (see *Resources*) the joins being hidden by means of brushed-on two-pack primer, sanded back. Once this has been done, two coats of the same primer are sprayed on and flatted before adding the final two-pack top coats.

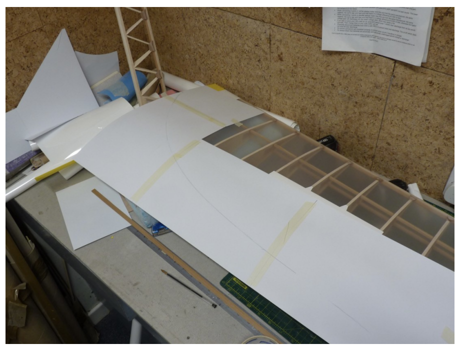
Left: Smoothing the fit of the fairing with car body filler. | Centre: Wing nearing completion. | Right: The Rhönadler airframe, complete & ready for covering.

The flying surfaces are covered with HobbyKing (HK) film; matt clear for the open structures and white and red film for the trim colours over the sheeted parts.

Left: The Solartex finishes on the edge of the nose block. | Centre: The nose now with brushed-on 2-pack primer to hide the 'Tex joins. | Right: Smoothing off the nose dry with a sanding block: 80 grit initially, then 120, down to 320.

With a four-and-a-half metre span, this is not exactly a small model, but at around 5.5kg, and even with that enormous wing area, it's not difficult to rig or to launch.



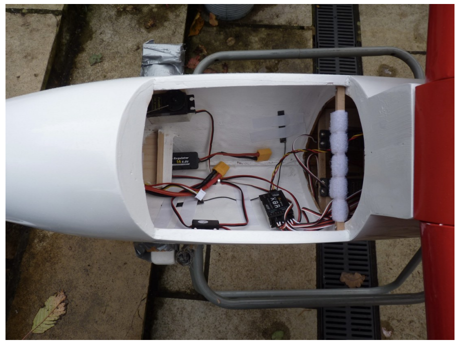


Left: All-moving tailplane blades covered with HK film. | Centre: HK matt clear film on the wing. | Right: Using a card template to cut out identical trim colour for each wing.

Rhönadler 35

Span	4.46m	**Scale**	1:3.9
Weight (dry)	5.5kg	**Wing Section**	Go 535 mod root, HQ35/12 tip
Control Functions	rudder, elevator, ailerons, spoilers, tow release		


25



Close-ups of the finished model

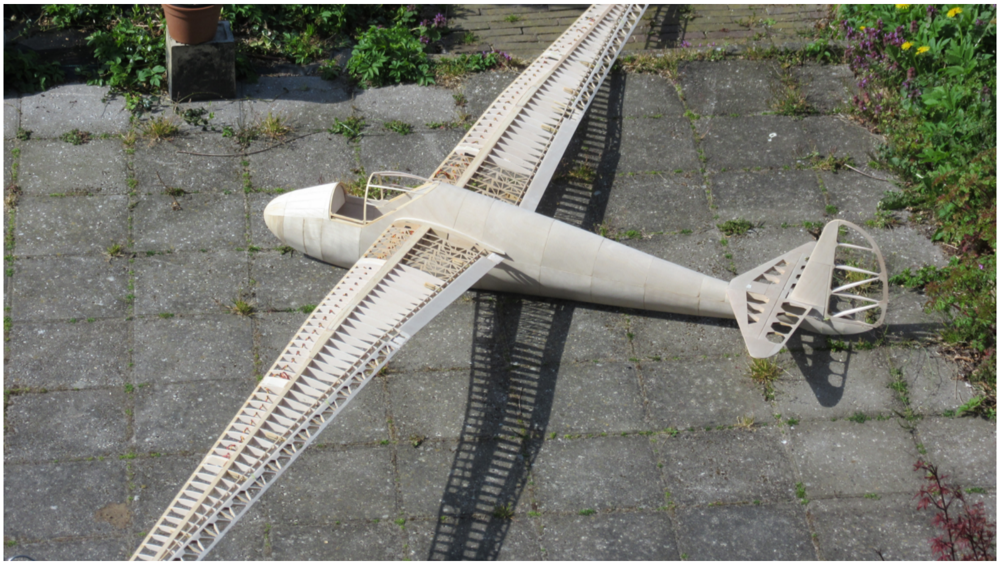
So how does she fly? Tune in for the upcoming Part II and the gripping conclusion!

Resources

- *CompuFoil* — From the website: “the most recognized name in airfoil template software. Easily produce foam template, built up wings, leading edge shaping guides, and planforms…”

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

The Slingsby King Kite



Sometimes it’s a pity to cover the basic structure.

Part IV: Fuselage Sheeting and Main Wing Structure

This is the fourth part of a six part series. Readers may want to review [previous parts] of this series before proceeding with this article.

A New (To Me) Method for Attaching Fuselage Skin

I didn’t want to do this with cyano, but wanted to try another long-known technique: with the heat of a covering film iron and dried white glue. This is how it is described: “apply white glue to both pieces of plywood to be glued, let dry, then press them together and heat it with a hot foil iron.” Sounded hopeful, but new to me.

I started sheeting the top of the fuselage, while clamped on the building jig again, which was easy with the central support batten. I made a template of strong paper and transferred it to the plywood.

Then I cut and sanded it. Now I had to sand the bevels (for the welds), a time-consuming job, especially if the panels are not straight. Some more about this technique can be found on videos on *Scale Soaring UK* (see *Resources*, below).

After sanding and fitting, glue could be applied which had to dry until it was no longer white. After drying the process was repeated to get more glue thickness. The gap of the scarfed joints, which are also curved, was critical and I didn't know if I could work accurately enough.

A tricky thing was the horizontal (longitudinal) seam, which was difficult to get straight; it was hard to get each panel exactly in place, the technique with the dried PVA made that easier than with cyano. When in place I heated it with a foil iron in the middle position (150C). After cooling, it was firmly in place. Because the front of the fuselage was already sheeted with ply on the inside, the fuselage was now rigid enough to be removed from the building jig.

Before sheeting the bottom of the fuselage I made the elevator control, a 1mm steel wire push/pull rod, in a double plastic guide. To be able to assemble and disassemble the stabiliser, I first made a hinge/swivel in the rod at the tail side. I bent a very small eye in this rod, in which a pin of a quick link fitted tightly. Then I made a short rod from two quick links and a piece of M2 threaded rod. I clicked one quick link over that eye and thus obtained a hinged steering rod. This piece could be lifted and then attached with the quick link to the rudder horn of the elevator. As soon as the stabiliser was lowered in place, the hinge was 'stretched' and thus became a stiff steering rod. The rudder was operated by two steel braided pull/pull cables. These were attached to the rudder hinges of the rudder by means of self-locking steel wire hooks so that the rudder could be easily dismantled for transport.

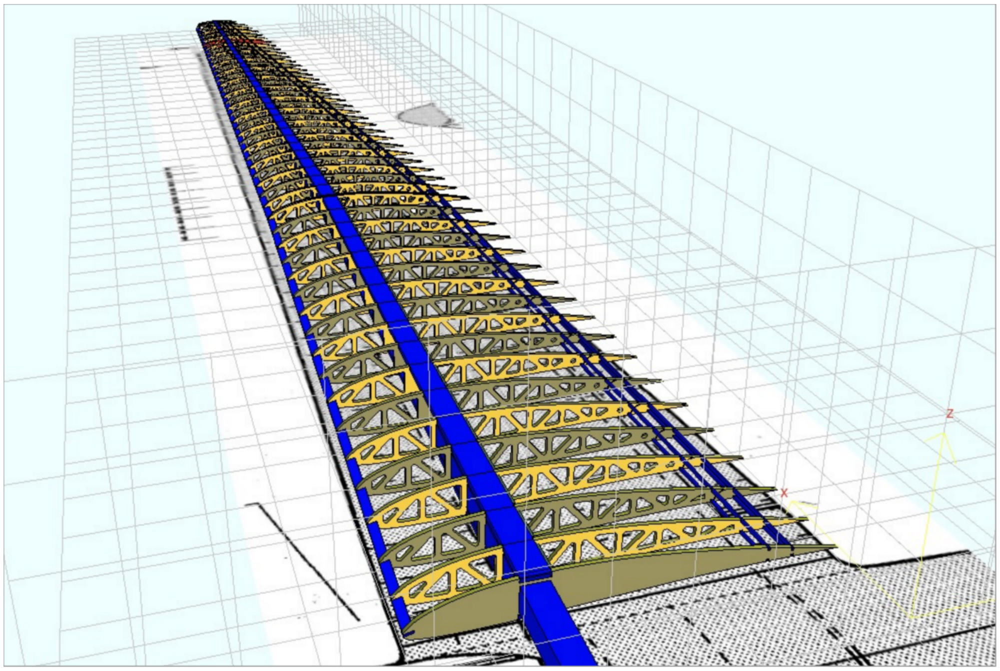
Now I sheeted the whole bottom of the fuselage. Then the nose, which had to be covered with narrow strips of ply, as with the original. A firm base was needed for this. I filled the spaces between the frames with 4mm balsa and sanded it smooth. I built the nose cone from 20mm balsa planks, roughly cut in shape according to the side view. Before gluing the balsa block, I had already hollowed out the inside before gluing the planks together, and glued a plastic jar in it. That jar can hold 130g of lead so after finishing the plane I could put 130g of lead in the jar, measure how much ballast I needed for the most forward centre of gravity and fill the nose with lead shot and epoxy resin. This would give the possibility to remove the ballast without having to chop it out.

After gluing the nose cone on, I sanded it to shape as best I could and then sanded in the faces where the sheeting had to be glued on later. It was hard to see, with a flat pencil I could mark it. Below the largest width the strips were vertical, above they were horizontal, tapering to the point. With light at a flat angle I could see where the faces had to be. I got the idea to mark the faces with pinholes in the balsa cone, so I could sand a bit without removing the marking. At the connection to the cockpit canopy, they followed the rounded frame shape. Further forward, the strips became flat so that they could be bent towards the nose tip. Double bending was out of the question. The strips were one-by-one glued on with thick cyano. I used veneer of 0.5mm instead of ply, that can be sanded without showing it.

Left: Fitting the bent panels on the nose. | Centre, Right: Fuselage and stabiliser almost ready, the wing fairing still to be made.

Starting The Wings

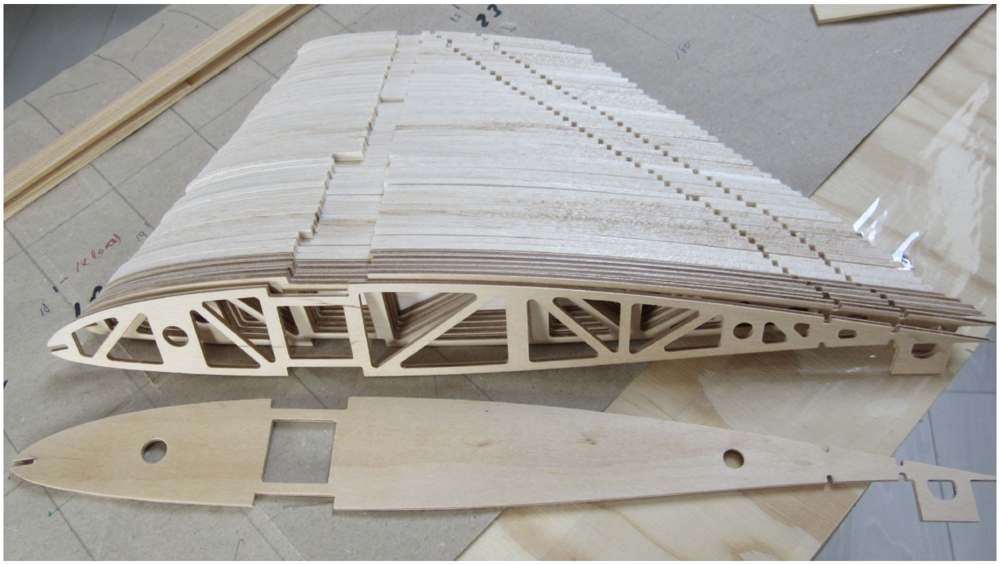
The airfoil choice was difficult. The full-size *King Kite* had a NACA 23021 which looked quite symmetrical. The profile and thickness determine the look of the aircraft and so I ended up with an HQ 2.5 airfoil with a thickness of 12% decreasing to 10% at the tip (link in *Resources*). With the flaps (and with the ailerons too, not prototypical) I could make more camber. I then drew the wing with *devWing* (see *Resources,* below).



Wing in 3D as provided by devWing CAD tool.

My friend Adri Brand was kind enough to mill the ribs and the web plates. The root ribs in 2mm plywood and the rest in 2.5mm medium-hard balsa. With the program *Calcul d'un Longeron* (link in *Resources*)

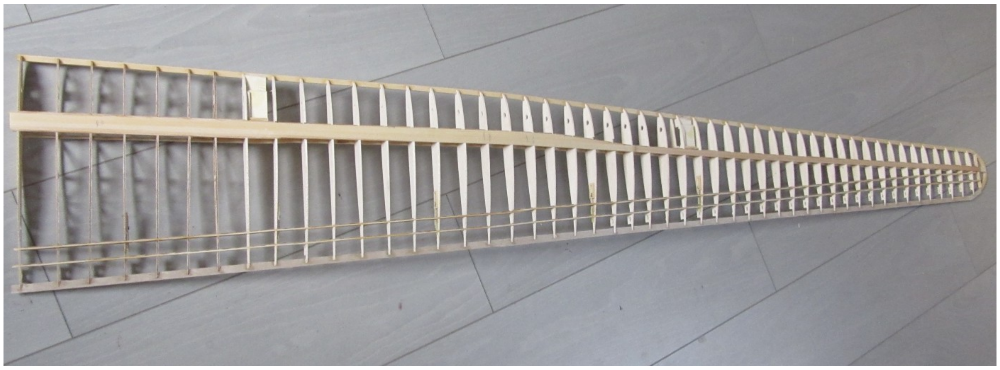
I calculated the main spar: 24x4mm spruce on top and bottom at the root to 2x10mm at the tip. It should be able to take 10Gs, not including sheeting.



The ribs milled by Adri Brand. Aren’t they beautiful?

I built the spars from 2x10mm and 4x4mm spruce, with scarfed joints glued with thickened epoxy resin. The spars themselves were laminated with white glue. As the model has a gull wing, I made a building board at an angle and laminated the spar at that angle too. The wing was quickly assembled. I had to improvise a bit with the servo attachment because the original had a small rib distance and the servos didn’t fit between the ribs.

The wing is completely sheeted with 0.6mm plywood, like the real one. I had already made a glass/epoxy wing joiner with dihedral that fitted in 20x20mm aluminium square tube. The space between the aluminium square tube and the main spar was filled with an epoxy/micro balloons slurry. Quickly it started to look like a wing, so the other wing went without delay and both wings could be fitted on to the fuselage.



Main wing structure under construction.

And at that moment I discovered a huge mistake! In my enthusiasm I had made the dihedral in the wing equal to the dihedral of the wing connector. It had to be half of that — **oops**!

Left: Top spar sawn through and chamfered. | Centre: I glued a thin auxiliary spar under it, to get a stable situation. | Right: New pieces of spar glued in with thickened epoxy, chamfered 1:10.

It was very annoying, to say the least, but I thought: “better now, than later in the construction”. So I cut out the curved section in the top spar and with my powerfile I bevelled both sides 1:10. I changed the angle in the build board (extensively checked now!) and glued two 1x10mm battens under the upper spar to get a stable situation. I made suitable pieces of 2x10 mm spruce and glued it between the spar with 24 hour epoxy with wood dust as filler. At least now the *King Kite* looked good and I proudly took it to the garden for a few pictures as shown above the title of this article.

With the basic structure of the wings now ready, it was time for the ailerons and flaps. But for that, tune in same time, same place next month!

Resources

- *Scale Soaring UK* — From the website: "We are a group of people with interests in Radio Control Large Scale gliders and Sailplanes and Tugs…" This link will take you directly to the plywood panelling videos mentioned above.
- *devWing* — From the website: "innovative application to draw ribbed wings…you can create in a very simple way a ribbed wing drawing…and cut [it] using a step-by-step approach. No CAD skills are required…"
- *Calcul d'un Longeron (Dédié Structure Bois)* — Translated (by Google Translate) as 'calculation of a spar (dedicated wooden structure)': "This spreadsheet was mainly dedicated to the composite construction of the spar. The formulas and the structure have been modified to adapt more particularly to wood construction…"
- *HQ 2.5/12 AIRFOIL* — As found on the *Airfoil Tools* website.

*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.*

Electricity for Model Flyers

(credit: Mariana Bocoi / Unsplash)

Part XI: Currents, Wires and Connectors

I'd like to thank my friend Keith Eldred for his help with this article. He has had a long career in electronic design and maintenance, including aviation, and he put me right over several things. The sections on soldering techniques and crimping are largely his. — PS

DC and Low Frequency AC Only

In a future article I will cover the way that wires react to high frequency alternating currents. This article will be about wires that handle direct (one-way) currents and low frequency alternating currents, say 50 or 60 hertz up to a few hundred. Names for types of wire are used loosely so let's sharpen up. A made up wire with connectors is called a lead in the UK and a cord in the US. The raw wire on a reel without connectors is called cable or just wire. Normally it really doesn't matter, but I'll use lead and wire in this article. I will also cover our connectors and soft soldering tools and techniques.

Why is it called soft soldering? Because lead is soft and relatively weak. For stronger non-wire joints you need silver soldering or brazing.

Wire Dimensions

There are six data you need to know about a wire:

- Material that the conducting part is made from, normally for us copper. This metal part is called the core.
- Number of individual wire strands that make up the core.
- Material that the insulation or sheath is made from.
- Overall size of the core given as a diameter or as a cross-sectional area of the whole core. It can also be specified as the number of, and area of, the individual strands. There are three ways to specify the thickness or gauge.
- Material used for the sheath.
- Current it can safely carry. This one is very uncertain as you will see.

Core Material

Copper is usually used as it is a very good conductor. It is also fairly plentiful though increasingly expensive, and is mined mostly in Chile, the Congo and the US. Aluminium is sometimes used but there are problems making connections to as it oxidises easily which makes an insulating layer and it gradually deforms under pressure. It is a poorer conductor so the cores have to be larger. Silver and gold are also used, mostly by high fidelity audio buffs with more money than sense.

Strands

The wires we use always have many strands. As the individual strands are thinner this makes them more flexible and less likely to break. It does mean more care is needed when making the connections, especially when soldering. Here are some examples of wire specifications:

- **Hook up wire —** 14/0.2 mm meaning fourteen 0.2 mm strands
- **Very flexible wire** — 55/0.1 used as probe leads for meters
- **Heavy duty wire** — 1050/0.16 for thick '4 gauge' wire in car audio

Wire Gauges (Sizes)

There are three in common use: American wire gauge (AWG) in the USA, standard wire gauge (SWG) in the UK, and metric used everywhere. AWG and SWG sizes are given a number, eg 16 AWG. Strangely, the larger the number the smaller the wire.

Metric sizes are given as a cross-section area in mm². You can calculate actual resistances from them and hence safe currents and voltage drops, so metric sizes are much more useful and this time larger numbers mean larger wires. However most of our wires are still given in gauges, usually AWG.

There are lots of tables on the web so I will just add a few sizes typical to us. For a more complete table, see *Resources* at the end of this article. The AWG sizes are correct and can have several different sizes and numbers of strands. The SWG and metric sizes are not exact equivalents but are close.

AWG	Diameter (mm)	Area (mm²)	SWG	Metric (mm²)	Used For	Current (A)	Resistance/m for AWG
10	2.59	5.26	12	6	Power	15	0.003
12	2.05	3.31	14	3 or 4	Power	9.3	0.005
14	1.63	2.08	16	2	Power	5.9	0.008
16	1.29	1.31	18	1.5	Power	3.7	0.013
22	0.65	0.33	23		Servo lead	0.92	0.053
24	0.51	0.20	25		Servo lead	0.58	0.084
26	0.40	0.13	27		Servo lead	0.36	0.134

When you look at the current carrying capacity, sometimes called ampacity, you will see that we modellers routinely and seriously overload our wires, but it doesn't seem to matter as they are usually in ventilated free air in the fuselage. The specified currents are for when the wires are restricted, for example bundled in a conduit. Most ESC leads are 12 or 14 gauge and we run many tens of amps, or even a hundred, through them. I always now only use 22 AWG servo leads but of course retracts or powerful servos can go up to five amps.

Resistance

If you push a current through a wire it will absorb some of the energy (voltage) and heat up. Sometimes this is desirable as in fuses, but normally it is a waste. You can calculate these voltage losses by finding out the resistance of the wire. Typical values for ohms per metre for the AWG sizes are in the above table. Say you were pushing 50A through a total length of 0.25 m of 14 AWG wire. What would be the voltage drop?

```
V = I R = 50 x 0.25 x 0.008 = 0.1 V
```

Nothing to worry about then.

Sheath Material

As always there are many materials used, including those for hazardous environments. I will just deal with those relevant to us, where the main hazard is over-heating, though abrasion can cause wear if the wires are free to vibrate.

- **Polyvinyl Chloride (PVC) —** This is generally the most common as it is cheap and easy to form. It is water and oil resistant though it can be damaged by high temperature. It can be recycled.
- **Silicone** — This is much more expensive and cannot be recycled. It is less resistant to abrasion than PVC. However it isn't affected by high and low temperatures so is the preferred material for us. We only use short pieces so the cost isn't important.

- **Polytetrafluoroethylene (PTFE or Teflon)** — This shrugs off attack by heat and chemicals but isn't very flexible so probably isn't useful for us. Or do gas turbine modellers use it near their jets? Must ask.

You can tell what the sheath is made from by touching it with a hot soldering iron. If it quickly melts or burns it is PVC.

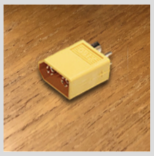
Radio Control Electric Power Connectors

Wherever you look in electronics you see a bewildering number of different connectors. Some manufacturers even invent their own that no-one else uses. Apple is bad for that as is my Waterpik tooth cleaner. The latter has the most weird mains lead connector. I dislike that 'Daddy knows best' attitude. Why can't everyone just use the larger (kettle) three pin or small (figure of eight) two pin mains connectors and the micro USB for low voltage charging leads? OK, there are now two micro USBs but that's better than a zillion.

I must clear up one thing. A connector with one or more metal pins is the male part. A connector with one or more hollow sockets is the female part. Please don't get wokey on me for that nor for the fact that joining them is called mating. It is what it is. Some suppliers use the shape of the plastic body for the male/female name, especially for servo leads. Always look at the part, or a picture of it, before buying.

These are what we use in radio control. Yes, only eight! I'll cover soldering later in the article. Current ratings are shown in square brackets — however, please note these are a guide and only for modelling applications. How much current the connection will carry depends on the cable size, how much ventilation there is and for how long the current flows.

HXT2 [30A], HXT3.5 [75A], HXT4 [90A], HXT6 [150A], HXT8 [250A]. In effect, bullets in sleeves.

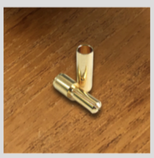


XT30 [30A], XT60 [60A], XT90 [90A], XT150 [150A]. This of course shows the male part.

I now use this variant of the XT60. It has a clip-on shroud. Combined with heatshrink over the joint it makes fatigue failure much less likely. However they are longer.

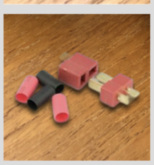
EC2 [20A], EC3 [50A], EC5 [80A]

JST/Molex crimps [5A]. For indoor or light outdoor models.

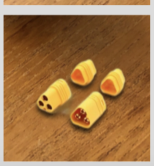


Bullet 2 [30A], 3.5 [50A],4 [60A], 5 [80A], 6 [150A], 6.5 [200A], 8 [250A]

JST-XH (3, 4, 5, 6 and 7 pin). Low current for balancing, telemetry and indoor flying.



Deans / T-style (HCT) Micro [10A], Ultra [60A]



MT60 [50A]. Handy for ESC to motor leads.

My Preferences

I wish I could like Deans. They are small and light, but easy to damage when soldering and more difficult to make fatigue-proof even with heat shrink. I like EC connectors. You solder the connectors to the wire then push them into the housing when still warm. They lock into place. However I mostly use XT60 or XT90 as they are the usual LiPo battery fitting. In the shrouded version they are very resistant to fatigue, especially when sleeved with heat shrink.

Soldering

Always use resin core 60:40 tin/lead solder, not the lead-free type used for plumbing. The resin acts as a flux, improving adhesion and keeping out the oxygen. Lead solder is best for electric joints and circuit boards. There were experiments done with low- or non-lead solders a while back but they didn't work well in electronics due to whiskering and other factors. Good sizes for electronics are 1.2 mm diameter for larger joints like connectors and 0.7 mm for finer work on circuit boards.

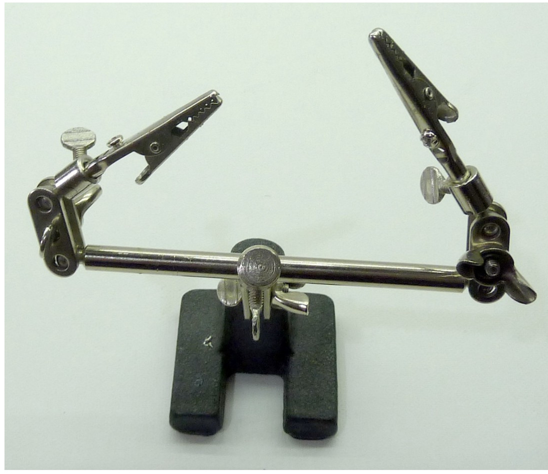
The Tools You Need

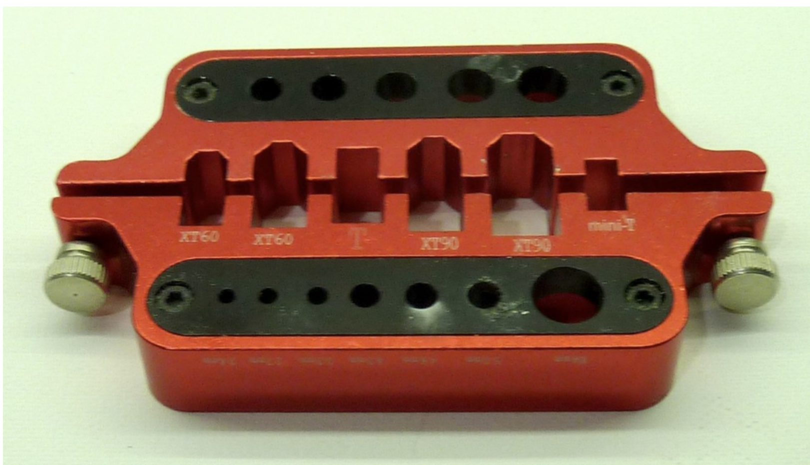
First you need a soldering iron. For small joints a temperature-controlled solder station is best. For larger joints get a 100 or 150 W solder gun. For really thick wires the very best is a gas soldering iron. I had a lot of trouble soldering 12 and 10 AWG wires into connectors even with a 175 W gun until a fellow flyer suggested a gas iron. None of these cost a lot. Probably no more than £20 ($25) for each, yes, even the station. The supermarket Lidl (see *Resources*), which is now almost worldwide, often has such equipment. You can of course also use the gas iron at the field.

Left: Cheap solder station from Lidl. | Right: 175 W solder gun.

Gas soldering iron (no, not gasoline!)

Secondly you need a support for the things you are soldering. Helping hands with crocodile clips are useful, as are the jigs that take standard size connectors.





Left: Helping hands. | Right: Soldering jig.

If remaking joints a spring loaded solder sucker is useful to clean up first. Or you can touch copper braid onto the melted solder and it will be removed by capillary action.

Solder sucker.

Soldering Techniques

Bullets can just be held in croc clips on a helping hands stand. Plastic bodied connectors like XT60 are best put in a jig ideally with the mating part fitted as a heat sink.

When you start using a new soldering iron the bit is likely to have a coating of another metal, usually iron. The worst thing you can do is clean it on something abrasive. That will immediately destroy the coating and lead to shortened life. There’s a flux for every application you can think of. For our purposes use a flux that is a grease-like paste that’s in a flat tin. I just dunk my soldering iron in it to clean it and use the damp sponge to wipe the stale solder off and reapply fresh solder and flux. And do it frequently. Also the parts being soldered benefit from being smeared with flux or have a liquid flux dripped on. It can be applied with something like a cocktail stick. Be sure not to use an acid base flux like the plumbers used to. Tin the iron tip by waiting until it is hot then wiping some solder on.

Liquid and paste flux.

Never carry a blob of solder on the iron to a joint as it is almost certain to form a poor joint. As the tips get old, especially the cheaper ones I use, they will need cleaning up with a fine file or emery paper. I am too mean to replace them earlier.

Now prepare the wires. Make sure your hands are clean. After removing the insulation from the end, twist the strands to firm them up. Then clip the wire into the helping hands, heat the strands with the iron and push on some solder all round so they look solid. This is also called tinning. The name helping hands is a good one. Without its clamps most soldering jobs require you to be an alien with three hands.

Now the connector. Don't touch the metal parts where the solder goes. There will be a hollow, sometimes called a bucket, into which the wire end goes. Heat it and push solder in until half full or so. Immediately heat it again and insert the tinned wire end. Wait till the two lots of solder merge and form a shiny surface. Hold steady while it hardens. If it goes wrong, reheat and try again. The silicone sheath should take a bit of abuse. However if the plastic part starts to distort throw it away and use a new connector.

Some people prefer to push the untinned stranded ends into an unfilled bucket then to solder both together. I think this heats the joint up for longer but you might find it preferable.

Never try to solder anything that is not shiny clean. Beware so-called solder tags plated with some coating that is years old and so oxidised that it is impossible to solder. Usually you can tell just by looking whether the soldering is successful. You can see if it is bright and has 'wetted' the parts fully.

Soldering is a skill that needs practice. To start with you might get bad dry or 'cold' joints that have a cloudy dull surface or you'll melt a few connectors. Speed, flux and cleanliness are the keys and you will soon acquire the skills.

Desoldering for Repairs

A solder sucker, or desoldering braid, performs badly without flux so use generous quantities of the stuff. The aim should always be to get in and out as fast as you can. Flux will enable you to do this without running the risk of overheating. The most important aim with desoldering is to not do more damage. Struggling for a long time with a hot iron to clear the work site of unwanted solder will often result in just that. But flux it well and the problem goes away, leaving you with a reusable device which might otherwise have been destroyed. Initially I [Keith] was taught always to make a wire joint mechanically strong before applying the solder. Then it was realised that so much damage occurred trying to separate it for servicing/repair that that practice was banned. From then on a joint had to come apart as soon as the solder melted. Result was a huge reduction in scrapped parts during workshop time. The saying, “The equipment is good despite the servicing,” lost its meaning.

Heat Shrink

Always strengthen your connector joints with heat shrink sleeving. You need several different sizes so it is probably best initially to buy a box with lots of sizes until you know what ones you use most. Wait until the joint is cool. At this point you discover that you should have slipped the sleeve on the wire before you soldered the wire on. You will only make this mistake once, perhaps. The sleeve needs to slip on to the connector easily so will usually be much larger than the wire. It will shrink to half or even a third of its size depending on make. You can heat it with the iron or a cigarette lighter but the best tool is a heat gun. Again there is no need to pay more than £20.

Heat gun.

Heat shrink is useful when joining two wires together for example to extend a lead or make up a special one from two different leads. Slide the sleeve onto one of the wires if there are connectors at the other ends. Remove about 10 mm of insulation from each wire then push the strands together to merge them. Twist to firm them up then it is easy to fill them with solder. Finally heat shrink the joint. Oh no! I forgot the heat shrink.

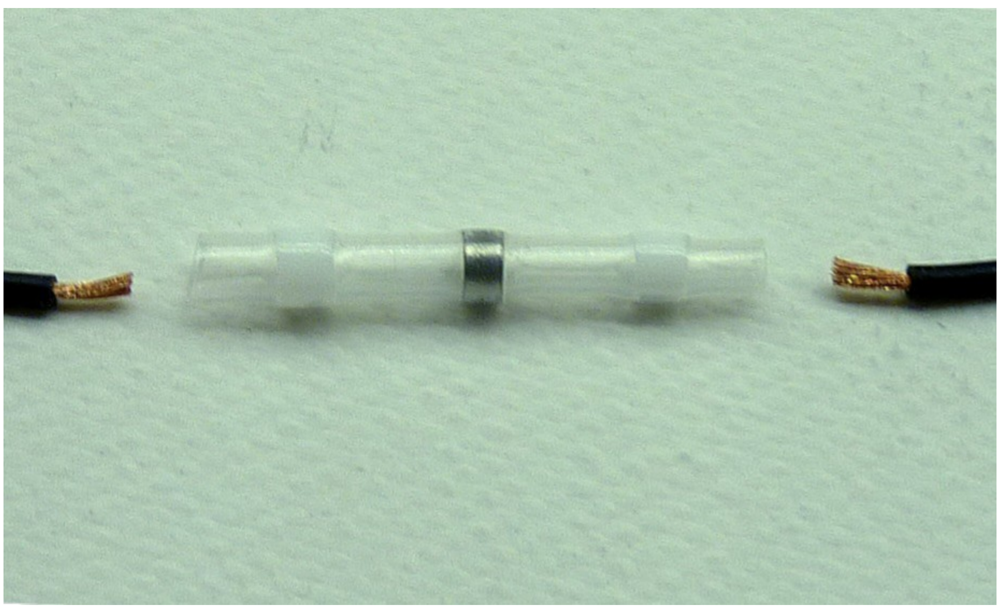
Crimping

This doesn't apply to our power connectors but could apply to others such as servo leads. To me crimping is counter-intuitive. I used to think that solder was always best but Keith put me right. It is of course vital to use the correct crimping tool, so buy the best.

In applications in high vibration situations, the moment you tin a high flexibility cable it becomes the least reliable link in the chain and a crimped joint becomes the method of choice. The auto industry didn't choose it just because it is quicker to do, cheaper and stronger. It is far more capable of withstanding the vibrations found in cars, etc. The act of tinning a multi-stranded cable turns it into a single strand and if flexed at the point where the solder has wicked to, it becomes highly susceptible to fracture. In fact, you will find a requirement to crimp written into most military specs.

Heat Shrink Soldering

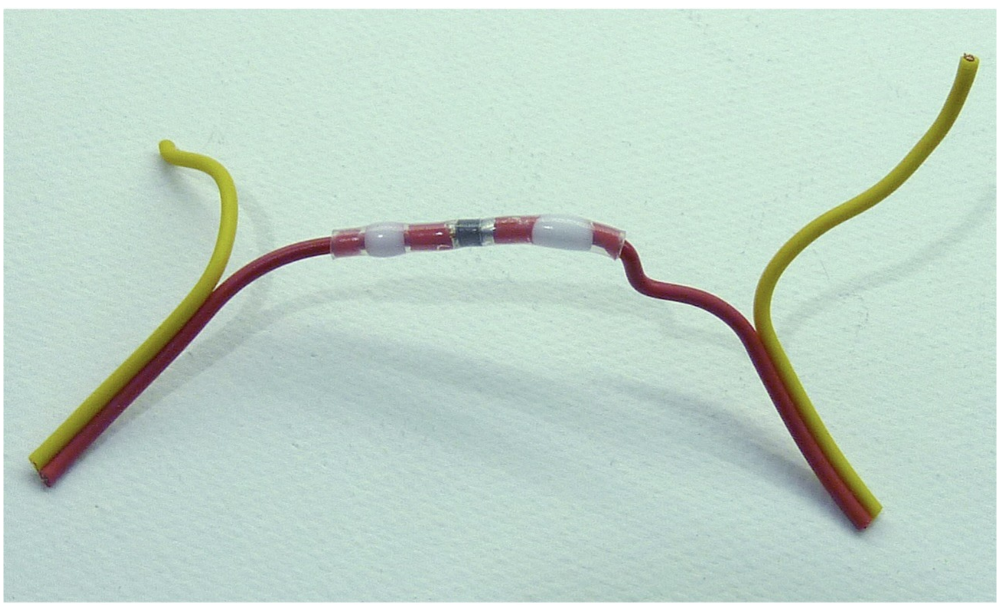
One exception to the solder ban is where you join two wires. The heat shrink sleeve will resist the bending stress and bending will be at the ends of the sleeve. You can now buy heat shrink joiners with solder built in. These were new to me until Keith Eldred told me about them. The idea is a piece of heat shrink sleeving with a ring of low melting point solder in the middle. You trim the two wires to be joined and push them in so the bare bits are meshed together inside the solder ring. The ones I bought shrink to one third the diameter.



These are bared a bit too long.

Here the 22 AWG servo wires pushed in.

I messed up the black wires due to too low a temperature. The data said minimum of 135C. I tried 150C but it was much too low. In the end I did the red join at 270C. The coloured part spreads as the shrinking happens.



Here you can see that the solder has wicked into the wires on each side.

This is the kit I bought. Sizes are colour coded from 26–10 AWG (0.25–2.5 mm²) with one size covering two sizes of wire. This set will cover just about every size we are likely to need. It cost £7 on eBay. No point in adding dollars at present and I don't see the point of the black heat shrink either.

That’s it for now. Good luck with your project, thanks for reading and see you next time.

A

Soaring the Sky Podcast

Schempp-Hirth Ventus-3 as rendered by the Condor soaring flight simulator. (credit: Condor)

E047: Condor Soaring Flight Simulator with Chris Wedgwood

Our fifth 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 we join Chris Wedgwood of *Condor*, the complete soaring simulator. Chris joins us from France to tell us how *Condor* got its wings. He shares his journey with us and the journey of *Condor* and how it's helping to teach people to fly all over the globe and keeping pilots flying in the virtual cockpit when they can't be in the air. Join us now for this interesting and exciting interview now on *Soaring The Sky*.

Resources

- *Condor* — From the website: “*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 the Sky* — From the website: “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:

Club in Focus

Torrey Pines Gliderport (credit: Ray Pili)

Torrey Pines Gulls (TPG)

TPG is one of the first AMA Chartered clubs dedicated solely to RC soaring. Located in San Diego, California, TPG was first chartered in 1970, celebrating our 50th anniversary in 2020.

The club has one slope soaring site and two thermal sites. Our slope site is the world-famous Torrey Pines Gliderport, overlooking the Pacific Ocean. The Gliderport is listed as a National Landmark of Soaring of the National Soaring Museum; a San Diego City Historical Site; listed on the California and National Registers of Historic Places (the first gliderport to have such recognition) and in 2003 also became the first site listed on the Academy of Model Aeronautics' National Aeromodeling Heritage Program.

RC soaring at Torrey Pines has its own amazing history dating back to the mid-1950s including the first eight-hour plus slope flight with RC by anyone in the world. Flight activities at the gliderport can be complex, as we share this unique resource with paragliders, hang gliders, and sometimes even manned sailplanes, following a comprehensive set of safety rules to avoid conflicts. Aside from general sport flying, we have monthly themed fun fly events. A checkout flight supervised by the TPG Slope Coordinator is required of all RC pilots new to the Gliderport. See *Resources,* at the end of the article, for more information about flying at the Gliderport as well as a beautiful panorama of the location.

Left: Winch launch at the Encinitas Flight Center. (credit: Cliff Hunter) | Right: F5J group launch at the Poway Flight Center. (credit: Bob Hirsch)

Our two thermal sites are in Poway, about 20 miles east of the Gliderport; and Encinitas, 14 miles north of the Gliderport. At the Poway Flight Center, we hold monthly discus launch glider (FAI F3K) contests and bi-monthly limited run electric launch (FAI F5J) contests. Poway is home to the International Hand Launch Glider Festival (IHLGF), held annually at the end of April, attracting F3K pilots from around the world. At the Encinitas Flight Center, we hold bi-monthly thermal duration contests. Both fields have strict limitations on the use of motorized aircraft and are designed for soaring use only. Due to the Southern California climate, we enjoy our contests and fun fly events year-round.

Pilots assembled at the 2022 International Handlaunch Glider Festival. (credit: Bob Hirsch)

The Torrey Pines Gulls holds bi-monthly general meetings where we update members on club activities, contests, fun flys and enjoy guest speaker presentations on a variety of RC soaring, aviation and other glider-related topics. We finish with a free raffle of a glider kit and related items. We also publish a monthly newsletter, and in addition to our website, we have a TPG Facebook page (linked in *Resources*).

In November 2020, TPG was named the AMA Club of the Month. An interview with club president, Ian Cummings and club historian, Dr. Gary Fogel, was featured on the on AMA Podcast #59 on TPG's 50th anniversary (see link in *Resources*, below).

TPG has approximately 125 members of diverse ages, backgrounds, and professions. We're a very friendly group of RC pilots who are always happy to welcome new members. If you're ever in the area, stop by the Gliderport and enjoy the view! Check out our website and Facebook page (see *Resources*, below) to learn more about the club.

Left: Wing mounted camera view of Ka-8s over Torrey Pines Gliderport (credit: Ian Cummings) | Center: Sometimes we get to fly with the pelicans (credit: Greg Houck) | Right: Launching on a perfect Torrey day. (credit: Ian Cummings). Click/tap any image for a larger version.

, TPG Communications Officer

Resources

- *Torrey Pines Gliderport Panorama* — A stunning panorama image provided by Ian Cummings. It's almost like being there!
- *Torrey Pines Gulls* — The TPG website provides everything you need to know including membership, calendar of events/contests, contact information, newsletters, etc.
- *Flying Torrey* — Rules for flying at the Gliderport and other related links may be found here.
- *TPG Facebook* — Check us out on Facebook for the latest postings and other news.

- *AMA Club of the Month Podcast* — "Joining us on the AMA Podcast today to talk about the Gulls is club president Ian Cummings and club historian Gary Fogel."
- *The 2022 International Hand Launch Glider Festival* by Gary B. Fogel — A write-up of the 2022 edition of the IHLGF which was featured in the June 2022 of the *New RC Soaring Digest*.

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

Stamps That Tell a Story

The saga of a single image used for stamps issued in two countries.

The German Post Office (Deutsche Bundespost) issued a set of two semi-postal stamps with the theme *For the Sport*. One honours the sport of rowing, the other soaring, the subject of this article. The surtax from the sale of these half postage-half donation 'semi-postal' stamps went to the German Sports Foundation. It was designed by Professor Gerd Aretz and issued at Bonn on April 10, 1981.

Dr. Claus-Dieter Zink provided some background information on the photo used: when the German Post Office decided on the theme, Professor Aretz contacted the publishers of the well-known *Segelflug-Bild Kalender*. They suggested contacting Claus-Dieter Zink for a photo of gliders flying in the Alps which had not been published by them.

This is the story of the photo, taken about three years prior to it being issued as a postage stamp: take-off was from the Alpine Glider Flying site near Niederöblarn in Southern Germany. Claus-Dieter flew his

Mistral C sailplane, and took this photo looking back. Andreas Deutsch from Switzerland piloted the ASW-20 (shown in the foreground) and Fritz Stehle, an oldtimer Lufthansa pilot from Germany, flew his ASW-15.

The ridge in the background is the southwestern section of the Austrian Dachstein mountains with the village of Radstadt/Tauern in the valley. One can barely recognise the radio tower on top of the Rossbrand Peak.

Eight years later the same photo, altered just a little, was used by Bulgaria for a postage stamp, one of a four part set to commemorate the four different aviation sport interest groups, one of which again honours the sport of soaring. The stamp was designed by Emilian Stankev and issued at Sofia and Varna on October 10, 1989.

The stamp was also used in the commemoration of the 82nd FAI General Conference which was held in Varna, Bulgaria on December 8, 1989. Frequently a commemorative stamp issue, especially in the former Eastern Bloc countries, goes hand-in-hand with such a conference. The photo was made into a postcard and it is estimated that more than 12,000 were used as First Day cards.

I am not sure how much gliding activity there is in Bulgaria, or how many good photos would have been available, but the Bulgarian Post Office's designer Stankev 'borrowed' Claus-Dieter's photo and used it as the design for one of their Bulgarian stamps. When asked, Claus-Dieter just said: "No they did not ask me; but if they did not have a good photo to use, I would gladly let them use mine. But they should have at least asked".

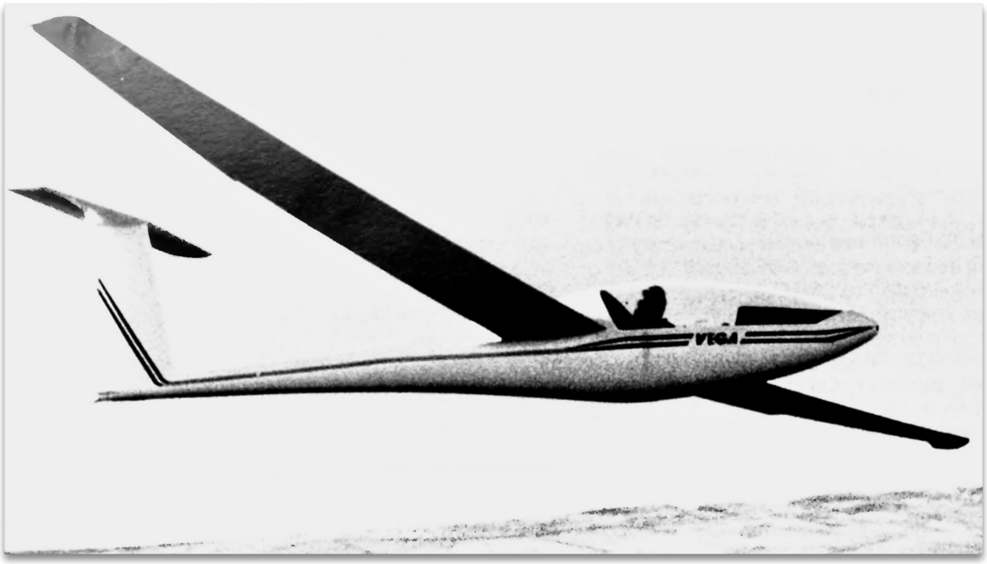
Resources

- *Stamps That Tell a Story: The Series* — Catch up on your missing instalments of this excellent and informative series of articles presented previously in the New RCSD.

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

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

Rediscovering Martin Simons



"The Vega prototype in flight. The fuselage was particularly clean, with both main and tailwheels retracted" as it appeared in the original volume. Drop shadows indicate photo/data taken directly from the original text. (credit: Vickers-Slingsby)

Part III: The Vega within the Development of Glass Ships

Last month in Part II (see Resources *below for link), we continued with a closer look at Slingsby's* Falcon (Falke)*, and some of Simon's thoughts on gliding technique. Both excerpts are from Martin Simons'* Slingsby Sailplanes *reprinted with kind permission of the family. We continue with Martin's look at Fred Slingsby's elegant* Vega*. The images and text below are from the same book (unless otherwise noted)*, with *curator Peter Scott's comments identified by italicised characters within [] (square brackets) embedded in the text. — Ed.*

"The Standard Class is dead," wrote Mogens Petersen, a former chairman of the Danish Gliding Union, late in 1975. Though his opinion proved false in the long run, it was shared by many in the gliding movement at the time. The Standard Class of competition sailplanes had been established by the CIVV (gliding commission of the Federation Aeronautique Internationale) in the 1950s. The original formula was straightforward. The span was limited to 15m, and there had to be speed-limiting airbrakes, a non-retractable landing wheel, no wing flaps, no water ballast tanks and no complications. The outstanding exemplar was Rudolf Kaiser's design, the Ka 6. No other sailplane since the old Grunau Baby has ever been produced in such quantities.

Bit by bit the rules were eroded. To save drag, undercarriages in some designs were so deeply buried in the belly of the fuselage that they caused poor take-off behaviour and gave inadequate protection from damage in field landings on rough ground. Retracting wheels were safer, caused less drag and were only a little more expensive. The Standard Class specification was changed. Such aircraft as the Standard Libelle and the Standard Cirrus resulted; glass-plastic aircraft with excellent performance, cheaper than the huge Open Class types and very popular. Then water ballast was permitted. Existing sailplanes could be adapted without too much cost, and the advantages in operational flexibility were worthwhile. There were few protests.

The next relaxation came close to destroying the Standard Class concept altogether. It was argued vigorously by some designers that simple trailing-edge flaps that could be lowered to 90°, as used on Richard Schreder's HP-14, were simpler and cheaper than airbrakes. This was true. Housing the usual vertical parallel- ruler type of brakes in the wings created many structural difficulties. Brake boxes and skin discontinuities in the wings created stress concentrations. Opening, closing and locking brakes shut required quite complicated mechanism, and sealing them properly against air leakages when closed was difficult. When the brakes were open the lift load distribution changed markedly, throwing more load on to the outer wing panels. The CIVV [Commission Internationale du Vol à Voile — 'vol à voile' translating to 'fly with sail'] changed the rules again to permit flaps, providing they were not coupled with the ailerons to change the camber across the whole wingspan. The idea was that they should be used only as brakes, but there was no way the Commission could prevent a pilot using the flaps to vary the wing camber in flight, gaining some aerodynamic advantage both in the climb and in high-speed glides.

In the 1974 World Championships, held at Waikerie in Australia, Helmut Reichmann of Germany flew the LS-2 with flaps conforming to the new rules. In this sailplane the ailerons were truncated to a bare minimum, allowing the flaps to extend over most of the span. The rules had nothing to say about this. Handling during the slow phases of take-off and landing verged on dangerous, and the rate of roll was poor, but Reichmann won the championship by a small margin over Ingo Renner in a Standard Cirrus. Ironically, on the 11th and last day, at the start of which Renner was leading, the Cirrus developed a problem with its airbrakes, which would not lock closed properly. This delayed and slowed Renner down enough to let Reichmann and the LS-2 take the title.

It seemed that all of the older Standard Class sailplanes were now uncompetitive. Aspiring champions would have to replace their aircraft with brutes like the LS-2. There were even suggestions that ailerons could be dispensed with altogether, to be replaced by wingtip spoilers for lateral control. Flaps then could extend from root to tip. The whole idea of the Standard Class originally was to produce a safe, practical and relatively inexpensive sailplane with a good enough performance for distance flights and competitions with other aircraft of similar performance. Reichmann himself made the point that the repeated rule changes had done serious harm.

The CIVV thought again. At the delegates’ meeting in March 1975 the Standard Class rules were put back to where they had been, but at the same time an entirely new class, the unrestricted 15m or, as it was immediately termed in illogical popular parlance, the Racing Class, was announced. (Illogical because all modern gliding competitions are races.) It was believed that the unrestricted 15m class would become most popular, surpassing even the Open Class in prestige.

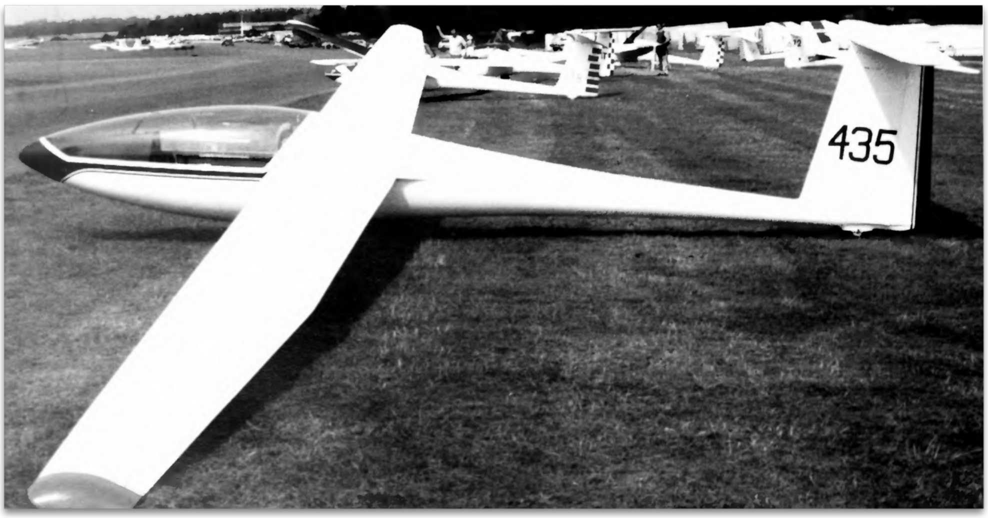
What might emerge in the way of complications and expensive machinery remained to be seen. The new rules were to take effect after the next World Championships in June 1976.

George Burton was full of enthusiasm for the new class. In the 1976 World Championships he flew the Finnish designed Pik 20 (with flaps as permitted under the 1974 rules) to third place in the Standard Class, and beat many of the large Open Class sailplanes when flying against them on the same courses. He broke the world record for distance over a triangular course with a flight of 720km (446 miles). Immediately after returning from Finland he made a proposal to his chairman, Sir Leonard Redshaw, for the design of a new 15m sailplane using a carbonfibre spar and new combined flap-airbrakes which he had outlined in talks with the Glasflügel company the previous year. (This ingenious flap design was incorporated in the Glasflügel Mosquito.) The fuselage would be based on the Kestrel, but without the excessive waisting which had caused so much aerodynamic trouble. Redshaw, now in his last year before retirement, agreed funding of £250,000 for the project. The technical department estimated the aircraft would be ready for test flying within one year.

Slingsby's accordingly announced the Type-65 Vega. Deliveries were promised for June 1977. More capital was invested in tooling than for any other British sailplane, in an effort to keep the labour costs down.

During 1976 a whole new crop of 15m Racing Class sailplanes appeared. They were based on the old breed, often using the same fuselages and tail units but with new wing profiles and flaps, ailerons coupled. The Mosquito and LS-3 (a much more sensible design than the LS-2) were German, and from Finland came the PIK 20D, which had a carbon fibre spar. All of these were available before the end of the year. The ASW 20 from Schleicher came on the market in 1977, and the Grob Speed Astir, the Glaser-Dirks DG 200 and the Schempp-Hirth Mini Nimbus soon followed.

The Slingsby Vega was the first sailplane ever to be designed from the outset for a carbon fibre main wing spar, stronger and stiffer yet lighter than glass. The PIK 20D had inherited a 17 per cent thick wing root from the 20B, so was not taking full advantage of the new material. The Vega wing was 15 per cent thick throughout. The Wortmann profiles were similar to those of the Kestrel and all the other contest sailplanes of the period. Balsa wood was no longer used for the filling of the sandwich skins, having been replaced by plastic foam. There were, of course, flaps with ailerons coupled to vary the camber across the whole span.



"A Sport Vega at Lasham in 1992." (credit: M. Simons)

For landing, the entire trailing edge inboard of the ailerons, earning the flaps, pivoted to present nearly vertical airbrake surfaces both above and below the wing. In normal flight the flaps could be moved independently for slow and fast flying. Burton had his own ideas about the mechanism, but had long arguments with the company's technical director and was finally convinced that the loads did not have balanced paths through the structure. An acceptable solution was found but it was complicated and seemed likely to create maintenance problems in the future.

Pilots were used to having two separate levers; one for the flap, another for the brakes. In the Vega one lever operated both controls. In the forward position the flaps could be drooped or raised as required for general flying. For landing, the lever was brought back through a gate and the full brake was available. The system gave some trouble in the prototype and was modified several times. In the final arrangement the flap settings were varied by moving the lever in a rotary sense, a spring-loaded latch holding them in any desired position. For opening the brakes the lever was pulled fully back. From the pilot's viewpoint the system worked well.

An interesting point was that the glass skin on the upper side of the flap-brake was continuous, forming a perfect seal. As the flaps were moved up or down through their range of 8° either side of central, the glass skin adjacent to the hinges flexed. The only visible discontinuity in the wing surface was at the forward edge of the brakes.

Provision was made for 100kg (220lb) of water ballast in plastic bags inside the wings, as had become normal practice. The amount of ballast permitted in the Vega was subsequently increased to 160kg (352lb), about the weight of two extra pilots. The fuselage front end and cockpit were based closely on the Kestrel. Indeed, the moulds were made from the same plug, but the somewhat too sudden contraction of the cross-section aft was smoothed out, avoiding flow separation. The canopy was in one piece, pivoted at the front and held open, when required, by a gas strut. An inflatable pneumatic seal, pumped up with a small hand bellows after closing the canopy, was provided. The landing wheel was large, also coming from the Kestrel and giving more ground clearance and a higher ground angle of attack than any of the other 15m sailplanes. The fin and T tailplane used the latest rather thick but low-drag symmetrical profiles developed by Wortmann for such applications. The tailplane junction with the fin was particularly neat, a small section of the fin being permanently attached and faired to the tailplane so that there was no gap or leakage at the junction. A neat fairing closed the place at the top of the rudder where, on most other sailplanes, there was an awkward air trap. A little drag was saved by making the tailwheel retractable.

There were many other good features of detail. George Burton wrote and said on many occasions that there could be no vast margin in performance over the rival racing class aircraft, all of which were using similar wings, similar fuselages and of course had the same span. The combined effect of all the small improvements would make the difference. At the same time the cockpit was slightly larger and the tailplane a little greater in area, so the Vega would be more comfortable to sit in for long flights and more stable.

'Vega is cleana', 'safa', 'lighta', a 'betta glida', the advertisements said. Everything about the new sailplane looked good, and about 50 were ordered even before the prototype had flown. Vega was 'a generation ahead of its competitors', or was expected to be so when in production. The first flight took place early in June 1977, the month in which customers had originally been led to expect delivery.

Sir Leonard Redshaw retired and a new chairman took charge of Vickers-Slingsby.

Flight certification had to be completed and a lot remained to be done after the preliminary air tests. At the most forward position of the e.g. elevator authority was lacking. Further modifications of the flap-brake system proved necessary. Burton felt that everything must be completely right before he could deliver sailplanes to waiting customers, but the technical department of the company was greatly preoccupied and there were delays. The first production batch, it was now said, would be ready in the spring of 1978.

Most of the work going on at Vickers-Slingsby at this time was to do with marine engineering. The last of four miniature glass-plastic submarines was approaching completion, a one-man deep-sea diving apparatus was under development, and there was much going on in associated electronics. Equipment for naval minesweepers ranging from washbasins to engine mountings was being made. A gondola for a small airship was built and an order for 15 wooden T-61 (Scheibe Falke) motor-gliders for the ATC was filled.

As a result of a bargain between British Aerospace and the Romanian Government, the BAG One-Eleven airliner was to be built under licence by the ICA aircraft factory at Brasov and motor-gliders and sailplanes produced by ICA were to be sold in the UK. Vickers asked Slingsby to undertake this agency. Although the price was low, the IS-28M2 motor-glider, shown at Farnborough, was not easy to handle in a crosswind take-off and Burton was not impressed. The IS-28 and 29 Brasov all-metal sailplanes proved quite popular and, coming from a state subsidised factory, were offered at a good price on the British market.

"The Vega at Chateauroux in 1978." (credit: M. Simons)

The Vega, it seemed, was in danger of being squeezed out of the Slingsby works altogether. In March 1978 there was still only one complete, with a few pre-production fuselage shells waiting for wings and tails. Derek Piggott flew the prototype a few times briefly and reported favourably though cautiously.

The World Championships, held every two years, are important occasions for sailplane manufacturers to demonstrate their wares and to have them thoroughly tested under severe conditions. On the ground, quick rigging and de-rigging after outlandings are necessary, and aerial racing goes on in all the variety of weather conditions that can appear during a couple of weeks. In July 1978 the great meeting was at Chateauroux in France. The Racing Class contest was won by Helmut Reichmann, flying a very special aircraft from the Brunswick Akaflieg. The SB 11 had huge flaps which not only changed the camber but also increased the total wing area for soaring and retracted entirely for high-speed flight, It was an expensive, heavy aircraft and not easy to fly. It looked as if the rulemakers had once again created a monster. Reichmann himself wrote afterwards that the CIVV needed to think yet again.

The Vega was at last said to be ready, but not for contest flying, and the British team could not use it. The second off the production line was brought to Chateauroux only for demonstration. There were signs of hasty preparation. Unlike the other sailplanes, which had the usual moulded gelcoat exterior, the Vega had an acrylic spray-painted finish. In places there were paint runs that had not been rubbed down, which, whether or not they had any important effect on the boundary layer, did not impress those who inspected the aircraft. The ailerons hinge gap was unsealed. The Vega was flown by a good many people and was well liked on the whole, though the rate of roll was rather less than desirable, the unsealed ailerons feeling rather spongy. It was difficult to assess allround performance while the competing aircraft were far away on task, but as one of those who tried it remarked, 'with the proverbial ha'porth of tar it should be a very good ship'. For much of the fortnight the Vega was left tied down outside. It was hard to avoid concluding that the Vickers-Slingsby company was not very interested in what happened to it. The Vega was now well over a year late in reaching production and the market was melting away.

Meanwhile, George Burton had taken the first prototype to important competitions at Hahnweide in Germany, and in June, at the invitation of Slingsby's American agent Duane Sprague, he agreed to fly at the US Nationals. Delays in preparing his Vega for this event were such that the sailplane had to be airfreighted to San Francisco. From there, arrangements for Sprague to crew for him having fallen apart, Burton by himself was obliged to tow the glider in its trailer to Ephrata in Washington State. He was further delayed for two days by long arguments with his new company chairman over the transatlantic telephone. Too late for the start of the competition and without a proper crew, he nevertheless flew some of the tasks against the latest German aircraft. On one occasion he beat George Moffatt, the eventual winner in an ASW 20, round a 300km triangle, so the Vega was obviously a good performer, but there was criticism from the knowledgeable Americans of the smoothness and finish of the wings. The good results were attributed to Burton's well recognised skill, not to the Vega.

After these experiences Burton was forced to admit that the Vega was about 3 per cent worse in the glide than the ASW-20 and LS-3. Standards of wing profile accuracy at Kirbymoorside were not yet good enough. There was no other explanation for the apparent disadvantage in performance, for, as he had said before, there was little difference on paper between any of the Racing Class sailplanes at this time.

Soon after his return to Kirbymoorside, Burton presented the works manager with a copy of the German specification for the waviness of sailplane wing surfaces. His staff apparently knew something that he had not yet been told. The manager bluntly remarked that there was no intention of trying to meet such standards. It was clear that Burton s time at Slingsby was at an end. On 13 September 1978, after a final very brief interview with the chairman, he left the company. Nobody in the gliding movement was very surprised. Burton felt he had been made a scapegoat for production delays and defects in the Vega for which he was not responsible. His position was filled by Jim Tucker, a graduate aeronautical engineer who had joined Slingsby's in 1967, and had been technical director and lately marketing director of the offshore engineering division.

Outstanding orders for the Vega had not been met, but full production began at last and faithful promises of delivery in 1979 seemed likely to be kept. Late in April an open day was held at Slingsby, 'designed to repair the company's reputation with the UK soaring movement, which had become somewhat tattered during the three years of delays and disappointments from when the Vega was first announced'. Three Vegas were made available for flying and 17 had already been delivered to buyers, five of these in the USA. They were coming off the line at the rate of one a week. But, with rather ominous implications, Tucker said: 'as long as our aerospace activities continue to be profitable, there is no cause for winding them up'.

On the same occasion it was announced that there was to be a simplified, cheaper version, the Sport Vega, with flaps deleted and fixed undercarriage. Production capacity for 48 Racing Class and 12 Sport Class Vegas per year existed. A self-launching Vega was also projected. Interest revived, but in mid-1979 there came yet another change of ownership. Vickers at this time had an overdraft of more than £11 million and was under pressure from corporate shareholders to reduce it. Interest in acquiring the Kirbymoorside factory was shown by a company providing diving services to the North Sea oil industry, for whom Slingsby had made submarine equipment. The development costs of the Vega were set off against taxation and the company was sold, to be renamed Slingsby Engineering Ltd.

During 1979 there were competitions in Europe and the USA in which the Vega was able to show its paces. The reports coming from the pilots were not especially enthusiastic. Wally Scott, a former American champion, said he found that the Vega would climb well but lost to the German aircraft in the faster glides, which Burton had admitted a year before. Scott admired many of the smaller features, and it was agreed that the aircraft handled well and was comfortable and very pleasant to fly. Scott concluded: ‘The Vega may prove to be the most costly 15m ship of the lot, but … it may be well worth it’. It was not at all clear what benefits the customer would gain by paying more. The contemporary German Racing Class sailplanes were also comfortable, handled well and performed slightly better. Scott welcomed the news that more ballast would be permitted in the Vega, which might produce the extra performance needed at high speed, but the fundamental problem of the wing surface accuracy was not addressed.

Left: “The Sport Vega cockpit.” (credit: M. Simons) | Right: “Apart from the lively paintwork, representing the constella tion Lyra, with Vega its brightest member, this photograph shows the lifting handle and non-retracting tailwheel of the Sport Vega.” (credit: M. Simons)

Very bad news came in August, Baar Selen, a Dutch pilot who had won the Standard Class championship at Chateauroux, entered his new Vega in competitions at Rieti in Italy. Flying at 120kt in moderately calm air, the Vega broke up. Selen used his parachute and escaped unhurt. There followed an intense technical investigation. The stressing calculations were checked and rechecked and Vega wings were subjected to renewed mechanical testing up to the ultimate negative and positive bending and under torsional loads equivalent to flight at 150kt. The first distressing discovery was that a batch of the steel wing root spigots, supplied to Slingsby by a subcontractor, had not been correctly heat treated, and these failed during the tests. All Vegas were grounded until those with faulty steel were found. The spigots were replaced at the expense of the contractor, who admitted liability.

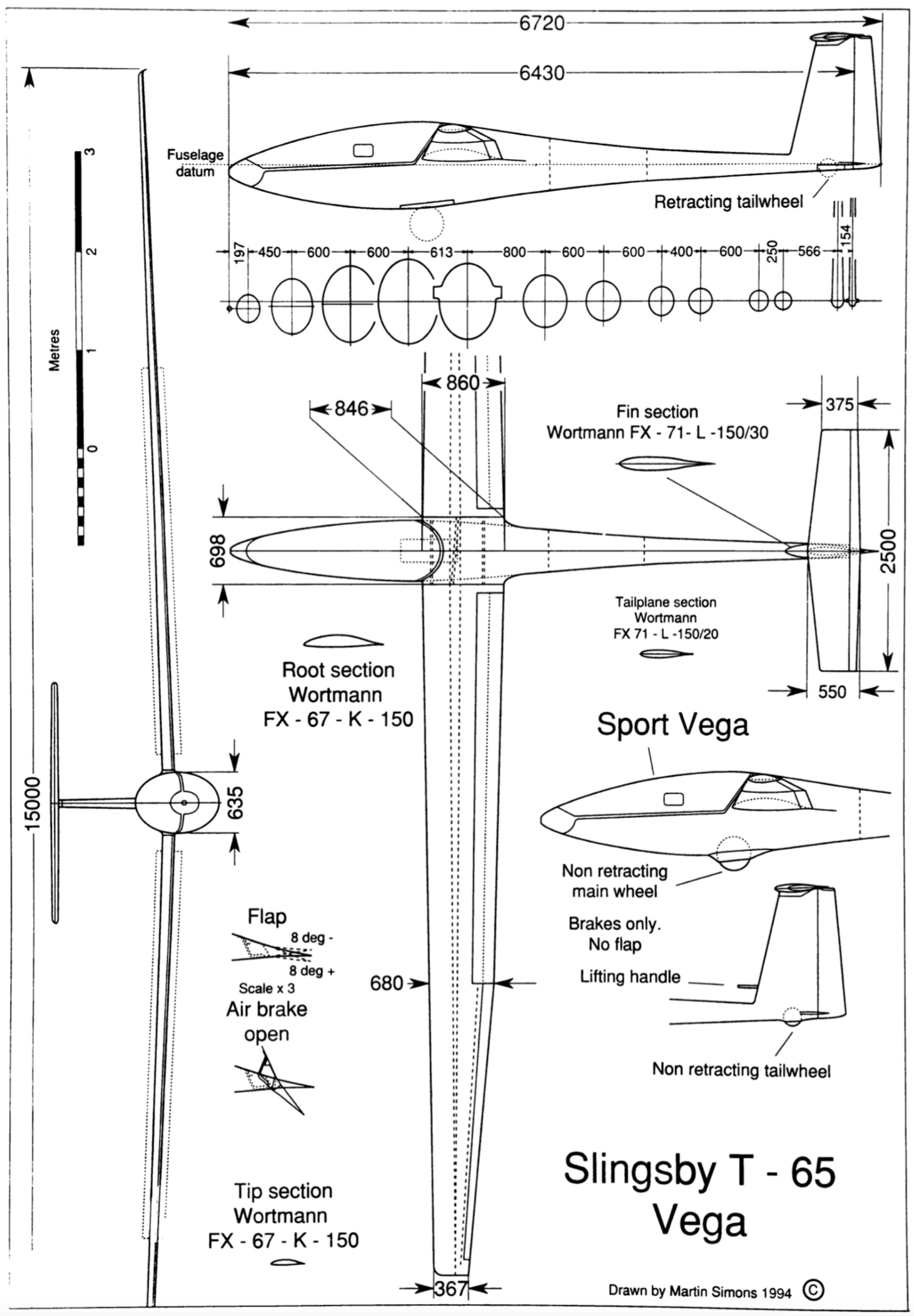
But the spigots were not the cause of Selen s accident. The port wing had broken off about a metre outboard of the fuselage; the carbon spar itself had failed. More testing was done, and many spars were made and loaded without failures. Photographs were taken and eventually published showing a Vega wing on test bent like an archer’s bow at full draw without breaking. At the end of all this it was still not entirely clear why the accident happened, although there was a suspicion that the aircraft had been overstressed during earlier stages of the day's racing, flying too fast in rough air. George Burton himself subsequently wondered if the the cause was, after all, wing flutter. The combination of a very stiff carbon spar with more elastic glass skins, as on the Kestrel 22, might have been responsible. More computing at last suggested that some slight reinforcement of the mainspar was sufficient. All existing Vegas were so modified and there was no further trouble.

Such a series of events coming after years of frustrations and delays did not help the Vega's reputation. It was not a cheap sailplane, and it had no measurable advantage, indeed some small deficiency, in performance. Production continued on a very limited scale to satisfy those few orders that had not been cancelled.

The Sport Vega prototype made its first flight in the spring of 1980, and was warmly praised by Derek Piggott after he had flown it. It was, he said, the best thing for many years, a relatively simple aircraft with excellent handling and robust construction, low maintenance costs and with a satisfactory performance for club flying and minor competitions, but there were plenty of rivals in the market for this type of aircraft.

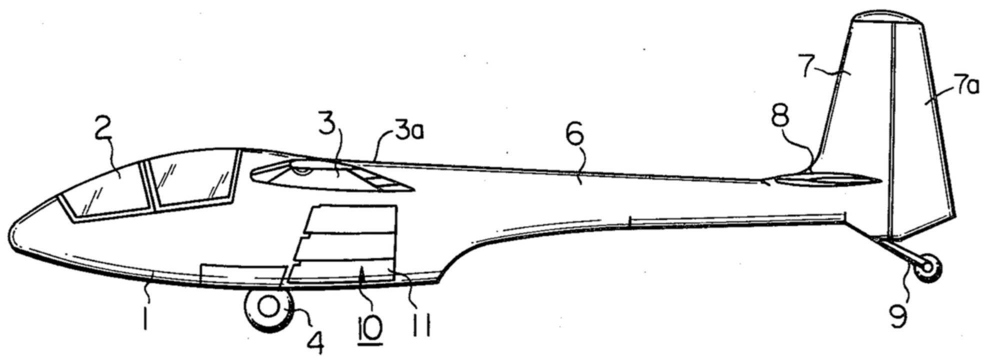
The total of all Vegas and Sport Vegas built was 70. From an accountant's viewpoint, a minimum of 100 might have represented the break-even point. The company now was taking another direction. A further order for 25 T-61E Venture powered gliders came from the ATC, and an agreement was reached for building, under licence, the Foumier RF 6, a French two-seat light aeroplane. This entered production in 1981. Soon it was completely redesigned for fibre-reinforced plastic materials, and as the T-67 Firefly became an outstandingly successful product, in its latest form still in production in 1995 and exported widely. Slingsby Aircraft Ltd, after yet another name change, at last reaped the rewards of the experience gained with the new materials.

In 1982 it was announced that Slingsby was ceasing all glider production. It was not surprising news, although it was very sad. The gliding side of the business had made no profits since the late 1960s. The home market was said to be too small to support a local company in this very specialised business. An influx of cheap gliders from state-owned factories in Eastern Europe was also blamed, but it was not Romanian, Polish or Czechoslovakian manufacturers who captured the international market for high-performance sailplanes. In the affluent west there were plenty of pilots willing to pay high prices for performance gains of one or two percent. It was German factories and young men trained in the Akafliegs of German universities who prevailed, and in 1996 they still do so.


6720
6430
Fuselage datum
Retracting tailwheel
197
450
600
600
613
800
600
600
400
600
250
566
154
Metres
0
1
2
3
860
846
Fin section
Wortmann FX - 71- L -150/30
375
698
2500
Tailplane section
Wortmann
FX 71 - L -150/20
Root section
Wortmann
FX - 67 - K - 150
550
Sport Vega
15000
635
Non retracting
main wheel
Brakes only.
No flap
Flap
8 deg -
8 deg +
Scale x 3
680
Lifting handle
Air brake
open
Non retracting tailwheel
Tip section
Wortmann
FX - 67 - K - 150
Slingsby T - 65
Vega
367
Drawn by Martin Simons 1994 ©

T-65 Vega		Sport Vega	
Dimensions		**Dimensions**	
Wingspan	15.00m (49.2ft)	As for Vega but no flaps, no water ballast, non-retracting wheel.	
Wing area	10.05m² (108.2ft²)		
Aspect ratio	22.4		
Length o.a.	6.72m (22ft)		
Wing sections			
Root	Wortmann FX 67-K-15 (15 per cent flap)		
Tip	Wortmann FX 67-K-15 (15 per cent flap)		
Weights		**Weights**	
Tare	236kg (520lb)	**Tare**	236kg (520lb)
Flying	331kg (730lb)	**Flying**	354kg (780b)
Ballasted	508kg (1,120b)		
Wing loading	30.5kg/m² (6.2b/ft²) to 50.5kg/m² (10.35lb/ft²)	**Wing loading**	35.2kg/m²(7.2b/ft²)
Flap movement	Up max. 8°, down (normal) 8°.		

Glider Patents



US 4,088,285: Motor-Glider

This is the fourth 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.*

United States Patent [19]

Sogabe et al.

[11] **4,088,285**

[45] **May 9, 1978**

[54] **MOTOR-GLIDER**

[75] Inventors: **Itsushi Sogabe; Kiyoshi Souda,** both of Yokohama, Japan

[73] Assignee: **Japan Aircraft Manufacturing Co., Inc.,** Japan

[21] Appl. No.: **723,557**

[22] Filed: **Sep. 15, 1976**

[51] **Int. Cl.**^{2} **B64C 31/02; B64D 41/00**

[52] **U.S. Cl.** **244/16;** 244/58

[58] **Field of Search** .... 244/16, 54, 55, 58, 244/12.3, 53 B, 53 R, 65, 67; 416/179, 189

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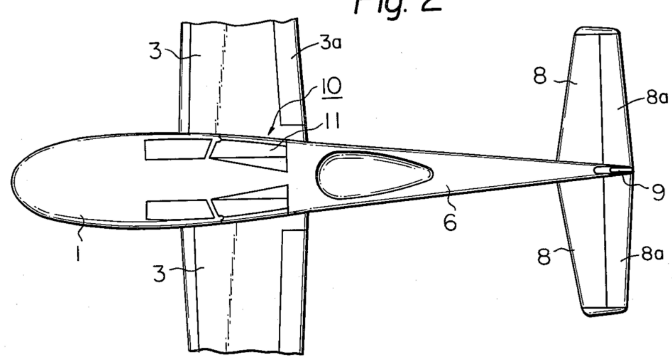
Primary Examiner—Barry L. Kelmachter

Attorney, Agent, or Firm—Ostrolenk, Faber, Gerb & Soffen

Abstract

In a motor-glider provided with a propeller power system fully encased within the fuselage thereof, outer shapes of the elements adapted for selectively closing air-intakes and, when required, an outlet are designed quite flush with the streamlined shapes of the surrounding portions of the motor-glider and the air is ejected in directions away from the tail boom, whereby aero-dynamic drag acting on the motor-glider during power-off gliding is considerably minimized.

Fig. 2

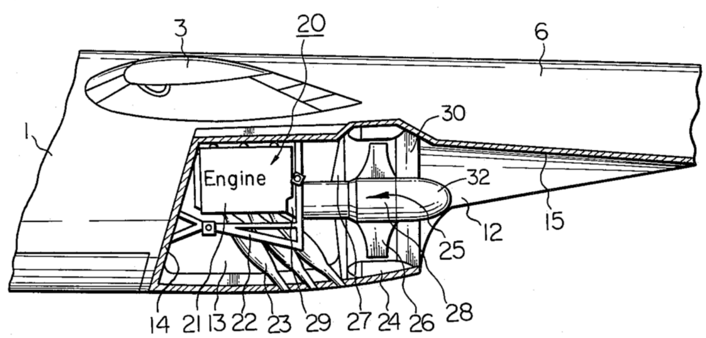


BACKGROUND OF THE INVENTION

The present invention relates to an improved motor-glider, and more particularly relates to an improved construction of a glider which is driven for powered flight and take-off by a motorcycle engine and performs power-off gliding with the motorcycle engine being off.

As is well known, gliders are in general roughly classified into three categories, i.e. primary gliders, secondary gliders and high performance gliders. Among others, the high performance gliders, which are also known as soarers, have special aerodynamic characteristics of an extremely high level. The gliders of this category are particularly suited for long distance soaring over a long period of time being carried on the thermals which are usually developed by wind passing over coast slopes, mountain slopes and cliffs, or on thermals developed under cumulonimbi, or on hot thermals developed over big cities and deserts.

Fig. 3

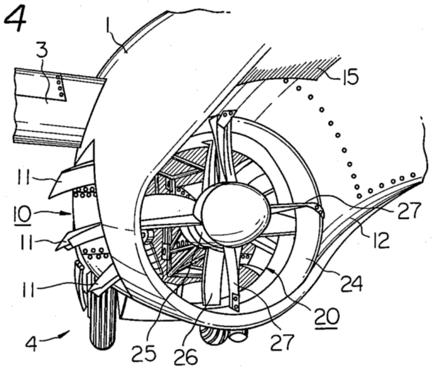


In order that a high performance glider should successfuly rise to a level suited for such long distance soaring, it is necessary to tow the glider by an aircraft. In order to attain the level at a training airport ground, it is necessary to tow the glider by an automobile or any other towing equipment such as an winch.

In the hope of avoiding the necessity for such troublesome towing operation, gliders equipped with internal combustion engines, i.e. the so-called motor-gliders, have been lately proposed in the field of this industry and some of the proposed motor-gliders have already been available in the market.

One of the conventional motor-gliders is provided with a propeller power system mounted to the nose cone of the fuselage. However, presence of such a propeller power system at the nose cone of the fuselage more or less detracts from the streamlined outer shape of the glider and tends to cause increased aerodynamic drag on the glider during power-off gliding.

Fig. 4



In another one of the conventional motor-gliders, the propeller power system is arranged atop a support which projects above the top of the fuselage during power drive and can be overturned for retraction into the fuselage, just like the retractable landing system, during periods of power-off gliding. Change in the position of the propeller power system, which in general occupys a relatively large share of the total weight of the glider of light construction, naturally causes a corresponding change in the center of gravity of the glider. Such a change in the center of gravity tends to pose significant stability problem regarding the posture of the glider just as power-off gliding is initiated, i.e. during flight without any positive control. In addition, inevitable presence of a gap between the propeller thrust line and the longitudinal axis of the glider amounting to about 1 meter have a delicate, harmful influence upon the glide characteristics of the glider.

(8) Further, in both of the aforementioned types of gliders, the turbulent air generated by motion of the propeller power system flows towards the trailing portion of the glider almost fully shrouding the tail boom and its related parts, thereby applying undesirable aerodynamic drag to the glider.

Fig. 5A

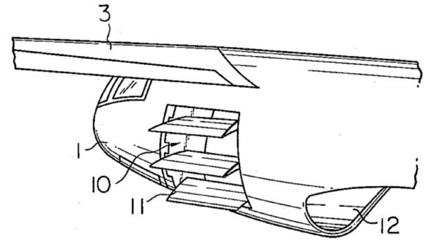
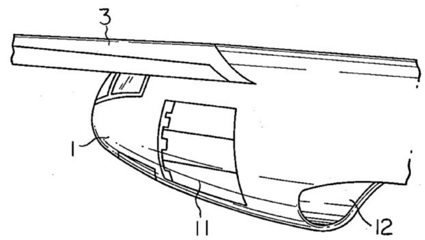


Fig. 5B



OBJECTS OF THE INVENTION

It is the principal object of the present invention to provide a motor-glider having enhanced gliding characteristics.

It is another object of the present invention to provide a motor-glider whose elements which are operative during powered flight and take-off are all encased within the fuselage during power-off gliding without in any way affecting the streamlined outer shape of the motor-glider.

It is another object of the present invention to provide a motor-glider which experiences no change in the center of gravity due to a changeover between powered flight and power-off gliding.

It is a further object of the present invention to provide a motor-glider whose propeller thrust line is substantially in line with the longitudinal axis of the motor-glider.

It is a further object of the present invention to provide a motor-glider whose posture is very stable during power-off gliding.

It is a further object of the present invention to provide a motor-glider which is free of any aerodynamic drag caused by turbulent air generated by the propeller power system.

Fig. 6A

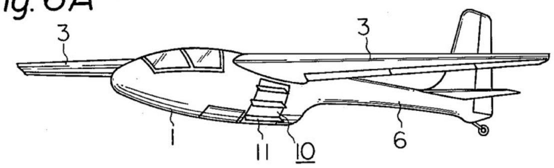
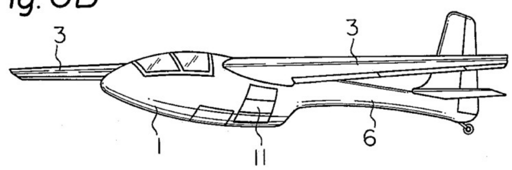


Fig. 6B



BRIEF DESCRIPTION OF THE INVENTION

In accordance with the basic aspect of the present invention, the motor-glider is provided with a propeller power system fully encased within a chamber formed in the rearward bottom portion of the fuselage. Air-intakes are located on both sides of the fuselage and open into the chamber. Movable shutters are annexed to the air-intake in order to selectively open or close the same, whose outer surfaces in the closed state are flush with the streamlined outer surface of the fuselage. An outlet opening is formed in the rear end of the fuselage in communication with the chamber.

In a preferred embodiment of the present invention, the propeller power system is located at a position close to the center of gravity of the motor-glider.

In another preferred embodiment of the present invention, the shutters are of a Venetian blind type and their hinge lines extend substantially parallel to the longitudinal axis of the motor-glider.

(20) In another preferred embodiment of the present invention, the outlet open rearwardly and downwardly.

In a further preferred embodiment of the present invention, additional means are provided for selectively closing the outlet.

Fig. 7A

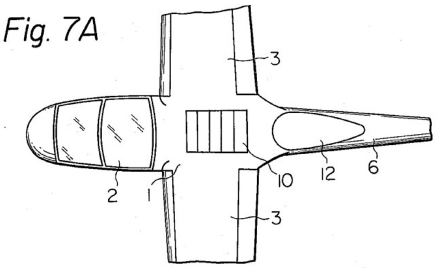
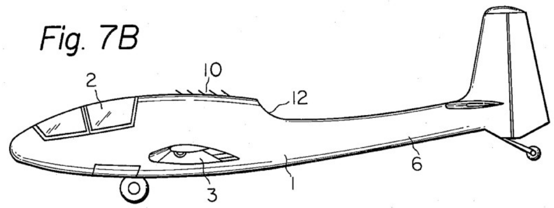


Fig. 7B



BRIEF DESCRIPTION OF THE FIGURES

Further features and advantages of the present invention will be made clearer from the ensuing description, reference being made to the embodiment shown in the accompanying drawings in which;

FIG. 1 is a side elevational view of an embodiment of the motor-glider in accordance with the present invention,

FIG. 2 is a bottom plan view, with parts of the wings omitted, of the motor-glider shown in FIG. 1,

FIG. 3 is an enlarged, partly sectional side elevational view of the propeller power system usable for the motor-glider shown in FIG. 1,

FIG. 4 is a rear perspective view of the propeller power system and its related parts shown in FIG. 3,

FIG. 5A is a rear perspective plan view of the fuselage and its related parts with the air-intake being in the open state,

FIG. 5B is a similar view but with the air-intake in the closed state,

FIG. 6A is a three-quarter front perspective plan view of the motor-glider shown in FIG. 1 during powered flight,

FIG. 6B is a similar view but during power-off gliding,

FIG. 7A is a top plan view of another embodiment of the motor-glider in accordance with the present invention with portions of the wings omitted,

FIG. 7B is a side elevational view of the motor-glider shown in FIG. **7A** with the air-intake in the open state,

FIG. 8 is a side elevational view of the other embodiment of the motor-glider in accordance with the present invention and with a rear portion thereof omitted,

FIGS. 9A and 9B are partial bottom plan views of a further embodiment of the motor-glider in accordance with the present invention, and

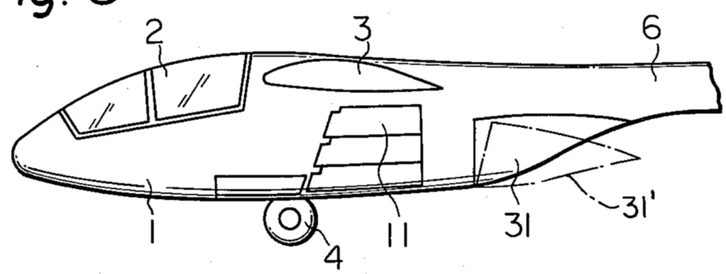
FIG. 10 is a partial bottom plan view of a still further embodiment of the motor-glider in accordance with the present invention, and

FIG. 11 shows a family of curves useful in the advantages of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

A basic embodiment of the motor-glider in accordance with the present invention is shown in FIGS. 1 through 4, in which, like most conventional motor-gliders, the motor glider is comprised of a fuselage **1** having a cockpit **2** formed in its upper leading portion, wings **3** of a single-spar structure with trailing edge flaps **3a**, each in two sections, that also function as air brakes, a two-leg landing gear system **4** with both main wheels fully retractable into the bottom portion of the fuselage **1**, a tail boom **6** extending rearwardly and integrally joined to the fuselage 1 forming a unitary body, a vertical tail **7** with rudder **7a** and horizontal tails **8** with elevators **8a**, both provided on the trailing edge of the tail boom **6**. A conventional tailwheel **9** is provided on the bottom of the vertical tail **7**. The above-described elements are all designed in streamline shapes in order to minimize the aerodynamic drag acting on the motor-glider during both powered flight and power-off gliding.

Fig. 8



In accordance with the present invention, the motor-glider is further provided with air intakes **10** located on both sides of the fuselage **1** each consisting of Venetian-blind-type shutters **11** which, as later described, can be closed for power-off gliding. The shutters **11** are hinged to the framework of the fuselage **1** in any known suitable manner, the hinge lines extending substantially parallel to the longitudinal axis of the motor-glider. About at the border region between the fuselage **1** and the tail boom **6**, the trailing bottom of the fuselage **1** is scooped for providing an outlet **12** which always opens downwardly and rearwardly.

As well seen in FIGS. 3 and 4, a chamber **13** is formed in the trailing bottom portion of the fuselage **1**, the chamber **13** being defined by the outer wall of the fuselage **1**, a bulkhead **14** and an elongated top duct board **15**. This chamber **13** is in direct communication with surroundings of the motor-glider via the air-intake **10** in, the open state of the shutters **11** and the outlet **12** and is adapted for encasing the power-system **20** described below. An internal combustion engine **21** of a relatively compact type is fixedly carried by support frames **22** fixed within the chamber **13** in any known manner, exhaust pipes **23** thereof each extending rearwardly to and communicating with an opening in the bottom of the fuselage **1**. At a position somewhat rearwardly of the engine **21** and close to the outlet **12**, there is a supporting cylinder **24** which is fixed to the walls defining the chamber **13** with its center axis being parallel to the longitudnal axis of the motor-glider. A ducted propeller fan **25** having a plurality of blades **26**, preferably four or more sets of blades **26**, is coaxially supported in the cylinder **24** via struts **27** fixed at their outer ends to the inner periphery of the cylinder **24**. The boss **28** of the blades **26** has its forward end coupled to the engine **21** via suitable flexible couplings **29** and is driven thereby for rotation. The boss **28** is coupled rearwardly to a tail cone **32** facing the outlet **12** and supported by the wall via stators **30**. The power system **20** is fully encased within the chamber **13** so that even the rearmost element thereof does not extend into outside of the motor-glider.

In the condition shown in FIGS. 5A and 6A, i.e. during take-off and powered-off flight, the shutters **11** are turned up and out in order to keep the air-intake **10** in the open state. Upon running of the power system **20**, outside air is taken into the chamber **13** through the air-intake **10** and ejected rearwardly and downwardly out of the chamber **13** through the outlet **12**, thereby providing propelling force to the motor-glider.

In the condition shown in FIGS. 5B and 6B, i.e. during power-off gliding, the shutters **11** are turned down in order to close the air-intake **10**. The outer shape of the shutters **11** are so designed that, in the closed state, the outer surfaces of the shutters **11** are flush with the streamlined outer surface of the fuselage **1**. Thus, presence of the shutters **11** in the closed state does not alter the streamlined shape of the fuselage **1**.

A modified embodiment of the motor-glider in accordance with the present invention is shown in FIGS. 7A and 7B, in which the outlet **12** is formed on the upper side of the motor-glider behind the cockpit **2** so that the air in the chamber **13** is ejected rearwardly and upwardly through the outlet **12**. In this case, the trailing top of the fuselage 1 is scooped about at the border between the fuselage **1** and the tail boom **6**. In the embodiment of FIGS. 7A and 7B, the air-intake 10 is formed atop the fuselage **1** at a position forwardly of the outlet **12**.

Fig. 9A

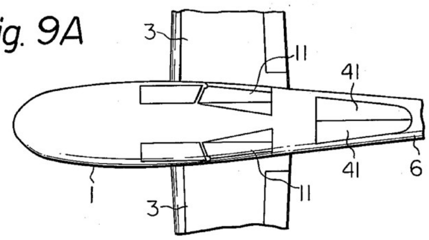
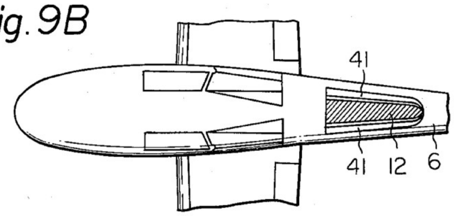


Fig. 9B



Another modification of the power-glider in accordance with the present invention is shown in FIG. 8, in which the outlet **12** is accompanied with a door **31** which is hinged at its front bottom to the framework of the fuselage **1**, the hinge line extending substantially normal to the longitudinal axis of the motor-glider. The outer surface of the door **31** is designed to be flush with the streamlined outer surfaces of the fuselage **1** and the tail boom **6**. As a result, in the closed state, the presence of the door **31** does not alter the streamlined shape of the motor-glider. During take-off and power flight, the door **31** is lowered to the open position as shown with chain-dot lines in order to allow smooth ejection of air through the outlet **12**. Whereas, during power-off gliding, the door **31** is raised to the closed position as shown with solid lines in order to minimize aerodynamic drag acting on the motor-glider.

The other embodiment of the motor-glider in accordance with the present invention is shown in FIGS. 9A and 9B, in which the outlet **12** is selectively opened by means of a pair of coactable doors **41**, each being hinged at the lateral side thereof to the framework of the fuselage **1**. The hinge lines run in the longitudinal direction of the motor-glider. The doors **41** are so designed that, when closed, their outer surfaces are flush with the streamlined outer surface of the fuselage **1**.

In the position shown in FIG. 9A, i.e. during power-off gliding, the doors **41** cover and close the outlet **12**, thereby minimizing aerodynamic drag acting on the motor-glider. Whereas, in the condition shown in FIG. **9B**, i.e. during take-off and power flight, the doors **41** are turned down in order to open the outlet **12**, thereby allowing ejection of air for propelling the glider.

A further embodiment of the motor-glider in accordance with the present invention is shown in FIG. **10**, in which the air-intakes each include a shutter **51** hinged at the rear side to the framework of the fuselage **1**, the hinge line extending substantially in the vertical direction. The shutters **51** are so designed that their outer surfaces are flush with the streamlined outer surface of the fuselage **1**.

During power-off gliding, the shutters **51** are turned in as shown by solid lines in order to minimize aerodynamic drag acting on the motor-glider. Whereas, during take-off and power-flight, the doors **51** are turned out as shown with chain-dot lines **51**' in order to allow ejection of air through the outlet **12**, thereby providing propelling force.

In order to confirm the advantageous aerodynamic characteristics of the motor-glider in accordance with the present invention over that of conventional motor-gliders, a constrast was made to glide ratios of the two.

A result of the analysis conducted by the inventors of the present invention is given in the form of a polar curve graph shown in FIG. **11**, in which the lift coefficient CL is plotted along the ordinate, the drag coefficient CD is plotted on the abscissa and characteristic curves A, B and C are given for angles of attack of, say, every 4° interval.

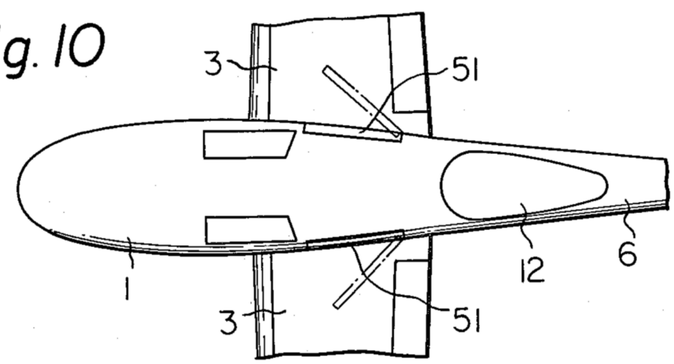
An angle of attack is a term meaning a crossing angle of a relative wind with the longitudinal axis of the motor-glider in question. A glide ratio is given in the form of a ratio of a lift coefficient CL with respect to the corresponding drag coefficient CD, and equal to a ratio of a horizontal distance (or speed) of flight with respect to the corresponding vertical distance (or speed) of descendent. Thus, the larger the valve of the glide ratio of a glider, the better the aerodynamic characteristics of the glider. The data given in the graph are on the basis of wind tunnel tests using model gliders.

In the polar curve graph, the curve A corresponds to power-off gliding of the motor-glider in accordance with the present invention, the air-intake **10** and the outlet **12** being both closed. In other words, the curve A corresponds to usual gliding operation of the conventional glider of same outer shape. (see FIG. 6B)

The curve B corresponds to powered flight of the motorglider in accordance with the present invention, the air intake **10** and the outlet **12** being both open. (see FIG. 6A)

The curve C corresponds to take-off of the motor-glider in accordance with the present invention, the air intake **10** and the outlet **12** being open and the landing gear system **4** projecting out of the fuselage **1**.

Fig. 10



In the case of a conventional motor-glider provided with a propeller power system on the nose cone side, the propeller power system and the shutters for the air-intake are both exposed outside the fuselage even during power-off gliding and, therefore, aerodynamic drag acting on the motor-glider is very large. Even in the case of a conventional motor-glider in which the propeller power system is fully encased within the fuselage and the air-intake is formed in the nose cone quite like jet aircrafts, it is almost impossible to deform the air-intake and its related parts so as to closely conform to the streamlined outer shape of the fuselage during power-off gliding, aerodynamic drag acting on the motor-glider cannot be reduced.

For these reasons, it is clear that characteristic curves for conventional motor-gliders fall on the right side of the curve A in the polar curve graph in FIG. 11.

It will be well understood also that the maximum glide ratio (CL/CD) of the motor-glider in accordance with the present invention is obtained at a point E on the curve A, at which the tangential line D passing through the zero point should be in contact with the curve A. Now it is assumed that another polar curve P should correspond to a certain type of conventional motor glider. As already explained, this curve P naturally falls on the right side of the polar curve A for the motor-glider in accordance with the present invention. The maximum glide ratio (CL/CD) of this conventional motor-glider is obtained at a point R on the curve P, at which the tangential line Q passing through the zero point should be in contact with the curve P.

Thus, the maximum glide ratio (CL/CD) of the motor-glider in accordance with the present invention is given in the form of the tangent of the line D and, likewise, that of the conventional motor-glider is given in the form of the tangent of the line Q. Needless to say, the former tangent value is larger than the latter tangent value as the gradient of the line D is clearly larger than that of the line Q. In other words, the maximum glide ratio of the motor-glider in accordance with the present invention is larger than those of any conventional motor-gliders. That is, the gliding characteristics of the motor-glider in accordance with the present invention is by far superior to those of any conventional motor-gliders.

Through employment of the present invention in the construction of a motor-glider, the following advantages should be resulted.

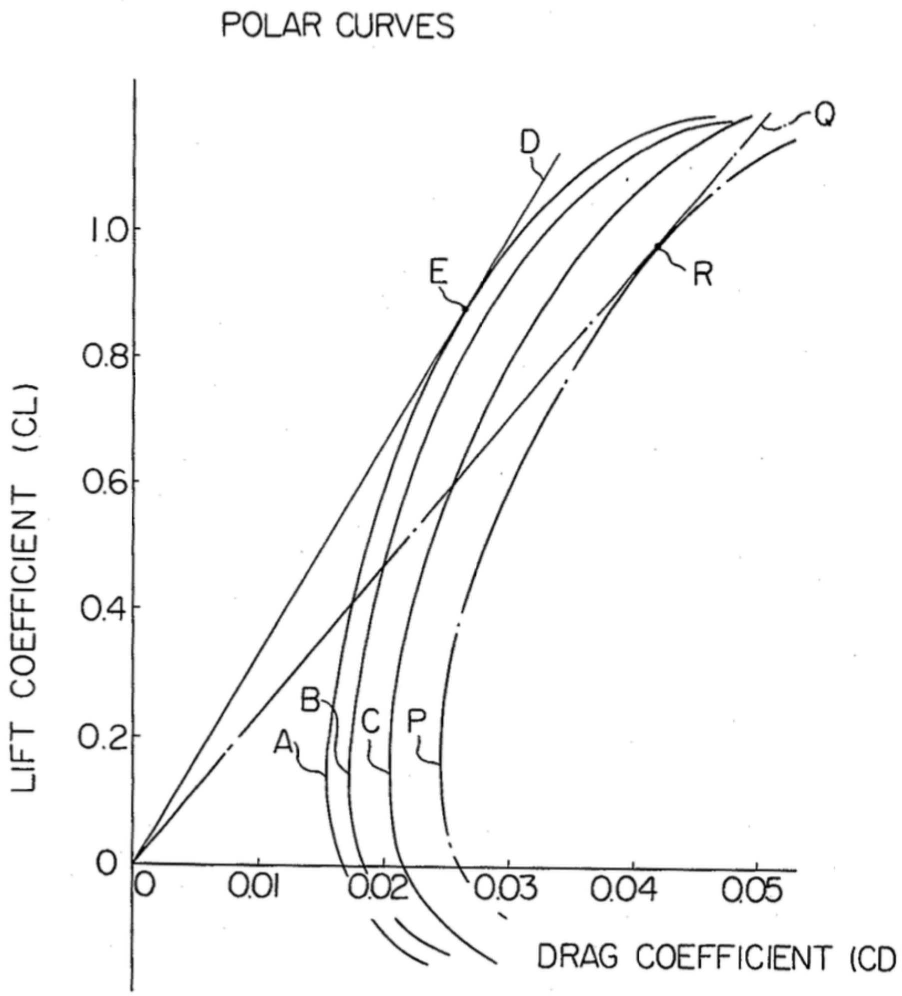
As the elements relating to the propeller power system are all fully encased within the fuselage when required without any disorder to the streamlined outer shape of the motor-glider, aerodynamic drag acting on the motor-glider can be considerably minimized.

As the propeller power system is fixed mounted to and fully encased within the fuselage at a position close to the center of gravity of the motor-glider, posture of the motor-glider during flight and gliding can be extremely well stabilized.

As the thrust line of the propeller power system is substantially in line with the longitudinal axis of the motor-glider, there is no harmful influence upon the gliding characteristics of the motor-glider which should otherwise be caused by a gap between the two.

As the outlet opens in the rearward and downward or rearward and upward direction with respect to the longitudinal axis of the motor-glider, the air ejected by the propeller power system flows in directions away from the tail boom, thereby minimizing aerodynamic drag to act on the tail boom, i.e. the motor-glider.

Fig. 11



CLAIMS

1. An improved motor-glider comprising:

a fuselage provided with wings and a retractable landing gear system;

a tail boom extending rearwardly and forming an integral part of said fuselage and provided with vertical and horizontal tails;

a propeller power system fully encased within a chamber formed in the rear bottom portion of said fuselage, said propeller power system including a tail cone facing an outlet formed in the rear end of said fuselage and rearwardly of and in communication with said chamber, and supported by the inner wall of said chamber via stators, a ducted propeller fan rotatably supported by said inner wall by struts on the front side of said chamber and an internal combustion engine supported by frameworks in said chamber and having a rearwardly extending drive means coupled to said ducted propeller fan for rotation of said propeller fan; and

air-intakes located on both sides of said fuselage forwardly of said power system and opening into said chamber and being covered by selectively openable shutters whose outer surfaces in the closed state are flush with the streamlined outer surface of said fuselage.

2. An improved motor-glider as claimed in claim 1 in which said propeller power system is located at a position close to the center of gravity of said motor-glider.

3. An improved motor-glider as claimed in claim 1 in which said struts are adapted to operate as guide vanes and are supported by a cylinder fixed to said inner wall of said chamber.

4. An improved motor-glider as claimed in claim 1 in which the drive means of said internal combustion engine coupling the engine to said ducted propeller fan comprises a flexible coupling assembly.

5. An improved motor-glider as claimed in claim 1 in which said chamber is isolated from the surrounding inner space of said motor-glider by a bulkhead and a top duct board.

6. An improved motor-glider as claimed in claim 1 in which said shutters are of a Venetian-blind-type and their hinge lines extend substantially parallel to the longitudinal axis of said motor-glider.

7. An improved motor-glider as claimed in claim 1 in which said shutters are hinged to frameworks of said fuselage on their rear sides and their hinge lines extend substantially vertically.

8. An improved motor-glider as claimed in claim 1 in which said outlet opens rearwardly and downwardly.

9. An improved motor-glider as claimed in claim **1** in which said outlet opens rearwardly and upwardly.

10. An improved motor-glider as claimed in claim **1** further comprising means for selectively closing said outlet.

11. An improved motor-glider as claimed in claim **10** in which said closing means includes a door hinged at the front bottom side thereof to the framework of said fuselage, the hinge line extending substantially normal to the longitudinal axis of said motor-glider and the outer surface of said door in the closed state being flush with the streamlined outer surfaces of said fuselage and said tail boom.

12. An improved motor-glider as claimed in claim **10** in which said closing means includes a pair of coacting doors hinged at the upper sides thereof to frameworks of said fuselage, the hinge lines extending substantially parallel to the longitudinal axis of said motor glider and the outer surfaces of said doors in the closed state being flush with the streamlined outer surfaces of said fuselage and said tail boom.

Resources

- *US Patent and Trademark Office* (USPTO) — The USPTO provides an oustanding search engine which enables digging through (seemingly) every patent in their office. Proceed with caution — you could easily spend **days** of your time digging through their utterly fascinating files.
- *US Patent 4,088,285* — A PDF of the original patent as downloaded from the USPTO website, on which this article is based.

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The Trailing Edge

Miguel Navarro and Tim Travers of Team USA flying at the Vigsø slope in Denmark while preparing for the F3F World Championships. They're coming up this month (see Resources). Miguel was flying his Freestyler 6. This was taken around 8:23 (in the morning!) on September 29, 2022. (credit: Sverrir Gunnlaugsson)

Trick(y autumnal weather can still make f)or (flights which are a) treat.

We get a steady stream of photographic images slipped under the door of the editorial offices of the New RCSD. We also spend an inordinate amount of time browsing Instagram, Facebook, Flickr, SmugMug and other photo sites looking for inspiration to creatively fill the vacant photo slots in each issue. Sometimes we apply filters so we're only seeing new stuff. A happy bi-product is the real time (sort of) snapshot it provides of what's going on around the globe in the RC soaring world.

This time 'round, we noticed a fair number of pictures featuring pilots and ground staff becoming increasingly layered up. Lightweight t-shirts (see below!) are steadily being replaced first by sweaters, then a sweater plus a light jacket. Pretty soon we're going to see the anorak crowd donning *actual* anoraks for the first time. And as that happens, can the down-filled jumpsuits accompanied by the outrageously large, mirrored Bollé goggles be far behind?

We think not. Of course, our friends in the Southern Hemisphere are making the reverse journey — lucky them, we say, steadily stripping off layers. If we ever win the lottery, we'll put an Antipodean abode on our list of 'must haves' and skip between hemispheres on a biannual basis and enjoy the proverbial endless summer. Until then, we'll live there vicariously through the fantastic photos our readers down there provide.

That said, we actually like the changing of the seasons and the 'interesting' weather conditions which naturally ensue. So excuse us while we bundle up, ballast up, Bollé up and then get out there and keep 'em flying.

What's New in The RCSD Shop

The November 2021 edition of the New RC Soaring Digest Cover Photo T-Shirt featuring photography by Erik van der Kooij.

Although we tend to run a bit behind we (eventually!) design and produce ***New RCSD Cover Photo T-Shirts*** for each issue. We just launched our November 2021 edition — in both English and Japanese

— which features the idyllic late summer cover photo by Erik van der Kooij. And if there is a particular issue not yet listed at the link above, let us know and we'll expedite adding it just for you.

All items in the Shop are made especially for you as soon as you place an order, which is why 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 and also helping to support the New RCSD!

Make Sure You Don't Miss the New Issue

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

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

Resources

- *F3F World Championship* — From the website: "The 2022 F3F World championship in Hanstholm, Denmark…organised by Modelflyvning Danmark in association with the Royal Danish Aeroclub (KDA), from 2nd of October to 8th 2022."

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

1