

Certification of Large Models

NZMAA Large Model SIG

Description of Certification Process

Purpose

The broad purpose of the Certification Process is to encourage and support the building and flying of large radio controlled model aircraft, with safety paramount, and enjoyment following closely behind. Although it is a process that involves inspections and approvals, and so necessarily has an element of compliance, the intent is to run it as a collaborative effort between modelers, inspectors and the Large Model SIG Committee. The aim is more to help and guide rather than just inspect. This spirit and essence of the process follows closely the one developed by the LMA in the UK. The assistance of the LMA is gratefully acknowledged.

Legally, this Certification Process gives effect to CAA regulations and to NZMAA safety rules as follows:

Category 1: Models 15kg – 25kg

Authority is delegated to NZMAA by CAA to issue Permits to Fly to owners of radio controlled model aircraft in the weight range 15kg – 25kg. It is illegal under NZ law for models of this weight to be flown without written permission from NZMAA. Certification is also required by NZMAA safety rules.

Category 2: Models 25kg – 100kg (in law, actually ‘pilotless aircraft’)

CAA authorizes NZMAA to manage the certification process and to recommend that CAA issues written permits to owners of pilotless aircraft in the range 25kg – 100kg, to be flown for recreational use only. NZMAA has sole authority from CAA to inspect such aircraft, to make recommendations to CAA, and to issue Permits to Fly at Public Sites, relating to aircraft/pilot combinations. Certification is also required by NZMAA safety rules.

Category 3: Models less than 15kg but with IC motors 75cc or electric motors 5,000 watts input or larger

NZMAA safety rules require that these models be certificated.

The Certification Process

This has three sequential parts, Part A, Part B, and Part C, as follows:

Part A: Registration of Project and Appointment of Inspector

The Owner of the project applies to the Large Model SIG for registration of the project, using Form A. When the Large Model SIG registers the project, it arranges for an Inspector who will then work with the Owner, and informs both the Owner and the Inspector, with contact information. It is then the responsibility of the Owner to contact the Inspector and so proceed to Part B.

Part B: Certification of Design and Construction and Permit to Flight Test

The Inspector appointed in Part A records inspection and approvals of the aircraft design and construction, using Form B, which is signed by both the Owner and the Inspector when construction has been approved.

Approval of construction will normally require a minimum of three inspections:

- **Inspection 1:** assessment of project intentions/plans
- **Inspection 2:** assessment of construction while internal structures are accessible/visible
- **Inspection 3:** assessment of the model presented ready for flight.

At the discretion of the Inspector, or request of the Owner, further inspections may be undertaken at any stage during construction.

Standards of Design, Engineering and Construction

General: The standards of design, engineering and construction shall conform to current best practice for the chosen technology (eg. wood-fabric, wood-wood, composites), power (eg. glow ignition, petrol ignition, turbine, electric, glider aero-tow/winch) and whether fixed wing or rotorcraft.

The Large Model SIG will arrange for the services of specialists to advise Inspectors pertaining to new and advanced technologies, if required.

Flight Batteries : Redundant (dual) flight batteries are mandatory for Categories 1, 2, and 3. This requirement may be met by use of separate battery inputs to the receiver, or a common supply from a battery backer or a Power Box (or similar) unit.

The total battery capacity shall take into account the number and power of the servos, the required control throws, the size and speed of the model together with the expected number of commands to be exercised in flight. It is

recommended that an individual battery capacity of at least 2,000 mah be utilised.

Servos : The following specifies the minimum servo torque required to power the primary control surfaces. Where servo torque is suggested for a control surface this can be provided by one or more servos working together. The minimum may not be sufficient for fast flying models or those with large control surfaces or throws. It is suggested that if the builder does not have experience with the size and class of model being built that he take into account the recommendations of the designer, best practice with models of similar weight and performance which are published in magazines or on the internet, the experience of other modelers, and relevant information published to calculate required servo performance. The Inspector is entitled to require the builder to justify his choice of servos and may require changes.

Mechanical or other means of boosting torque supplied to a control surface may be taken into account when considering servo torque requirements on a control surface. This may be in the form a boost tabs or similar systems that assist control surface movements.

In order to reduce likelihood of control surface flutter, each servo shall be mounted with its longitudinal axis parallel to the direction of drive to the control surface. For the same reason, all aspects of the linkage to the control surface shall be free of 'slop'.

Guidelines for minimum servo torque for primary control surfaces are as follows:

Category 1

Elevators – If separate, 8kg.cm per elevator: if single elevator, 12 kg.cm.

Ailerons – 12 kg.cm each.

Rudder – 12 kg.

(Note: Inspectors of highly aerobatic models in this Category may require different servo configurations and/or larger servos)

Category 2

Elevators – two servos totaling 24 kg.cm., either one per separate surface or ganged on single surface.

Ailerons – two servos per aileron totaling 24 kg.cm.

Rudder – 24 kg.cm

(Note: Inspectors may require different servo configurations and/or larger servos for specific models in this Category, especially in the heavier range)

Category 3

Elevators – two servos totaling 18 kg.cm

Ailerons – two servos per aileron totaling 18 kg.cm

Rudder – 18 kg.cm

Heavy-duty servo connector wiring is required for models in all Categories.

Control Linkages: For all Categories the control linkages, clevises and horns shall be able to withstand the maximum torque output of the servo. When selecting the type and design of pushrods, consideration should be given to

the likely forces that will be imposed on the control surfaces, to ensure that bending of pushrods and/or uncommanded deflection of control surfaces does not occur.

Heavy duty hinges are recommended for all control surfaces and careful attention given to the required number of hinges in each control surface to ensure control surface integrity in relation to the likely loads on the control surface during flight.

All hinges shall be 'pinned' in such a manner to prevent control surface separations. The gap between the moving control surface and the fixed surface shall be minimised.

Where pushrods / clevises are used for primary control surfaces, the minimum size shall be 4-40 (or 3mm).

Pull/pull systems are recommended where appropriate.

For large aerobatic models, specialized heavy-duty linkages, servo arms, and hinges are recommended.

Dual Receivers for Category 2: Radio installations for Category 2 aircraft (25kg-100kg) shall have dual receivers that provide redundancy for essential lateral and longitudinal controls. Common installations would have each receiver controlling one aileron and one side of the elevator but other approaches, such as dual servos for each surface controlled by separate receivers, are also feasible. Redundant flight batteries for both receivers and separate batteries for servos and receivers are encouraged, but are not mandatory. Various forms of integrated systems that provide this functionality may be approved.

Dual receivers are not required for models in Categories 1 and 3 but their use is strongly encouraged.

Radio systems that have 'dual receivers in one package', including some brands of 2.4GHz systems, have dual output circuits but a common signal processing unit for both output stages. Such units do not qualify as dual receivers for Category 2. (However, they are preferred to single-receiver systems for Categories 1 and 3.)

The use of fully independent dual 2.4 GHz receivers is currently infeasible so that such systems cannot meet Category 2 requirements. The LM SIG Committee recognises that technical developments may change this situation, will keep this matter under review, and will advise any consequent changes to the certification requirements.

Certificate of Design and Construction and Commencement of Flight Testing

The Categories have different processes, as follows:

Categories 1 and 3: The model is eligible to commence flight testing as soon as both the Owner and the Inspector have signed Form B, but before sending it to the Large Model SIG. Upon receiving Form B, the Large Model SIG will issue to the Owner a **Certificate of Design and Construction** and a confirmation of authorisation to Flight Test. A copy will be sent to the Inspector.

Category 2: Flight testing requires prior CAA approval in writing. The large Model SIG will arrange this as soon as it receives Form B signed by the Owner and Inspector. The **CAA permit to fly** will be sent to the Owner and

Inspector by the Large Model SIG, together with a **Certificate of Design and Construction**. Flight testing may commence only after these documents have been received.

Part C: Approval of Flight Testing and Permit to Fly at Public Sites

Flight Testing must be completed within one year of the Certificate of Design and Construction being issued.

Flight Testing may take place only at a model flying site authorised by NZMAA. If this site is adjacent to a full-size airfield, testing shall not take place while full-size aircraft are active.

The personnel present at Flight Testing must be limited to the Owner, Pilot, Inspector/Witness, and essential helpers. No spectators are permitted and no other flying may take place while Flight Testing is in progress.

All other flight safety standards and rules established by NZMAA must be observed.

Witness: All flights must be witnessed by the Inspector or another person appointed by the Inspector (the 'Witness'). It is the responsibility of the Witness of each flight to ensure that all the requirements of the Flight Test Log (see below) are met, and that the flight is signed off.

Flight Test Log: Approval of Flight Testing requires completion of the Flight Test Log (Form C). The Witness of each flight should include brief notes about the performance of the model and pilot, if appropriate. By signing the Log, the Witness confirms that the model appears to be safe to fly at the place and in the weather conditions noted. The Witness should take care that this confirmation is carried out accurately and without fear or favour.

Flight Testing Requirements: These are different for the Categories as follows:

Categories 1 and 3: The model will complete 5 flights with all specified manoeuvres completed on every flight. If all manoeuvres are not completed, the flight cannot be counted. The manoeuvres listed in the Flight Test Log must demonstrate the integrity and controllability of the model in the entire envelope in which it is intended to be flown.

Category 2: The completed Flight Test Log must total a minimum of one hour flying time with all specified manoeuvres completed on every flight. If all the manoeuvres are not completed within the flight it cannot count for the Log. The flying time must be completed in not less than 6 flights and each flight must demonstrate controlled start up and shut down of all engines and the radio. It is stressed that one hour is the absolute minimum and it is likely that it will take longer than this to satisfactorily complete the test programme. Any requirements for

modifications to the model that are identified during the test programme shall be carried out and this may mean further testing is required. It is expected that for unusual or complex types of model new to the pilot, the test programme will be extended.

For all Categories, the Flight Routine specified in the Log of Flights must be approved in advance by the Inspector and must include demonstration of all control functions and manoeuvres that are intended to be flown under the Permit to Test Fly. At the discretion of the Owner or Pilot, prior flights that are not eligible for the Log may be undertaken to establish control settings and flight envelope.

It is expected that the Log will be completed over a period of time and not in one day. Witnesses should ensure that the model can be operated in a variety of weather conditions and not only on a “nice” day.

Pilots: The requirements concerning pilots differ between the Categories, as follows:

Categories 1 and 3: Flight testing may be undertaken by any pilot holding a Wings badge in one of the categories ‘A’, ‘M’, and ‘L’, and any such pilot may operate the model when it has a Permit to Fly at Public Sites.

Category 2: The aircraft and pilot are tested and certified as a combination. Thus, a separate and new Flight Testing programme is required for each pilot that the Owner registers to fly the aircraft. The Permit to Fly at Public Sites is limited to a specified pilot, who has operated the aircraft throughout Flight Testing. A separate Permit to Fly at Public Sites is issued for the model with each pilot who qualifies the aircraft through completing a Flight Testing programme.

Permit to Fly at Public Sites: When Flight Testing has been completed, the Inspector will verify that the model remains airworthy, and will then complete and sign Form C.

Upon receiving the completed and signed Form C with attached Flight Log, the Large Model SIG will issue to the Owner a **Permit to Fly at Public Sites**, which authorises the model to be flown, subject to the ‘Pilots’ specification above, at any public site approved by the NZMAA, subject to the Large Model SIG reserving the right to limit the operation of Category 2 aircraft to specifically designated sites.

For Category 2, the permission obtained from CAA prior to Flight Testing remains the primary permit, to which the NZMAA Permit to Fly at Public Sites is added after completion of Flight Testing.

A Permit to Fly at Public Sites remains valid only if the Owner maintains the model in the state of airworthiness that existed at the time of the Permit being issued. Models that hold this Permit must be re-inspected when required by the Large Model SIG, which may decline to renew the Permit.

At its own discretion, the Large Model SIG may suspend or cancel a Permit on the grounds that the model (and the Pilot in the case of Category 2) no longer reaches the necessary standards. It is the responsibility of all Pilots of Category 2 aircraft to advise the Large Model SIG of any events or occurrences that may limit their piloting capabilities.

In the event of a mishap requiring substantial repairs, the Large Model SIG may require repetition of Part B and/or Part C. It is the responsibility of the Owner to advise the Large Model SIG of any such mishaps.

Special Cases: Completed, Semi-Completed and ARF Models

If an Owner registers a project when it is already completed to apparent flight condition, semi-completed, or as an Almost Ready to Fly (ARF) kit, the above process will still be followed. Within Part B, it is likely that the Inspector will proceed directly to either Inspection 2 or Inspection 3. In cases where internal construction is not visible the Inspector will be obliged to rely on information provided by the Owner, such as plans and/or the specifications and manuals provided by ARF manufacturers. The acceptability of such evidence is at the sole discretion of the Inspector; if the information available is insufficient to make responsible judgements at Part B, construction will not be approved and no authorisation to Flight Test will be issued. The risk of such an outcome is borne entirely by the Owner. At the discretion of the Inspector, the Owner may be given the option of removing specified parts or structures so that an appropriate inspection may take place.

Under all circumstances, a model acquired by a new Owner will be required to undertake Part C.