Airscrew

Facts, opinions, pictures and fun

https://northreppsmfc.com/ *March 2020*

To contact me send an email to peter@northreppsmfc.com

Contents

Model of the month: Tom’s Slick

Tom Edgecombe brought his beautiful new Slick (Skywing 104" Slick 360-V2 from Black Raven) to the field. It’s a superbly designed model made of almost nothing. Get him to show you the clever wing and tailplane fixings. They are latches with magnetic locks. Very quick to do and very solid. After the first flight Tom danced around saying it was immediately his favourite model. He gave us three impressive displays of impossible 3D manoeuvres.

Genius: number seven - Bix bootees

Dave Fines has added a modified undercarriage to his Bixler. He bent the legs so the nose didn’t point up so much and left off the spats and tail wheel. The model takes off and lands really smoothly. As you see the new monster was given strange outward pointing dentures too.

Deep joy

I feel so much better now. I am officially registered with the CAA (I’ll tell you privately my version of what the letters mean if you are over eighteen). There has been this great gap in my life. I now feel complete.

To be serious please make sure you have stuck or written your number, with at least 3mm high characters, into each of your models’ fuselages. It must be readable without needing a tool (no not the CAA). As a club we won’t be checking but you could be without insurance if you don’t. And if so don’t crash on my car.

New battery technologies: part one

The advantages of electric flight are very obvious. The only real disadvantage is the battery. It is large and heavy and doesn't contain enough energy. When we leccies applaud our model managing a ten minute flight, the IC-heads rightly point out that they can do that several times over. Each time I buy new batteries I add another 0.5 Ah to the capacity, so now I bung 500 gram bricks into even modest models. And still I only get maybe twelve minutes. And the ducted fan flyers only get three or four minutes compared with double that for gas turbines running on paraffin.

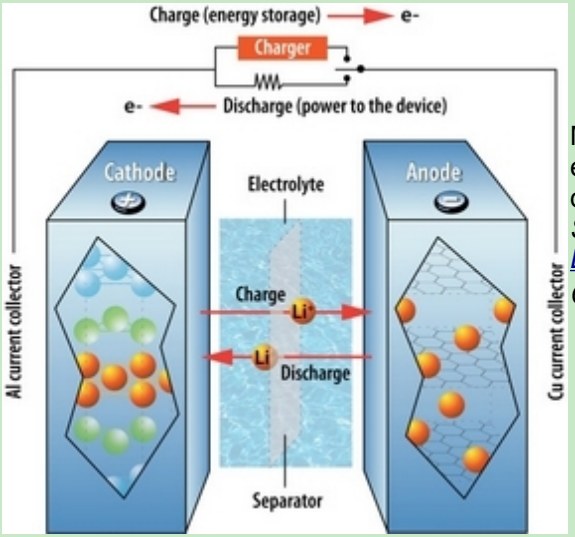
The key criterion is energy density. This is the amount of energy the cell can store per unit volume. The energy is usually specified as watt-hours (Wh) so energy density is Wh/m^3 or per litre. Colloquially energy density might also be used for energy per unit mass (Wh/kg), though the correct term for this is specific energy. Secondary factors are cyclability (how many times it will recharge), charging time and safety. Next month there will be a comparison of specific energies that shows that currently methanol has twenty times and petrol forty-five times the specific energy of lipo. However in theory lithium-air could achieve parity with petrol.

So, what is on the horizon for we leccies? I did a major read and present my conclusions in two parts - the second next month. It's anyone's guess which will mature into a form suitable for flying. My notes are in [ ].

Lithium ion batteries

Lithium-ion batteries (LIBs) are currently used in the majority of electric vehicles, and it's likely that they will remain dominant into the next decade [presumably 20's] Manufacturers, including Tesla and Nissan, have invested heavily in this technology. In LIBs, positively charged lithium ions travel between the anode and the cathode in the electrolyte. LIBs have a high cyclability – the number of times the battery can be recharged while still maintaining its efficiency – but a low energy density – the amount of energy that can be stored in a unit volume. LIBs have garnered a bad reputation for overheating and catching on fire (e.g. Boeing jets, Tesla cars, laptops), so manufacturers have not only worked to make LIBs more stable, but they have also developed many safety mechanisms to prevent harm if a battery were to catch fire.

The LIBs on the market today primarily use graphite or silicon anodes and a liquid electrolyte. A lithium anode has been the holy grail for a long time because it can store a lot of energy in a small space (i.e. it has a high energy density) and is very lightweight. Unfortunately, lithium heats up and expands during charging, causing leaked lithium ions to build up on a battery's surface. These growths short-circuit the battery and decrease its overall life. Researchers at Stanford recently made headway on these problems by forming a protective nanosphere layer on the lithium anode that moves with the lithium as it expands and contracts.



Movement of lithium ions and electrons in a lithium-ion battery during charging and use. *Source: Argonne National Laboratory. Used under Creative Commons license.*

New generation Lithium-ion

What is it?

In lithium-ion (Li-ion) batteries, energy storage and release is provided by the movement of lithium ions from the positive to the negative electrode back and forth via the electrolyte. In this technology, the positive electrode acts as the initial lithium source and the negative electrode as the host for lithium. Several chemistries are gathered under the name of Li-ion batteries, as the result of decades of selection and optimization close to perfection of positive and negative active materials. Lithiated metal oxides or phosphates are the most common material used as present positive materials. Graphite, but also graphite/silicon or lithiated titanium oxides are used as negative materials.

With actual materials and cell designs, Li-ion technology is expected to reach an energy limit in the next coming years. Nevertheless, very recent discoveries of new families of disruptive active materials should unlock present limits. These innovative compounds can store more lithium in positive and negative electrodes and will allow for the first time to combine energy and power. In addition, with these new compounds, the scarcity and criticality of raw materials are also taken into account.

What are its advantages?

Today, among all the state-of-the-art storage technologies, Li-ion battery technology allows the highest level of energy density. Performances such as fast charge or temperature operating window (-50°C up to 125°C) can be fine-tuned by the large choice of cell design and chemistries. Furthermore, Li-ion batteries display additional advantages such as very low self-discharge and very long lifetime and cycling performances, typically thousands of charging/discharging cycles.

When can we expect it?

New generation of advanced Li-ion batteries is expected to be deployed before the first generation of solid-state batteries. They'll be ideal for use in applications such as Energy Storage Systems for renewables and transportation (marine, railways, aviation and off road mobility) where high energy, high power and safety is mandatory.

Zinc-Air

Scientists at Sydney University believe they've come up with a way of manufacturing zinc-air batteries much cheaper than current methods. Zinc-air batteries can be considered superior to lithium-ion, because they don't catch fire. The only problem is they rely on expensive components to work. Sydney Uni has managed to create a zinc-air battery without the need for the expensive components, but rather some cheaper alternatives. Safer, cheaper batteries could be on their way!

Aluminum-ion batteries

Aluminum-ion batteries are similar to Lithium-Ion Batteries (LIBs) but have an aluminum anode. They promise increased safety at a decreased cost over LIBs, but research is still in its infancy. Scientists at Stanford recently solved one of the aluminum-ion battery's greatest drawbacks, its cyclability, by using an aluminum metal anode and a graphite cathode. This also offers significantly decreased charging time and the ability to bend. Researchers at Oak Ridge National Laboratory are also working on improving aluminum-ion battery technology. [Aluminium is a lot less reactive than lithium so presumably will produce a lower voltage per cell. Might need more cells in each pack.]

Aluminium-air battery

A car has managed to drive 1,100 miles on a single battery charge. The secret to this super range is a type of battery technology called aluminium-air that uses oxygen from the air to fill its cathode. This makes it far lighter than liquid filled lithium-ion batteries to give car a far greater range.

Lithium-sulphur

What is it?
In Li-ion batteries, the lithium ions are stored in active materials acting as stable host structures during charge and discharge. In lithium-sulphur (Li-S) batteries, there are no host structures. While discharging, the lithium anode is consumed and sulphur transformed into a variety of chemical compounds; during charging, the reverse process takes place.

What are its advantages?
A Li-S battery uses very light active materials: sulphur in the positive electrode and metallic lithium as the negative electrode. This is why its theoretical [specific] energy density is extraordinarily high: four times greater than that of Li-ion. That makes it a good fit for the aviation and space industries.

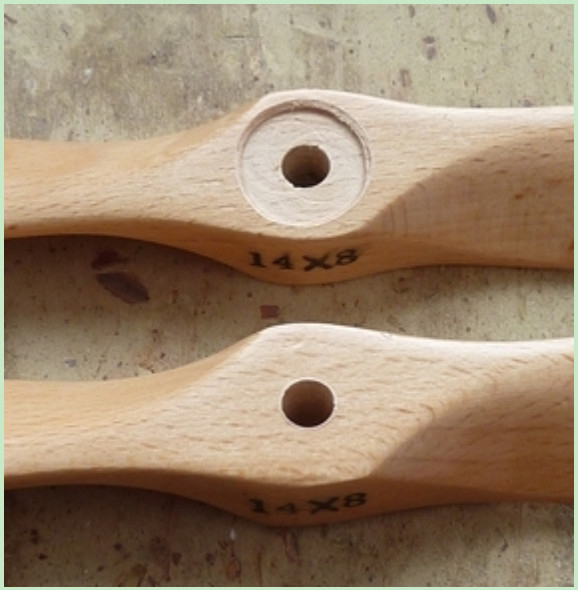
Saft has selected and favoured the most promising Li-S technology based on solid state electrolyte. This technical path brings very high energy density, long life and overcomes the main drawbacks of the liquid based Li-S (limited life, high self discharge). Furthermore, this technology is supplementary to solid state Li-ion thanks to its superior specific energy density (+30% at stake in Wh/kg).

Lithium-sulphur batteries (Li/S) typically have a lithium anode and a sulphur-carbon cathode. They offer a higher theoretical energy density and a lower cost than LIBs. Their low cyclability, caused by expansion and harmful reactions with the electrolyte, is the major drawback. However, the cyclability of Li/S batteries has recently been improved. Li/S batteries, combined with solar panels, powered the famous 3-day flight of the Zephyr-6 unmanned aerial vehicle. NASA has invested in solid-state Li/S batteries to power space exploration, and Oxis Energy is also working to commercialize Li/S batteries. [The higher energy density of this cell looks promising for models.]

More next month:
Solid-state batteries
Sodium-ion
Metal-air
Graphene
Gold nanowire
Foam
Dual carbon
Super-capacitors
Iron-air
Energy and power density comparison
Reference sources and further reading

Top tip: Thick prop hubs

I like wooden propellors. They are light and are easy to balance with sandpaper and an extra coat of varnish on one side. However the hubs tend to be thicker than plastic. I found that the threaded part of the adaptor supplied with one motor was too short for the nut to get safe purchase. I was using a spinner with a metal backplate and the prop washer was thick. I used a 20mm diamond holesaw in a bench drill to cut the outside of a recess and then used a smaller one to grind out the centre at a constant depth by moving the prop around with the drill running and locked for height. The finished prop needed very little balancing. Here are the modified and original props



Joke of the month

Police recently confiscated the models from two illegal pilots they had arrested. One was electric and the other was a model rocket. They charged one and let the other one off.

Quote of the month: CAA and J. S. Mill

From John Stuart Mill but relevant to model flying today: ‘Let no man live uncurbed by Law, nor curbed by tyranny’.

Feedback on the beast

Chatting to Tom Edgecombe on the field between his extraordinary displays, I mentioned the electric motor beast from the last newsletter. He said he had seen such things used in 3D models but they have very short flight times even with 14S battery setups. He thought they were around four minutes.

Bob’s Tales

Bob May has had a long career in aviation and tells some great tales on the flying field. He has agreed to let me record some of them and put them into the newsletter. So here is the first.

Australian tales number one: The baby

I started flying in 1958 and obtained my Commercial Pilot Licence whilst working for Channel Airbridge at Southend in 1962. They were operating Bristol Freighters, referred to by us pilots as Bristol Frighteners, to airports across the channel. They carried three cars, loaded through clamshell doors in the nose and sixteen passengers in the rear.

The cockpit was reached by a vertical ladder on the car deck. It was a taildragger with two piston engine Bristol Hercules sleeve valved engines of about two thousand horsepower each. It was quite a handful on take-off and VERY noisy. Unfortunately, many pilots were laid off at the end of the summer season and, being at the bottom of the seniority list, I was one of them. I found myself competing with a lot of more experienced pilots, many of them ex-wartime people. So, in short, I decided to flee the country and try my luck in Australia. I did not wish to emigrate so I bought a ticket on a boat going via Panama and Tahiti, arriving in Perth, Western Australia.

Upon arrival in Perth I converted my UK Licence to an Australian one. In a short time I had a job as a Bush Pilot based in Port Hedland in a small town of two thousand people, about a thousand miles north of Perth. Port Hedland is located on the north west coast well up into the tropics. There were only two aircraft at Port Hedland, mine and the Royal Flying Doctor Service Beech Baron. I was flying a Cessna 205 single engine six seat aircraft. It was one of only two in Australia and could be converted quickly to carry a stretcher. It was also the first tricycle undercarriage I had ever flown. It certainly seemed a hell of a lot easier than any other aircraft I had flown to date.

My job at Port Hedland was to carry out general charter and be standby for the RFDS aircraft when not available. I was on my own so was pilot, manager, booking clerk, loader and engineer. After a short course in Perth I was issued with a Maintenance Authority up to 100 hours. I was kept pretty busy as we were the only aircraft within five hundred mile radius.

One RFDS call out I can remember was in the summer, or wet season as the locals called it. At this time of the year we tried to get all flying over by midday due to the build up of thunderstorms and cumulonimbus cloud. On this particular day I had just finished flying and arrived home at lunchtime when the phone rang. The call was to go out to a sheep station called Pingin out near the Throssil Range, about an hour and a half inland from Port Hedland.

I picked up the Flight Nurse, who told me that we were to pick up a baby that had swallowed a bottle of camphorated oil and that it was very serious and would require hospital treatment. Conditions were extremely rough and very turbulent with line squalls and heavy rain. One would not normally fly in such conditions but this was what I got paid for.

On arrival at the sheep station we found that the baby belonged to one of the aboriginal families that lived and worked there. So without delay we loaded up mum and baby plus gramma and two aunties who all insisted on going despite my warnings about the rough ride ahead. Anyway I gave them each a sickbag and off we went. Of course it was an horrendous trip back, with everyone throwing up and the smell of camphorated oil mixed in. I must admit I was begining to feel a bit queasy myself.

About a week later I was asked to take everyone back to Pingin, early in the day. Conditions were much better but they all sat there chewing betel nuts, which was almost as bad as the camphorated oil. I am pleased to say that the baby recovered well. It is amazing the feeling of satisfaction one gets after a successful medivac. Far more than any other flying that I have ever done.

Gordy's travels: trim and balance

Gordy Stahl Louisville, Kentucky GordySoar@aol.com

"Gordy's Sailplane Balancing System"

In my travels I get to meet lots of RC Sailplanes.... And their owners. It amazes me how little we all know about trim and balance. So often, I see a plane flying that I know is way out of balance. It balloons, lands like a rocketing rock, and falls out of low speed, down wind turns, or just ends up in a tree, somewhere, with its owner saying, "I don't get it! It just wouldn't turn!" When I ask about how they balanced their sailplanes, they say, "Just where the plan said!"

Aside from the science involved in determining Center of Gravity, Center of Pressure and all those other cool terms, I find that to get a sailplane to fly at its optimum, you have to get the lead out.

After balancing one fella's plane, which moved its 'balance' point back about a full 1 1/2" from what the plan showed, I asked him a simple question.… "You see that your plane flies the same at virtually any speed, it doesn't porpoise, and it lands super slow. It turns on a dime and shows the smallest thermal... But it's balanced way behind what the plan shows. Are you going to put the lead back in, so it balances where the plan showed, so it flies goofy again?" He said, "Yes, because the designer must know the right spot to balance it at, since he designed it." So, he put all the lead back in and proceeded to put it in the top of a tree on the subsequent flight. Go figure…

I hear guys say things like, "I like my plane a little nose heavy; it makes it more stable." Or, "If you get the balance point too far back, it gets too twitchy." The first statement implies that 'more stable' is a good thing, so we should all fly an unbalanced plane. The second statement has a negative connotation, because of the word 'twitchy'. The 'more stable' statement implies that the guy has through trial and error found the farthest balance point back behind or at the 'neutral' balance point, then added lead to the nose to get it just right. Which he didn't. Guys like this add lead to get the plane to balance slightly ahead of where the plan showed... Really nose heavy.

A plane balanced forward of the neutral point, takes more elevator to get the nose to raise, as in when you are low and slow, going down wind. That condition causes you to add more up to get that heavy nose to raise when there is very little air for your elevator to react against... Causing you to pull even more elevator. All that up causes the airflow to stop traveling over the surface, which causes a 'snap roll', what other guys would blame on a "tip stall".

The second statement has a negative connotation because of the word 'twitchy'. How about substituting a different word... And stating that a neutrally balanced sailplane is 'controllable'? Doesn't sound like a bad thing now does it? So if, when the plane is 'balanced', it doesn't need much up elevator to raise the nose, you

can reduce the travels or use dual rates to ‘calm’ the plane down at high speeds.

You’ve heard of the ‘Dive Test’? Probably the dumbest thing anyone ever came up with for checking balance. I hear modelers talk about it saying that when the plane is nose heavy, it will cause the model to pull up quickly and, one that is neutrally balanced or tail heavy, will ‘tuck’ or increase its dive angle as speed increases. All probably true but goofy to be talking about in the context of balance.

A nose heavy plane has to fly with UP elevator trim, so naturally it will balloon with airspeed. More air passing over the elevator’s surface gives it more authority. A tail heavy plane tucks because it has some down elevator — since a tail heavy plane flies a lot better backwards, that’s where the weight is!

But lots of things affect what a sailplane does at high speeds. Tail boom flex causes a reaction on the pushrods, changing the position of the rudder. The shape of the stabs can put huge twisting down loads on its tips. Push rod flex can also create things like tuck....But all this is still goofy to be used for determining optimum balance. Since when do we ever achieve and maintain those kinds of speeds when circling in a thermal?

There is never a good reason to have an unbalanced plane. Because the plan shows a CG, that doesn’t ever mean it is the optimum balance point for the plane you built. (A lot of what we have done with CG comes from the Free Flight days, where planes were balanced forward so that if they got tipped into a dive they would pull up. We don’t fly free flight, we pay big bucks for a transmitter so that WE can decide when or if we want our plane to pull up.)

Here is a simple way to get your plane almost perfectly balanced before launching. *(Keep in mind that this system is easiest to use with a sailplane equipped with a full flying stabilizer, as fixed stabs bring decalage, or the alignment (usually mis-alignment) of the horizontal stabilizer to the wing, leaving the elevator to attempt to compensate for the two surfaces fighting each other.*) It’s called “Gordy’s Sailplane Balancing System”, named after a brilliant, intuitive RC soaring legend.

On the bench, balance the plane on a couple of pencils, or your finger tips, at about 40% of the root chord, from the leading edge of the wing. (Root chord is the width of the wing panel at the center of the wing). (No I don’t care what the plan says; unless it says 50%, then go ahead.) Go do a few hand tosses to get the plane trim, so that hands off, it flies flat and level, not diving nor ballooning… Just a long flat glide. If your glide is heading downward, it’s not trimmed for a long flat glide!

Now, once trimmed as stated, give it a good toss, get it flying straight and keep your hands off of the elevator stick! The only important part of this system is the last 10’ of its glide, so watch what the nose does very carefully. If at the end when the sailplane slows, the nose suddenly drops to the ground, GET THE LEAD OUT. The nose dropped because the elevator ran out of power (air moving over it) to hold all that lead in the nose up. So start pulling lead. (Note! With each chunk of lead you pull out, you will need to take some up trim out, as the elevator is having to do less work.) When finally your plane flies flat off the toss, and at the very end, the tow hook touches first, YOU ARE BALANCED, or at least as close as you can tell this close to the ground.

[Next] step, launch the plane and get it trimmed in the air for flat and level flight. Then flip it over inverted. Your goal is to pull lead

until almost no (thats like almost NONE) down elevator is required to hold the plane inverted in level fight.

Now when your plane enters lift it will pop its tail up like a dog [bitch surely? – ed] in heat, as it is not being forced downward with compensating up elevator, trying to hold a lead laden nose from diving down. It will land like a feather, because it can be slowed to incredibly low flying speeds without the nose dropping like a descending rock. The bottom line is that it doesn't matter where the balance point of your sailplane measures. What matters is that your sailplane is optimized to be as 'clean' in the air as possible, and that it reacts when told, always maintaining its attitude, regardless of air speed.

So get rid of that plan and get that plane balanced! Once balanced, you can reduce surface movement travel, use your dual rates or expo, and get that plane tuned up for attempts at the winner's circle!

From RCSD June 2002 with permission

Caption competition

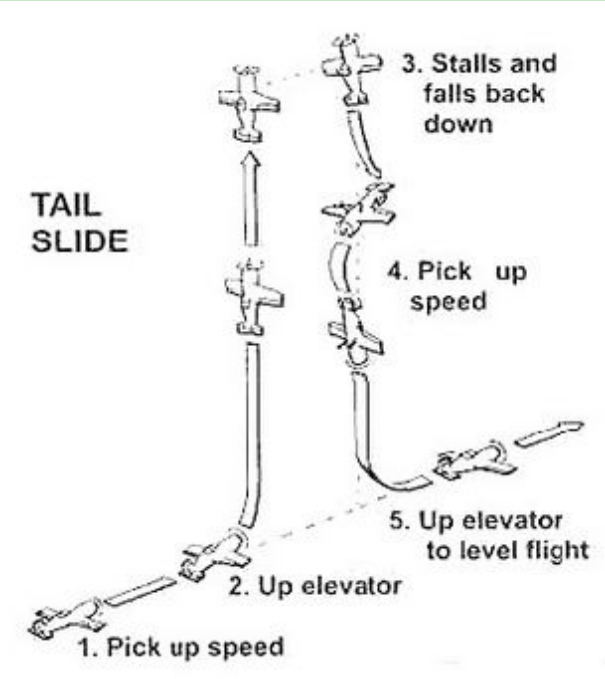
Picture from RCSD

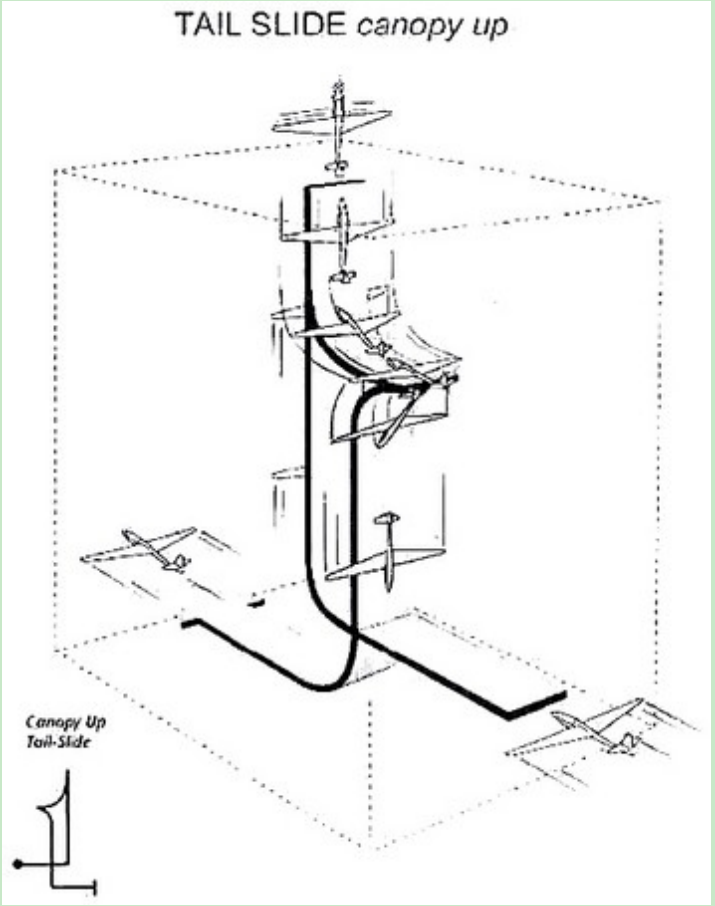
My first attempt: 'Don't be cross. It looked like a tree.'

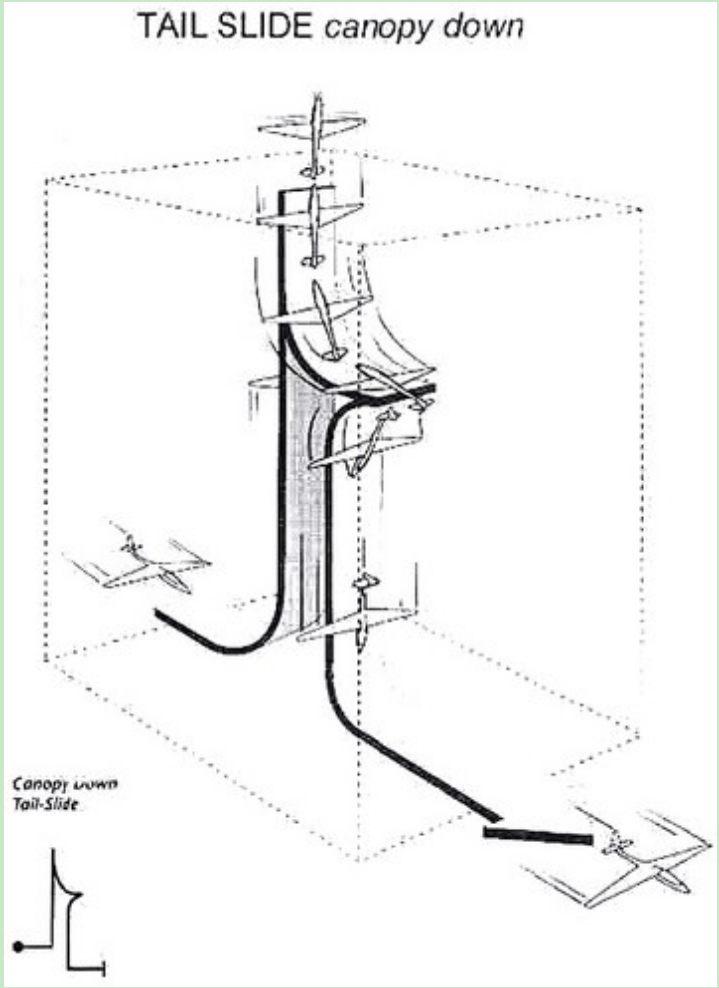
Manoeuvre of the month: Tail slides

From RCSD

This a fiendishly difficult manoeuvre to get consistently right. The second and third diagrams are from ‘The Handbook of Glider Aerobatics’ by Peter Mallinson and Mike Woollard ISBN 1 84037 110 2 published in 1999. The book was highly recommended in RCSD so I have added two diagrams from it here. Though intended for gliders the manoeuvres are the same for power.







Spot the fault

I have no new puzzle this month. Anyone got one to contribute?

Answer to February's puzzle

Reason

There are two possible reasons. The first is that the suggested centre of gravity was wrong and beyond the ability of elevator trim to correct. However the model flew stably so does not behave as you would expect from being tail heavy. The second possible reason is that adding large amounts of expo reduced the trim throw. This appears to be the case with the Taranis. Confirmation of this is the fact that rudder trim works and there was no expo on the rudder.

Cure

There is no risk in trying the centre of gravity a little further forward and see if that corrects the nose up attitude. If it doesn't then reduce the expo and see if that works. Once happy with the trim the linkages must be altered to remove the need for trim.

Cartoon

From RCSD with permission

Solution to February's number puzzle

If numbers fry your brain stop now!

Remember from last month 31oct = 25dec
The oct in 31oct means not October but octal, the number base where you count in eights not tens.

So lets look at the columns:

Column value	8	1
	3	1
Result in decimal	24	1

Decimal total = 25 (or denary if you are a mathematician, gawd help you)
Which is the same as 25dec where the dec this time looks like December but really means decimal.

For more information, and despair, listen to Tom Lehrer's song 'New Math'.

The birth of a legend: Radio Control Models and Electronics

I was looking through an Aeromodeller magazine from November 1959 and out fell a loose sheet of paper, sixty years old.

And it was … (long, irritating TV pause supposedly to raise the tension but actually boring you to tears) … a flyer for the launch of Radio Control Models and Electronics. And here it is. Yes folks, you saw it here first.

There was a questionnaire on the back asking what type of radio-controlled models you use (aircraft, boats, yachts, cars). It also questioned:

- Do you build your own radio or buy ready-made?
- Are you single or multichannel?
- How long have you done modelling and RC?
- How advanced a flyer are you?
- How old are you?

A Grand New
Brand New
MONTHLY
MAGAZINE
for
R/C Fans!

Will YOU support it?

RADIO CONTROL has passed from the development stage to be the obedient servant of growing thousands of modellers—so much so, indeed, that we feel the time has come to test the market for a specialist magazine devoted exclusively to the expanding needs of an enthusiastic public. Already our AEROMODELLER and MODEL MAKER cater for the immense model hobby public and our correspondence carries more letters on r/c matters than any other single subject. Our filing cabinets positively bulge with interesting and informative articles on radio control—far more than we can ever release through the limited space available as a "fair share" in these existing magazines. We have a grand team of experts lined up to cater for the three main classes of radio control fans: (1) The out and out beginner, who must be led gently through his first designs, by simple step-by-step articles; (2) The middle-man, who is progressing perhaps from rudder only to his first "multi", but still needs some guidance; (3) The expert who knows far more than we do, but would welcome a forum to exchange ideas with fellow experts wherever they may be. Then again, we have on tap, an unequalled group of collaborators and correspondents in all parts of the world, a splendid connection with most of the better known—and some of the lesser—manufacturers of radio control equipment in all countries, plus "blanket" agreements with many controlled circulation publications dealing with our subject in many languages to use their items with due acknowledgement.

YOUR SUPPORT

is solicited at this stage, only to the extent of completing and returning this form—which needs no stamp. It commits you to nothing more than an expression of interest in a proposed new publication. If and when it appears, you can please yourself whether you buy it once, always, or not at all. But, if you do not let us hear from you, we can only assume lack of interest and must defer its launching. By giving us your name and address you assist by enabling us to "zone" interest which may help us in later distribution; your form is completely confidential.

All this adds up to the right sort of background to launch what may well be the first "fullsize" publication of this kind in the world. Are there enough of you would-be readers to make it worthwhile? We don't know! But throughout the world there must be getting on for 100,000 of you—if only one-tenth give us their blessing, it will be sufficient encouragement for us to make a start. The kind of magazine we are thinking of will be same page size as AEROMODELLER and MODEL MAKER with presentation much the same. To start with, a maximum of 32-pages and cover including a few pages of advertisements is contemplated, packed full of pictures, diagrams, circuits, news, mainly from the constructional angle, but including informed test reports and reviews of the latest equipment, query columns, experts views, and material for all stages of advancement. To complete the picture, we shall also cover the field of electronics in its special radio control applications. You can have it if you want it —Do you?

People’s Mosquito update February 2020

Since our last update, our supplier Retrotec has moved focus into engineering the in-fills between the bulkheads. The engineering approach was to find the perfect balance of material strength capable to absorb the pressures on the fuselage under construction and an efficient method for producing the in-fills. Original wartime wooden moulds used mahogany wood, today however this material is not sustainable and very costly to obtain. The answer Retrotec came up with is Jelutong wood, which not only is a hardwood capable to take the pressures on the mould but also is a sustainable wood product. You will also note the trial of two steel straps, these are used to tie down and apply pressure to the layers of ply and balsa sandwich of the fuselage.

As you can see from the main picture one of the moulds stands are now painted in bright RAF maintenance yellow. The mould in the picture is sitting in the new factory space being constructed by Retrotec. The new factory itself has also been designed to be 'green', from the latest insulation technology in the roof to converting rainwater to use for the bathroom facilities.

The starboard fuselage mould sitting in Retrotec's new factory in East Sussex.

The wing behind under storage is also made from wood, and is a Russian WW2 fighter type, can you name it?

Sources

There are two Chinese on-line distributors who can often supply items that are difficult to find or are very expensive in England. Examples are servo and balance leads in various lengths, alloy servo arms, LEDs, switches, servos, spinners, etc. Quality is usually excellent. If you are buying a lot of items it is best to split the order so you don't exceed the £18 threshold on each for paying VAT and duty (that was the amount when I last looked). Postage is usually free so the number of packages doesn't matter. Things go wrong on rare occasions but the companies that I use refund readily. If you use paypal you can also get refunds there.

I considered not buying direct from China until the Covid19 business is over. However expert opinion is that the virus is shortlived outside the body and would not survive on a surface more than about twenty-four hours. It seems that there is no risk.

The two that I use are:
https://www.banggood.com
https://www.tomtop.com/

I make no money out of these source suggestions. They are not advertisements, just sources that I have found good. If you have any to recommend please let me know.

Events

NMFC Climb and Glide	Sunday 1st March at 11:00
Insiders	Saturday 7th March 12:00
NMFC Spot Landing	Sunday 15th March at 11:00

Newsletter archive

Members can read or download past newsletters from the club's website. Non-members can find the ones from September 2019 on my website at peterscott.website under Flying.

New things for sale

Don't forget to check the General Sales page on the club website as there are more items there.

1. Edge 540 with a DLA32cc with Power Box. Has all Hitec HS5685 MH Servos and 2 x 2200 batteries. £300 ovno.
2. EFX Racer in yellow from HobbyKing. Tatty but flies well. £20.
3. Flight Box with petrol cans, hand pump, glow panel with serviceable 12V battery with lots of bits and pieces. £50 ono.

Contact: James Leeks on 07961 719578