Newsletter

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Getting balance into your life *by Alan Veitch*

One of the important skills in flying an RC model is to be aware of the balance point of your aircraft. When you turn up to the field with an un-flown plane, wanting to maiden it, you, or whoever is going to pilot the plane on its maiden flight will need to go through several checks before taking to the air.

First, make sure that all the control surfaces are operating in the correct direction.

Apologies Dave Kelly. Yes I'm the guy who turned up one day saying, "I've tried to fly this hand launched Kinetic 4 times, and every time I power up, launch it, it just dives to the ground and snaps in two". "Would you try and maiden it for me, I just want to see if it flies?" He took it from me and said "Do you know the elevator control is the wrong way round ?" In my defence it is a fully pivoted stabiliser, but it meant when I pulled up following launch it was diving to the ground from 6ft up. 4 times in a row, and I still didn't realise!!

Next, range check. Check physical integrity of the structures. Check the power system works. Finally, and the subject of this article, check the C of G **BALANCE.** This is easy enough if the plane is an ARTF but what if like me it's second hand, or a scratch build?

How do you find where it should be ?

A safe place to start is 25% to 30% of the MAC, but what on earth does that mean? I can't afford an Apple computer or even a quarter of one simply to fly a plane, and which quarter?

Well you've guessed, it is aerodynamics we are talking about. How do I find this safe point? Start with the basics. If it's a kit or ARTF read the manuals and look for the measurement from the front (leading edge) of the wing, taken at a point next to the fuselage (root of the wing). Note, I'm trying to take the mystery out of my description, so we can all understand it. Apologies to the technical minded of you.

Simply measure this distance and put a mark on the underside of the wings at this point. To check the balance with an empty fuel tank, or with the battery installed on electric powered planes, place a finger on each of these points and lift the plane. You want the plane to balance with a slight nose down attitude or dead level. Or if like me you have a balancer, place the mark of the C of G on the pads of the balance unit, and note the measurement to the front of the wing (leading edge). This takes a lot of the guesswork out of the measuring, and stops me dropping planes on the bench and creating hangar rash.

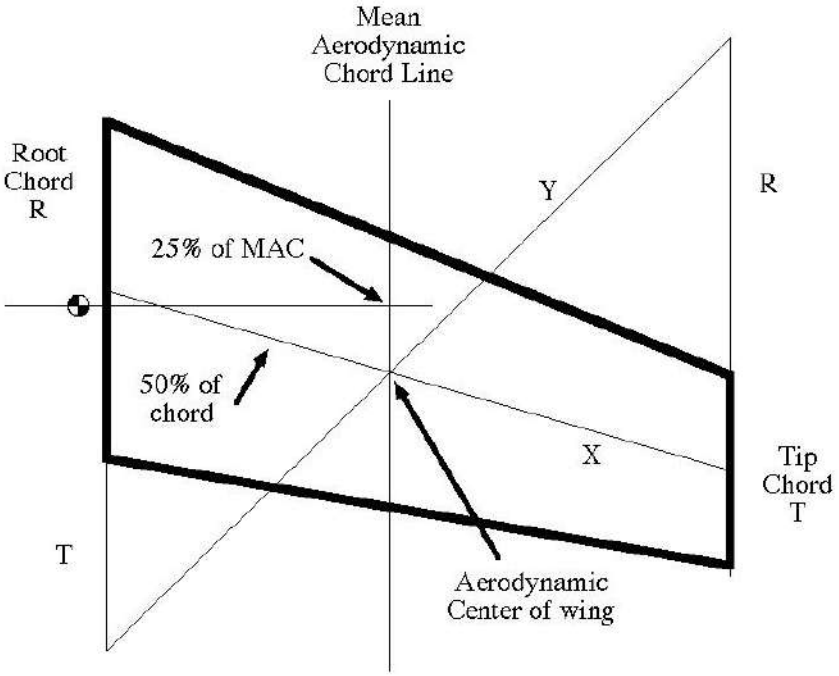
To get it to this attitude (level or slight nose down), add lead weights either to the nose or tail end, remembering that the nearer to the extreme ends you add the weight the less you need to add.

If it is not an ARTF or Kit with documents showing the correct C of G, and it's a parallel wing, take a measurement of the chord (width) of the wing, divide by 4 (25%), then use that measurement to mark and balance as above. At the root (fuselage) end of the wing.

If it is not ARTF or Kit with documents showing the correct C of G, and it is not a parallel wing, now we need to find the MAC (Mean Aerodynamic Chord) of the wing. There's 2 ways to do this depending on if you are a theoretical person or a hands on practical person. Both give the same answer.

Theoretical

Draw the wing out, either to scale or full size. Old wallpaper rolls are good if you prefer full size. Measure the root chord R, and add it to the tip chord T. Measure the tip and add it to the root as in this diagram.



The diagram shows these as R and T. Join these corners together line Y. Now draw the centre of the wing by halving R (root), and T(tip) and join these as X. The MAC line is now drawn parallel to the centre line of the plane. We measure the chord (width) at this line then divide by 4 (25%) and Mark

that point from the leading edge (front) of the wing. This gives us our C of G point, then we balance the plane as before. In theory anywhere along the line 90 degrees from this point to the root can be used, but if the wing is a complex shape it is best to use the exact point shown on the diagram as 25% of MAC.

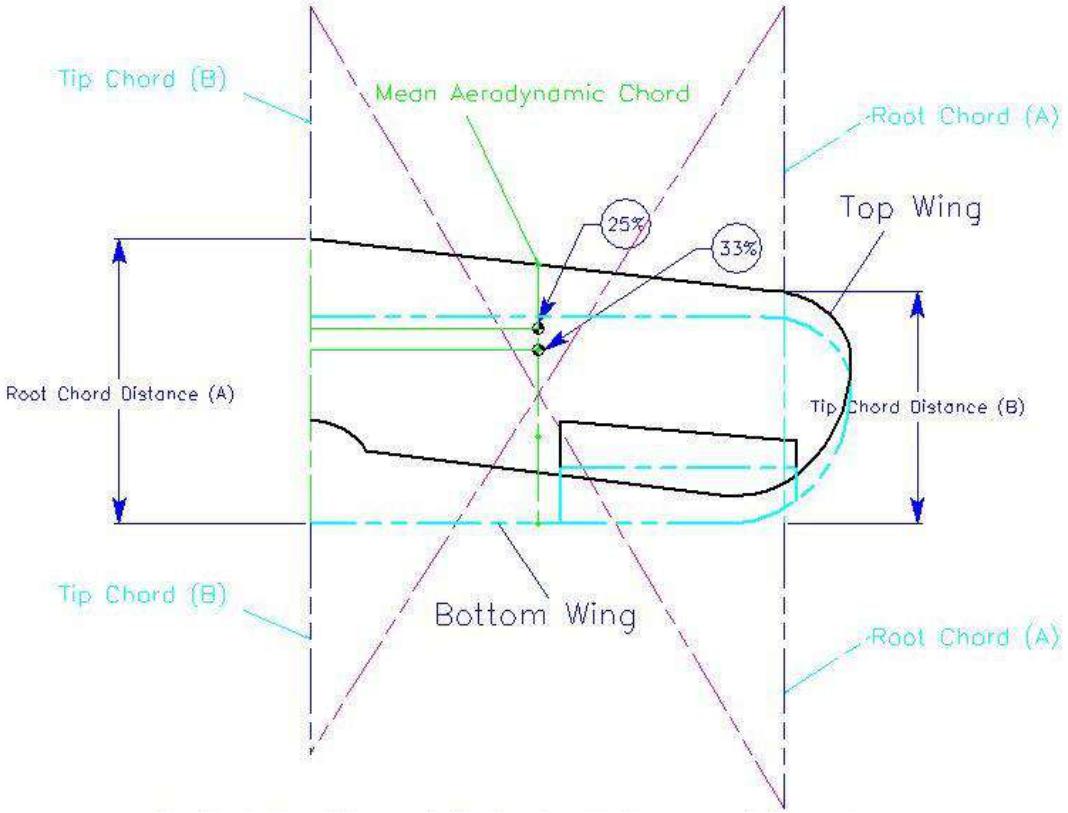
Practical

Trace one wing half from root to tip (the bold shape above) onto card or foam of a uniform thickness. Balance it on a straight edge parallel to the root chord. That is your MAC line, divide by 4 (25%) mark the point on the line from the leading edge (front) of the wing, cut a hole at that point and transfer mark it on the wing. Turn over the card and Mark on the opposite wing, balance as before.

Biplanes

What if it's a bi-plane I hear you ask, well how good is your spatial awareness I reply. Put simply you need to treat the wing area as a single surface. Looking from the top draw out the wing areas as a single entity and treat just the same as before, only difference is that you find the MAC using two diagonal lines intersecting point instead of wing centre line.

This diagram shows a biplane with a swept back top wing such as the Pitts Special has, and is one of the simplest to demonstrate the principle. On a biplane in general the C of G tends to be on the top wing, and on most designs will fall roughly above the leading edge of the bottom wing, but be careful, this doesn't apply to all biplanes.



Biplanes due to their vast wing area, and low lift coefficients create a lot of drag, the force that holds the plane back in the air. Hence the balance point can be more critical in them, coupled with companies like Beechcraft making aircraft like the Stagger Wing. Don't ask me to tell you how to find the balance point on one of those! Aircraft with canards have different calculations. In a lot of situations because our models tend to be very much overpowered compared to the full sized ones we can cope with basically flying a slab with an engine, until you want to slow it down to scale that is. So don't let this trouble you too much.

I have tried to show the extreme basics to this problem, you can take from 25% to 30% if you want to push the limits. And it is a good starting point for model aircraft. But it is so much more complicated than this on full size or competition models. Wing profiles, washout, tail area, even the friction coefficients of the wing surface all have massive effect on this subject. Which when you consider the wing is the only thing holding you up, and you are balancing on thin air it's amazing that these things fly at all. The joy of it is if you get a model balanced right, trimmed right, it becomes a pleasure to fly. If you ever manage it let me have a shot, I would love to know what it feels like.

FPV to LOS (First Person View to Line Of Sight)
by Jon Gruitt

Thank you for the invitation to introduce myself and my recent journey into beginning to fly RC planes. I'm a new member of KRMFC, coming from flying FPV quadcopters and more recently, FPV wings as a member of Fife FPV. I've been an avid RC fan for as long as I can remember, going from toy RC cars to Tamiya kits to 1/10 and 1/12 scale racing. RC flight has always interested me but the opportunity to try it never presented itself until fairly recently.

Toy Drones to Quadcopters

I fell into this fantastic hobby thanks to a friend who received a toy 'drone' for Christmas in 2014. Enjoying the experience, I bought myself something similar with the addition of a tiny onboard recording camera. Shortly after this, I began excitedly scouring the web for YouTube videos and my next 'drone' as my interest grew.

Above: Hubsan X4 H107 (camera version)

Stumbling across the multi-rotor.co.uk forums was the real start of the hobby for me. I found a thread full of enthusiastic individuals ordering and building a 'budget FPV quadcopter kit' from China. The kit promised to get you in the air with a carbon 'ZMR250' frame and the required electrics for £60. Adding a transmitter and receiver, a few LiPos, a charger and an FPV kit from Hobby King took me to around £180.

Above: ZMR250 kit and HobbyKing Quanum FPV kit

FPV stands for First Person View. It is the experience of flying in first person view as if you were sitting on (or in) the craft. A camera is mounted to the front of the craft which provides a real-time low-latency video transmission to the operator's video goggles or monitor.

I had thoroughly enjoyed playing around with the recording camera on my little toy drone but the concept of actually *flying via a camera* was mind-blowing to me. I proceeded with the build, eagerly following the advice, tips and tricks from others on the forum. At this point my eldest son was less than a year old so my build time was whenever I could manage during his naps and in between watching Charpu and MetallDanny videos with my mouth wide open in amazement.

FPV Setup and Maiden

With the build finished it was time to work out how to flash and program the flight controller, a CopterControl CC3D. Thankfully, things in the open source flight controller world were fairly well developed by this point and once the board was flashed, I was able to use the nice GUI of OpenPilot (now discontinued) to configure the software side of things. Not too long before this, hobbyists were stripping Nintendo Wii controllers for accel-gyro units to build flight controllers and flashing them with the aptly titled 'MultiWii' firmware. I am very grateful to those who pushed forward with developing and refining this, turning it into something accessible to the average punter with a PC!

I took my first wobbly flight on the playing field of the school where I worked. I managed a minute of flight with my polystyrene box goggles strapped to my head and the flight

controller in self-levelling mode. That first minute of flight felt like a huge achievement and I headed home absolutely buzzing.

Since that first build and flight, I have witnessed the blur as things evolve rapidly in the FPV world. The 'Hype Train' has no brakes and new products are announced and released weekly, claiming to be the latest and greatest. I've built a good few quads since and things move so quickly that a fresh build becomes an antique within months, both from a hardware and software point of view.

As a pretty awful racing competitor, I don't keep up with the hype train. I don't fly often enough, well enough or seriously enough to justify the time and expense of keeping my gear on the bleeding-edge of technology. I still bumble around on 3+ year old frames and motors when I get the opportunity to fly. Depending on restrictions next year, I might bring myself up to date (or at least into 2019/20 😆) with racing gear.

FPV Racing

Unfortunately, Covid-19 stopped all FPV racing in Scotland this year. There are a number of Scottish clubs who each host one or more official racing events throughout the year with points counting towards positions in the Scottish Drone Racing League.

These clubs include Fife FPV Racing Club, Edinburgh FPV, Dundee MAC FPV, Glasgow FPV, Granite FPV, Renegade Racing and Ayrborne FPV. Apologies if I've missed anyone!

Above: Some of Fife FPV at an Edinburgh FPV Hosted Event Photo by Mariusz Misiurek

Events are held outdoors on tracks designed by each club. The community spirit is great, with clubs often loaning timing gear, PA equipment and other essentials required to host the events between one another. The same goes for loaning equipment and spares to keep other racers in the race. Although competitive, events are friendly and fun.

Most racing builds are now 6S machines to help avoid voltage sag during a race. LiPos are well and truly abused thanks to what is being asked of them and it's not unusual to see them coming off the track puffed and ready for disposal.

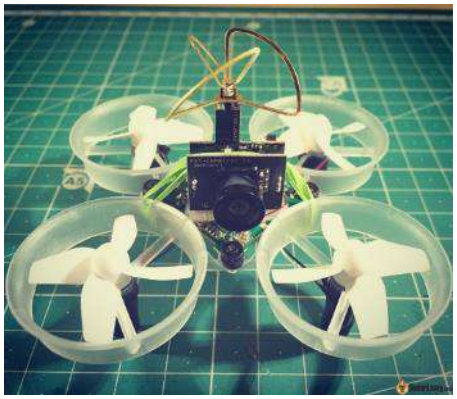
Indoor Micro Racing

The evolution of micro 'Tiny Whoop' racing has been amazing to see and partake.

The name 'Tiny Whoop' covers micro quadcopters of between 65mm and 90mm motor to motor size. It originates from an American FPV group called 'Big Whoop' who began taking Horizon Hobby Blade Inductrix micro quadcopters and adding micro all-in-one FPV cameras to them. They nicknamed these 'Tiny Whoop' and now have a huge following with micros even being included in a number of FPV simulators.

Fife FPV enjoyed a winter of weekly micro racing indoors at Parkgate Community Centre in Rosyth last year. Track design was improving weekly and we had some impressive track features including tunnels and lots of LED gates to race through (credit to SpexFPV - Graeme Tait for the clip).

Sadly, it looks like this winter will not feature an indoor Whoop series due to restrictions. However, next year could possibly be a special one for micros as we get closer to micro size digital HD components. The community are already de-casing Air Units (see HD FPV below) to reduce weight and flying on as small as 75mm ducted frames. Fingers crossed we'll be flying 1S micros indoor in full HD very soon!



Above left: Original Tiny Whoop - photo by Oscar Liang
Above right: Emax Tinyhawk 2 - photo by KababFPV

HD FPV

Until recently, FPV racing and freestyle flying was done mainly with analogue video. A company called Fatshark have dominated the FPV video goggle market for the best part of a decade but were beaten to market by DJI who released a solid and widely adopted digital HD FPV system.

Above left: DJI HD
Above right: Fatshark HDO Goggles with Byte Frost HD receiver

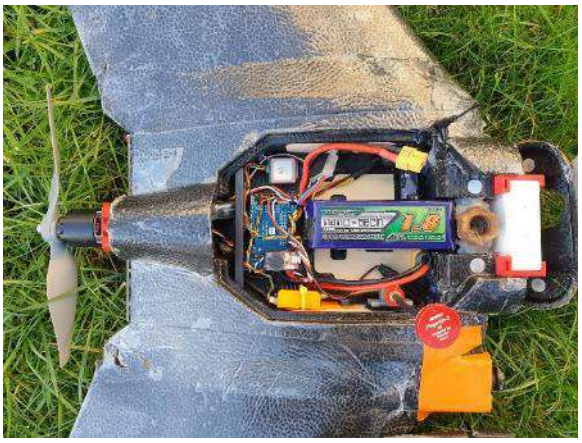
Fatshark do now have their own analogue HD FPV system, Shark Byte (known as Byte Frost during development) on the market but this does not seem to have been as well received as the DJI offering.

I invested in a DJI HD setup earlier this year just before Covid-19 reared its head in the UK. I have a freestyle quad fitted with an Air Unit (DJI's name for their combined receiver/video transmitter and camera unit) and intend fitting an Air Unit to a fixed wing craft very soon. If anyone would like a look at HD FPV, please let me know and I'll bring the kit along to the field when we're allowed to cross county lines again.

FPV Wings and Planes

Flying FPV wings is what ultimately lead me to KRMFC. Along with a few other members of Fife FPV, I learned about the flight controller firmware iNav which is defined as 'a fork of clean flight with a heavy focus upon GPS features'.

I learned how to assemble and laminate a foam wing, install a flight controller, GPS module and the associated FPV electronics. I learned about CG (the hard way). I learned how to configure launch mode and all of the associated autonomous flight modes such as 'return to home', loiter and 3D cruise. I had a huge amount of fun chasing other wings, recording and reviewing flights and even had a lot of fun gluing things back together regularly, following many unscheduled landings and failed launches.



Above left: SonicModell AR Wing 900
Above right: AR 900 electronics bay with improvised ballast in the nose 😆

Above left: FPV camera on left, HD recording camera in nose
Above right: iNav OSD example

iNav [fixed wing setup guide](#)

FPV is great fun but something I never learned was how to fly 'Line Of Sight' which is why I've joined KRMFC.

KRMFC

I have mainly been flying my Durafly Tundra at KRMFC since July this year. Being nervous and unsure of what should be my first high wing trainer, I initially bought a wee Eflite UMX Turbo Timber with SAFE. My thinking was that it was so small and light (a little over 100 grams) that it wouldn't damage much upon crashing and that SAFE would hopefully help me to stay out of trouble and transition at my own pace to unassisted flight.

Unfortunately the wee Turbo Timber got carried away by the wind and my lack of experience during my second visit to KRMFC. I was able to find it using the RSSI signal on my transmitter. It had fail-safed and glided perfectly to a landing in a field across the other side of the main road around 1km away. The horses in the field had checked it out by the time I found it and it has required a bit of repair work to get it back in the air.

Above left: Turbo Timber UMX after meeting the horses
Above right: After a bit of hot water, glue and laminating film to fix the leading edge.

I know it's not a binbag full of foam snow but what you can't really see very well in the photo is the broken landing gear, bite marks, hoof marks, buckled wing and broken control horns. It's been back in the air a couple of times now since repair and is still fun to fly but maybe a little heavier due to the glue and laminating film.

I am really enjoying learning to fly my Tundra and I intend to print a mount for a DJI Air Unit to allow me to fly it FPV as well as LOS. If anyone is interested in 'FPVing' one of their planes, please let me know. I can bring a removable micro FPV unit and some spare goggles/screens to the flying site. No modifications to your plane are needed other than a strip of Velcro to hold the micro FPV unit and 1S LiPo that powers it.

Thanks very much if you've read this far without falling asleep. I've enjoyed the opportunity to share my experience so far and will no doubt be pestering some of you at the site for help and advice in the near future. Thank you to those who have already steered me right with flying tips and advice. I intend to practice on the simulator and in my local park while I'm confined to the Kingdom of Fife and will hopefully return to Kinross slightly more proficient when restrictions are eased.
If anyone has questions about FPV, just give me a shout or jump on Fife FPV or FPV Scotland where you'll find lots of like-minded folk who are more than happy to help. Cheers!

Activity at the Field – November 2020

Wednesday 4th November 2020

A lot of people down the field today. David Callender, Neil Grayson, Bert Nicholson, Alan Veitch, Douglas Gilmour, Douglas Fulton. Mike Hill, Jon Gruitt. Wind light but from a south easterly direction.

Jon Gruitt was there learning to fly his Durafly Tundra. He only started flying planes and "line of sight" earlier in 2020. Previously he flew drones and FPV. He now owns the Tundra and an Eflite UMX Turbo Timber.

Neil had a serious crash with his Tutor 2. He took off successfully and did a couple of circuits and managed a couple of loops but then was at the west end of the runway at a low altitude when the engine cut out. He tried in vain to reach the end of the runway and miss the barbed wire fence but failed miserably. Damage was extensive when he and Alan V reached the scene. The battery cover had broken off, the battery, nosewheel and bits of balsa and plywood were scattered over a large area. The engine compartment was broken and the tail plane had snapped off cleanly, bending the control rods to 90 degrees. It will take some repairing.

Douglas Gilmour had a few successful and confident flights with his IC Arising Star but on the final flight he lost orientation some distance east of the runway and turned the wrong way causing his plane to hit the ground with some force. Two trips had to be made across the field to collect all the pieces. Will it arise again like a phoenix? – we will see.

David Callender had a scratch built trainer model from a Ben Buckle plan which flew extremely well and looked great in the air.

Friday 6th November 2020

Bert Nicholson was at the field alone around 12:20. Virtually no wind and a bit misty. He set up the engine on his Arising Star and successfully flew his electric Riot.

Douglas Fulton arrived around 13:30. He had bought a second hand Boomerang trainer with a .46 engine from the Facebook page, RC Classified. He didn't have a full flight as he had left it too late. He wanted to get used to the steering again as he hadn't flown a trike undercarriage for a long time. It steered well and lifted within a few metres then had a steady glide to the bottom of the runway. He had two glides then went back to the bench, refuelled, turned round and fog had come in and he couldn't see the end of the runway. Within minutes everything was covered with moisture. Visibility was so bad on the way home he had to drive very slowly.

Saturday 7th November 2020

Alan Veitch was first at the field. Neil Grayson turned up around 11:30 and Mike Hill appeared after 12:00 for a test flight of his helicopter which is now working. Neil ran the OS .46 on the renovated Stearman Biplane. Neil's Apprentice was ready to go with the battery connected but the fog was too thick for a flight. Alan however was very brave and flew his Kingfisher but kept very close, even then it disappeared into the fog. At least someone at KRMFC had a go at flying even if you can't see the end of the runway and maximum height is kept at 20 feet! Cold, wet and foggy with no wind

Friday 13th November 2020

Fife and Perth and Kinross put into level 3 due to Covid-19. Very little flying done for the rest of the month. (at least none that anyone would admit to!).

Newsletter Feedback and Contributions

Please let Neil or Alan know of anything you think should be included in the Newsletter, things you like or dislike. Any feedback would be much appreciated. If anything happens at the field whilst you are there send us an email (with pictures) for the Activities at the Field section. More articles are always needed. Let us know how you got into the hobby, what planes you have owned etc... It is hoped to publish the Newsletter monthly around the 1st of each month but on occasion could be delayed for a few days. Emails addresses for articles are: alnvkrmfc@gmail.com krmfcng@gmail.com.

Do you have anything you want or have for sale? Send the details including pictures for inclusion in the next Newsletter.

Good health to you all

Merry Christmas when it comes

KEEP WELL

The Committee