

MODEL AERONAUTICAL ASSOCIATION OF AUSTRALIA



ROCKETRY PROCEDURE

MOP031

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This Policy and/or Procedure, forms part of the MAAA Manual of Procedures. This entire document is for the use of all classes of members of the MAAA in the conduct of activities associated with the MAAA and is not be used for any other purpose, in whole or in part, without the written approval of the MAAA Executive.

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Shading of text identifies changes to the previous version.

ROCKETRY PROCEDURE

1. INTRODUCTION

- 1.1 Model rocketry competition is covered by the FAI, under the CIAM Bureau, and therefore is considered part of the sport of model aviation. As such, the construction and operation of model rockets is considered part of the activities of Affiliate Members of the MAAA.
- 1.2 Rockets that conform to FAI Class S requirements are permitted under MAAA rules.
- 1.3 Where there is any discrepancy, the Commonwealth and/or applicable State Law has precedence. The MAAA advises that where Commonwealth Law - including CAR (1998) Part 101 - is referred to, it is for guidance only. It is up to every Affiliate Member to take the necessary precautions to ensure that they are aware of the actual detail of current Commonwealth and State legislation. The MAAA can accept no responsibility for any errors.
- 1.4 It should be noted that each state of Australia has its own laws which impact on the operation of model rockets. Rocketeers must be aware of, and conform to, the law within the State in which they intend to operate model rockets.

2. PURPOSE

- 2.1 The purpose of this publication is to ensure that model rocketry activities are carried out safely.

3. DEFINITIONS

AAAO	Approved Aviation Administration Organisation - an organisation approved by CASA to administer a particular aspect of sport aviation
Affiliate Member	A person properly affiliated with a Club that is properly affiliated with an MAAA Ordinary Member
CASA	Civil Aviation Safety Authority
CASR or CAR	Civil Aviation Safety Regulation or Civil Aviation Regulation
CIAM	Commission Internationale d'Aero Modellisme - the model aviation bureau of the FAI
Club	A Club properly affiliated with a State Association
Commercial Rocket.	Rockets used for a commercial purpose other than for the study of rockets by hobbyists or students at school. Commercial rockets are described in the CASA Advisory Circular AC101-2(0).

- Experimental Rocket.** Any rocket powered by motors which have not been batch tested in an independent laboratory for reliability and safety. This category of rocket may also include models powered by commercially certified motors, but using an airframe construction which falls outside the definition of a Model Rocket.
- FAI** Federation Aeronautique Internationale
- Firework Rocket.** Rockets which are of a paper or cardboard construction with an offset stick as launch guide. These rockets are not designed to be recovered or reused, and may contain a destructive pyrotechnic payload.
- High Power Rocket** A High Power Rocket refers to a rocket whose construction technique is similar to a model rocket but exceeds the limits for a model rocket. A high power rocket weighs more than 1500g and is propelled by one or more engines having a total impulse greater than 320Ns.
Not permitted under the MAAA Manual of Procedures.
- MAAA** Model Aeronautical Association of Australia Inc.
- MAAA Ordinary Member** A State Association properly affiliated with the MAAA Inc.
- Model Rocket** Defined in Civil Aviation Safety Regulations, Part 101.H Rockets. Part 101.425. A reaction engine powered aeromodel weighing less than 1500g with no metal as structural parts. MAAA requires that a Model Rocket is designed to be recovered after flight using an acceptable means of retarding its descent. See also Small Model Rocket and Space Model.
- Ordinary Member** See MAAA Ordinary Member
- Propellant** The chemical component of a rocket motor (or engine) which provides the thrust for the duration of the motor burn
- Range Safety Officer** The Affiliate Member designated as being responsible for the safety of the rocket range for the duration of the rocketry operations
- Rocket.** See Model Rocket
- Rocket Motor** The rocket motors referred to in this document are commercially available units which have been independently batch tested and verified for compliance with advertised parameters as marked on the rocket motor body. These are variously named *model rocket motors* because they impart motive force to a model rocket, or *model rocket engines* under FAI competition specifications and rules.
- Rocketeer** A person who constructs and/or operates model rockets

- Small Model Rocket.** Defined in CASR Part 101.440 (1) as any model rocket weighing less than 500g, that either (a) uses no more than 25g of propellant or (b) produces no more than 20Ns of total impulse.
- Space Model** A model rocket, eligible for FAI competition, the various classes of which are defined in the FAI Sporting Code, Section 4 – Aeromodelling, Volume SM Space Models, 2007 Edition.
- Space Model Engine** A solid propellant rocket motor (or engine) in which all chemical ingredients of a combustible nature are pre-mixed and ready for use. Eligible for use in Space Model Competition after certification by MAAA. (See FAI Space Model Code).
- State Association** See MAAA Ordinary Member

4. ABBREVIATIONS

- HPR** High Power Rocket
- LCO** Launch Control Officer
- NAR** National Association of Rocketry (USA)
- MOP** MAAA Manual of Procedures
- N** Newtons, the SI unit of force
- Ns** Newton-seconds, (eg. the average force yield of a rocket motor)
- RMS** Reloadable Motor System/s
- RSO** Range Safety Officer

5. MODEL ROCKET AND MOTOR SPECIFICATIONS

A model rocket must comply with the following requirements prior to launch, operation and flight.

5.1 WEIGHT

Gross or maximum weight, including motor(s), of a model rocket shall not exceed 1500g.

FAI competition S7 (scale) models shall not exceed 1.00kg (1000g).

Gross or maximum weight of a small model rocket or FAI competition space model (other than S7) including motor(s), shall in no event exceed 0.5kg (500g).

5.2 SIZE

The maximum permitted size of rocket motor is a commercially available motor up to size G, with maximum thrust up to 160 Newton-seconds.

For FAI competition S7 (scale) models, the maximum allowable total impulse is 160 Newton-seconds and maximum engine size allowed is 80 Newton-seconds.

5.3 PROPELLANT

A model rocket motor (or space model engine/s eligible for FAI competition) shall contain no more than 125g of propellant materials at the moment of launch.
A small model rocket motor shall contain no more than 25g of propellant materials at the moment of launch.

5.4 STAGED MODEL ROCKETS

5.4.1 There shall be no more than three (3) operable stages. A stage is defined as a portion of the model airframe containing one or more model rocket motors that is designed to separate, or which actually separates, from the model while in flight. An un-powered part of the model is not considered to be a stage. The configuration of a model at the instant of first motion on the launcher shall determine its definition. Engines ignited simultaneously are considered one stage regardless of the number of separated parts, for example: Soyuz or Space Shuttle.

5.4.2 Total impulse of engine(s) in a lower (booster) stage must, for safety reasons, be equal or greater than the total impulse of engine(s) in (any of) the upper stage(s). The thrust of the booster stage must also be equal or greater than the thrust of each of the upper stages. This does not apply to strapped-on boosters which may be/are ignited simultaneously with the booster stage.

5.5 ROCKET CONSTRUCTION REQUIREMENTS – FUSELAGE

5.5.1 A model rocket shall be constructed so as to be capable of more than a single flight and shall contain a means for retarding its descent to the ground so that its structure may not be substantially damaged and so that no hazard is created to persons and property on the ground.

5.5.2 A model rocket must not eject its engine(s) in flight unless they are enclosed in an airframe that will descend in accordance with the provisions of paragraph 5.5.1. In the case of boost-gliders, engine casings not enclosed in an airframe or boost-glider engine pods, must descend with a deployed streamer with dimensions no less than 25 mm by 300 mm or a parachute with an area no less than 4 dm². The engine(s) of the models cannot be fastened by glue and cannot be an integral part of a model's construction.

Tumble recovery of lower stages of multi-staged models is permitted without recovery device provided that:

1. The lower stage has three or more fins.
2. Length is no greater than 1½ times the engine length.
3. Descent is declared safe by the Range Safety Officer.

5.5.3 Construction shall be of wood, paper, rubber, breakable plastic or similar materials without substantial metal parts.
FAI competition models of Classes S1, S2, S3, S6, S9 and S10 must have a minimum diameter of 30mm of enclosed airframe for at least 50%, and for Class S5 for at least 20%, of the overall body length. In the case of Class S1, the smallest body diameter must be not less than 18mm for at least 75% of the overall length of each stage, including their back sections. No boat tails or reducers are allowed unless they meet this requirement. (Refer to the FAI Space Model Code for specifications).

- 5.5.4 Design and construction shall include attached surfaces that will provide aerodynamic stabilising and restoring forces necessary to maintain a substantially true and predictable flight path. If required by safety officers or judges, the builder of the model must present data regarding the locations of the centre of gravity, centre of pressure, gross weight, burnout weight, and/or calculated or measured flight performance of the model.
- 5.5.5 A model rocket (including small model rocket or space model) shall not contain any type of explosive or pyrotechnic payload.

5.6 ROCKET CONSTRUCTION REQUIREMENTS – MOTOR/S

5.6.1 General

A model rocket motor shall be a solid propellant reaction engine which has all propellant ingredients preloaded into the casing in such a manner that they cannot easily be removed. Delay trains and ejection charges may be pre-mixed and packaged separately if the auxiliary package is a single, pre-assembled unit containing all of the remaining combustible material.

5.6.2 Casing

A model rocket motor casing shall be made of non-metallic material of low thermal conductivity. The temperature of the external surface of the casing shall not exceed 200°C during or after operation. Minimum casing diameter shall not be less than 10mm. Re-loadable types of model rocket motors with aluminium canisters are only permitted if the manufacturer's instructions are followed in the assembly and use of the motor.

5.6.3 Internal Overpressure.

A model rocket motor must be so designed and constructed that it will not rupture its casing in the event of internal overpressure. Any malfunction resulting in internal overpressure should dissipate its force along the longitudinal axis of the motor.

5.6.4 Spontaneous Ignition

A model rocket motor must be so designed and constructed as to be incapable of spontaneous ignition in air or in water as a result of physical shocks, jarring, impacts or motion under conditions that would reasonably be expected to occur during shipment, storage or use, or when subjected to a temperature of 80°C or less.

5.6.5 Loading, Thrust and Impulse

A model rocket motor shall contain no more than 125g of propellant materials (as specified in 5.3), and must have a thrust duration of more than 0.050 seconds.

The maximum permitted size of rocket motor is a commercially available motor up to size G, with maximum thrust up to 160 Newton-seconds.

5.6.6 Storing and Shipping

A model rocket motor shall be shipped and stored with no ignition element installed that may be actuated by an open flame, a temperature of less than 150°C, or by incidental radio-frequency radiation normally encountered during shipping, storage and use.

6. DESCRIPTION OF ACTIVITY AND SCOPE

- 6.1 Model rocketry involves building, launching and recovering small pilotless rockets as permitted by the relevant State and Commonwealth legislation. This specifically excludes the building or launching of Firework, High Power, Experimental and Commercial Rockets.
- 6.2 CASA is responsible for safety regulation of civil air operations in Australia. This responsibility extends to the regulation of rocketry insofar as rocketry has the potential to create a hazard to air navigation. All but the smallest of model rockets have the ability to exceed the limits published in CARs and therefore must comply with CASA legislation.
- 6.3 CASA legislation governing the operation of rockets is contained in Civil Aviation Safety Regulation (CASR) Part 101 Unmanned Aircraft and Rockets.
- 6.4 State and Territory legislation also covers the purchase, transport and use of model rocket motors. Strict limits apply to the size (measured as mass of propellant or average thrust of the rocket motor) which may be purchased as part of the model rocket motor package. Strict limitations apply to the sale of model rocket motors to minors. Limits vary from State to State.
- 6.5 Local Government by-laws may apply, depending on the locality of the launch site, and must be complied with. These include, but are not limited to, requirements to observe fire bans or to notify police and local fire authorities before conducting rocketry activities.
- 6.6 The launching of rockets can only take place at Club fields where the activity is covered by the Club rules or otherwise agreed to in accordance with Club rules.

7. RESPONSIBILITIES

- 7.1 It is the legal responsibility of the operator of a rocket to ensure that the rocket is flown in accordance with all relevant MAAA, CASA, State and Local legislation.
- 7.2 The operator of a rocket must ensure that the rocket motor/s is a commercial type, of a composition and total impulse allowed by the MAAA Manual of Procedures.
- 7.3 Any Affiliate Member wishing to fly with motors or igniters requiring legal documentation under State or Federal legislation shall ensure that they have such documentation: ie. Pyrotechnician's Licence, certification or letters of permission.
- 7.4 Affiliate Members who intend to engage in Rocketry should inform the relevant Club of these activities and gain approval prior to commencement. Affiliate Members must abide by the MAAA Manual of Procedures.
- 7.5 The Range Safety Officer (RSO) is responsible for ensuring that all flying takes place within the scope of the MAAA Manual of Procedures. The RSO should have a working knowledge of the MAAA Manual of Procedures, CASR. Part 101.H, and Local and State Government rules pertaining to the conditions to be met, before allowing any rockets to be launched.

- 7.6 The RSO is responsible for implementing measures to ensure the safety of Rocketeers, model flyers and spectators attending a rocket launch.
- 7.6.1 Individuals launching rockets where there is no Range Safety Officer in place must carry out all of the responsibilities of the RSO themselves.
- 7.7 The list of duties of the RSO is at Appendix 3.
- 7.8 The Launch Control Officer (LCO) is responsible for the electrical apparatus which is used to ignite the rocket motor. The LCO must ensure that the safety interlock disables launch pads while rockets are being mounted prior to and after launch. No personnel are to approach the launch pad until declared safe by the LCO.
- 7.8.1 The LCO must check with the RSO before allowing a launch to proceed.
- 7.8.2 Where public displays are being conducted, the LCO (the Display Director nominated on form MOP019) is responsible for ensuring that the conditions specified for the launch by CASA are adhered to and that the RSO is aware of those conditions.
- 7.8.3 Individuals conducting rocket launches must ensure that the duties of the LCO are carried out.
- 7.9 The list of duties of the LCO is at Appendix 4.

8. QUALIFICATIONS OF PERSONNEL

- 8.1 Certification Procedures for Gold and Bronze Wings (Rocketry) are detailed in MOP027 – Guidelines of the Award of MAAA Wings.
- 8.2 The RSO, or the individual Rocketeer if launching independently, must be suitably experienced on the rocket type and motor being used for the launch event. The RSO must be able to demonstrate competence and understanding of the requirements for the launching of model rockets to the Club.
- 8.3 Model Rocketeers using Black Powder type model rocket engines must gain at least Bronze Wings before launching rockets, unless supervised by a suitably qualified person.
- 8.4 Model Rocketeers using greater than 20 Newton-seconds D motor powered model rockets up to 160 Newton-seconds G Motor powered model rockets, or re-loadable model rocket engines, shall have at least the Gold Wings certificate of competency. (Additional licensing may be required by the State Explosives Inspectorate. It is the responsibility of Rocketeers to avail themselves of the relevant documentation and obtain requisite licensing and/or Police registration applicable in their State or Territory).

9. SITE PREPARATION AND SITE OPERATIONS

- 9.1 Two factors dictate the maximum rocket motor size which may be used to launch rockets at MAAA affiliated club sites. They are the field's CASA approved ceiling and the size of the flying field measured horizontally.

- 9.2 Adequate measures must be taken to limit the altitude of rockets to the approved ceiling, by limiting the size of rocket motor used. (Adequate measures include sightings taken at apogee and triangulating the resultant altitude, or a predictive rocket simulation program).
- 9.3 The maximum rocket motor size which can be used to launch is listed in the Table of Launch Site Dimensions at Appendix 1. The table dimensions are to be applied to the length of two bounding sides of the field, or radius of a circle around the launch point.
- 9.4 The separation of model rockets from persons not directly involved in the launch shall be 30m.
- 9.5 The separation of model rockets from persons directly involved in the launch shall be maintained at the distance corresponding to the motor size being used. These are detailed at Appendix 2.

10. LAUNCH APPARATUS REQUIREMENTS

- 10.1 An electrical ignition system must be used which allows for remote operation of the igniters. The device should be operated from at least the minimum safe distance as determined by the total impulse of the rocket motor(s) according to the Safe Distance Table (see 9.5).
- 10.2 The LCO will use a removable "key" which causes a positive isolation to prevent current from being available at the ignition clips. The key function must never be circumvented. This key will be removed from the launch panel or launch controlling device whenever any person is within the nominated safe distance from the launch point. The RSO will ensure the launch area is clear of any persons prior to allowing the key to be inserted, and the launch controlling device being rendered "active" or "live".
- 10.3 When the safety key is inserted to enable a launch, the ignition circuit should only be alive for a period of approximately 1 to 3 seconds (using a momentary action switch) and then return automatically to the open circuit condition. When a firing button is used it must return to the off position when released.
- 10.4 All rocket launches shall take place from a rigid launcher/launch tower/launch pad which provides steady guidance until the rocket reaches a speed adequate to ensure a safe flight. The launcher must incorporate a blast-deflector to prevent damage to the base or the ground.
- 10.5 The launch pad should be placed such that the end of the launch rod is above eye level. If not, the end of the launch rod should be capped when not in use.
- 10.6 The launch pad must give guidance to the model rocket to ensure that the take off trajectory is never more than 30 degrees from the vertical.
- 10.7 Any ignition sequence should ignite the rocket motor/s within three seconds of the current being applied.
- 10.8 Continuity tests should not be carried out while the igniter is fitted to the motor unless the continuity test is part of the launch countdown sequence.

11. ACCEPTABLE FLYING CONDITIONS

- 11.1 Rockets shall not be launched where aircraft, including model aircraft, are in the air within 1km of the launch site at the intended launch time.
- 11.2 Rockets shall not be launched into cloud or fog.
- 11.3 Rockets may not be flown when the flight might be hazardous to people, property or flying aircraft.
- 11.4 Rockets may not be flown to a height in excess of the CASA approved ceiling of the flying area, unless a specific height extension has been granted by CASA. In this case, all conditions required by CASA under the height extension must be observed. Application for temporary ceiling height extension may be made using MOP004 (Form 007).
- 11.5 Winds over 15kmph are deemed unsuitable for model rockets, but some models may require gentler cross winds. The RSO is the final arbiter of whether the wind conditions will prevent launching.
- 11.6 The existence of an extreme or high fire danger must be taken into consideration by the RSO. Rocket launches should not be held when there is a declared fire ban.

12. CONDUCT OF DISPLAYS

- 12.1 Organisers and Directors of Displays of Model Rocketry must follow the requirements of MOP019 Display Procedure, as well as all the requirements of MOP031 Rocketry.

13. APPENDICES

Appendix 1. Tables of Launch Site Dimensions

1.1 Model Rockets and Small Model Rockets

INSTALLED TOTAL IMPULSE (Newton-seconds)	EQUIVALENT MOTOR TYPE	MINIMUM SITE DIMENSION (Metres)
0-1.25	¼ A & ½ A	15
1.26 - 2.50	A	30
2.51 - 5.00	B	60
5.01 -10.00	C	120
10.01 - 20.00	D	150
20.01 - 40.00	E	300
40.01 - 80.00	F	300
80.01 -160.00	G	300

1.2 High Power Rockets

Are not permitted under the MAAA Manual of Procedures

Appendix 2. Safe Distance Table

Total Impulse All Motors (Newton-seconds)	Equivalent Motor Type	Minimum Distance From Rocket With Single Motor (Metres)	Minimum Distance From Rocket With Multiple Motors (Metres)
Less than 30	Up to D	5	5
30.01 - 160	G	10	10

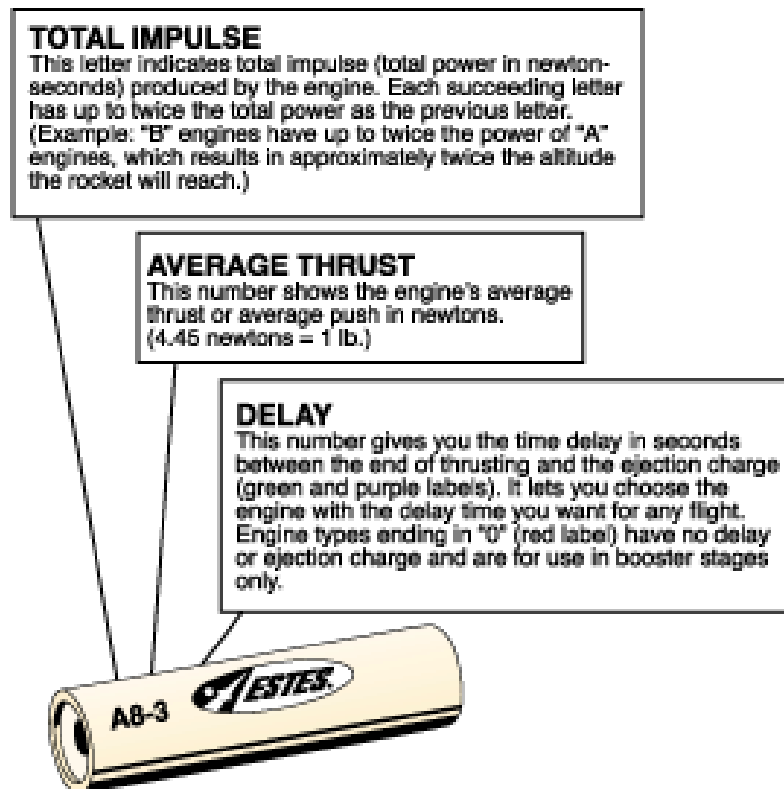
Appendix 3. Duties of the Range Safety Officer (RSO)

- 3.1 The RSO authorises each and every flight.
- 3.2 The RSO has the power to stop any and every flight.
- 3.3 At any time there will be only one RSO responsible in a launch area.
- 3.4 The RSO will be the final arbiter of the rules at the time of any launch.
- 3.5 The RSO should inspect any rocket that falls outside usual parameters. For example: strange design, size of rocket, materials used etc.
- 3.6 Prior to countdown, the RSO must ensure that the flight area is free from aircraft.
- 3.7 In the case of any person refusing to obey reasonable instructions from the RSO, that person shall be asked to leave the launch site. A report is to be made out on the Incident Report Form, on the day of the launch.

Appendix 4. Duties of the Launch Control Officer (LCO)

- 4.1 The LSO must conduct a Rocketeers' briefing prior to the beginning of launches so that all participants are made aware of the safety requirements of the launch and range.
- 4.2 The LCO shall check with the RSO before allowing a launch to proceed. An agreed protocol shall be used to verify that the sky above the range is clear, that the range is clear, and to initiate the countdown.
- 4.3 The LCO is responsible for making announcements about the launch, and conducting an audible countdown so that Rocketeers and all persons present are watching the launch. The LCO may either press the ignition button after the countdown or supervise another person doing so.
- 4.4 The LCO shall be responsible for disarming the ignition circuit system between launches and re-arming the system immediately prior to the launching of the next rocket or set of rockets. The LCO is responsible for any other person carrying out these duties while under the LCO's supervision.
- 4.5 The LCO shall keep a launch log of all rockets launched, noting the details of the Rocketeer, the rocket and the motor; and flight details, including height attained and success or otherwise. The log shall be kept for a minimum of three months after the date of the launch.

Appendix 5. Standard Motor Markings



Appendix 6. Diagram of the Flight of a Model Rocket

