Dumfries Model Flying Club

# SAFETY COMPENDIUM

**This Safety Compendium is a collection of articles selected from DMFC Safety Bulletins and Newsletters for the benefit of new members and also existing members who may wish to use them as useful reminders from time to time.**

## Contents

# The Basics

Like all model flying clubs, the DMFC takes safety very seriously. Model flying is tremendous fun, but nevertheless model aircraft are not toys. They can travel at great speed and they can kill or do considerable damage to persons and property, which is why the entire hobby/sport is governed by the Civil Aviation Authority in the UK and is subject to laws, rules and guidelines, just as full size aircraft are. Since most models (indeed ALL of those flown at the DMFC flying site) are powered and the vast majority are propeller-driven, there are hazards not only in flying models but also some very significant dangers in ground handling.

There are also strict government rules relating to the use of radio transmitters for model radio control. Add to all this the inherent dangers of highly inflammable fuel and high powered flight batteries and it should be appreciated that this is not a hobby for young children, but only for adults and adolescents with a strong sense of responsibility and safety awareness.

Third party insurance is an absolute requirement of the DMFC and this can be obtained very cheaply via the sport's national governing body, the BMFA, and details can be found on their website. The DMFC's own website also contains important information about club rules and safety issues and all members should regularly access the site to keep up to date with all Club matters. Newcomers are also strongly advised to obtain the BMFA Members Handbook which contains a wealth of valuable information. Subscribing to one of the monthly aeromodelling magazines may also be a useful source of information.

In common with most clubs, it is a policy of DMFC that model pilots may only fly under the direct supervision of an experienced pilot until they have passed a basic flying proficiency test to ensure that they can fly solo safely. Ideally in the early stages of learning to fly radio-control, this supervision should include the use of a "buddy box" dual-control system.

BMFA operates an Achievement Award Scheme to recognise various levels of flying and safety proficiency. The most basic of these is the BMFA "A" Certificate and this incorporates both a flight handling test and a series of questions covering a range of safety issues. This basic test is really to determine whether a pilot is sufficiently proficient at flying and knowledgeable of fundamental safety issues to be able to safely fly solo (unsupervised), in the proximity of other flyers. Candidates for these tests can avoid having to answer the safety questions verbally by successfully completing the BMFA Registration Competency Certificate (RCC) test online prior to the flight test.

DMFC has experienced pilots who can act as trainers and are willing to assist newcomers to acquire the necessary basic modelling skills, safe practices and flying skills. The club can also arrange for an approved Examiner to conduct the appropriate test and award the proficiency certificate to pilots who complete the test satisfactorily, meeting the necessary standard of safety knowledge and flying ability.

There is much to learn for newcomers, for this is a hobby which incorporates many different types of knowledge - a fact which makes it very interesting and absorbing in many different ways. Even for experienced modellers, recent advances in electric powered flight, has brought a whole new world of opportunity and challenges - with brand new learning-curves to climb. Most radio control transmitters are now computerised and programmable which adds another element to understand and master, and telemetry is another new innovation recently to arrive on the scene.

Of course nobody can acquire all this knowledge overnight, but don't be put off by that because it means that you'll never get bored with this hobby as there is always something new to learn. DMFC is a very friendly club where most members are happy to spend time with newcomers to the hobby to pass on their knowledge and experience.

The one area in serious decline generally is that of model-building. Several members still enjoy building their own models from plans or kits, and some are very skilled at scratch-building model aircraft from plans, but that is no longer a necessary skill for newcomers to the hobby, and there can be few aeromodellers now who do not buy most of their beloved models in ARTF (Almost Ready To Fly) or even RTF form.

This has enabled many people to enjoy this wonderful hobby without having the necessary skills or spending months to build their own model. But it does mean that some take to the air without having to get to grips with understanding some of the issues relating to airframe design, stresses and strengths, control linkages, servo and power-train suitability etc., which is not such a good thing, for these are important things for every aeromodeller to learn about and understand.

For this reason new members would be well-advised to seek the guidance and assistance of experienced members when choosing and assembling their models and ALWAYS have them checked out by an experienced flyer before committing them to a maiden flight.

**The Flying Field**
After 20 years at Bankend, in 2018 the DMFC acquired the use of a new flying field at Mabie Meadows. It is an excellent well-drained flying site, remote enough so as not to be a nuisance to any near neighbours, yet easily accessible from Moss Road. The new site boasts a hard-standing car-park, a Clubhouse and Toilet facility. The large designated "pits" area and runway are well away from the road, and there are no power lines or other obstacles to avoid.

But all flying sites have their pros and cons and there are the inevitable variables such as wind strength and direction and the position of the sun in the sky at any particular time which can impact on comfort and safety when flying.

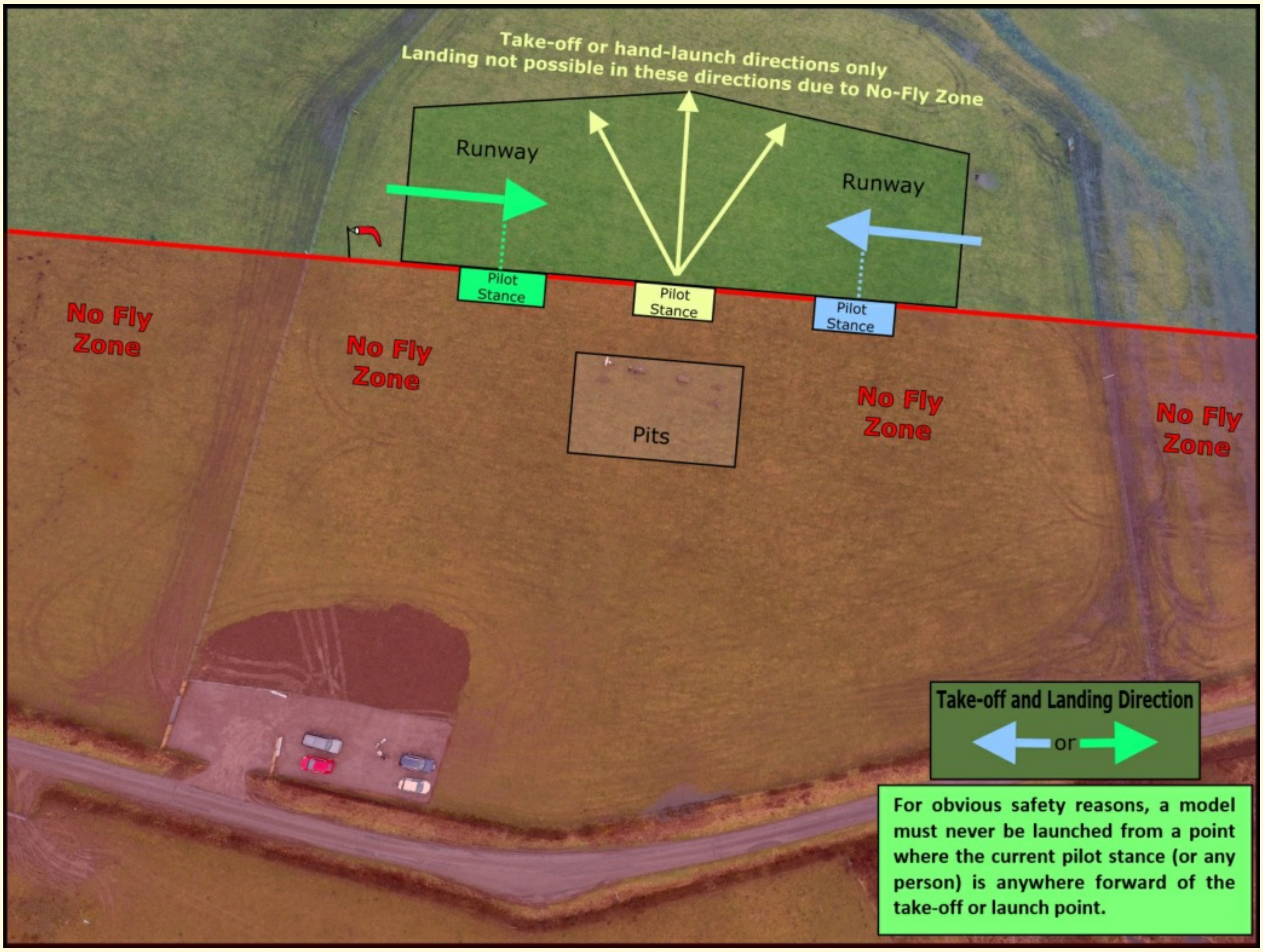
It is the responsibility of all club members to make themselves familiar with the layout and orientation of the site and especially to both understand and abide by the Club Rules many of which apply to use of the flying site. Safety is a serious issue in all model flying clubs, and particular notice must taken of the following:-

**The No-Fly Zone** - the area which must not under any circumstances be over-flown at any height by any model. This includes specifically the pits area and the entire car park area. Roads and buildings must also not be over-flown, and pilots must never fly directly overhead or behind the designated pilot stance in use. Overflying the pits and car-park areas is an extremely dangerous practice and repeat offenders may be subject to sanctions by the Club Committee.

**The Designated Pilot Stances.** As it is not easy to judge the linear distance or position of a model when flying, the pilot stance rules are designed to help prevent pilots from inadvertently overflying the pits and car park. The wind direction determines which runway will be in use at any particular time and thereby the pilot stance. As this may change during the day, it is agreed by mutual consent of flyers present on site at the time.

Pilots will always stand with their backs to the road and the No-Fly Zone and should position themselves close to the take-off and landing threshold of the designated runway. By this means it should not be possible for a model taking off or landing to endanger another pilot beyond the threshold. This is also by far the best pilot stance position to judge the correct touch-down point and avoid landing too long or short, and both the take-off run and the landing run are away from other pilots.

There is a club maximum of four models flying at any one time. Pilots should stand close enough together to ensure that any warning calls can be heard by all those flying. Under no circumstances may pilots fly from the north side of the runway facing the road, car park or pits. At Mabie, the position of the sun is rarely problem as it was at Bankend from time-to-time, so there is never any justification for flouting this rule. A fundamental rule of model flying is that the risk to personal safety always takes priority over the risk to a model.




# Transmitter Batteries

Although some of the latest transmitters are designed to be powered by LiPo or LiFe battery packs, the BMFA warns of some inherent dangers in the increasingly common practice of retro-fitting LiPo or LiFe packs to power older transmitters which were not designed for them.

In 2012 there was a crash involving a large turbine-powered model due to the sudden loss of transmitter power, due to retro-fitting of Lithium battery pack in an older transmitter. LiFe is often the more popular choice when replacing 8 cell NiMh, because the voltage range seems similar, but the basic advice is that unless your transmitter is specifically designed for LiPo/LiFe packs, don't fit them.

Although LiFe packs and even the new Eneloop NiMh batteries seem to offer a better alternative to traditional NiCd/NiMh batteries, they have a very flat power curve until it suddenly "drops off a cliff" when its power is almost exhausted. With such a steep terminal power curve when they get near 9V they can fail to trigger the TX low-power alarm, with disastrous results.

The BMFA advice is therefore to fit only the battery types the transmitter was designed for.

# Mobile Phones

The potential for mobile phones to affect the link between transmitter and receiver is well-known, as is the less-defined potential to compromise programmed settings on computer radio transmitters. For this reason the official advice has always been not to have mobile phones in your pocket whilst flying, not only because of the risk to the radio links of everyone on the flightline, but also because they represent a significant distraction exactly at the time when concentration and focus should be at the maximum.

However the BMFA has recently drawn attention to a specific danger which has been found to be significant and repeatable under experimentation and extensive testing. These tests have demonstrated that the receiving by a mobile device of DATA in close proximity to radio control transmitters causes definite interference between transmitter and receiver, at a level significantly greater than speech transmission. It is clear that receipt by mobile phones of emails, text messages, WhatsApp messages and downloads (all data) has a visible and repeatable effect on the receiver.

This measurable and repeatable issue makes a clear case for avoiding having mobile phones switched on anywhere near the flightline, and although it has often been thought advisable for anyone flying alone to carry a mobile phone, it is highly advisable for all flyers also to keep their phone switched off whilst flying, or at least to switch it to aircraft/flight mode which prevents calls, messages and data transfer.

BMFA makes the point that our RC equipment already has to work very hard in what is a busy 2.4Ghz environment, and our aim should be to give it the best possible chance to do its job effectively. A nearby mobile phone signal could be all it needs to push our RC equipment beyond its capability to provide a secure link between transmitter and receiver.

# Electric-Powered Models

It is now apparent that electric-powered flight has been embraced by virtually all members as mainstream, and probably all now own and fly electric models regularly. For some however, electric power is still something of a novelty, and it is evident that there is a widespread lack of appreciation of some of the specific dangers and safety issues related to electric power.

Everyone seems to be aware that LiPo batteries are quite volatile, and require great care especially when charging, as they have a quirk called "thermal runaway" - a chain reaction which means they can suddenly burst into flames if overcharged or short-circuited, or discharged at too high a rate, or physically damaged. Treat them with great respect, especially when charging and storing them.

But LiPos are far from being the only major safety issues with electric power, and whether at the field or even at home, there are other very serious safety issues that require vigilance and great care. The most important of these to keep constantly in mind is that whereas an i/c engine will never spontaneously burst into life, an electric motor can do just that, very unexpectedly at any time once a battery is connected, and potentially with very nasty consequences. Electric motors may look relatively small and innocuous, but they can do very serious harm indeed – and whereas an i/c motor might stop if the propeller is obstructed, there is actually an instant power surge if an obstacle (like a hand!) intrudes into the whirring propeller arc of an electric motor. There have been some very gory incidents involving accidents with electric motors so it's best never to get complacent with them.

For this reason you should never connect a battery-pack inside an unrestrained model. If you cannot use one of the benches with restrainers at the field then consider buying or making a simple restrainer such as the one illustrated here.

If a restrainer in not available then stand behind the model with your legs astride the rear fuselage, restrain the model with your legs against the tailplane. When doing this, ensure and that the model is on the perimeter of the pits facing outwards and away from any person or vehicle when you connect the battery. Always assume the motor could burst into life as soon as power is connected. One day it will surprise you!


This need for great caution is just as true when bench-testing or setting control throws at home. Restrain the model and/or remove the prop if possible. If you need to check or adjust the control surface throws etc., but don't want to remove the prop, don't use the power pack – just unplug the ESC from the receiver and use a 4.8V Receiver pack to power just the servos.

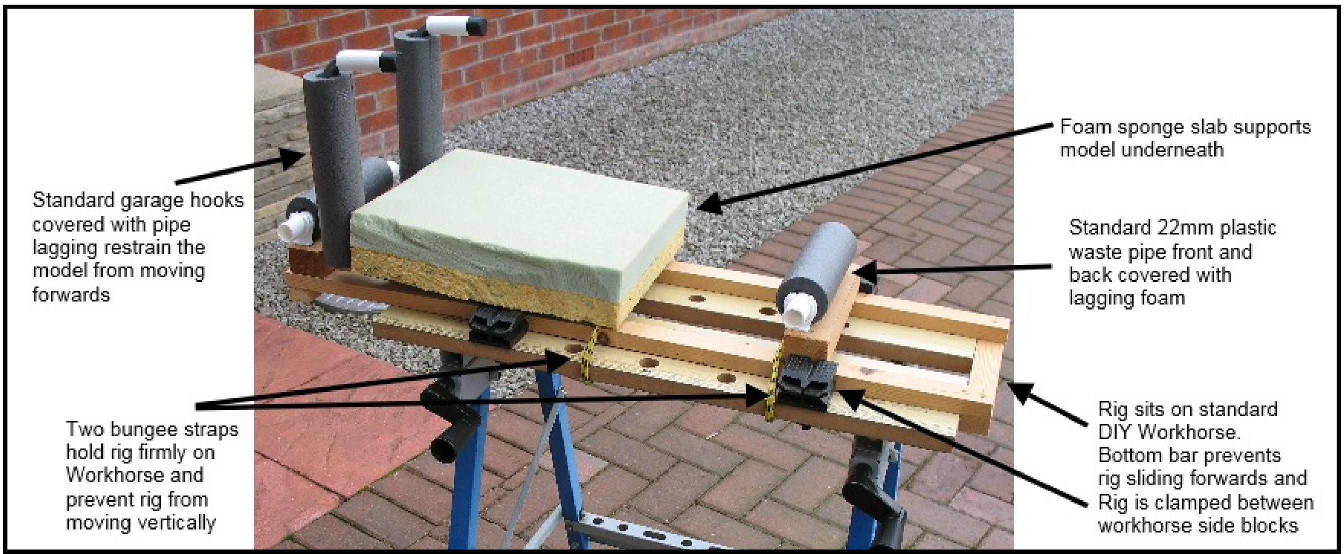
Also, because a powered-up electric motor is "live" even when the prop is stationary, great care must be exercised when handling or "parking" the transmitter, so that the throttle stick cannot accidentally be moved. This applies both before you connect the battery and after the flight. Don't put the transmitter down so that it stands upright where it it can fall or be blown over – lie it on its back if possible, where it is much more stable.


The BMFA now also strongly recommend the use of a Throttle-Cut switch with electric models. The method by which this is set up varies between transmitters so if this is not clear from the transmitter manual it may be necessary to obtain the necessary information from one of the main online model flying forums.

And when carrying the transmitter (eg. when walking to the take-off point), best practice is to carry the transmitter in the left hand (assuming Mode 2) with the thumb over the throttle stick holding it down. Then, even if you trip, it is less likely that you'd inadvertently or accidentally push the throttle stick forward.

You will certainly need to set up the flight control throws etc at home, and for electric-powered models you should ideally also check your power set-up with a watt-meter to ensure that the power output will not exceed the capability of your motor, speed controller and battery! With electric models this all means arming the model while it is static "on the bench" which of course presents the danger of it trying to take off in your workshop!

A really useful solution is to make yourself a bench-testing rig, and if you do you'll soon wonder how you ever managed without it! These can be made in various ways from different materials of course, but here is a very simple design which fits on a folding DIY workhorse when in use, and can hang up in the garage out of the way when not in use.





Rig with model "on board" ready for bench-testing

# 2.4 Ghz Transmitter/Receiver Binding

The BMFA has advised that if two model receivers are being bound at the same time, to the same type of transmitter and in close proximity to one another, it is possible for both models to be inadvertently bound to the same transmitter - which could result in a nasty accident in the pits if the wrongly bound (electric) model was unexpectedly started by the wrong transmitter. The DMFC Committee has therefore sensibly decided to require members to announce "TRANSMITTER BINDING" in a loud voice, before starting a binding process in the pits or in the proximity of other members who might be doing the same thing.

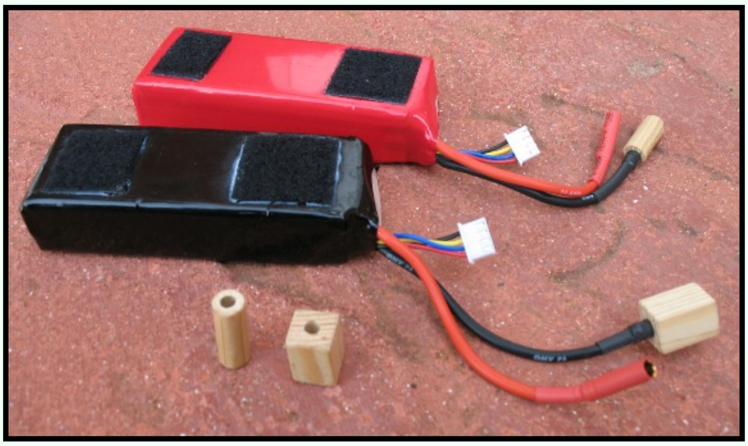
# Managing Flight Batteries

Lithium Polymer (LiPo) battery packs have almost completely replaced dry cell NiMh rechargeable batteries for powering electric model aircraft. They offer a high level of power (voltage and capacity) in a form that is both lightweight and compact. But they do need handling with great care and respect as they can be very dangerous if due care and attention is not constantly maintained.

If they are discharged below 3V per cell they will die and become useless, but worse, if they are overcharged or short-circuited they can spontaneously burst into an inferno of flames which will burn extremely hot and emit toxic smoke even if deprived of oxygen.

For this reason, only ever use a charger specifically designed for LiPo batteries of the type and cell-count you are using, and make sure it is capable of balancing the cells within the pack since the above problems can affect individual cells within packs. Take the time and trouble to learn about all the available settings on your charger(s) and double-check the cell-count, charge rate and capacity setting on the charger every time you charge, especially if you charge batteries of different sizes and capacities from time to time. You should also check that the cells are reasonably balanced before a charge.

The most common connectors used connect the battery to the Speed Controller these days are the XT60 and EC3 types, although 4mm gold bullet connectors are still popular.
When 4mm gold connectors are used the standard is to use a female for the positive (red) battery lead and male on the negative (black) lead. It is usual to cut the black lead slightly shorter than the red lead so that the terminals are less likely to touch one another.
However, although heat-shrink sheathing is a help against short-circuits it is really not adequate on its own. Another important though unrelated issue at the field is ensuring that you don't mix up batteries which are freshly charged with ones which have already flown and are therefore depleted.



For 4mm connectors a simple solution to both these issues is to make some wooden connector plugs to fit over the male connector. 8mm dowel and 12mm square section wood strips are cut into approximately 20mm lengths. Then get a 4mm drill bit and drill a blind hole into the end of each one, the depth of the male 4mm connector. Use the round ones as safety plugs for your freshly charged packs, and the square ones to denote packs which have just been flown.

If XT60 or EC3 connectors are used you must devise another method to differentiate freshly charged packs from exhausted one, and ideally always use a battery checker to do a voltage check prior to every flight. Putting a discharged battery into a model and taking off is a recipe for a very short flight and an early deadstick!

There is additional information regarding safety issues relating to Lithium Polymer Batteries on the DMFC Website and the BMFA also publishes an excellent booklet on this subject which is available to download free from their website.

# Electric Power and Aborted landings

There are some special considerations to be taken into account relating to aborted landings in electric-powered flight. Obviously the main reason pilots choose to make a landing is because the flight battery is nearing exhaustion of its capacity. No doubt we are all aware that electronic speed controllers (ESCs) incorporate a feature called "Low Voltage Cut-Off" or LVC. This is not the same as BEC, which means "Battery Eliminator Circuit" and is designed to enable the receiver and servos to be powered from the flight power pack and thereby eliminate the need for a separate receiver battery.

The LVC exists for two reasons:-

1 It prevents the LiPo battery voltage from falling below 3V per cell (which would destroy it), and

2 **Much more importantly**, it cuts power to the motor (which draws a high current) BEFORE the battery is so drained that it no longer has the power to operate the servos via the BEC. This means that when the motor cuts out, you still have enough battery power left to do a controlled dead-stick landing.

But aborted landings introduce an important factor to be aware of. Quite obviously, most landings are made at the end of the flight when it is felt that the battery is getting to the end of its capacity, but this also means that its voltage is considerably reduced since the start of the flight, and may be very close to the LVC cut-off voltage.

As you make your final approach you want the aircraft to sink slowly towards the runway and you therefore throttle back and trade altitude for speed using the nose-down sink rate to keep the speed above stalling speed until the aircraft virtually stalls onto the runway and lands smoothly. This is just fine if all goes well, but if you need to abort the landing attempt and go around the circuit again for another attempt, the model may be perilously close to stalling speed and you'll have to gun the throttle to quickly build up speed again to maintain control.

The problem is that with electric power, pushing the throttle stick forward will not only cause the motor to immediately try to draw more power, but in doing so will cause the battery voltage to drop suddenly. Not only does this mean you won't get as quick a surge of power as you might wish, but the real danger is that the sudden voltage drop can trigger the LVC cut-off, just at the point when the model is at its most vulnerable - at low altitude, beyond the runway, facing into wind, and close to stalling speed.

Even if this doesn't happen you need to be prepared for the model suddenly swinging to the left as the prop-wash surges over the tail fin, and be aware that coarse-pitch propellers (a x >½a - designed for high speed models) can take a few seconds to bite into the air enough to give you the extra speed you need. And if you try to turn too soon, before the speed has built up enough, there's the danger of stalling in the turn and spinning in. And even if that doesn't happen there's then the downwind leg with the wind behind the model as you come round for another landing attempt. It's hard to find good news in all this!

**The moral of this tale of woe is to try to time your flights so that you make your first landing attempt while you've still got around 30% capacity left in the battery, and not try to squeeze every possible second of flying time out of the pack.**

Many ESCs are programmable, and allow the LVC to reduce power to the motor gradually to avoid a sudden dead-stick situation, and while this is desirable and should be used where possible (many ESCs have this setting by default), pilots must be alert to this sudden power reduction when flying, because it indicates that the battery capacity is very near to exhaustion and should be landed immediately. Both for safety reasons and for preserving the useful life span of batteries you should plan to land well BEFORE the LVC starts to do its job.

ALWAYS make your landing approaches with sufficient battery capacity left to enable you to abort the landing and go around the circuit again for another attempt at least once. This means learning to time your flights carefully, using the timer alarm on your transmitter.

How long your flight time can be with any given model and battery depends upon a number of factors. The main ones are:- battery capacity, the age of the battery (they deteriorate over time and with use), how you fly (obviously fast and furious = shorter flight times), wind conditions (more battery power is consumed if it's windy), and ambient temperature (batteries perform less well when cold).

Make a note of the actual flight time each time you fly, and use a battery checker to monitor residual capacity. Then if necessary adjust your timer alarm accordingly. But don't forget that battery checkers do not show the battery voltage under load, so some bench-testing with a watt-meter is also useful, especially with new models.

For larger models flying on 4 cells and above, it is necessary to power the receiver and servos with a separate power source than the battery which powers the motor. This can be a 4-cell NiMh pack, or more commonly these days, a small 3-cell LiPo with a UBEC voltage regulator. (Receivers and servos require voltage of about 4.8V, so you cannot directly connect a 3-cell LiPo to the receiver or you'll fry it).

# The Dreaded Dead-Stick!

Every pilot dreads that horrible moment when the engine or motor dies suddenly at an inopportune moment (as if there is ever an opportune moment!). For this reason, every new pilot (both RC and Full-Size) has to learn how to deal with such a situation and and must practise, practise, practise it. In RC flying it is also an integral part of the initial flight safety test for all new pilots - the SAA Bronze or BMFA 'A' Certificates.

In military and commercial full size aviation it does not stop there. Training to deal with such situations is continually practised with mandatory hours in flight simulators, but in RC flying, unfortunately it often does stop there, until one day the situation strikes out of the blue and we are suddenly faced with trying to remember what we were taught in training. Or rather, because our training was so long ago, we tend to act on instinct and deal with it as best we can.

The trouble is that at that critical moment, all our attention is fixed on the aircraft and our first instinctive priority is to save our precious model. The reality however is that with a model in the air with limited options of time, distance and control, our first priority should be to ensure the safety of people and property on the ground. A few years ago, a young teenage girl bystander was killed by a model aircraft which apparently went dead-stick on the landing approach, and it seems likely that it tip-stalled out of control.
And the BMFA Safety Officer also recently reported that many insurance claims he has to deal with indicate that many RC pilots put the model before safety and end up compromising both in the process. He also points out that in many cases models have flown considerable distances out of control before they eventually hit cars or people.

It is interesting that in full-size flying, the emphasis is always on trying to ditch the aircraft in a controlled way with minimum danger to life and property, whereas in model flying all our concentration is almost always on saving our precious model. As responsible RC flyers we would do well to put the safe controlled "ditching" of the model at a higher priority than just trying to keep the model in the air as long as possible.

All the indications are that instinct does not serve us well in dead-stick situations, and that means that there is no substitute for training and practice. The most dangerous instinctive reaction is to try to buy thinking time by holding the model's nose up to stop it losing height too quickly. That is the worst thing you can do, as it is a sure recipe for a sudden stall or tip-stall and a probable rapid spiral descent completely out of control. And that doesn't only mean the model being totalled, but a model out of control also represents a very serious danger to people and property on the ground.

The most critical times in flying of all types are the take-off and the landing approach, and in both situations, because the aircraft is at low altitude this is when the pilot has the least amount of thinking time and his quick reactions are vital to avert disaster. However in both these situations, although low, the aircraft is usually headed into wind which is a distinct advantage provided you don't try to turn the aircraft around! To maintain control of an aircraft it must have airspeed over the control surfaces. Without power the only means of keeping control is to trade height for speed - in other words keep it into wind and push the nose down. You need airspeed more than you need height! Airspeed gives you control over the aircraft; height can just mean you make a bigger hole in the ground if you have lost control! Unless you've got plenty of height, the worst thing you can do is to try to turn the model around to bring it on to the runway.

Consider this: - a soft, controlled landing in long grass is entirely preferable to a hard uncontrolled landing on the runway. Indeed, with all models, there are times when you should deliberately induce a dead-stick and ditch the model as quickly and safely as possible. Any model which you feel is behaving erratically or where control is impaired for any reason should be deadsticked and quickly brought back to earth before it runs amok and causes any damage. You may have only a few seconds to react before a serious situation develops.

Electric models present particular issues which necessitate immediate deliberate dead-sticking if they occur.

A jammed electric motor will fry your ESC and very likely send a voltage spike back through the works to initiate thermal runaway in your LiPo pack, causing it to burst into flames. So kill the motor immediately if you hear unexpected noises from the model or there is sudden vibration or you notice smoke emanating from the model. And if ever an electric model is headed for a crash for whatever reason you MUST shut the throttle before it hits terra firma or you may have a nasty fire to deal with.

Of course a lot of problems can be avoided with the proper pre-flight planning and checking. It goes without saying that this means checking the model functions, transmitter model-memory, servo connections etc. But how many times do we stop and think out the safety implications of such things as the position of the sun, wind strength and direction, runway in use, etc.? Even the choice of which model to fly on a particular day is relevant.

Every day when we turn up to fly we should stop and think about these things and work out a contingency plan in the event of engine failure on take-off (EFTO) or landing or other control issue which might necessitate a forced premature landing - especially if the wind is coming from over the pits or car parks because aircraft naturally tend to weathercock into wind. One difference between full size and RC flying is that in full-size flight the worst engine-failure catastrophes often occur during take-offs, but in RC flying, most dead-sticks occur due to running out of "juice" - ie. fuel or battery capacity - towards the end of the flight and often when preparing to land, and of course this is common to both i/c and electric power.

It should be pretty obvious that flight duration is clearly a factor which is under the direct control of the RC pilot, and therefore "running out of juice" is not normally an issue for which he can claim to be blameless.

In electric flight it often comes down to proper battery management. Are we sure we know which batteries are freshly charged and which are discharged or depleted? Do we take account of windspeed - most models consume more power when flying in windy conditions. What kind of flying are we doing on a particular flight? Flight duration is obviously varied considerably by how much throttle we use.

Do we take account of the fact that LiPo (and other) batteries perform badly in very cold conditions and that this can significantly reduce flight duration on wintry days.

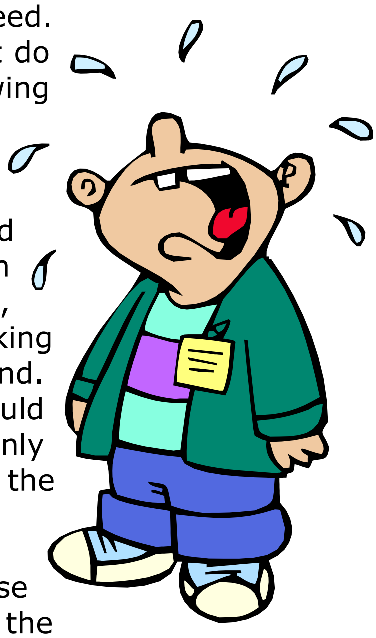
Get to know your Speed-controller (ESC). If you program it right with a soft LVC you can usually have ample warning that you are nearing the end of the flight pack's capacity. (Of course the new-fangled telemetry gizmos are even better at this, but they consume power themselves).

It might surprise some to know that in the early years of electric powered flight, ALL landings were dead-stick because almost all electric models were belly-landers with no undercarriage and were glided in to land. NiCd batteries were so heavy that brushed motor power trains just didn't have the power to do wheeled take-offs and in any case wheels would have just added more weight, so models didn't have them. That is also how and why foam models came into being of course - the battery pack was so heavy that the model itself had to weigh virtually nothing in order to fly at all. And of course with gliders every landing is dead-stick too, and it is all about judging and juggling height, distance and airspeed.

Every pilot should practise forced landings. Some may have wondered how to do practice forced landings without risking damaging the model, but it's really very simple.

PPL students have to do a lot of this. I notice from my log book that more than 6% of my entire flight training programme was spent learning and practising forced landings without power. It is practised in two phases. We've probably all heard of "circuits and bumps" - which is just practising circling the airstrip in a prescribed direction and then touching down with the main wheels before gunning the throttle and going around to do it all again. That is practising the final stages of making a forced landing (or any landing for that matter).

Practising the initial phase of a dead-stick forced landing situation is really about learning how to glide the aircraft. This is important and different models behave quite differently in the glide. Some don't glide at all well without a lot of airspeed. You should really get to know every one of your models. Most do their SAA Bronze or BMFA "A" Test with a very forgiving high wing model, but you should be able to dead-stick any model.



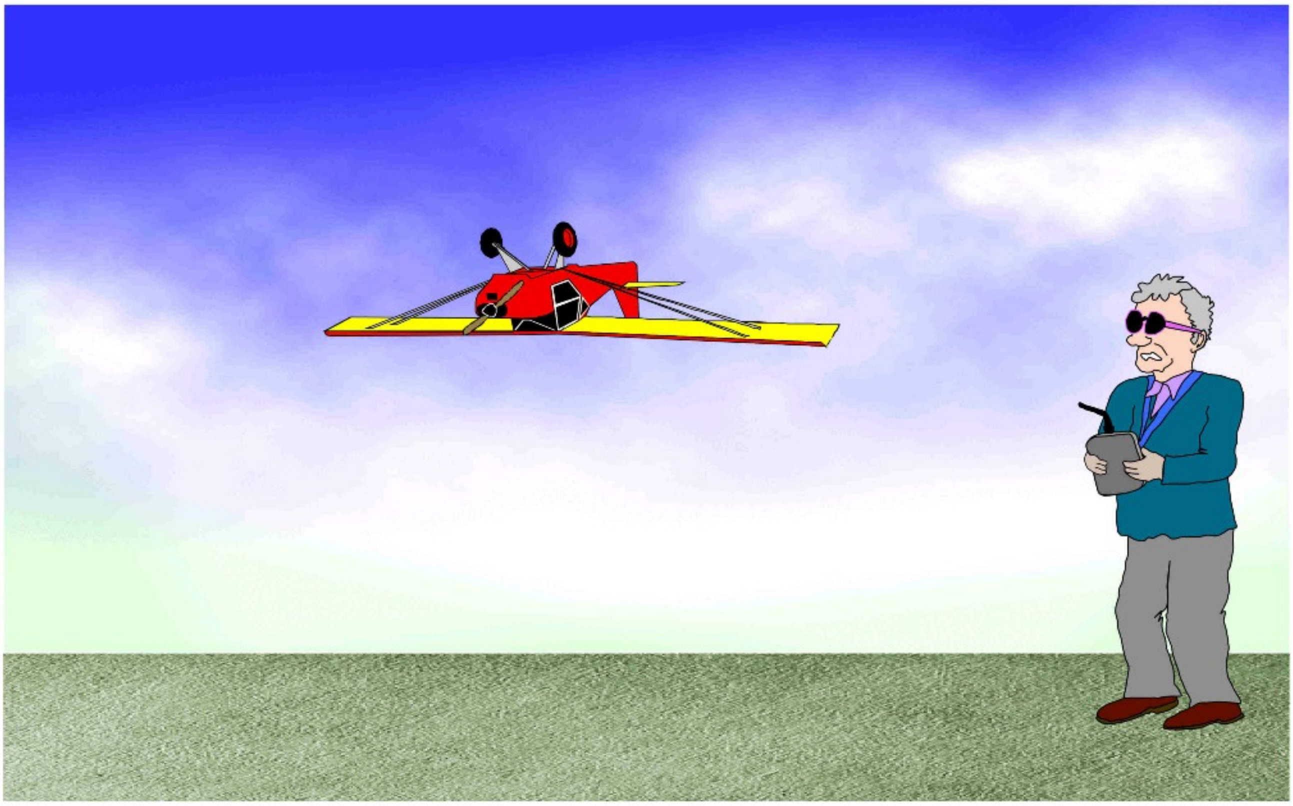
So it is important to glide-test EVERY model you fly to see how it behaves without power. To practise the initial stages of a forced landing student pilots (full-size) first get plenty of height and then they throttle back the engine as if they have suddenly lost power, and then glide down to 500ft looking for a suitable place to try to land. Wicked flying instructors would sometimes throttle back suddenly on their dual controls to see how the student would react.


With RC it's basically the same. To practise forced landings, start with the model high up and cut the power (or throttle an i/c engine back to idle) and put the nose down to see how it glides. You'll find that some models - especially heavier ones with high wing-loading need a lot of airspeed to avoid a stall or tip-stall and spin. You need to know the model well if you're going to save it and avoid a dangerous out-of-control model situation in the event of a sudden dead-stick. Don't forget it is airspeed that gives you control, not height. Height is only useful to buy speed and thinking time!

Once you've got to know the model and its gliding characteristics well, you should be comfortable cutting the power and pushing the nose down to maintain flight and keep full control of the airframe. You don't have to bring it too low before you turn the power on again - but you do need to start with enough height to let it glide for a short while until you've got the feel for its glide characteristics. Of course you need enough height to recover from a stall or spin if it inadvertently gets into one. Make sure you know how to do this first of course.

Once you've got the hang of it, the next stage is to cut the power on the landing approach - not too far out of course - and simply land the model, gliding safely onto the runway. In a real situation of course you might not be able to get it down on the runway, but by then you should then be able to land just as smoothly and with minimal damage off the runway (long grass can be very forgiving in forced landings).

Knowing how your models glide, and being able to manage their descent under full control builds great confidence. Almost certainly the day will come when a dead-stick occurs suddenly and unexpectedly. The better you know all your models, and the more practised and prepared you are, the more likely you'll be able to avoid a dangerous out-of-control scenario, and the more likely you'll be able to minimise the damage to your model.



**There is never a good time for a dead-stick!**

# Dead-Sticks & Forced Landings - Summary

1. Always observe pre-flight checks of your model to ensure you will have proper control while it's in the air. Make sure you have the correct model memory selected on your transmitter. These vital actions should be done for every flight.

2. At every visit to the flying field, before flying, observe the sun, wind and weather conditions carefully to ensure you can fly your chosen model safely. Check with colleagues on an agreed flight stance and runway use, and work out a contingency plan in the event of unexpected impaired control or a dead-stick situation especially on take-off or landing circuit or approach.

3. If your model suddenly becomes noisy or erratic, or you are losing control, kill the power immediately, put the nose down and carry out a controlled dead-stick landing as quickly as possible.

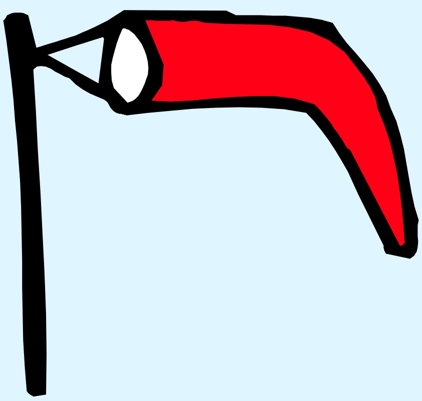
4. In the event of a dead-stick situation, if you're headed into wind and at low level do NOT try to turn the model (if the model is high you can turn the model into wind or circle to bleed off altitude, but NEVER turn towards the no-fly zone).

5. WHATEVER height the model is, push the nose down to keep the airspeed above stalling speed - and don't pull back on the stick except to slow it for the final touch-down.

6. Keep the model well away from the pits, people, cars and other property, (ie. the no-fly zone) and NEVER under any circumstances steer a dead-stick or erratic aircraft towards the no-fly zone even for a moment. If you must turn the aircraft, always do it in a direction away from the no-fly zone.

7. Go for a controlled ditching if at all possible and put the safety of people and property on the ground ahead of the preservation of the model.

8. When you maiden any new model, be sure to include a glide test as an integral part of the first flight. Get plenty of height and then cut the power and try to keep the nose up until it stalls. You will then see its stall characteristics - if it has a tendency to tip-stall, dropping a wing alarmingly, or goes into a spin, or just mushes. Then recover from the stall and put its nose down to go into a controlled glide. Get to know its glide characteristics. What is its sink rate? What is its stall speed? All these will help you considerably if you ever have a real deadstick with it.



# Throttle-Cut

It has been common practice for some time for radio control transmitters to incorporate a system for cutting the throttle and thereby stopping an engine or motor.  Since the minimum throttle stick setting for an internal combustion engine powered model would normally be the engine's idling speed, it is clearly desirable to be able to stop the motor completely by use of a transmitter switch.  However once an i/c engine has been "killed" in this way there is no danger of it suddenly bursting into life again, so a stopped i/c engine may be considered to be safe.

The situation with electric motors is quite different however, and in several respects they are potentially more dangerous than i/c engines:-

- as soon as the battery is connected the motor is "live" and can spontaneously burst into life, due to electronic component failure or human error by inadvertently nudging the throttle stick forward or by incorrect transmitter programming

- an electric motor will not stall if the propeller is obstructed by a hand or finger, and indeed it is likely to induce a power surge and cause more severe damage or injury

- many models require the battery to be installed and connected with fingers and hands perilously close to the propeller, and often with the model inverted

- electric models can be quite large these days so that carrying them on to the runway while armed, and while holding the transmitter, can easily lead to accidental activation of the throttle stick

In the days before brushless motors were used for model aircraft, electric-powered models relied on brushed motors, and it was then normal for brushed speed controllers to incorporate a switch.  Also, there were often additional safety features such as requiring the throttle to be pushed fully forward and then fully downward before the motor would start, and also a system to prevent the motor from starting when the battery was connected unless the throttle stick was at zero.  All of these features have found their way into some brushless ESCs, but it was never considered wise to totally rely on these features and another problem is that there are no standards, so there are many different brands and models of ESC which may all behave differently.

For all these reasons it is highly desirable to designate a two-position transmitter switch to act as a throttle cut for electric powered motors as well as for i/c engines, and indeed this is highlighted in the videos of the Achievement Scheme Tests on the BMFA website.

There may be several different ways of achieving this on some transmitters, and in any case different brands of transmitters may implement this facility by different methods and programming processes, so it is advisable to refer to the manual or seek guidance online if need be.  When setting throttle cut however it is important to note that there is a major difference between i/c and electric power which has a direct bearing on how it must be set.

The throttle on an i/c engine is a mechanical device activated by a servo and the engine is usually set to idle at the zero throttle stick setting.  For this reason, the throttle-cut setting is normally set to -130 (ie. below the zero throttle stick position).  However this is not the case with electric motors as they normally stop at the zero throttle setting.  So for electric motors the throttle cut setting should be -100 (not -130).  Since transmitters and ESCs vary so much it is important to always check the operation of the throttle-cut settings with the model safely restrained before attempting to use it at the field.  In some cases it may be necessary to recalibrate the ESC to the TX throttle stick movements in accordance with the ESC instructions.

Nevertheless is it strongly recommended that throttle-cut should be set for every model as a very significant safety feature.

# In Emergency - Dial 112

In the UK we have always understood that 999 is the telephone number to dial in an emergency to access the immediate assistance of the Fire, Police or Ambulance services. But if you are out and about, especially if using a mobile smartphone, there is another BETTER number you should dial - the pan-European Emergency Number 112 which can also be used in many countries around the world.

The reason that this number is preferable to 999, especially when in a remote location, is that this number activates an automatic system called AML (Advanced Mobile Location) which instantly gives the emergency services your precise GPS location reference to enable them to find you quickly.


In an emergency, say a road accident, you might not know exactly where you are, but this system gives them your location automatically. Similarly, if there was an accident on the field at Mabie, it could be difficult to give clear concise location and directions to an emergency services operator based in Glasgow or Edinburgh!

But by dialling 112, they would know your precise location and could therefore get the emergency services to you much quicker without having to write down our attempts to give directions to a field in the middle of nowhere.

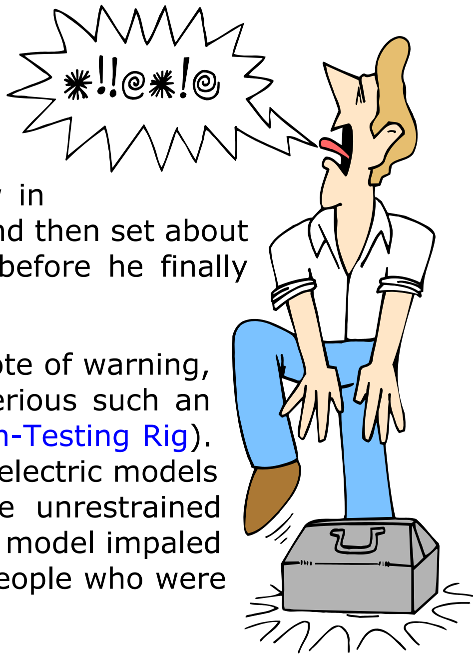
There is also a smartphone app called "What3Words" which is free to download, and by accessing the app it will use the GPS facility in your smartphone to return a three-word code that identifies your precise location anywhere in the world and this can then be given to the emergency services when you telephone them.

The What3Words code for our Mabie flying site car park is:-

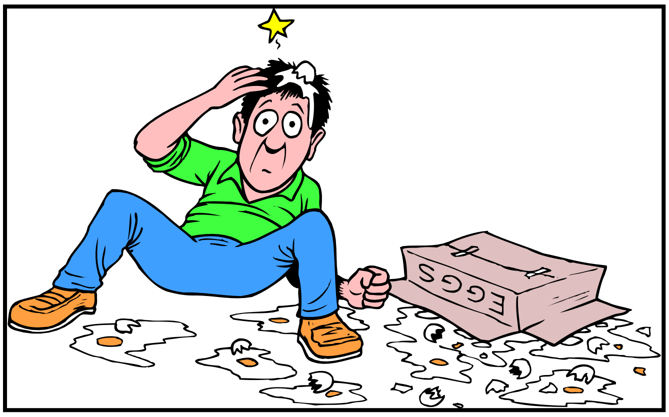
**flying.driveways.system**

# Accidents are not always funny

There is no doubt about it, accidents can be very funny. Indeed they are the raw material for most of the slapstick humour which we've all enjoyed since childhood, and the long-running TV programme "You've Been Framed" is almost totally reliant on the humour derived from spectacular accidents. A while ago there was a hilarious article by the editor of a popular aeromodelling magazine who admitted that in a moment of mental abstraction he had inadvertently started up an electric model while sitting in bed one Sunday morning. He vividly described how in seconds the whirring propeller had devoured his duvet, and then set about his pillows creating a veritable snowstorm of feathers before he finally managed to stop it.



Of course the article ended quite properly on a serious note of warning, as the writer was clearly mindful of how much more serious such an accident might actually have been - (see article on Bench-Testing Rig). Yet there have been similar incidents within the DMFC of electric models making a break for freedom when being armed while unrestrained indoors at home or elsewhere. And at Bankend we had a model impaled on the windsock pole, and propellers flying off towards people who were unwisely standing in front of the model.




And that's the problem. It's funny if you get away with it, but far from funny if someone is seriously hurt or worse. The actor David Niven's first wife was tragically killed during a party game when she fell downstairs while blindfolded. End of party fun! And of course many less famous people have also experienced tragedy when a fun occasion was brought to a sudden end by a nasty accident.

Not all accidents end with a smile. And even the funniest accidents come with a serious warning attached. Model aircraft have killed people. Model propellers have maimed people for life. LiPo battery fires have utterly destroyed homes and cars.

Safety is in everyone's interest, and although we can all enjoy the humour of a mishap when no-one is hurt, we should all, like the above-mentioned editor of the aeromodelling magazine, be mindful of the underlying warning about unsafe practices which is inherent in the circumstances of every such incident.

# Airmanship

A personal article by Richard Whiting

When I was learning to fly many years ago, my Chief Flying Instructor (whose name was Frank Spencer by the way – an ex-Lancaster pilot from WW2!), made great efforts to drum into me something which directly relates to flight safety, which in full-size aviation is about staying alive! This is the importance of good **Airmanship**. Airmanship is not piloting ability – in fact it has nothing to do with it directly. It is really a holistic approach to flying safety and covers every other aspect of managing the aircraft and related facilities you are about to entrust your life to.

No sensible pilot just wheels his aircraft out of the hangar and then simply climbs into the cockpit and takes off. Yet that is precisely the approach that too many aeromodellers have to their flying.

When the aircraft is safely out of the hangar, before getting into the cockpit, the pilot very carefully walks round the aircraft checking for any signs of damage or other issues which might affect flight safety. Are the tyres properly inflated? Is there any leakage of fluid from the brake pipes or other hydraulics? Are there any chips, dents or cracks in the propeller or turbine blades, or damage to the wings and fuselage? Are the pitot tube covers removed? - (if not the airspeed indicator and altimeter won't work). When parked in the open, light aircraft are often tethered to the ground and the control surfaces have locking bolts or plates fitted so they are not damaged by the wind – so the pilot needs to make sure these have been removed. Are the wheels chocked so the aircraft is safely restrained when he starts the engine?

Note that the responsibility for all these checks is the pilot's – not just the ground crew's - their lives are not on the line! In model flying we are both pilot and ground crew of course.

The pilot must consider other factors too. Like the meteorological forecast. Is he competent to fly safely in the weather conditions he is likely to meet? Does he have instrument rating to fly in poor visibility – if not and such conditions are forecast, he must not fly. If it's windy, how competent is he at cross-wind take-off and landings?

When he gets into the aircraft there are more checks to do before he even thinks about starting the engine. Is the windscreen clean and not cracked? Is the cockpit hood secure and can it open easily in the event of emergency? He waggles the control column to ensure that all the control surfaces have full, free and correct movement. Is there anything loose in the cockpit that could start flying about when the aircraft is airborne. Is the safety harness in good condition – not frayed or cut, and does the mechanism lock and unlock properly? Then when he starts the engine there's another load of "vital actions" – checks to do before he moves an inch. So many in fact, that in larger aircraft they have printed Vital Action Check Lists which must be gone through before every flight and signed off by the pilot and co-pilot. The point is that as far as possible, nothing is left to chance or "luck" because aircraft of all kinds are very unforgiving of human negligence or incompetence.

Yet in model flying we often talk about "bad luck" when a model crashes due to something other than pilot error. And sometimes perhaps it is. But the principle of good airmanship which is behind all the above-mentioned pre-flight checks made on full-size aircraft can and should be applied to model flying too. While still at home, before we even put a model into the car, we should always carefully check it for damage. And are the wheel collet grub-screws tight? Control horns and linkages OK?

At the field, before we fly a model, there are more checks to be made. How secure is the battery and battery hatch? How secure is the cockpit canopy? Are the servo lead connections tight and, if necessary, taped or locked together? Did we check we've set the right model memory!!!! Are all the control surfaces functioning properly and in the right direction? Are the flaps in the right position for take-off? Did that previous heavy landing weaken or break anything? It is surprising how often a model is immediately flown again after coming down hard or off the runway, with barely a squint of a check. When did we last do a proper range-check? What are the Transmitter and Receiver voltage levels? And how old are the TX and RX batteries anyway? Can we fly safely in the prevailing weather conditions? Is the model suitable for these conditions?

In Radio-control flying the pre-flight checks must encompass the model itself, the transmitter settings and battery condition, the weather and other prevailing site conditions, and years ago the BMFA recommended the use of acronyms to prompt us to carry out these important preflight checks. The S.W.E.E.T.S. acronym covers Sun position, Wind direction and strength, Eventualities, Emergencies (eg. Failsafe set and Dead-stick plan), Transmitter, and Site Rules. The S.M.A.R.T. acronym covers transmitter checks - Switch positions (especially Throttle-Cut and Dual Rates switches), correct Model Memory, Aerial security, orientation and extension (if applicable) and Transmitter Battery Voltage OK. Full details are in the BMFA Members Handbook which is downloadable from the BMFA website. (You do not have to be a BMFA to access this).

And what about our own state of health and capability? We should be responsible enough to assess this honestly. If we are feeling unwell or below par in any way, we should seriously consider making the decision not to fly.

In model flying we are both the pilot and the ground-crew so the buck stops with us and there is no-one else to blame. Even if faulty equipment is an issue it is our job to check it before we fly it. Though thankfully it is rare for model flying accidents to harm persons or property, it is still sad to see nice models wrecked, and we all feel the pain. Sometimes it shakes our flying confidence too.

Eric "Winkle" Brown, who was chief test pilot of the Fleet Air Arm for many years and is widely regarded as the greatest pilot of all, having flown 487 aircraft types - a world record which will never be beaten - was asked how he survived when so many of his fellow test pilots did not. He said that too many pilots operate on the basis of "Kick the Tyres, Light the Fires, and last one in the air is a cissy!". He was a stickler for pre-flight preparation and insisted it was that, and not luck, that was the single most important factor that kept him alive throughout his long and distinguished career and in many extremely hazardous situations.

It could be argued that every model aircraft accident or crash has the potential to cause damage or injury, which is why most Clubs are sited in rural areas, why Club safety rules are imposed, and why Third Party insurance is mandatory.  However these mitigation measures do not release model flyers from the personal responsibilities which model flying demands.  Club Rules state that safety is everyone’s responsibility, both individually as well as collectively, and good airmanship is a very important component for ensuring the safety of everyone on site.  It is always very disappointing when a beautiful model - often expensive or the result of hours of work - meet their demise for whatever reason.  That disappointment is compounded when, but for a few simple pre-flight  checks, the disaster could have been avoided.

Fly Safe, and “Happy Landings”.

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