SAFETY

A Summary of Flying Safety Rules

Principles

Safety is an important issue for Aeromodellers, and it is *no accident* that a large portion of this handbook is about safety. Statistics and low insurance rates show that model flying is not a dangerous sport but, as with other sporting activities, hazards can arise if common sense rules are not adopted and applied.

This complete chapter is designed to make you aware of SAFETY. It is not intended to be a comprehensive list of rules. There are two reasons for this. Firstly, it is impossible to produce a fully comprehensive set of rules that cover all eventualities. Secondly, rules are not always appropriate for all conditions, and once a rule is ignored for a sound local reason, others tend to be ignored as well. You must have a commitment to the safest reasonable operation of model aircraft at all times.

We share our environment with a wide variety of people, some of whom may be upset or disturbed by our impact on their area. Noise and safety issues can be a concern to members of the general public, particularly to those who are unfamiliar with the sport of Aeromodelling. Safe operation is therefore vital to avoid the imposition of unreasonable rules and regulations from groups and authorities that see modellers as a threat or nuisance.

Model Flying NZ cannot be aware of all local conditions and variations so it is important that clubs also have local guidelines for safe operations on their own sites. These local rules should be specific to the site, and could also include non-safety but other very important sections, typically those relating to noise limits, hours of operation, no-flying zones and directions on where car and foot access is not permitted.

This and the ‘General’ section have a number of important safety principles that will assist all modellers to operate safely. Specific sections follow on: Free Flight, Control Line, Radio Control, R/C Gliders, Electroflight, Large Models and Turbojets.

General

a) All members must at all times actively seek to identify aeromodelling hazards and reduce or eliminate them.

b) No modeller is to wilfully or negligently cause or permit a model aircraft to endanger any person or property.

c) No modeller is to do or say anything that would make another modeller perform any unsafe act.

d) All model aircraft ***must*** be flown in accordance with CAA Rules Part 101. If you cause an accident whilst in breach of CAA Rules, you may be deemed to be criminally negligent. In particular, no person is to fly an R/C model within 4 km of a licensed airfield without either being qualified as proficient under the Model Flying NZ wings badge program and having an observer, or being under the direct supervision of a badge holder or Model Flying NZ approved Instructor. Flying within 4km of an airfield can only be done with the agreement of the airfield users and/or controller. Further details of the CAR 101 are contained in Annex A (Note that CAA rules do not apply to models below 100 g, and any pilotless aircraft over 25 kg must have a specific permit to fly).

e) Large R/C Models (as defined in Chapter 5) must meet the extra requirements of the 'Large R/C Models' section of this Chapter.

f) No modeller is to operate a model while being intoxicated with drugs, alcohol, or any other substance.

g) No modeller is to operate a model: higher than the maximum permitted height for that site (Generally this will be 400 feet, but check with your local rules), further away than safe control can be maintained, in cloud, or outside the legal hours of daylight. CAR 101 specifies further meteorological limitations.

h) At rallies, demonstrations, advertised events, or any other flying event where large numbers of public spectators might reasonably be expected to attend, extra safety controls will be put into place and are to be observed by all participants. Local club regulations and rules must be followed at all times.

Free Flight
In addition to the 'General' section, the following requirements apply to the operation of all F/F model aircraft, be they sport, competition or Vintage:

a) F/F models must not be launched when manned aircraft are overhead.

b) F/F models must not be launched from an area where they could overfly buildings, major roads, aerodromes, active runways, power lines, railways, or similar places, on their expected flight paths.

c) F/F models, in particular all types of powered models, must be launched well away from, and downwind of, any spectators and vehicles. Tow launched models must be kept at least one towline length away from spectators, vehicles and buildings.

d) When a fuse type dethermaliser is used a snuffer tube must be used and extreme care should be exercised when lighting the fuse.

e) Flying surface alignment, dethermaliser operation and any automatic systems must be checked for correct operation before release.

Control Line
In addition to the 'General' section, the following requirements apply to the operation of all C/L model aircraft.

a) Steel lines, preferably stranded and of sufficient strength for the C/L model being operated, must be used.

b) Before every flying session starts a C/L model and its lines must be subjected to a pull test of at least 10 times the model's weight and control lines and linkages shall be checked after a pull test (competition models must be pull tested as detailed in the C/L Rule book). If any damage is obvious the model *MUST NOT BE FLOWN* before the damage has been repaired and another pull test satisfactorily completed.

c) The control handle must never be released while a model is flying. When high line pulls are expected, or the type of flying might cause accidental release of the handle, a safety strap connecting the control handle to the operator's wrist should be used.

d) The centre of the flight circle must be clearly marked and pilots must remain at the centre of the flight circle when flying. Adjacent flight circles must be located so they have an adequate clearance between them. Spectators should be encouraged to stand up-wind of the circle and must not be in, or adjacent to, the circle when a control line model is hand-launched or released for take-off.

e) A C/L model must be ditched is there is an immediate risk of collision between the model and a person.

Radio Control Models

In addition to the 'General' section, the following requirements apply to the operation of all powered R/C model aircraft.

a) Only the frequencies specified in the Model Flying NZ R/C Frequency System (Annex B) may be used, and transmitters must comply with RFS27 or RFS29 specifications. A system of frequency control similar to that in Annex B must be used.

b) R/C sites must be at least 8km from each other to avoid interference unless some sort of robust and approved frequency sharing system is in place. See Annex F for further information.

c) Many R/C equipment "defects" are caused by faulty batteries, connecting wires or switches. Battery failure will almost certainly cause an R/C model to crash and "Fail Safe" devices will not work if the battery fails. Therefore, modellers must take particular care of batteries, connecting wires and switches in their radio control equipment and:

i) must ensure all batteries are fully charged before flying;

ii) should use a monitor to check battery condition and/or a battery backup;

iii) should use batteries less than 5 years old;

iv) should cycle batteries at regular intervals, not exceeding 12 months; and v)

should take care to detect the early stages of "black wire" corrosion.

d) No R/C model is to be flown without thorough pre-flight check as per the wings badge requirements and a ground range test before the first flight of the day or the first flight of a new or repaired model, or after the RC equipment has been repaired or modified.

e) There have been some quite serious, and potentially fatal, accident caused by large models. The precise chain of events differ in each case, but the ultimate cause was an unrestrained model. Positive and effective restraint is very strongly recommended for any larger models, generally regarded as being greater than a 40 size engine. Such constraints can take many forms depending on the model type and construction, and will generally be guided by local club practices, but can include:

A dedicated helper.

A rope or strap around or on the tail.

Wheel chocks.

Metal rods (covered with foam).

f) The flying field for all R/C flying (except Pylon and Soaring*) will conform to the following rules:

i) **The Flying Area:** The area reserved for R/C flying must be of sufficient size to enable safe control of the model types flown at the site. As a guide, the area is typically 300 meters by 100 meters but a larger area may be required for large or heavily loaded models, and a smaller area could be suitable for small models such as park fliers.

ii) **No-Flying Areas:** The area overflown by models must be free of pedestrians, cyclists, occupied vehicles, car parks, and buildings occupied by people. If a person or vehicle enters the area while a model is airborne, flying must cease until the area is free. If the usual landing area is obstructed by the people or vehicles, models must be landed elsewhere. The flight line in front of the pits must be at least 70 meters from any organised public activity not associated with model flying.

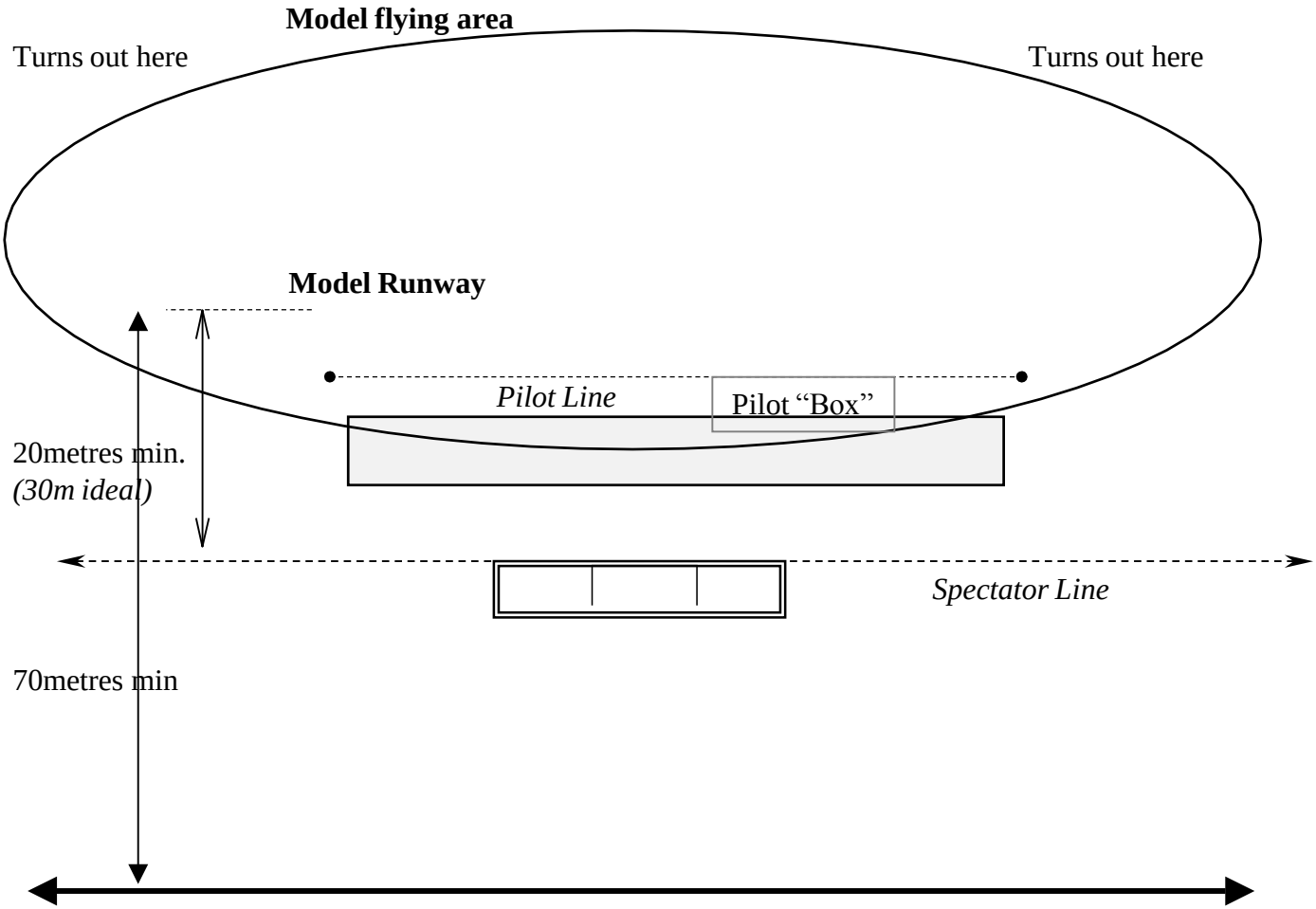
iii) **The Pits Area:** An area where models are stored between flights and where maintenance and start-up procedures are normally carried out. The pits area should be behind a line at least 20m (an absolute minimum), and preferably 30m from, and parallel to, the side of the runway being used for R/C. Where the 20 meters separation cannot be met, a barrier at least 1metre high should be placed next to and in front of the pits to prevent a model on or near the ground entering the pits from the flying area.

i) **Spectator Line(s):** A line, or lines, established at least 20m from, and parallel to, the side of the runway being used for R/C models. The line(s) should extend at least 150m past either end of the runway. When Large Models are being operated, at least 30m distance should be provided and preferably more to increase the safety margin.

ii) **Pilot Line(s):** A line(s) established between the runway in use and the spectator line, behind which R/C models must not be flown. This line shall bound an area where pilots are to stand in a relatively closely spaced group while operating their models.

* The proper flying field designs and safety rules for Pylon and Soaring flying are specified in the Codes of Practice of these SIGs.

Members are encouraged to ensure that their club publishes a map of each flying site, based on the diagram below, and also showing any sports and recreational fields in the vicinity.



Public activity not associated with model flying.

Observer - Duties

Scope

EVERY pilot of a radio controlled model aircraft operating within 4km of an operational airfield is required by the Civil Aviation Regulations to have their own competent OBSERVER with them in the PILOT'S BOX while their model is in the air. Members are urged to make themselves familiar with the excerpt from the Civil Aviation Regulations printed in the NZMAA Members Handbook (page 26, CAR 101.205(a)(1)(iii)).

Please understand that this is not a requirement invented by the NZMAA nor the Club Committees – it is a requirement under the Civil Aviation Regulations and we have no input on the matter. Non-compliance with these regulations could easily cost a Club use of a site.

Primary Functions of an Observer

Ensuring the safety of the public, air traffic and other Club members is the paramount role of the OBSERVER. This is achieved by keeping the pilot fully informed of:

- Other aircraft movements, both full size and other models, so that proper aircraft separation is always maintained.
- Other pilot's calls and flight intentions (take-off, landing, dead stick, low pass, etc.);
- Any other hazards that may appear during the flight (pedestrians on the strip, dogs, etc.).

Note:

Being an OBSERVER is not a social engagement in the PILOT'S BOX. While the duties are neither difficult nor onerous, full attention is required.

Secondary Functions

Additional input from an OBSERVER could be to:

- Assist with safe engine start up and aircraft handling in the pit area and to the flight line;
- Ensure that all other pilots and OBSERVERS are aware of the pilot's flight plans (take-off, landing, dead stick, etc.).

Enforcement

Any Club member noted by a Committee member as not complying with the rules on OBSERVERS will have their name referred to the next Committee meeting. The Committee should take appropriate action to ensure the member is fully conversant with the CAA requirements

FPV Code of Practice

Introduction

First Person View (FPV) flying is a branch of the model aircraft hobby whereby the pilot controls the model using a video image transmitted from an onboard camera to a screen or goggles at ground level rather than directly observing the aircraft. FPV equipment can be fitted to any flying model including power, glider, helicopter and multi rotor. New Zealand CAA restricts FPV operations to flying for sporting or recreational purposes and within direct line of sight of the pilot/observer. All other operations using video transmission for control fall within UAV/ UAS regulations.

Regulatory Requirements

CAA regulations require that FPV flying takes place within the following constraints:
The model must remain within the height restrictions for the flying site.
The model must remain within the direct line of sight (LOS) of the pilot/observer
The pilot using the FPV equipment must be accompanied by an observer who can maintain a lookout for other aircraft and assist the pilot with identification and orientation of the model in the event of any system failure.

MFNZ Recommendations for successful FPV flying

1. Safe Airframes

Where appropriate, pilots should use lightweight, low-speed models which will minimise impact forces if things go wrong. Faster, heavier aircraft should only be used when the FPV pilot is expert and is flying in a suitable and safe location (i.e. far away from people and property).
FPV aircraft should only use electric motors for propulsion. Liquid fuelled motors and Jet engines should not be used. Aircraft should not weigh more than 5 kg and not be capable of more than 100kph in level flight.

2. Safe Location

Pilots should make a considered judgement when choosing their FPV flying field and only fly from a safe location away from populated areas and busy roads. It is important to consider whether, in the event of something going wrong during a flight, the location is safe.

3. Suitable Conditions

Pilots should only fly when weather conditions are suitable for their aircraft and their level of ability. Nil wind is usually ideal (with the exception of slope soaring) and anything below approximately 10kph is suitable for beginners with most aircraft. Pilots should leave more challenging conditions until they have considerable FPV flight experience. Beginners should choose a bright day with a clear horizon so that they have a good attitude reference.

4. Quality Equipment

As with all R/C flying it is important to use good quality components. In addition to a good quality radio transmitter, receiver, servos, etc. a good quality camera should be used that has adequate resolution to easily see the plane's attitude, location, and proximity to other objects. Pilots should also ensure that a high quality video downlink and viewing system (eg video goggles) are used. Pilots should select high quality tried and tested components available from the dedicated FPV sources. The video link and the control link must use different frequencies. If using 2.4Ghz for the video link, interference may occur with other users of 2.4Ghz equipment at the flying site. This may result in loss of the video link for the FPV aircraft and loss of control for other pilots. When designing an FPV system it is best to choose R/C and video frequencies that are significantly separated. For example 35MHz R/C control and 2.4GHz video, or 2.4GHz R/C control and 5.8GHz video. Return to home/ Return to land systems, if fitted should not be used to assist with flight beyond the visual range of the pilot/observer.

5. Pre-Flight Checks

Pilots should:

a) double check the centre of gravity location of their aircraft before flight.

b) check R/C Tx/Rx range – as specified in the transmitter manual.

c) repeat the R/C Tx/Rx range check with the video Tx switched on.

d) check the video system range. On new set-ups this is best done by flying a LOS circuit whilst recording the FPV feed and then checking the quality before attempting to fly FPV. Alternatively this can be checked by someone else flying a LOS circuit with the newly configured aircraft whilst the pilot monitors the live video. Nb. Ground range tests of video will usually show 1/4 to 1/3 of air to ground range.

6. Battery Charge Status

Flying FPV can involve several more batteries than normal R/C flight. All batteries should be checked for full charge before each flight. If possible the pilot should power all ground equipment from a single, voltage/ capacity remaining monitored audio-alarmed high-capacity source (eg a large capacity gel cell). Ideally the airborne equipment should similarly be powered from a single voltage/ capacity remaining monitored battery, or several if they can all be monitored through an OSD/ low battery display. The batteries may include:

a) Video Receiver Battery

b) Video Transmitter/ Camera Battery

c) Aircraft (Motor) Battery

d) Video Goggles Battery

e) R/C Transmitter Battery

7. Training

First Person View flying means that the pilot controls the aircraft by reference to the horizon just as with full-sized aviation. It is recommended that novice FPV pilots practice on a radio control simulator with FPV mode and become proficient before attempting FPV flight for real. Before attempting a first flight it is a good idea for a novice FPV pilot to wear the goggles and view the video feed as a "passenger" whilst another pilot flies the aircraft. This will give the new pilot a feel for FPV flying and allow him to become familiar with the flying field and locality before taking control. Until the pilot is proficient at flying FPV, it is advisable that flights are carried out with an experienced person in charge who will carry out the take offs and landings by traditional line of sight flying.

8. Positional Awareness

FPV flying is different to line-of-sight flying. The pilot sees a completely different perspective, and during his first flights, it is easy to lose track of where the aircraft is relative to the flying field - especially when directly above it. Pilots should get to know the flying field and locality from the air by flying as a "passenger" and also by using tools such as OS maps, or Google Maps/ Google Earth to become familiar with the terrain, trees, buildings, roads, landmarks, etc. Equipment such as OSDs (on screen displays) which can overlay GPS data on to the pilot's screen and provide an arrow and distance back to the field ensure that positional awareness is never lost. Flights should be planned to ensure that obstacles such as woods or terrain cannot come between the plane and the pilot thus disrupting control or vision. The observer should be able to see the entire area of operation and be able to spot full-size aircraft that may entering the model flying area. The observer should establish an effective communication routine to inform the pilot of full-size activity and how to maintain separation between models and aircraft.

9. BEC Capacity

If the aircraft uses servos for a pan/ tilt mount, the pilot should ensure that the BEC on the ESC can drive the total number of servos in the system – or they should use a UBEC. Most

BECs, especially when running off 3s LiPos, can only drive 3 or 4 servos. (Regulating thevoltage down to 5v creates heat - and supplying amps to servos creates heat: too many volts or too many servos can result in thermal overload - which shuts down the BEC and the power to the Receiver). If 3 or 4 servos are already in use to fly the plane, adding 2 more for the pan/tilt mount could result in disaster. Pilots need to take care not to overload their BEC.

Summary

1. All members are responsible for familiarizing themselves and complying with Civil Aviation Laws applicable to model flying. See NZ CAA Rule Part 101.
2. FPV activities are confined to the flying of model aircraft for sporting and recreational purposes.
3. Members involved in any type of incident that could lead to an insurance claim must not admit fault or liability.
4. When flying from club sites pilots must familiarise themselves, and comply with the club site rules.
5. Members must not act in a manner which brings or may bring MFNZ or the FPV activity in general into disrepute.

R/C Gliders
A radio controlled glider is a model aircraft which is not provided with a propulsion device and in which lift is generated by aerodynamic forces acting on surfaces remaining fixed in flight, except control surfaces.

A glider is usually launched using an electric winch, a rubber bungee or by hand.

Flying field areas used for glider flying and launching differ from that used by powered models and as such, reference must be made to the "Model Flying NZ Soaring Code of Practice" and the 'General' safety section above.
Copies are available from the Model Flying NZ Secretary, Competition Manager, the Soaring SIG or the Model Flying NZ website www.modelflying NZ.org.nz

Electroflight
The following additional requirements apply to the operation of Electroflight models:

a) Use a foolproof system for fast charging batteries. Overcharging at high currents will ruin the battery cells and may cause them to explode. Use a charger with a timer or a temperature or voltage controlled cut-off.

b) Check the motor operation does not interfere with the R/C equipment in the model. Range checks with the motor off and with it on will highlight any problems.

c) Any type of lithium battery* must *be removed from the model for charging and only the correct type of charger used.
d) To prevent the risk of injury and property damage when a model with extended undercarriage or with ducted fan propulsion is parked unattended in the pits, an effective means to prevent inadvertent starting or movement is mandatory.
The preferred method is by disconnection of the battery circuit(s) or by a clearly marked switch that disables the electronic speed controller. The disconnection or disabling must be verifiable through being either external to the model or clearly observable through a hatch.
The above rule may be waived provided that the model has a secure mechanical restraint engaged at all times when it is parked – not just for starting purposes.

Helicopters

It is emphasised that model helicopter flying needs a higher degree safety awareness than perhaps any other model type. The following additional requirements apply to R/C model helicopters:

a) A helicopter must never under any circumstances be flown or run up:

i) with metal rotor blades;

ii) with sharp leading edges on main or tail blades;

iii) with unproven radio equipment;

iv) within 10 meters of spectators;

v) in any fashion that might endanger spectators;

vi) in the presence of spectators or at a competition, until properly tested and proved airworthy;

vii) until thorough maintenance checks are carried out as set out in b) and c) below; or

viii) with a receiver battery pack which is not of welded or soldered construction.

b) Checks before daily flying session:

i) check all ball links for wear;

ii) check all main and tail rotor blades for damage, check root at blade pivot hole and check tip weight installation;

iii) check for signs of loose or missing nuts and bolts;

iv) check main drive system for integrity;

v) check servos are secure and operating correctly;

vi) check fuel tank and piping is secure;

vii) check receiver aerial in good condition with no chafing or damage;

viii) check radio range; and

ix) ensure batteries have been fully charged. (Helicopters place heavy demands on servos, so an on-board battery monitor is recommended.)

c) Checks before each flight:

i) If the helicopter on the previous flight suffered damage or a heavy landing, recheck all of b) above;

ii) check all controls before starting for correct operation, especially for binding links, or slowing of servos;

iii) check receiver aerial cannot become entangled with any moving or rotating part;

iv) at operating RPM, just before lift-off, check for correct operation of controls;

v) check for abnormal vibration, and eliminate before flight;

vi) check main rotor blades for correct tracking in hover.

Turbojets

A Turbojet Engine is an engine where air drawn in at the inlet is compressed, heated by the burning of a fuel, the resulting hot gases are delivered to a turbine that drives the compressor. The hot gases leave the engine to provide thrust or the thrust is provided from a propeller driven from the turbine. This section does not cover rockets or pulse jets where a compressor and turbine is not part of the design. Turbojet engines have many unique inherent features, namely; continuous combustion, high temperatures, high energy release rates, and the potential for unconfined combustion, especially during the starting phase.

Gas turbine operation requires that operators must be aware of the flying characteristics which arise from the application of gas turbine power. Paying particular attention to:-
The delay in response to opening the throttle.
The high speeds which can result from the available thrust not decreasing with increasing air speed.
The residual thrust at engine idle speed which can make for difficulties in slowing the aircraft down for landing.

Reference must be made to the "Model Flying NZ Turbine Code of Practice". Copies are available from the MODEL FLYING NZ Secretary, the Turbine Technical Committee or the Model Flying NZ website www.modelflyingNZ.org

R/C Power Models

Large R/C models (see definitions of 'large' in Chapter 5) must be built and operated to higher standards than small R/C models.

In addition, models 15kg - 25kg , pilotless aircraft 25kg – 100kg and models under 15kg using motors of 75cc or larger require, a Permit to Fly achieved through an Approval Scheme operated by the Large Model SIG, and which requires specified inspection of models during construction and completion of observed test flight regimes.

For all R/C Models the following checks must be made in addition to those already covered in the 'General' and the 'Radio Control' sections, before every flying session:

AIRWORTHINESS INSPECTION: The ultimate responsibility for the safety and airworthiness of the aircraft rests solely with the owner and/or pilot.

INSPECTION CHECKLIST	ACCEPT	REJECT	RECHECK
GENERAL APPEARANCE – Overall appearance	…	…	…
(Check for damage, warps, loose covering etc.)	…	…	…
PROPELLER - secure (check for cracks, damage)	…	…	…
ENGINE – Securely attached (including muffler)	…	…	…
Method to prevent accidental starting	…	…	…
(Ask if able to kill with radio)	…	…	…
LEFT WING – Attachment secure	…	…	…
LEFT WING – Aileron hinges secure	…	…	…
LEFT WING – Control link keeper	…	…	…
LEFT WING - Control pushrod stiffness	…	…	…
ELEVATOR – Hinges secure	…	…	…
ELEVATOR - Control link keeper	…	…	…
ELEVATOR – Control pushrod stiffness	…	…	…
RUDDER - Hinges secure	…	…	…
RUDDER – Control link keeper	…	…	…
RUDDER - Control pushrod stiffness	…	…	…
TAIL SURFACE - Brace wires secure	…	…	…
TAIL SURFACE - Brace wires keepers	…	…	…
RIGHT WING - Attachment secure	…	…	…
RIGHT WING - Aileron hinges secure	…	…	…
RIGHT WING - Control link keeper	…	…	…
RIGHT WING - Control pushrod stiffness	…	…	…
CANOPY OR WINDSCREEN – Secure	…	…	…
HATCHES OR COVERS – Secure	…	…	…
WHEELS AND LANDING GEAR – Secure	…	…	…
BATTERIES FULLY CHARGED – Ask	…	…	…
RESTRAINT – While Starting	…		

Radio Checks: On Frequency … Control directions OK … Failsafe closes throttle …

Between Flight Checks:

a) If the aircraft has suffered damage, or a heavy landing, all checks listed above must be repeated.

b) Check all controls before starting the engine, especially for binding control links or slowing of servos.

c) Re-check all controls for correct operation at high engine speed.

Check that battery capacity or voltage under load is greater than the minimum for safe radio control operation before take-off. The use of a "Go", "No Go" tester is considered to be a sufficient test method.