



# NEW SOUTH WALES ROCKETRY ASSOCIATION INC. (NSWRA)

## POLICIES AND PROCEDURES March 2020

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## 1.0 New South Wales Rocketry Association Inc. By-laws

### 1.1 Name

The name of this organization shall be the New South Wales Rocketry Association Inc. This is commonly abbreviated to NSWRA.

### 1.2 Purpose

It shall be the purpose of the NSWRA:

- to operate and maintain a rocket range based on AMRS, NAR and TRA Safe Practices, and in accordance with local laws and regulations
- to promote safe model rocketry in NSW
- to hold meetings for the purpose of educating, aiding and encouraging those interested in rocketry

### 1.3 Office holders

The administrative offices shall include President, Vice-President, Secretary, Treasurer and Senior Advisor. An individual may not hold two administrative offices except as an interim measure.

The operational offices shall include the Launch Control Officer(s) and the Range Safety Officer(s). An individual may hold up to two operational offices and one administrative office.

All officers must be current full members of the NSWRA.

### 1.4 Duties of the Officers

The duties of the officers shall be as follows:

#### ***President:***

- To call and preside over meetings, organize events, and to see that activities proceed in an orderly and timely manner,
- To ensure that launch range equipment is appropriate and available,
- To assign duties to officers and members where necessary,
- To approve all launch days based on landowner's approval, CASA notification, Fire & Rescue notification (if required), and insurance coverage.

#### ***Vice-President:***

- To assist the President in administrative duties,
- To act as President in the absence of the President.

#### ***Secretary:***

- To assist the President in administrative duties,
- To take the minutes of the meetings, and to preside at meetings in the absence of the President and Vice-President.
- To conduct internal and external correspondence.

#### ***Treasurer:***

- To maintain finances and registrations, and to control disbursements and receipts.

#### ***Senior Advisor:***

- To advise officers and members on technical and organisational matters.

#### ***Launch Control Officer:***

- To control launch activities on launch day. *Refer to Section 5.0 Duties of the Launch Control Officer.*

**Range Safety Officer:**

- To enforce safety and assist in procedures and technical matters on launch day. *Refer to Section 6.0 Duties of the Range Safety Officer.*

**1.5 Scheduling of meetings**

An Annual General Meeting shall be held between the commencement of the financial year (one year being July to June) and the 6 months following. Other meetings may be held at the discretion of the President as needed. Notification is to be provided to members at least 14 days in advance.

**1.6 Elections**

General elections for every official role shall be held at the Annual General Meeting.

**1.7 Amendments**

These policies and procedures may be amended by a majority vote of the committee members.

**1.8 Removal of Officers**

Any officer may be removed by the President for incompetence, negligence, or unlawful acts. There are three steps to this disciplinary process that the President must follow. First, a verbal warning is given. In the event that this warning fails to correct the problem, a written notice shall be delivered in person. As a last resort, an impeachment vote may be taken at a meeting of the members; a vote of two-thirds majority is required to remove the officer. If the President is the officer to be disciplined, then any other officer may initiate the actions.

**1.9 Committees**

A two-thirds majority of the membership at any official meeting may appoint or disband a committee. Regular reports from each committee shall be presented at meetings. The President shall be a member of all committees.

**1.10 Incidents**

All incidents shall be recorded and investigated. If the potential remains for a similar incident to occur in the future, actions to correct the issue shall be completed in a timely manner.

End of By-Laws

The constitution of the club is in accordance with the Model Constitution issued by Fair Trading NSW

## 2.0 Launch Operations Safety Policy

The NSWRA values the safety of its members and visitors. To minimise any potential risks involved in NSWRA launch operations, the following processes are in place:

- Portable fire fighting equipment is to be available.
- Portable first aid equipment is to be available.
- Safety barriers or tape to keep spectators behind a control line.
- No launch shall be conducted without a Launch Control Officer (LCO) and Range Safety Officer (RSO) taking charge of proceedings. These two roles may be performed by the same person if the number of participating flyers is less than or equal to five. These officers have certain responsibilities for ensuring that the range is safe. Members and visitors are required to follow their instructions.
- MPR assessment flights will be conducted at the discretion of the LCO and RSO.
- The LCO shall not launch a rocket without a flight card.
- All rockets are to be scrutinised and approved for launch by the RSO.
- A Fire Marshall is to be appointed for the launch of a rocket with a sparky motor
- People in the launch area shall be made aware of an impending launch with an audible countdown.
- Range launch equipment must be electrically isolated prior to any person approaching a rocket on a launcher.
- Any misfire will result in a minimum one-minute wait before any person can approach the launcher.
- Launches will take place from a cleared area, free of any readily combustible materials.
- Launches will be cancelled if high wind or if weather prevents observation of the full duration of the flight.
- Rockets will not be launched during a fire ban. Compressed-air, water, and mechanical propulsion systems are excepted.
- Appropriate stability & pre-flight checks shall be performed before the first flight of all modified and scratch-built rockets.
- “Drag races”, where 2 or more rockets are launched simultaneously, are unlikely to be allowed at most club launches due to the enhanced risk.
- Parents are responsible for the actions of their children. Children must also adhere to all safety guidelines as stipulated in the policies and procedures and the range rules.
- No pets or animals are allowed in the launch area.
- During NSWRA launch events the decisions of the RSO on matters of safety are final. If a member or visitor refuses to abide by the applicable safety codes, the RSO has the authority to bar that person from further participation at that event.
- At the end of the event, the field must be returned to its original condition (or better). This includes the removal of all empty motor casings, igniters, plugs, rocket parts, litter and other debris.

Safety, it's everyone's responsibility.

## 3.0 General Guidelines for Model Rockets

Model rocketry has an excellent safety record and everyone would like to see it stay that way. If you have trouble with your model rocket, read the instructions supplied with the model or get assistance from an experienced flier. Follow the Rocket Safety Codes and you will find model rocketry to be an enjoyable and safe hobby/sport for everyone.

The most important aspect is to not create a hazard to an aircraft, person or property.

Model rockets should be launched, with permission from the landowner, in a large cleared area free of trees, power lines, buildings, dry bush and dry grass.

Small model rockets (weigh less than 500 grams and use nothing larger than a “D” motor) should be launched at a site at least as large as that shown in the Model Rocket Safety Code (below), provided it is not in a movement area or runway of an aerodrome, and it is not in the approach or a departure path of a runway.

Large model rockets cannot be launched to higher than 400 feet in controlled airspace, and not within 8km of an aerodrome, unless authorised by CASA and air traffic control

The Civil Aviation Safety Regulation (*CASR Part 101 Unmanned Aircraft and Rockets*) must be followed. Large penalties apply for non-compliance.

Persons under the age of 18 years should be supervised by a responsible adult who is competent in the preparation and launching of model rockets and can follow the necessary safety requirements and regulations.

NSWRA activities are conducted in accordance with established model rocket and high power rocket safety codes.

### 3.1 Model Rocket Safety Code

1. **Materials.** I will use only lightweight, non-metal parts for the nose, body, and fins of my rocket.
2. **Motors.** I will use only certified, commercially-made model rocket motors, and will not tamper with these motors or use them for any purposes except those recommended by the manufacturer.
3. **Ignition System.** I will launch my rockets with an electrical launch system and electrical motor igniters. My launch system will have a safety interlock in series with the launch switch, and will use a launch switch that returns to the “off” position when released.
4. **Misfires.** If my rocket does not launch when I press the button of my electrical launch system, I will remove the launcher’s safety interlock or disconnect its battery, and will wait 60 seconds after the last launch attempt before allowing anyone to approach the rocket.
5. **Launch Safety.** I will use a countdown before launch, and will ensure that everyone is paying attention and is a safe distance of at least 5 metres away when I launch rockets with D motors or smaller, and 9 metres when I launch larger rockets. If I am uncertain about the safety or stability of an untested rocket, I will check the stability before flight and will fly it only after warning spectators and clearing them away to a safe distance.
6. **Launcher.** I will launch my rocket from a launch rod, tower, or rail that is pointed to within 30 degrees of the vertical to ensure that the rocket flies nearly straight up, and I will use a blast deflector to prevent the motor’s exhaust from hitting the ground. To prevent accidental eye injury, I will place launchers so that the end of the launch rod is above eye level or will cap the end of the rod when it is not in use.
7. **Size.** My model rocket will not weigh more than 1,500 grams at lift-off and will not contain more than 125 grams of propellant or 320 N-sec of total impulse.
8. **Flight Safety.** I will not launch my rocket at targets, into clouds, or near airplanes, and will not put any flammable or explosive payload in my rocket.
9. **Launch Site.** I will launch my rocket outdoors, in an open area at least as large as shown in the table below and in safe weather conditions with wind speeds no greater than 32 km per hour. I will ensure that there is no dry grass close to the launch pad, and that the launch site does not present risk of grass fires.

Total Impulse (Ns)	Motor Type	Minimum Site Dimensions, m
0-1.25	MMX, ¼A & ½A	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
160.01–320.00	2 Gs	450

Minimum site dimension is the length of the shortest side of a rectangular field, or the shortest diameter of an oval

10. **Recovery System.** I will use a recovery system such as a streamer or parachute in my rocket so that it returns safely and undamaged and can be flown again, and I will use only flame-resistant or fireproof recovery system wadding in my rocket.
11. **Recovery Safety.** I will not attempt to recover my rocket from power lines, tall trees, or other dangerous places.

**Note:** “High Power” “F” and “G” motors (those with an average thrust greater than 80N, all sparky motors and hybrid motors) require an extension to the minimum safe distance and may require a larger cleared area. Refer to the High Power Rocketry Safety Code

Due to the enhanced fire risk associated with sparky motors, an assessment regarding their use will be made on the launch day. Members intending to use these motors must advise the RSO and LCO beforehand. See also the document “Sparky Motor Protocols”

### 3.2 High Power Rocket Safety Code

1. **Certification.** I will only fly high power rockets or possess high power rocket motors that are within the scope of my user certification and required licensing.
2. **Materials.** I will use only lightweight materials such as paper, wood, rubber, plastic, fiberglass, or when necessary ductile metal, for the construction of my rocket.
3. **Motors.** I will use only certified, commercially-made rocket motors, and will not tamper with these motors or use them for any purposes except those recommended by the manufacturer. I will not allow smoking, open flames, nor heat sources within 8 metres of these motors.
4. **Ignition System.** I will launch my rockets with an electrical launch system, and with electrical motor igniters that are installed in the motor only after my rocket is at the launch pad or in a designated prepping area. My launch system will have a safety interlock that is in series with the launch switch that is not installed until my rocket is ready for launch, and will use a launch switch that returns to the “off” position when released. The function of on-board energetics and firing circuits will be inhibited except when my rocket is in the launching position.
5. **Misfires.** If my rocket does not launch when I press the button of my electrical launch system, I will remove the launcher’s safety interlock or disconnect its battery, and will wait 60 seconds after the last launch attempt before allowing anyone to approach the rocket.
6. **Launch Safety.** I will use a 5-second countdown before launch. I will ensure that a means is available to warn participants and spectators in the event of a problem. I will ensure that no person is closer to the launch pad than allowed by the accompanying Minimum Distance Table. When arming on-board energetics and firing circuits I will ensure that no person is at the pad except safety personnel and those required for arming and disarming operations. I will check the stability of my rocket before flight and will not fly it if it cannot be determined to be stable. When conducting a simultaneous launch of more than one high power rocket I will observe the additional requirements of AMRS Safe Launch Practices.
7. **Launcher.** I will launch my rocket from a stable device that provides rigid guidance until the rocket has attained a speed that ensures a stable flight, and that is pointed to within 20 degrees of vertical. If the wind speed exceeds 8 km per hour I will use a launcher length that permits the rocket to attain a safe velocity before separation from the launcher. I will use a blast deflector to prevent the motor’s exhaust from hitting the ground. I will ensure that dry grass is cleared around each launch pad in accordance with the accompanying Minimum Distance table, and will increase this distance by a factor of 1.5 and clear that area of all combustible material if the rocket motor being launched uses titanium sponge in the propellant.

8. **Size.** My rocket will not contain any combination of motors that total more than 40,960 N-sec of total impulse. My rocket will not weigh more at lift-off than one-third of the certified average thrust of the high power rocket motor(s) intended to be ignited at launch.
9. **Flight Safety.** I will not launch my rocket at targets, into clouds, near airplanes, nor on trajectories that take it directly over the heads of spectators or beyond the boundaries of the launch site, and will not put any flammable or explosive payload in my rocket. I will not launch my rockets if wind speeds exceed 32 km per hour. I will comply with the Civil Aviation Safety Authority airspace regulations when flying, and will ensure that my rocket will not exceed any applicable altitude limit in effect at that launch site.
10. **Launch Site.** I will launch my rocket outdoors, in an open area where trees, power lines, occupied buildings, and persons not involved in the launch do not present a hazard, and that is at least as large on its smallest dimension as one-half of the maximum altitude to which rockets are allowed to be flown at that site.
11. **Launcher Location.** My launcher will be 450 metre from any occupied building or from any public highway on which traffic flow exceeds 10 vehicles per hour, not including traffic flow related to the launch. It will also be no closer than the appropriate Minimum Personnel Distance from the accompanying table from any boundary of the launch site.
12. **Recovery System.** I will use a recovery system such as a parachute in my rocket so that all parts of my rocket return safely and undamaged and can be flown again, and I will use only flame-resistant or fireproof recovery system wadding in my rocket.
13. **Recovery Safety.** I will not attempt to recover my rocket from power lines, tall trees, or other dangerous places, fly it under conditions where it is likely to recover in spectator areas or outside the launch site, nor attempt to catch it as it approaches the ground.

Installed Total Impulse (Ns)	Motor Type	Minimum Diameter of cleared area (m)		Minimum Safe Distance from rocket (m)	
		Regular	Sparky <sup>2</sup>	Non-complex	Complex <sup>3</sup>
20.01 – 160.00	F – G <sup>1</sup>	As required	23	9	9
160.01 – 1,280.00	H, I, J	15	23	30	61
1,280.01 – 2,560.00	K	23	36	61	91
2,560.01 – 5,120.00	L	30	45	91	152
5,120.01 – 10,240.00	M	38	60	152	300
10,240.01 – 20,480.00	N	38	60	305	457
20,480.01 – 40,960.00	O	38	60	457	610

<sup>1</sup> “High Power” “F” and “G” motors (those with an average thrust greater than 80N, all sparky motors and hybrid motors) shall use the distances for “H” motors

<sup>2</sup> Due to the enhanced fire risk associated with sparky motors, an assessment regarding their use will be made on the launch day. Members intending to use these motors must advise the RSO and LCO beforehand. See also the document “Sparky Motor Protocols”

<sup>3</sup> A complex rocket is one that uses more than a single motor ie a cluster or more than 1 stage

## 4.0 General Guidelines for Members

### 4.1 Registration and Membership

Only current financial members and registered participating visitors will be allowed to fly rockets on launch days - no exceptions.

For the fee structure, refer to the NSWRA website.

Membership is to be paid annually and is valid from 1<sup>st</sup> July to 30<sup>th</sup> June.

Fees are payable in advance.

New members pay a pro rata amount to cover them from the date of joining to 30<sup>th</sup> June.

All membership applicants and participating visitors will need to provide identification and contact details. A membership card will be issued once the application has been processed.

### 4.2 Mid Power Assessment

All NSWRA members are entitled to fly rockets with motors up to a total impulse of 20Ns (equivalent to black powder "D" motors), and black powder 24mm "E" motors. (Low Power Rocketry)

Members are required to have completed "MPR Assessment" to fly rockets using larger black powder motors and composite motors in the range "E" to "G" (impulse greater than 20Ns, up to 160Ns).

Juniors wanting to fly MPR can only do so under the supervision of the parent/guardian who is a member.

Refer to the "MPR Assessment Procedure" for further details.

### 4.3 High Power Certification

To use motors "H" and above (ie High Power Rocketry), individuals need to be certified by a recognised authority eg AMRS, NAR, TRA. Refer to their procedures.

Certification	Motors	Motor Impulse range (Ns)
Level 1	H, I	160.01 - 640.00
Level 2	J,K,L	640.01 - 5,120.00
Level 3	M,N,O	5,120.01 - 40,960.00

### 4.4 Launching of High Power Rockets

High Power Rocket launches using solid propellant motors shall only take place in the presence of a person with a Pyrotechnician's Licence endorsed for rocket motors with propellant greater than 62.5g, issued by SafeWork NSW.

#### Setting up on the launch pad

The rocket must be placed on a suitably rigid rod or rail. The rod or rail must be sufficiently long so that the rocket is travelling fast enough to be stable when it clears the rod or rail. Launch angles must comply with the relevant safety code.

#### Conditions for launching HPR

It is recommended that HPR launches take place when conditions are calm. Maximum wind speed is 32kph.

#### Range Safety Officer

It is at the discretion of the RSO whether or not a HPR launch occurs. The RSO must consider the safety of the public (not associated with the launch activities) above all else.

#### **4.5 Guidelines for the use of electronic ejection charges**

Electronics can be affected by radio signals, vibration, movement, air pressure, etc. Without appropriate safeguards from radio signals (like CB radios), an electronic device may be inadvertently triggered at an inappropriate time.

Before a rocket is prepared for launch, the individual must notify the RSO that an electronic charge is to be used in a rocket. The individual must take all precautions when other people are in the vicinity of the rocket being prepared and must inform them of the activity taking place. All persons not associated with the preparation of the rocket must keep away. Once prepared, the individual must inform the RSO that the rocket is to be placed on the launch pad.

The RSO must decide the most appropriate time for the rocket to be placed on the pad in order to minimise exposure to other individuals. Ideally, it should be the last rocket to be set up. It is the RSO's responsibility to notify all individuals that a rocket with an electronic charge is being armed on the pad.

The LCO must notify the spectators and members that no-one other than the owner is to approach the rocket after it has landed.

In the case that the ejection charge was not triggered, the owner of the rocket must wear appropriate personal protective equipment before approaching the rocket. No-one else is to be in the vicinity of the rocket until it has been disarmed.

#### **4.6 Members' responsibilities**

It is the responsibility of all members and participating visitors to:

- abide by all requirements of the NSWRA policies and procedures and the instructions of the NSWRA officers on launch days
- have a valid membership or visitor registration to launch rockets
- ensure that a flight card is filled out for every launch
- ensure that rockets are built to a high safety standard according to manufacturers' instructions and NSWRA procedures
- ensure that all rockets, components, debris, litter, tools, etc. are collected before leaving the site
- ensure that the property is left in the same or better condition

In addition,

- Parents are responsible for the behaviour of their children.
- Junior flyers must be supervised by a responsible adult who is competent in the preparation and launching of model rockets and can follow the necessary safety requirements and regulations.
- No animals or pets are allowed in the launch area.
- If in doubt, ask the LCO or RSO for assistance.

#### **4.7 Launch day procedure for members**

This is the typical procedure to be followed for launching a rocket:

- Get your rocket ready to fly. Make sure that you are using a properly certified motor, safe recovery system, and fire-retardant wadding (if the design requires it)
- Enter all details accurately and legibly on the flight card. Check to make sure all fields have been completed before signing it.

- Submit your rocket with the flight card to the RSO for inspection and approval. The RSO has the final decision on whether or not a rocket will be allowed to fly.
- Once the RSO has signed the flight card, choose an available pad that is suitable for your rocket. If you are unsure which pad would be appropriate, ask the RSO for assistance. Each person is allowed a maximum of one pad per session unless authorised by the LCO.
- Write the number of the pad used in the “Pad #” box on the flight card.
- Place the flight card on the “Ready to Launch” pile on the LCO table. Ensure that these cards are secured and not able to be dislodged or blown away.
- When all the rockets are ready for the launch session, the LCO will ask everyone to clear the launch area. The RSO will conduct a final inspection of the area and give their approval to the LCO. Any issues need to be raised with the LCO who will determine whether to postpone the launch session or pass on individual rockets.
- It is **everyone’s** responsibility to ensure all the launches occur safely. If there is any hazard, eg. aircraft in the vicinity, people in harm’s way, yell out ‘HOLD’, ‘HALT’, ‘STOP’, etc.
- The LCO will go through the flight cards and launch the rockets. If you want to push the button to launch your own rocket (LPR only), this will be at the discretion of the LCO and RSO.
- Do not retrieve your rocket until the LCO gives the OK. Once all the rockets are launched in that session, the LCO will isolate the controller and state ‘the range is safe’ or similar. Do not retrieve other people’s rockets without their authority. Some rockets may have pieces broken off or charges that may not have triggered. Only the owner will know how to safely disarm the rocket.
- If your rocket fails to launch, wait until the LCO gives the OK. Then, rectify the problem. If the details on the flight card haven’t changed, the card is still valid and may be re-used. If the only change is to a different pad, cross out the pad number on the card and write the new pad number. If you change any of the rocket’s parameters, eg using a different motor, you must remove the existing flight card and complete a new card for RSO approval.

If you ever have any questions about proper launch procedures, ask the range officers on duty.

**Have fun and be safe!**

## 5.0 Duties of the Launch Control Officer

The LCO has the following responsibilities:

- Verify that the launch site and facilities conform to the applicable safety codes.
- Ensure that the launch control system is set up correctly.
- Allocate an area for recording launch information.
- Together with the RSO, ensure the range is safe for launching before any launches take place.
- Ensure that all rockets have a flight card signed off by the RSO.
- Flight cards for rockets to be launched will be in the “Ready to Launch” pile. Ensure that these cards are secured and not able to be dislodged or blown away.
- If the rocket uses a sparky motor, refer to the document “Sparky Motor Protocols”.
- Announce all flights. An audible countdown must be given for each flight.
- After every flight a comment about the flight and recovery should be recorded on the flight card. Also write the sequential launch number on the card. Then transfer the completed flight card to the “Launched” pile. Completed cards should be kept well away from those for rockets yet to be launched. Ensure that these cards are secured and not able to be dislodged or blown away.
- The LCO will call ‘heads up’ and warn spectators in the case of any flight failure. A ‘heads up’ shall be called on all “first flight” rockets, modified rockets, rockets with motor clusters, staged rockets, or on any rocket that the RSO deems necessary.
- The flight card for a rocket that fails to launch should be left in the “Ready to Launch” pile.

On completion of a launch session, the LCO will isolate the ignition system electrically and will state that the ‘range is safe’ or similar to allow members to collect their rockets from the range. A misfire will require a minimum one-minute wait after the last ignition attempt before any person is allowed to approach the rocket.

## 6.0 Duties of the Range Safety Officer

The Range Safety Officer has the following responsibilities:

- Verify that the launch site and facilities conform to the applicable safety codes. Aspects to be taken into account include wind speed, wind direction, launch angles, cloud cover, cleared area requirements, fire hazards, etc.
- Ensure that the launch pads are set up correctly and are stable.
- Ensure that fire safety equipment is accessible.
- Ensure that first aid equipment is accessible.
- Scrutinise all rockets for suitability to be launched.
- Check that the information on the flight card is legible and matches the rocket, and the card is filled out accurately and completely.
- Confirm that the flyer is registered. If in doubt, check the flyer's membership card or receipt. Expired memberships are not valid and must be renewed before any participation in rocket launches
- Refer to the checklist below before approving a rocket for launch. Any issues are to be communicated between the owner and the LCO.
- If the rocket uses a sparky motor, refer to the document "Sparky Motor Protocols".
- Ensure that the allowed ceiling of the flying area will not be exceeded.
- Once a rocket is approved to launch, sign the flight card. Recommend an appropriate pad to the flyer.
- Provide constructive feedback for rockets which were not approved for launch.
- Highlight any prominent aspects to the LCO (first flight, certification attempt, cluster, sparky motor, etc)
- Coordinate with the LCO for all activities.
- Abort any launch if deemed to be unsafe.
- Remain vigilant of all safety aspects throughout proceedings.
- Not be distracted when rockets are being launched (eg conversing with members or spectators - this activity should be deferred to after the completion of a launch session)

## 6.1 RSO checklist for rockets

### Pre-Launch

**Membership validity** – check list of members, flyer’s membership card or receipt

**Flight Card** – check that **all** required fields are completed, writing is legible and card has been signed by the adult member

**Airframe** – structurally intact, sturdy, and undamaged

**Launch Lug/s or rail buttons** – securely affixed & clear of obstructions. Size appropriate for the weight and thrust of the rocket. Aligned with direction of flight

**Nose** – not too tight or too loose. Nose should not fall off when rocket is inverted

**Motor mount** – The motor should not move when gently pushed or pulled (unless part of the recovery design).

**Fins** - securely mounted to the airframe and aligned with direction of flight (unless spinning is part of the design).

**Recovery System** – Shock cords, attachment points, chute or streamer in good order, packed appropriately, and protected from ejection gases and particles.

Shock cord strong enough to handle the ejection charge as well as a high-speed parachute deployment.

The size of the parachute must be appropriate for the rocket.

#### **Motor**

No chipped or cracked nozzles, damaged ejection caps, structural distortions in the case.

The motor must be certified, commercially-made and comply with site restrictions. Flier must be certified to use the motor (unless attempting certification).

For a composite motor, the flyer must present the motor packaging/label to show the propellant type.

Is the motor a “sparky”? Site conditions may prevent their use. Extra precautions to be taken. Refer to “Sparky Motor Protocols” document.

CTI motors with Vmax propellant are not allowed unless using electronic deployment.

Motor must be of adequate impulse to safely propel the rocket. Rule of thumb is that the thrust:weight ratio should be at least 5:1.

Motors with propellant weight >62.5g can only be used if a licensed pyrotechnician is present and Safework NSW has been notified.

If ejection is provided by the motor, check that black powder been loaded

**Delay correct** – Ejection should occur as close as possible to apogee – not too early or too late

**Stability** – Scratch-built rockets and any modified rockets need to be checked for stability. CG to be at least one calibre forward of the rocket’s CP. A swing test can be used for smaller rockets

**High power rockets** – must have the position of the CP marked on the rocket (or at least known), and should not have the igniter installed until on the launch pad.

**Altitude prediction** – Altitude attained by the rocket must not exceed that allowed at the site

### Rocket on the pad

Launch angles OK

Rocket slides freely on the launch rod/rail - no binding

Igniter(s) connected correctly – clips not touching each other. Pay particular attention to clusters of motors.

### Launching

Pad area clear of people

Watch for shifting of rockets on pads and launch angle changes.

Winds below safety limits (32 kph or less)

No aircraft in vicinity

Give OK to LCO

For any "heads up" flight, make sure that everyone is on their feet with their eyes on the rocket

Be on the lookout for: fires, falling parts, falling lower-stage boosters, any object heading towards spectators, children running into the range area.

## **7.0 Range Preparation / Setup Procedures**

### **7.1 Site Set-up**

The range shall be set up and launches conducted in accordance with protocols established for the particular site. Refer to the site document (if available).

### **7.2 Launch pads / level surfaces**

A launching device or mechanism must be used that shall provide rigid guidance until the rocket has reached a speed adequate for the aerodynamic controls to ensure a safe flight path.

Launching devices may comprise:

- Steel rods, approximately 3mm diameter, 800mm to 1 metre in length - for light models and models using less than 20 Newton-seconds of impulse.
- Steel rods of 5 or 6mm diameter, approximately 1 metre in length - for heavier or higher powered rockets. Longer rockets may require the use of longer rods
- Supported rails that provide superior rigidity for heavier and higher power rockets.

Launching angle must be less than 30° from the vertical for LPR & MPR, and must be less than 20° from the vertical for HPR.

The launcher shall be set up on reasonably level ground, be stable, and must allow the rocket to travel smoothly along the full length of the launcher. The launcher may use a jet deflector device to prevent the motor exhaust from hitting the ground directly. The area around the launcher should be clear of dry grass or other readily combustible materials

The top of the launch rods should be 1.8m above the ground in order to avoid eye injuries. Shorter launch rods may have a cap or ball placed on them when not in use.

### **7.2 Launch Ignition System**

Launching or ignition of a model rocket must be conducted by remote electrical means from a distance as required by the safety code, and must be under the control of the LCO. All persons in the vicinity of any launching must be advised when a launching is imminent. All persons need to check for any aircraft in the vicinity. An audible countdown must be given before ignition or launching of a model rocket. Members may be allowed to use their own launchers if approved by the RSO and LCO.

### **7.3 Spectator barriers / separation from launch area**

Spectator barriers may be used to separate people from the launch area. Refer to the "Minimum personnel distance" in Section 3.0.

The spectator and parking area should not be located directly upwind of the launch pad. Rockets fly into the wind and people and property should not be in this area.

### **7.4 Safety considerations when running cables to launch pads**

Cables should be completely unwound where possible and laid flat on the ground in such a way as to avoid any trip hazards. Cables should be placed at the launch rods in the order corresponding to the launch controller.

### **7.5 Flight Cards / Inspection point**

The LCO shall set up a station for flight cards. This will typically be the location from where the LCO will co-ordinate proceedings. The RSO may operate from this area for the purpose of scrutinising.

## 8.0 Emergency Procedures and Contact Numbers

In case of personal injury seek first aid. If further assistance is required emergency services should be called on '000'.

In case of a fire that cannot be controlled, Fire & Rescue must be called on '000'.

## 9.0 Abbreviations and Definitions

AMRS	Australian Model Rocket Society Inc.
APCP	Ammonium Perchlorate Composite Propellant – see Composite Motor
Apogee	The highest point of a rocket's trajectory ie maximum altitude attained
BP	Black Powder. A slow-burning form of gunpowder. Motors using this propellant generally have casings made of wound paper and range in impulse from ¼A (or smaller) to F.
CASA	Civil Aviation Safety Authority.
CASR	Civil Aviation Safety Regulation.
CATO	Catastrophe At Take Off - An extremely rare occurrence where the manufactured motor will suffer a failure in operation or structure at the time of ignition, or immediately after. The cause may include a cracked or chipped nozzle, premature ejection, or incorrect assembly. The risks can be minimised by proper storage and installation.
Centre of Gravity	(Centre of Mass) The point in an object where its weight is balanced.
Centre of Pressure	The point along the axis of an object where the aerodynamic forces balance.
CG	Centre of Gravity (Centre of Mass)
Complex Rocket	A rocket using more than a single motor ie a cluster or more than 1 stage
Composite Motor	Motors that use a propellant mixed and cured to hardness, based on ammonium perchlorate as the oxidiser. They generally have a phenolic, fibreglass, or metal casing (metal casings used in RMS motors).
CP	Centre of Pressure
Fire Marshall	A person appointed to check for fires immediately after the launch of a rocket, primarily if using a sparky motor
HPR	High Power Rocket (High Power Rocketry)
High Power Rocket	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/or is propelled by one or more motors having a total impulse greater than 160Ns. The rockets are generally manufactured from higher strength materials including heavy gauge cardboard, phenolic, fibreglass, carbon fibre, plywood, and high strength plastics.
Impulse	The total energy provided by a rocket motor (units: Newton-seconds). Rocket motors are classed by their impulse level, designated by a letter. Each letter has up to twice the power of the preceding letter. Eg a "C" motor is twice as powerful as a "B" motor, which is twice as powerful as an "A" motor.
Instrument (CASA)	A permit issued by CASA for the use of additional airspace. Commonly (incorrectly) referred to as a "waiver" in Australia.
Large Model Rocket	A model rocket weighing between 500g and 1,500g at lift-off and using one or more motors with impulse more than 20Ns and less than 160Ns (equivalent to E to G motors). The nose, body, and fins of model rockets use lightweight, non-metal parts. Materials used are typically balsa, wood, plastic, and cardboard.
Launcher/launch pad	A rigid, stable structure with a launch rod or rail from which rockets are launched
LCO	Launch Control Officer
LMR	Large Model Rocket
LPR	Low Power Rocketry. See Small Model Rocket
MMX	Abbreviation for Micro Maxx – very small model rocket motors
Model Rocket	As defined by CASR: Any rocket weighing not more than 1500g which is propelled by one or more rocket motors producing not more than 320Ns

	total impulse, with no more than 125g of propellant. The nose, body, and fins of model rockets use lightweight, non-metal parts. Materials used are typically balsa, wood, plastic, and cardboard. A model rocket contains a device for returning it to the ground in a condition to fly again.
MPR	Medium Power Rocketry. See Large Model Rocket.
MR	Model Rocket
NAR	National Association of Rocketry (USA)
N	Newton, the SI unit of force. The force required to accelerate 1kg by 1metre/second/second (equivalent to 102 grams-force)
NOTAM	NOtice To AirMen. A notification produced by CASA to alert aircraft pilots of any hazards at a specific location.
Ns	Newton Seconds, the units for impulse of a rocket motor.
Reloadable Motor System	A rocket motor consisting of a metal casing and a reload kit. This provides for users a more cost effective option in the longer term.
RMS	Reloadable Motor System.
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.
Rod bind	Excessive friction between the lugs/buttons on the rocket and the launch rod/rail due to a complication or undue interaction between the model and the launcher. In these instances, the motor will ignite, and propel the model up the rod a short distance, or at a very slow speed, and fail to become airborne at a safe velocity. This problem is typically caused by residue accumulating on the launch-rod, undersized launch lugs, inappropriately placed launch lugs, or strong cross winds.
RSO	Range Safety Officer
Propellant	The chemical component of a rocket motor which provides the thrust for the duration of the motor burn.
TRA	Tripoli Rocketry Association
Small Model Rocket	Any model rocket weighing less than 500g and having 20Ns or less total impulse at lift-off. The nose, body, and fins use lightweight, non-metal parts. Materials used are typically balsa, wood, plastic, and cardboard
Sparky motor	A composite motor that contains particles of titanium (sometimes referred to as 'titanium sponge') in the propellant grains.
Static Centre of Pressure	A crude method of determining the Centre of Pressure of an object. A two-dimensional model of the object is made and the balance point determined. Also called the "cardboard cut-out" method
Waiver	A term used in the USA for a permit for the use of additional airspace (see Instrument).