AUSTRALIAN ROCKETRY ASSOCIATION INC

BLUE BOOK

Code for Hobby Rocketry

JULY 2018 EDITION

CHAPTER 1 – Blue Book Introduction

This 'Code for Hobby Rocketry' is for all ARA Members guidance in their rocketry activities.

This is not a legally binding document except as is required for insurance coverage for all members. .

The ARA is a national club which self regulates hobby rocketry.

This code is based on a compilation of information from ARA members, Government bodies, and other independent sources referred to in the Appendix of this Book. This Book is not necessarily the final opinion of the referenced bodies.

If your local official requires more information, this Book can be used as a reference, and any clarification on points should be directed to the ARA Chairman of the Blue Book Sub-committee.

HOBBY ROCKETRY IS ONE OF THE SAFEST HOBBIES WORLD WIDE

This statement can be established by:

A. A 60 year safety record!

B. International insurance underwriters,

C. A successful common sense safety code and all rocketeers' willingness to follow it

CHAPTER 2 – Table of Contents

CHAPTER 3 – Purpose, Definition and Range

(1) Purpose

1.1 The purpose of this code shall be to ensure that the creative and experimental urges of the public regarding rocket devices has reasonably safe outlets and the wide and easy availability of commercial rocket motors that meet standards of safety and reliability.

1.2 The purpose of this code shall also be to discourage the making and launching of homemade rocket-like vehicles propelled and/or intended to be propelled by homemade rocket propulsion devices.

1.3 The purpose of this code shall be to avoid tragic deaths and injuries as has happened in other countries around the world to discourage, experiments with explosive or highly energetic rocket propellants, construction of homemade rocket propulsion motors, attempt launchings and operations of these homemade rocket devices.

1.4 The purpose of this code is to give guidance to current, new members and public officials if required.

(2) Definitions - **For the purpose of this code, the following terms shall be defined as stated in this section.**

2.1 Aero Model - A miniature or model flying device that includes the category of model rocket, as defined in this section.

2.2 Amateur Rocket – An Amateur Rocket is a rocket that is defined into 4 classes. Class 1 Model Rocket, Class 2 High Power Rocket, Class 3 Advanced High Power Rocket and Class 4 other.

2.3 Approved - Acceptable to the authority/is having jurisdiction over the rocket use.

2.4 Authority Having Jurisdiction (AHJ) - The organization, office, or individual having responsibility for approving equipment, installation, or procedure.

2.5 Black Powder - A type of propellant that is used in a model rocket motor. These motors are typically single use only for safety.

2.6 Commercial Manufacturer - A business engaged in research, development, production, preparation, testing maintenance, or supply of rockets, rocket motors, rocket propellant chemicals, rocket propellant, or rocket components or parts may be represented by any individual, firm, partnership, joint venture, corporation, or other business entity.

2.7 Composite Rocket Motor – A rocket motor whose primary propellant is Ammonium Perchlorate Composite Propellant (APCP). These motors can be of single use or reloadable type. The reloadable type come in kits where a person can choose from a series of replaceable propellant and time delay modules which are installed by the user.

2.8 Experimental – Means user made or prefabrication of rocket motors also commonly known as EX.

2.9 Field (Range) Safety Officer – This is a well qualified person who keeps constant check on the launch sites, the spectators, the weather, check for aircraft, the recovery area, the tracking teams, and all other areas which are involved in the launch so that no unsafe activity is permitted. They also make certain that all rockets placed on the launcher have passed inspection by the Safety Inspection Team. They can also call a halt to launch operations if any unsafe conditions develop and will not permit launching to resume until the problem is solved.

2.10 Fire Guard - A person (minimum of 18 years of age) that has been appointed by the Range Safety Officer that has had instruction and is competent in the use of a knapsack fire extinguisher or other suitable fire extinguisher. The purpose of a fire guard is to ensure rocketry activities are conducted so there is a zero risk of fire. The fire guard should have a suitable fire extinguisher in his/her possession at all times. The fire guard's eyes are not permitted to leave the launch pad even after the rocket has been launched. Fire Guard is only needed when launching from dry grass which generally is prohibited.

2.11 Fireworks - Means any device containing chemical elements and chemical compounds capable of burning independently of the oxygen of the atmosphere and producing audible, visual, mechanical, or thermal effects which are useful as pyrotechnic devices for entertainment. (UN 0333, UN 0334, UN 0335, UN 0336, UN 0337) Fireworks are not applicable to this code.

2.12 Flame Retardant Wadding - Wadding that is used as part of the recovery device which should be able to withstand the ignition by a match for one second and immediately extinguishes itself and is also biodegradable. See Chapter 5, Section 2.3

2.13 High Power Rocket - An Amateur rocket whose construction technique is similar to a model rocket but exceeds the limits for a model rocket. A high power rocket either weights more than 1500grams or is propelled by one or more motors having a total impulse greater than 320Ns or contains more than 125grams of propellant. Upper power class is O. These rockets require permission from the CASA liaison officers to fly. Full guidelines are described in the High Power safety code and guidelines in this book. High power rocket in this manual does not include a Advanced High Power Rocket or other Amateur Rocket, sounding rocket, suborbital rocket or a launch vehicle within the meaning given by the space activities act 1998.

2.14 Advanced High Power Rocket – An amateur rocket that exceeds the limits of a High Power Rocket. Advanced High Power Rockets have a greater combined total impulse of 40,960 Newton-Seconds.

2.15 Hybrid Rocket Motor - A rocket motor in which the fuel exists in different physical state (solid, liquid, or gaseous) than the oxidizer and derives its force and/or thrust from the combustion thereof.

2.16 Labeled - Equipment and/or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority/is having jurisdiction and concerned with product evaluation that maintains periodic inspection of production of labeled equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

2.17 Launch Control Officer - This person has complete control of all operations. Everyone operates under his directions. He always checks with the range safety officer before permitting launches. He may personally press the launch switch for each launch, may supervise the person pushing the launch switch, or may deputize a member to do the actual launching.

2.18 License - Means any non-transferable authorization granted by the authority having jurisdiction to engage in any regulated activity.

2.19 Liquid Propellant Rocket Motor - Shall mean a rocket motor that contains a fuel and an oxidizer in liquid form or in a combined monopropellant form as a single chemical and which derives its force and/or thrust from this combustion.

2.20 Listed - Equipment and/or materials included in this list published by an organization that is acceptable to the authority/is having jurisdiction and concerned with product evaluation that maintains periodic inspection of production of listed equipment or materials and by whose listing states either the equipment or material meets appropriate standards or has been tested by an organization and found suitable for use.

2.21 Model Rocket - Shall mean a rocket that is propelled by a model rocket motor, that contains a device for returning it to the ground in a condition to fly again, whose structural parts are made of balsa, paper, wood, or plastics or a combination of those materials, but contains no metal as structural parts and whose primary use is for the purpose of education, sport or recreation. It weighs less than 1500 grams at liftoff, containing not more than 125 grams of propellant, and not containing any combination of motors with more than 320 Newton-seconds total impulse.

2.22 Model Rocket Motor - Shall mean a solid propellant rocket motor that conforms to the standards for rocket motors as set forth in this code. All model rocket motors currently manufactured are manufactured in strict accordance with international and national standards developed jointly by the Federation Aeronautique International (FA1 Sporting Code), U.S. National Fire Protection Agency, the U.S. National Association of Rocketry. This motor will contain no more than 62.5 grams of solid propellant and produce no more than 160 Newton Seconds of total impulse and have an average thrust of no greater than 80 Newton. Exception; Model Rocket Motors shall be permitted to contain 125grams propellant and have a total impulse of 320 Newton Seconds as described in CASA part 101 legislation but shall not be permitted to have an average thrust exceeding 80 Newton Seconds with such motors only available to certified persons over 18 years old. (UN 0431, UN 0432, UN 0349, UN 0323, UN 0351, UN 0471, UN 0186)

2.23 Module - A component of a reloadable rocket motor in which its chemical composition is cast into a finished Assembly to avoid the measuring or mixing of ingredients or the handling of raw pyrotechnical materials by the user.

2.24 Motor Reloading Kit - A package produced by a commercial manufacturer that contains all the components necessary to reload and reuse a non expendable rocket casing specifically designed and manufactured for use with such components. (UN 0349, UN 0323, UN 0351, UN 0186, UN 0272)

2.25 Permit - Means the non transferable permission granted by the authority having jurisdiction.

2.26 Person - Shall mean any person, partnership, organization, firm, corporation, association, or any combination thereof, and shall include any of the employees and authorized representatives.

2.27 Pressurized Liquid Rocket Motor - Shall mean a rocket motor that derives its thrust or force from liquid expelled from the rocket motor by pressurized gas and involving no combustion or change in state.

2.28 Production Lot - A quantity of rocket motors, motor casings, or motor kits produced during a single work shift on the same manufacturing device, using the same batch of material.

2.29 Propellant - The materials used in a motor that produces thrust by the discharge of a working fluid generated by combustion, decomposition, change in state, or other operation of such material contained, carried stored within the rocket.

2.30 Retailer - Means any person, who at a fixed place of business, sells, transfers, or gives motors to a consumer or user. This includes on-site or on-line vendors. Retailer is recognised by ARA as either having a ABN or being a registered business in a specific jurisdiction.

2.31 Rocket - Means a pilotless vehicle powered by reaction that carries all the components necessary to provide its jet. Rocket does not include a rocket powered or rocket assisted aircraft.

2.32 Rocket Motor - Shall mean a device, or combination of devices, that provides the necessary force or thrust to cause a rocket to move. The force or thrust shall be created by the discharge of gas generated by combustion, decomposition, change of state, or other operation of material contained, carried, or stored solely within said rocket motor or rocket and not dependent upon outside environment for reaction mass.

2.33 Safety Inspection Team - These are persons who should perform a safety check on each rocket for correct engine selection, secure engine mounting, proper ignition installation, good parachute and wadding packing, aerodynamic stability, structural strength, and make certain that the recovery system will work before allowing the rocket onto the launch equipment.

2.34 Sell - Means any arrangement between two or more persons as a result of which there is a transfer/exchange of Property for a consideration.

2.35 Shall - Indicates a compulsory requirement.

2.36 Should - Indicates a direction that which is advised but not required.

2.37 Solid Propellant Rocket Motor - Shall mean a motor which derives its force or thrust from the combustion containing fuel and an oxidizer in solid form.

2.39 Structural Parts - Specifically, the nose cone, body tube, and fins - the load bearing parts of a rocket.

2.40 Thrust Augmenter - A device that increases the force of a rocket motor by imparting a portion of the momentum of the rocket motor's exhaust jet to the surrounding environmental medium and that is considered to be part of a rocket motor when and where used.

2.41 Wholesaler - Means any person, an importer, exporter, or manufacturer selling to a retailer or any other person for resale.

(3) Range

3.1 This code shall apply to the construction, design, limitation of propellant mass and power, reliability of rocket motors, other than fireworks rockets, produced commercially for sale to and/or use by the public for the purpose of education, recreation and sporting activity.

3.2 This code shall also apply to the conduct of launch operations of the rockets specified in the Range operations guide for launching within ARA sections.

3.3 This code shall apply also to High Power Rocketry as defined.

3.4 This "Code for Hobby rocketry" shall not apply to the design, construction, fabrication, production, manufacture, launching, flight, maintenance, test, operation, or use of rocket motor propelled radio controlled model aircraft which sustain their mass against the force of gravity by aerodynamic lifting surfaces that support the aircraft during the entire duration of their flight in the air. But, this code shall apply to the rocket motors and their components that provide the propulsion for such model aircraft.

3.5 This code shall not apply to toy rockets propelled by pressurized liquid rocket motors containing less than 250 milliliters of water.

3.6 This code shall not apply to fireworks rockets as defined in 2.11.

3.7 This code shall not apply to Experimental also known as EX, Advanced High Power Rocketry, Amateur class 3, or Other Amateur class 4 as defined in 2.2, 2.8 and 2.14

3.8 This code shall not apply to ARA Motor Testing, but shall apply to some standards ARA Motor Testing must meet, refer to the latest ARA motor testing manual for procedures.

CHAPTER 4 – Civil Aviation Safety Authority Requirements 1

The below is intended as a short guide to the current regulations that are in place for further detail please refer to part 101 subpart H of the relevant legislation.

(a) Model Rocket; Means any rocket weighing not more than 1500grams; and which carries no more than 125 grams of propellant; and produces no more than 320Ns total impulse; that contains a device for returning it to the ground in a condition to fly again; whose structural parts are made of paper, wood, balsa or plastics or a combination of those materials, but contains no metal as structural parts. Model rockets may be further classed as:

(i) Small model rocket; Means any model rocket weighing less than 500g and either uses no more than 25grams of propellant; or produces no more than 20Newton-seconds of impulse.

(b) High Power Rocket; means 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 motors having a total impulse greater than 320Ns and contains more than 125grams of propellant.

(c) Commercial. The term 'high power' would also cover rockets used for a commercial purpose other than purely for the study of rockets by students at school. Such rockets would include space launchers (within the meaning given by the space activities act 1998); sub-orbital rockets, sounding rockets and rockets, which would normally be able to exceed an altitude of 60,000ft. Commercial rockets may require a launch permit from the Department of Industry, Science and Resources.

Some common Questions and Answers;

Can I launch my model rocket within 5 nautical miles of an aerodrome? Yes you may launch your model rocket up to 400ft AGL provided it is not a movement area or runway of an aerodrome; and it is not the approach or a departure path of a runway of an aerodrome.

Can I launch my small model rocket above 400ft AGL within 5 nautical miles of an aerodrome? When operated in a manner that does not create a hazard to persons, property or aircraft and not operated in a movement area or runway of an aerodrome and/or the approach or departure path of a runway of an aerodrome. A small model rocket (when operated in this safe manner) may be operated at any time day or night, in any airspace, at any height and at any distance from an aerodrome.

If controlled airspace starts at 1500ft AGL, can I launch above the 400ft AGL? Yes as stated above you can only launch a rocket including a "model rocket" to 400ft AGL in controlled airspace the key word many people miss is **"in controlled airspace"**. So if controlled airspace starts at 1500ft AGL you are not flying in controlled airspace unless you exceed over 1500Ft AGL. You will however need to comply with any restrictions the landowner/council may have in place and abide by the site dimensions recommended by the ARA safety code.

I went and brought the biggest rocket I could find can I launch this up to the 1500ft AGL if it's not controlled airspace? Firstly is the rocket a "model rocket" or a "High Power Rocket"? Definitions are supplied within this page please read them to understand the definitions. If your rocket classes as a "High Power Rocket" (HPR) then **no** you cannot launch your rocket as a HPR must only be launched at an approved area with appropriate notification to the CASA liaison officers.

High Power Rockets may only be launched at approved locations please contact CASA or your local rocketry club or ARA sections for appropriate HPR sites in your state/territory

If you are ever in doubt in regards to High Power Rocketry we recommend you contact your local CASA office or a reputable rocketry club in your state.

400ft = 122 metres

Civil Aviation Safety Authority Requirements 2

This is basic advice for ARA member's rocketry activities

MODEL ROCKETS (GENERAL)

1. BACKGROUND

1.1 Hobby rocketry was born in 1957 as a result of the first satellite being launched. Enormous public interest in rockets became apparent and excited young enthusiasts became involved in launching and making homemade rockets

1.2 This activity involved mixing of dangerous explosives and handling of experimental rocket motor devices by members of the general public and, during this early period serious injuries and fatalities occurred.

1.3 Due to the wisdom of such people as Harry Stine, it became apparent that measures needed to control the experimental urges of the general public. This led to the evolution of model rocketry, as we know it today. Models were developed utilising paper tubing, balsa, wood and other materials using a pre-loaded factory made model rocket motor. No mixing of volatile explosives by the public was necessary. Model rocketry is now a safe sporting and recreational activity and a recognised educational tool.

2. FLYING SMALL MODEL ROCKETS

2.1 Small model rockets are considered rockets that weight less than 500g and produce less than 20Ns total impulse and contain less than 25grams propellant. Check that your rocket falls within this category. If not, still read this section then go to **4** (Model rockets other than small model rockets)

2.2 Safety begins in the preparation stage of your rocket. Ensure that the model has been constructed according to instructions included in kits. It would not hurt to add extra glue to areas that may need reinforcing such as fins. Motor mounts are also an area requiring strength. Once you are satisfied with the structural integrity of your model it is time to move to the next stage.

2.3 Check to determine that you have all the necessary equipment to launch your model. On most occasions this involves a launch pad, electrical launch system (including safety key). Recovery wadding (if the design of your rocket requires this) and your model rocket motors.

3 CHOOSE A SUITABLE LAUNCH AREA

3.1 Prepare your rocket for flight. You will first need to do the rocket pre-flight. This involves preparing your recovery device (ie parachute or streamer). Place the required amount of wadding in the tube as recommended by your instructions. Be sure it fits loosely.

3.2 Then fold parachute or streamer as suggested by your instructions. Be sure to do this at the launch site not at home before you leave. Once this has been done, place the recovery device in the body tube loosely and insert the nose cone. (Ensure the nose cone fits on loosely)

3.3 Prepare your motors for flight. Only use motors recommended in the instructions supplied with your kit.

WARNING: Never use homemade motors or motors not recommended by the kit manufacturer. Homemade motors would be considered an unauthorised explosive under state and territory explosives acts. This usually carries a mandatory $10,000 fine! Furthermore such motors have been known to cause serious injury by actual incidents in Australia.

3.4 Separate the igniters and insert them in the motor (it is important that the igniter touches the propellant when you do this) Fold the igniter over and then insert the plug supplied with the motors. Be sure not to insert this too hard as it may damage the igniter. If you do not have plugs use adhesive tape to hold the igniter in.

3.5 Insert the motor in the rocket ensuring it is in the retaining hook. If you do not have a hook, use masking tape wrapped around the motor to ensure a tight fit. This is particularly important to ensure your recovery device works.

3.6 Place the model on the launch pad (ensure it slides loosely on the launch rod) and hook up the micro clips as recommended by your instructions. (Be sure the safety key is not inserted while you do this)

3.7 Check the weather for your flight. It is best to launch only during calm weather with little or no wind and good visibility. If in doubt, do not launch. It is better not to launch than take the risk of losing your model.

3.8 It may be necessary to angle the launch rod (not more than 30 degrees from the vertical) into the wind to ensure the model lands within the launch site.

(1) Move back from your rocket as far, as the launch wire will permit (at least 5 meters)

(2) Insert safety key to arm the launch controller.

(3) Observe and listen for any aircraft before beginning your audible countdown. (If an aircraft is spotted wait for it to be well clear).

(4) Give audible countdown (be sure everybody in the vicinity can hear you) 5,…4,…3,…2,…1, LAUNCH (never say fire, only say fire if there is one).

(5) Remove safety key from launch controller. Replace safety cap on launch rod.

MISFIRES: FAILURE OF THE MODEL ROCKET MOTOR TO IGNITE IS NEARLY ALWAYS CAUSED BY INCORRECT IGNITER INSTALLATION.

PROCEDURE: When an ignition failure occurs;

(1) Remove the safety key from the launch control system.

(2) Wait one minute before approaching the rocket.

(3) Remove the expended igniter from the motor and install a new one as suggested previously.

FOR YOUR SAFETY AND ENJOYMENT READ AND FOLLOW the ARA model rocket safety code while participating in any model rocket activities.

4 FLYING MODEL ROCKETS OTHER THAN SMALL MODEL ROCKETS

4.1 A model rocket (other than a small model rocket) is considered to be a model rocket, which weights between 500g and 1500g, has less than 125grams of propellant and produces between 20Ns and 320 Ns total impulse of power.

4.2 Check to determine whether your kit comes under this category. If it does not then your rocket may be under the category of high power rocketry.

4.3 Read all the guidelines for small model rockets as these apply again for model rockets However, there should be much more emphasis on construction strength and integrity when building a model rocket. Greater power means stronger construction. It is advisable to consider using two part epoxy in construction of a model rocket kit.

4.4 Before flying your model rocket, be sure to comply with all applicable CASA regulations. You may need to follow guidelines in subpart H of part 101 with notification requirements. Model rockets (other than small model rockets) are not permitted in areas as mentioned in CIVIL AVIATION SAFETY AUTHORITY REQUIREMENTS 1of the blue book.

4.5 Also be sure you are complying with applicable state and territory explosives regulations and local government by-laws if applicable.

4.6 When flying your model rocket a greater emphasis is needed on safety.

(1) Be sure you are at least 10 meters from the launch pad before ignition sequence.

(2) Read and follow instructions very carefully before launching your model rocket.

(3) Be sure all spectators are aware of any impending launch.

(4) Be sure to observe and listen for any aircraft before launching. Even if CASA has been notified, this does not guarantee aircraft will not be in the area.

(5) Read and follow the ARA model rocket safety code prior to any activity involving model rockets.

Civil Aviation Safety Authority Requirements 3

ARA CASA part 149 procedures **DRAFT**

Part 1 Procedures for issuing NOTAMS to air services.

(1) Introduction

1.1 As part of the ARAs obligations under CASA part 149 it is required on occasion for the association to issue NOTAMs for some rocket operations. These are the procedures for dealing direct with Air Services for issuing these NOTAMs.

1.2 Scope; This procedure is for ARA registered sites where under the Aviation Referenced Number (ARN) 578770

(2) Definitions; For the purpose of this procedure the following shall be defined as follows;

2.1NOTAM; Notice to airman

2.2 CASA liaison officers; an officer of the association who has been granted the authority by the executive committee to issue NOTAM requests.

2.3 UTC; Universal time co-ordinate UTC = standard time minus 9.5 hours or standard time minus 10.5 hours with daylight saving.

2.4 Letters on NOTAM requests; **A** = Location in longitude and latitude, **B** = Date, time of activity start, **C** = Date, time of activity ceasing, **D** = Periods of activity, **E** = Description of activity **F** = Lower level of activity, **G** = Upper level of activity

2.5 AMSL; above mean sea level.

(3) General;

3.1 Upon receiving a request from an ARA section head for a NOTAM the CASA liaison officer shall submit the Air Services NOTAM request form to the Australian NOTAM office.

3.2 The request shall be submitted no less than 48hours prior to the proposed operation.

3.3 The information required from the section head for the request shall be as follows;

(A) Location in longitude and latitude
(B) Date, time start in UTC and standard time
(C) Date, time Finish in UTC and standard time
(D) Summary of start and finish time
(E) Type of rockets and description of operation
(F) SFC
(G) Height level in AMSL

3.4 The template that is to be used by the CASA liaison officer shall be the Air Services one as specified in page 15.

3.5 The CASA liaison officer shall check the NOTAM for accuracy after issue from the NOTAM

office by way of Air Services pilot briefing service.

3.6 At any time the CASA liaison officer may request more information from a section head that he or she considers appropriate particularly in regards to the type of rockets to be flown and the types of motors to be used.

Procedure for Approval of a High Power Rocketry launch site

Introduction; The procedure for approving a High Power launch site by the CASA liaison officers shall be a minimum requirement to determine the launch site meets the following;

☐ **The launcher location** must be at least one half the minimum launch site dimension, or 460 meters (whichever is greater) from any inhabited building, or from any public highway on which traffic flow exceeds 10 vehicles per hour, not including traffic flow related to the launch.

☐ **Is the launch site away** from power lines, buildings, and persons not involved in the launching and does not present a hazard, and that is as large on its smallest dimension as one-half of the maximum altitude to which rockets are intended to be flown at that site or 460 meters, whichever is greater.

☐ **Rocket launch sites** should be 8kmh away from aerodromes and only areas that meet the requirements as specified in 101.470 (3) can be granted an approval for an area.

☐ **Access Permission**
Before any activities can be begin, written permission for the use of the selected site must be obtained from the owner or manager of the site

☐ **If the altitude to controlled airspace** is intended to be exceeded, then a specific approval must be obtained from Air Traffic Control for that area with a contact direct to the tower as specified in 101.435 (1)(b)

☐ **Visibility Range** good horizontal visibility at all levels in the site's airspace, up to its intended ceiling is required for all launch sites.

☐ **Consultation** Has the local district office of CASA been contacted and consulted in regards to the specified area.

ARA SECTION HEADS; Upon completing the above tick boxes the section head shall contact the appropriate CASA liaison officers for the issuing of an area approval.

TEMPLATE; A specified template shall be assigned for the specific area by the CASA liaison officer for dealing direct with the Australian NOTAM office.

CHAPTER 5 – TESTING AND CERTIFICATION

2.1 Rocket motor types offered for sale, exposed for sale, sold, used, or made available to the public shall be examined and tested by the AHJ to determine whether or not they comply with the standards and requirements in Chapter 11 4.1. The AHJ, shall certify as acceptable for sale and use of these products. At the discretion of the AHJ, such examination, testing, and certification may be carried out by an approved testing laboratory or an organisation such as the ARA. Motors which have been tested by foreign organisations such as NZRA, NAR, UKRA, TRA and CAR are recognised by the ARA as being already tested, and need not be retested here in Australia under the procedures in the ARA motor testing manual. (except if the authorisation expiry date has been passed).

2.2 The AHJ shall maintain a current and complete list of all those rocket motor types that are certified as complying with the standards and requirements detailed in Chapter 11 4.1 and make copies of the list available to citizens and public safety officials that may request it.

2.3 TEST GUIDELINES FOR FLAMEPROOF RECOVERY WADDING.

These guidelines have previously been accepted by the Fire Protection Association of Australia.

2.3.1 Background; The wadding used in a rocket is ejected under pressure from a charge of gas by the combustion and expansion of hot gas produced by the use of flash powder or similar product. This gas is at temperature of around 280 degrees Celsius for less than 0.25 seconds. This ejection charge also deploys a recovery device which has to be protected from these hot gasses.

2.3.2 Test Procedure; This test will exceed by a factor of around 7 times, that required for the time duration of the use of the material at 280 degrees Celsius experienced by the flame resistant wadding.

2.3.3 Procedure; A 100mm x 100mm piece of flameproof material is lightly crumpled into a ball of approximately 25mm in diameter and then exposed under this material, a lighted match for two seconds. When the match is removed, the material should self extinguish without any glowing material remaining within 0.5 seconds.

CHAPTER 6 – Prohibited Activities and Permits

The following activities shall be prohibited by this code;

(A) Using model rocket motors, high power motors, motor reloading kits, or components for the primary purpose of producing a spectacular display of colour, light, sound, or any combination thereof.

(B) Using a model rocket, high power rocket or model rocket motor, high power motor, motor reloading kit, or component as a weapon.

(C) Using a model rocket, high power rocket or model rocket motor high power motor, motor reloading kit, or component contrary to the instructions for its use.

(D) Tampering with any model rocket motor, high power motor or motor reload kit or component in any manner or to any degree that is contrary to the purpose for which the model rocket motor, high power motor, motor reloading kit, or component is designed and intended to be used.

(E) Selling, offering for sale, exposing for sale, purchasing, making, or using fuse, wick, or other ignition devices intended to be activated by a handheld flame for the purpose of starting or igniting a model rocket motor, high power motor or motor reloading kit.

(F) Reloading any expendable solid-propellant model rocket motor, high power motor with any material or by any means not specifically provided or recommended by the manufacturer.

(G) Making, launching, operating, flying, testing, activating, discharging, or other experimentation with model rocket motors, high power motors, motor reloading kits, or motor components that have not been certified in accordance with the ARA motor testing manual. Other than for the purpose of evaluation of new model rocket motor, high power motor, motor reloading kit technology by an AHJ.

(H) Transporting or using any model rocket motor, high power motor, motor reloading kits that

have not been authorised in any Australian State or Territory Jurisdiction in accordance to the Australian Code for the Transport of Explosives by Road and Rail Third Edition.

(I) The operation, discharge, or activation of a model rocket motor, high power motor, motor reloading kits contrary to the provisions of the regulations set down by the Civil Aviation Safety Authority.

PERMITS

(A) When in compliance of the Blue Book no permits shall be required for using, selling, transporting, possession or storage of model rocket motors, high power motors, motor reloading kits.

EXCEPTION; A licence to sell shall be required for anyone who holds a quantity of model rocket motors, high power motor, motor reloading kits that exceeds 11kg. The licenced seller shall keep records for not less than 5 years which shall include the following;

(1) Name and address of the purchaser

(2) Address and name of the organisation who certified the purchaser for high power motors, motor reloading kits.

(3) Number and type of high power motors, motor reloading kits sold to the purchaser.

(4) Sale date and shipment date to the purchaser.

(B) The licenced seller shall make available on request of any police officer or AHJ all the details specified in (A).

(C) Adoption of code; Permission is granted by the ARA for any AHJ to adopt this code as an approved code of practice for hobby rocketry.

CHAPTER 7 – Range operations guide

(1) For the purpose of the range operations manual general definitions are as follows. Where a definition cannot be found refer to definitions on page 4.

1.1 Certification; Qualification to use and fly rockets of a given power and size. Certification levels are determined by the A.R.A.

1.2 Static Stability; The measure of the degree to which an object is held in equilibrium, at rest, when acted on by outside forces. Typically measured by the relationship between the Centre of Pressure and the Centre of Mass measured in units of object diameter. Static stability is used in hobby rocketry for most stability calculations.

1.3 Centre of Mass, Centre of Pressure; The point at which the object will balance.

1.4 Centre of Gravity; The point at which forces acting on the cross-section of the object balance.

1.5 Hold; A pause in a countdown.

1.6 Abort; A cancellation of a launch.

1.7 Apogee; A maximum height above the earth.

1.8 Newton-Second; A force of one Newton applied for one Second. (NS)

1.9 Motor Class or Power Class; A means of identifying the general power level of a model rocket motor or high power motor. The basic model rocket motor is defined to be Class A - with a total maximum impulse of 2.5NS. Each higher class (B,C,D,etc) doubles the maximum power of the engine, whilst each lower class (1/2A,1/4A) halves it.

1.10 Impulse; The total energy provided by a motor, measured in Newton-Seconds
.

1.11 Motor Type; A specific engine variety, specified in terms of Class, Average Thrust and Delay Time after burn-out.

1.12 Newton; The force required to accelerate 1kg by 1m/s/s. (N)

1.13 CASA; the Civil Aviation Safety Authority.

1.14 Air services; Air services Australia.

1.15 Permission; A document detailing an exception to a regulation; usually referring to a permit to use airspace to a given altitude.

1.16 Ceiling; The maximum height permitted.

1.17 Visible Range; The maximum distance at which object can be seen by the naked eye

1.18 AGL; Above Ground Level

1.19 AMSL; Above Mean Sea Level.

1.20 Cloud base; The minimum altitude occupied by clouds.

1.22 Controlled Airspace; Any airspace controlled by air services or the military.

1.23 LWR; Lift to Weight ratio; the ratio between the initial thrust of a motor and the mass of the model.

1.24 Member; A current financial member of the Australian Rocketry Association, or organization affiliated with the Australian Rocketry Association.

1.25 Equipment, Launch Pad; A device designed to hold a rocket in an upright position prior to flight.

1.25 Launch Controller; An electronic device used to control the ignition of model rocket motor or high power motor.

1.26 Model Rocket; Means any rocket weighting not more than 1500grams; and which carries no more than 125grams of propellant; and produces no more than 320Ns total impulse; that contains a device for returning it to the ground in a condition to fly again; whose structural parts are made of paper, wood, balsa or plastics or a combination of those materials, but contains no metal as structural parts.

1.27 Small Model Rocket; A model rocket that masses up to 500g, and uses no more than 25grams of propellant or produces no more than 20 Ns of total impulse.

1.28 High Power Rocket; An Amateur rocket whose construction technique is similar to a model rocket but exceeds the limits for a model rocket. A high power rocket either weights more than 1500grams or is propelled by one or more motors having a total impulse greater than 320Ns or contains more than 125grams of propellant. Upper power class is O. These rockets require permission from the CASA liaison officers to fly. Full guidelines are described in the High Power safety code and guidelines in this book. High power rocket in this manual does not include a Advanced High Power Rocket or other Amateur Rocket, sounding rocket, suborbital rocket or a launch vehicle within the meaning given by the space activities act 1998.

1.29 Model Rocket Motor. Shall mean a solid propellant rocket motor that conforms to the standards for rocket motors as set forth in this code. All model rocket motors currently manufactured are manufactured in strict accordance with international and national standards developed jointly by the Federation Aeronautique International (FA1 Sporting Code), U.S. National Fire Protection Agency, the U.S. National Association of Rocketry. This motor will contain no more than 62.5 grams of solid propellant and produce no more than 160 Newton Seconds of total impulse and have an average thrust of no greater than 80 Newton. Exception; Model Rocket Motors shall be permitted to contain 125grams propellant and have a total impulse of 320 Newton Seconds as described in CASA part 101 legislation but shall not be permitted to have an average thrust exceeding 80 Newton Seconds with such motors only available to certified persons over 18 years old. (UN 0431, UN 0432, UN 0349, UN 0323, UN 0351, UN 0471, UN 0186)

1.30 Approved Model Rocket Engine ; A model rocket motor and that has been approved for use by a

suitably qualified body. Example bodies are:
(a) Australian Rocketry Association
(b) National Association of Rocketry (U.S.A.)

1.31 Recovery Device; Any means of returning a model rocket to the ground in a safe and undamaged state.

1.32 Safety Interlock; A removable device required for a launch controller to become active.

1.33 Igniter; An electrically operated device that ignites a model rocket engine.

1.34 Payload; An object carried by a model rocket that does not have a structural or aerodynamic purpose.
1.35 Airframe; The non-engine, non-payload portions of a model rocket.

1.36 Wadding; Flame proof material used to protect a recovery device from a motor's ejection charge.

1.37 Boost Glider; A glider lifted in a ballistic manner by a rocket that detaches from the glider. The glider then transitions to an aerodynamic profile, and the booster recovers by other means.

1.38 Rocket Glider; A glider lifted in a ballistic manner by a rocket that is retained. The glider then transitions to an aerodynamic profile, and recovers intact. Rocket Glider does not include Radio Control Rocket Glider.

1.39 RSO; Range Safety Officer

1.40 LCO; Launch Control Officer (Sometimes also called Range Control Officer)

1.41 SCO; Safety Check Officer (sometimes also called Range Safety Officer)

1.42 FO; Fire Officer

1.43 Tracker; Person designated to track the flight of a model

1.44 Recovery Team; Person or persons designated to recover a model after landing

1.45 Flyer; Person responsible for the flight of a model

1.46 Spectator; Any person in the area not involved in
(a) the operation of the range
(b) the flying of the model

1.47 Flight line; A line which separates the launch area from the preparation and spectator area and is usually marked with a type of bunting.

(2) Personnel Duties and Responsibilities

This section defines the duties and responsibilities of the range officers. For small meetings, some of these roles may be merged. The Safety Officer roles, however, are always separate from the other roles.

2.1 RSO; The RSO has to ensure that the range is operated safely and legally at all times. If they must, they can ask flyers to leave, and then even close the range if things get out of hand. They can reject

rockets as unsuitable for the range, dangerous, or not legal to fly. They must prevent flyers from launching outside of their certification.

The RSO must validate their decisions based on the recommendations within this Range Operations Guide. If a flyer wishes, they may discuss the RSO's decision, but it is the RSO that must make the final go/no-go choice. As a matter of protocol, another RSO may not accept another's rejection, in the event of the post being passed to another person (e.g. at a shift change). The RSO may also close the range if conditions become unsafe, or for any other reason. The RSO also has the power to assign duties to others on the range, and to relieve range officers of their duties if they are not performing them adequately.

2.2 LCO; The LCO's role is to ensure that the pad area is run safely, and quickly. They are to assist in speeding the turn-over of rockets on the pads, and are there to help flyers see as many *safe* launches as possible. The LCO has control over which pads are in use, the launching order, what models are allocated to which pads, and announce each launch. They may also issue countdowns for flyers.

2.3 FO; An FO, if needed, watches the pad area for signs of fire resulting from a launch. He MUST watch the pad area at all times, and not watch flights at all. As for other safety positions, this should be rotated. An FO is not needed if launching from short green grass, sand, or other non-flammable surface.

2.4 SCO; An SCO is responsible for checking models that are to be presented to the LCO for launch. They must ensure that the model is sound and safe to fly, and that the fitted motor(s) and recovery device(s) are correct and appropriate. If an SCO is unsure of the safety of a model, he may choose to either reject it (giving the reasons, and how they may be addressed), or request a ruling from the RSO.

2.5 Trackers; Trackers are responsible for keeping the model in view during flight. They may also have additional duties, such as measuring altitude.

2.6 Recovery Team; A Recovery Team is responsible for retrieving a model once it has landed. This role is often filled by the flyer.

(3) Site Preparation

This section deals with the procedures to gain access to a site, arranging appropriate altitude clearances, and the physical set-up of a range.

3.1 Access Permission; Before any activities can be begun, written permission for the use of the selected site must be obtained from the owner or manager of the site.

3.2 Ceiling; Every site has a ceiling; this ceiling is the minimum of:
(i) A permission as granted by the controlling authority stating the maximum height
(ii) Four (4) times the minimum dimension of the site
(iii) The current cloud-base

3.3 Altitude Permission; If flight operations require specific approval; then an appropriate permission must be sought from the CASA liaison officers. Sites intended for regular or frequent use may be issued with permanent permission for a given ceiling whereby an aeronautical symbol is placed. Three aeronautical symbols are available and may be used dependant on the site.

3.4 Fire Precautions; No flight operations are permitted until a risk assessment has been completed as per safety code of the launch site. If a risk exists, for high power rocketry areas around the high power

launcher must be cleared to the distance as recommended for the type of high power motor being used as per high power safety code table. Cleared being defined as; free of brown grass, dry weeds and other easy to burn materials. A non-flammable tarpaulin or blanket can be used as an alternative to clearing the area provided this tarpaulin or blanket is the same size as the recommended minimum area to be cleared. This should be placed under each pad. For model rocketry this tarpaulin shall be a minimum of 1.5 meters square. Fire suppression devices shall be located at the site in key areas as recommended by the RSO.

3.5 First aid kit; A first aid kit shall be available at the launch site.

3.6 Range Setup; The boundaries of the range should be clearly marked, and, if possible, the individual areas of the range also marked.

3.7 Range Head / Launch Pad Placement;
The range head and launch pad area should be placed as near as is practical to the centre of the range area. If there is a prevailing breeze, this area maybe offset up to 1/4 of the site dimensions upwind of centre, so as to provide more recovery area. See **7.8** setup. The only personnel permitted in this area are:

(a) RSO, LCO and Flyers. The only exception is when a person is given specific and explicit permission by the RSO.

(b) Pad Separation; Launch pad is to be separated by the minimum safe distance for the rockets being launched from them, as given in the appropriate safety code. The exception to this is for launch racks, where a number of rockets are prepared simultaneously and launched sequentially. Such racks should be treated as one pad for safety purposes.

(c) Pad Specifications; All launch pads are rated for models of certain sizes.

(i) A launch pad must: be capable of supporting the largest model it is rated for.
Have a rigid guide for the model to travel along prior to gaining flight speed.

(ii) A guide must be designed such that it prevents the model from leaving the guide until it has traveled the entire length of the guide. If the wind speed is greater than 8 Km/h this guide shall be of a suitable length for the intended rocket launched.

(iii) Either be unable to be tilted past 30 degrees from vertical, in the case of high power rocketry 20 degrees from vertical, or be clearly marked as to when that angle is exceeded.
(iv) Have a means of protecting the ground from the exhaust of the rocket.
(v) Be stable when loaded.

3.8 Range Control Area; The Range Control area is where the launch controllers are placed. This is also the area that the LCO operates from.
All controllers must be clearly linked to the appropriate pad.
Non-flying personnel may not enter this area without the permission of the LCO or RSO.

3.9 Preparation/Loading Area
The Preparation/Loading Area can be open to the public at the discretion of the RSO, and is where models are prepared for flight. SCO inspections are also carried out in this area.

3.10 Recovery Area
The Recovery area is all areas not otherwise specified. Most (and ideally all) recoveries, however, will

take place in the area of the Range Head. This area is also termed "Down-range".

3.11 Tracking Stations
If measured tracking is taking place (i.e. theodolite tracking for altitude determination) then the tracking stations should be placed as recommended by the RSO.

3.12 Spectators
The spectator area is behind the flight line which includes the Preparation Area, and may include a parking area. Place spectators as per Range layouts example in **7.8**.

(4) Site Operations
This section relates the operation of an active range. Also refer to the RSO Range Checklist.
It is acceptable practice for RSO, SCO, FO and LCO duties to be combined, and for the Flyer to assume the duties of tracking and recovery. Thus the minimum personnel for a range is two.

4.1 Acceptable Conditions
In addition to the conditions addressed in this section, a "safety first" attitude must be observed. Any unexpected conditions that could affect spectators, other air users, or the area surrounding the range should also be considered.

4.2 Wind Speed
During launching, the wind-speed must not exceed the maximum specified in the ARA safety code applicable to the rocket being launched. If possible, a simulation should be run to ensure that the rocket being launched will recover in the recovery area. A weather station should be used to determine the exact wind speed at the range. As an alternative to a weather station internet access at the launch site may be used to determine the wind speed via the nearest Dulux weather station applicable to the launch site.

4.3 Cloud Cover/Ceiling
Cloud cover must not exceed 1/8 at any point in the flight path.
Flights into airspace containing greater than 1/8 cloud cover are prohibited, as are any flights that will penetrate a cloud-mass. To ensure this, the ceiling will be the lower of the posted permission altitude or the cloud base, less 10% of the altitude of the cloud base.

4.4 Visibility Range
Good horizontal visibility at all levels in the site's airspace, up to its operating ceiling is required.

4.5 Recovery Area Obstructions
If the Recovery Area contains vehicles, animals or people not part of a Recovery Team, the range will be closed until the obstruction is cleared, or has left the area.

4.6 Pre-launch Rocket Safety Check

This check is performed in the Preparation Area by the SCO. The SCO may request a ruling from the RSO, if they are unsure of any point. In any event, the RSO's rulings are final.
Only current financial members may present models for checking a launch. A current financial member may present a third party's model, but assumes full responsibility for that launch. This does not confer permission for a third party to undertake the actual launch.

4.7 Proof of Current Membership
The first time a Flyer presents a model to be checked at any given session, they must present their membership card, or other proof, showing a valid financial membership. A check in procedure should be used for this.

4.8 Structural Integrity
The airframe and motor-mount will be constructed so as to be able to withstand the stresses of launch and recovery with the fitted motor and recovery device.

4.9 Approved Motor
The motor being used must be:
(i) An approved model rocket motor or high power motor
(ii) Provide a LWR greater than 5
(iii) Have a delay that will ensure safe recovery

4.10 Stability
The model will exhibit at least 2 calibers of static stability, or be of an otherwise proven design. Design test flights may be carried out if the range has been opened for the express purpose of design testing. Formal proof of design stability (using the Barrowman centre of pressure calculations) is an acceptable substitute for previous flights.

4.11 Recovery
The fitted recovery device must be properly attached and packed, and be designed to recover the model safely. Any protective wadding must be of an approved type as defined in the definitions.

4.12 Estimated Apogee
The estimated apogee must not exceed the site ceiling.

4.13 Special Types and Requirements
Special types of models may require additional considerations. These include Boost-Gliders, staged models, clustered engines, and specialized payloads.
Examples of these are given in the SCO checklist

(5) Range Operation
This section is summarized in the LCO checklist. Any model presented for launch must have passed the pre-flight check.

5.1 Launch Pad Loading
During the loading process, the Flyer, who must be present during the loading, must retain the safety interlock for the pad being loaded.
Only personnel required to load the model onto the launch pad are permitted to approach the pad during the loading operation, unless specifically approved by the RSO. Approval must be given in each and every instance.
The rocket must be loaded onto a pad that has specifications that at least match the model's requirements.
After loading onto the pad, any other pre-flight preparations are made (e.g. removing protective hoods from lenses, arming recovery systems).
After all other pre-flight preparations are made; the model's igniters are connected to the launch controller.
After the igniters are connected, all personnel must leave the pad area.

5.2 Pre-launch Checks
The safety interlock is inserted into the launch controller; continuity is confirmed through the igniters, And the pad is announced as armed. If continuity is not established, then the safety interlock is removed,
And the loading personnel may be permitted to approach the pad to correct the problem at the LCO's discretion. The LCO may choose to abort the launch and require the model to be removed for diagnosis and correction.

5.3 Tower Notification Not Required
The LCO checks the surrounding airspace and the recovery area, and, if clear, gives the go-ahead for launch.

5.4 Tower Notification required (controlled airspace)
The LCO contacts the appropriate ATC, as advised by CASA liaison officers, and informs them of the launch location, the permission reference, and intended altitude. If a series of launches will be following, an estimated end time must also be provided. If the ATC gives clearance, then the LCO proceeds as per following. If clearance is not given, then either a hold is placed until it is given, or the launch is aborted.

5.5 Countdown and Launch
The Flyer must be a current financial member of the club. With specific and explicit permission from The RSO, a flyer may designate a third party to perform the actual act of launching. Under such circumstances the third party must be under direct supervision by the flyer at all times
.The LCO, or by the LCO's choice the Flyer, will issue a five second count down, as follows: "Five, Four, Three, Two, One, Start"
During the Countdown, the LCO will maintain a lookout for hazards, and may call a hold at any point.
At the call of "Start", the launch controller will be activated by the flyer.
If the engine(s) fail to ignite after two (2) seconds, the flyer may request a re-count, or safe the controller.
After safing, the LCO may permit (after no less than 60 seconds) the flyer to attempt to correct the ignition problem at the pad, or order an abort.

5.6 Tracking
The model will be tracked, as far as is practical, through its flight, to the point of landing, by at least one person.
Tracking may be interrupted by the LOS being blocked, or by the model traveling too fast to track, or by being too small to track at its apogee. If at all possible, the track should be regained as soon as is possible.
Failure to successfully track may result in the model being unrecoverable.

5.7 Recovery
Once the model lands, its position should be noted by the recovery team, who then approach the model, safe any payload, and return it to the flyer.

5.8 Holds and Aborts
Holds may be called by any person spotting a hazard during a countdown. After a hold, the LCO determines the nature of the hazard, and either restarts the countdown (from the start) calls an abort, or requests clarification from the RSO.
Aborts may be called by the RSO, the LCO or the flyer.

(6) Site Closure

These procedures are to be followed after the range has been closed, and will not be re-opened that day.

6.1 Equipment Recovery

All ground equipment is to be safed, checked for damage by the RSO, and packed. If equipment belongs to specific persons, it is to be returned, and club equipment passed to the responsible officer.

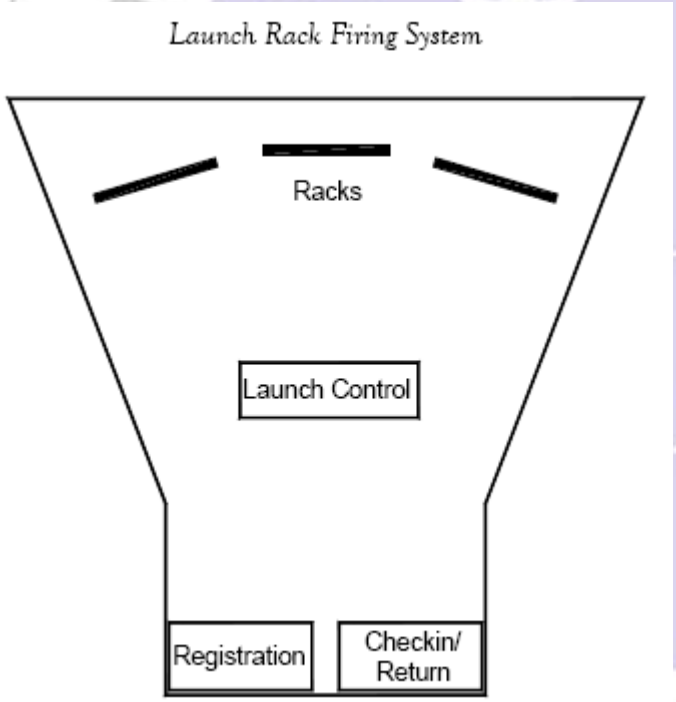
6.2 Waste Disposal

After all equipment has been packed, the site is to be searched for launch debris (e.g. used wadding, igniters, etc) and other rubbish.
Particular attention is to be paid to the pad areas, where there may be numerous small items remaining..

6.3 Security

After all other personnel have left; the site is to be secured by the RSO and the LCO, jointly. The level of security required is to be determined by the site owners/managers.

(7) Range layouts example only



7.1 Range Situation

1. Is range large enough for ceiling?
2. Is pad area clear?
3. Is spectator area at appropriate distance behind launching line?
4. Are prep areas, launching line, and spectator line all clearly marked?

Range Closure Conditions

1. Is cloud below permission ceiling? (Reduced ceiling is an option.)
2. Is wind above maximum safe speed?

3. Limited visibility?
4. Airspace occupied?

5. ANY OTHER CONDITION THAT THE RSO FEELS WARRANTS THE CLOSING OF THE RANGE.

7.2 RSO POWERS

1. A rocket may be rejected for any reason.
2. A flyer may be asked to leave the range for any reason.
3. A countdown may be halted for any reason.
4. A range may be closed for any reason.
5. Any flyer attempting to bypass the RSO or any other officer of the range *will* be ejected for compromising range safety.

An RSO *MUST* justify their rejection, closure or ejection from the field.

7.3 RSO Range Checklist
LCO Checklist
Setup
1. Ensure all pads/controllers are at at least minimum safe distance.
2. Number each pad and controller clearly.
3. If possible, separate
Pads Empty
1. Are all controllers clear?
2. Call for flyers.
3. Check each flyer has cleared the SCO
4. Allocate 1 flyer per pad.
5. Mark flyer, motor, and model on flight sheet.

7.4 Pre-launch
1. Pad area clear?
2. Recovery area clear?
Loaded Pads
1. Call flyer name, model and motor.
2. Check airspace for other users.
3. Call " clear to launch!". If misfire, call "Hold !".
4. Repeat for each pad.
If any misfired pads remain at end of sequence, allow re-try, then remove from pad to diagnose. In the case of drag-race launches, announce all fliers and
pads as a group.

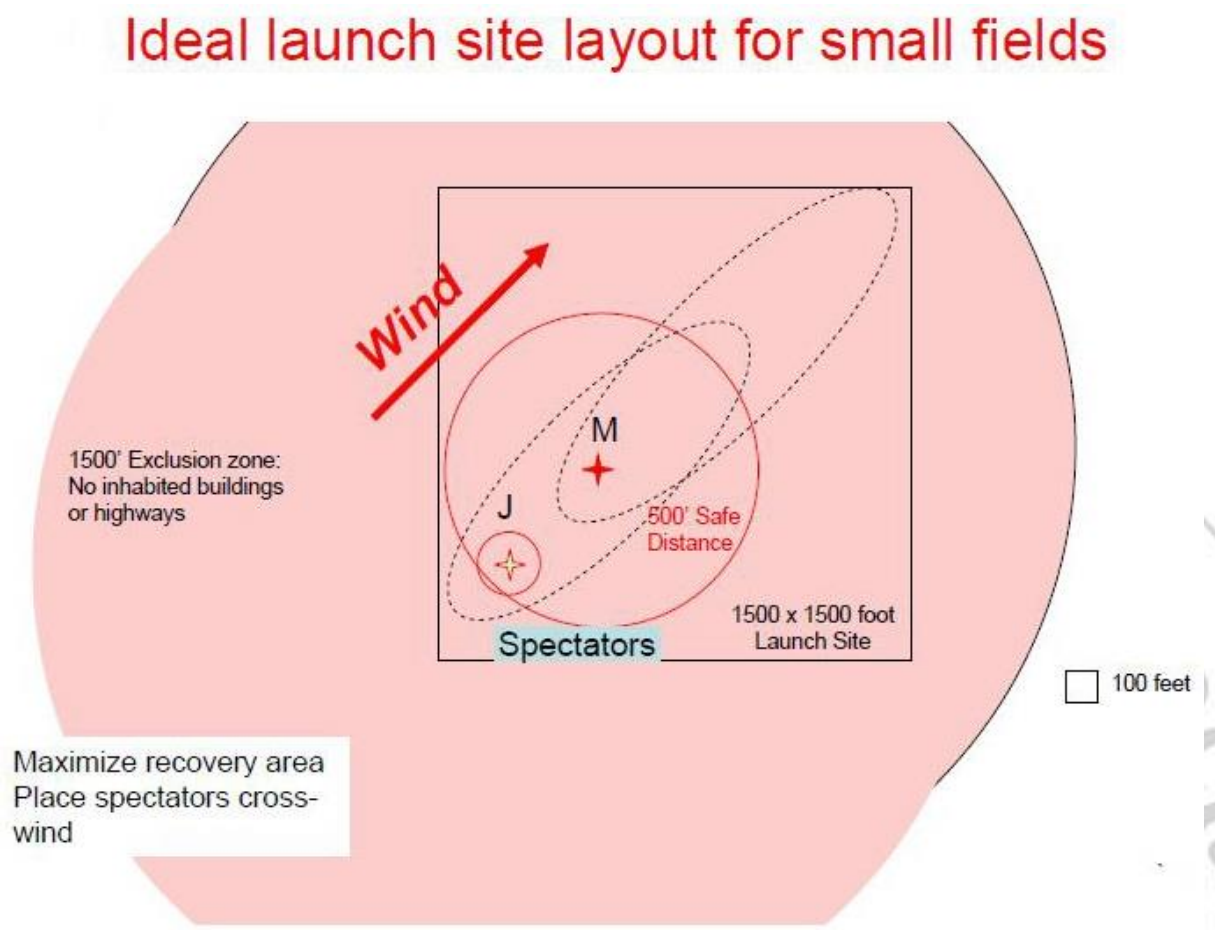
7.5 SCO Checklist
1 / Is flyer a valid member?
2 / Is the motor approved?
3 / Does the flyer have the appropriate certification for the motor in use?
4 / Motor properly retained?
5 / Is the delay correct?
6 / Is the LWR>4 (i.e. enough thrust to lift the model safely)?
7 / Is the model aerodynamically stable?
8 / Is the model structurally fit to fly with the fitted motor?

9 Are the igniters suitable for the motor?
10/ Is the recovery device securely fitted, and correctly packed?
11/ Is the nosecone/payload bay correctly fitted (too loose too snug?)?
12/ Are any launch lugs strong enough, and securely fitted?
13/ Is the proposed altitude in excess of the ceiling?

7.6 Ejection Controlling Altimeter Only
1/ Can the system be disarmed until ready to launch?
2/Properly wired?
3/ Can the altimeter be activated with the ejection leads isolated?
4/ Power supply fresh and secure?
5/ Proper indicators from altimeter module?
6/ Compartment properly vented?
7/ Compartment isolated from ejection charges?
8/ (Dual deployment systems only) Main systems secure enough not to deploy on drogue deployment or apogee?
9/ The recovery system should have a backup method of deployment if space in air frame permits. Redundancy must be present in the power sources, recovery control electronics and output devices (EG; bridge wires, electric matches). Redundancy is not required in the pyrogen materials, parachutes, attachment points, risers, and disconnects.

7.7 Multistage Only
1/ Each stage combination stable?
2/ Each stage has appropriate recovery system?
3/ If separating by drag, do the stages separate easily?
4/ Is the upper stage delay appropriate

7.8 Ideal launch layout small fields. Spectators



Electric Match Detonators and Assembly of Ejection Charges

8 INTRODUCTION

With dual deployment electronics are used to ignite parachute deployment within hobby rockets. The requirements needed for this process requires use of specialised igniters or electric match detonators to ignite an ejection charge.

SCOPE

This procedure is for use within an ARA section. EG; Section 1 Adelaide Advanced Rocketry Club Inc (AARC)

Purpose

8.1 The purpose of this procedure is to control and utilise how electric match detonators will be managed within an ARA section.

8.2 The purpose of this procedure is also to control the assembly of ejection charge devices at ARA sections.

General

8.2.1 Upon a request from a section member to use an electric match detonator for the purpose of dual deployment the following procedure shall be followed;

8.2.2 One member shall be appointed in each section by the section head to control and distribute use of electric match detonators within a section. Example; In the case of AARC this member would be the Tech officer.

8.2.3 If required this member must have a current permit for the use of electric match detonators for the purpose of hobby rocketry.

8.2.4 The appointed member shall store, distribute and keep up to date records of all usage of electric match detonators.

8.2.5 The electric match detonators shall be distributed only at the launch site on the launch day for the purpose of assembly of ejection charge devices.

8.2.6 Any unused electric match detonators shall be collected at the end of the launch meeting and records adjusted accordingly.

8.2.7 Only authorised manufactured electric match detonators in a specific jurisdiction may be used.

8.2.8 Authorised explosives for use for assembly of ejection charge devices shall be limited to black powder (type FFFG or FFFFG) or smokeless powder with typical charges of 2 to 5 grams per device.

8.2.9 There shall be no exemptions to this procedure.

Storage

8.3.1 Storage of electric match detonators shall be in a designated secure authorised receptacle (EG ammo box) by the appointed member.

8.3.2 Exemptions; members who have their own permit with prior approval from the authority having jurisdiction (EG safework) may store electric match detonators themselves in an approved receptacle.

Usage

8.4.1 Members with prior approval shall be permitted to use electric match detonators.

8.4.2 Electric match detonators shall only be used for safe recovery of Hobby Rockets which are utilising electronic timers or altimeters and for the purpose of part of an assembly of an ejection charge.

8.4.3 There must be a safety means within the electronics to ensure that if a misfire occurs the recovery system can be made safe as per model and high power safety codes section 3 & 5 ignition systems. EG; safety key which renders electronics inactive**.**

Hybrid Pre-heater grains and pyro ignition

9 INTRODUCTION

Ignition of some types of hybrids require use of pre-heater grains in conjunction with an igniter. Due to the non-availability of hybrid pre-heater grains this procedure has been developed to ensure the safe use of alternative pre-heater grains.

SCOPE

This procedure is for use within all ARA sections when igniting hybrids of diameter sizes of 29mm, 38mm, 54mm, 75mm and 98mm.

PURPOSE

9.1 The purpose of this procedure is to discourage self-manufacture of alternative sources of pre-heater grains.

9.2 The purpose of this procedure is to provide clear concise guidelines for those who wish to utilise pre-manufactured reload kits used for solid motor propulsion.

9.3 The purpose of this procedure is to avoid misfires and catos in hybrid systems that utilise pre-heater grains.

GENERAL

9.4 When a section member wishes to use a Ammonium Perchlorate Composite Propellant (APCP) pre-heater grain for pyro ignition the following shall be followed.

9.4.1 The member may use any propellant type although it is considered best practice to use a fast burning propellant type. As specified by the following chart which shows the recommended amount of APCP pre-heater grain to be used for safe ignition of the motor, for the differing sized hybrids motor systems.

Note; The size and length quoted below are used by the most common hybrid systems on the market as is what most certified manufacturers use and recommend, please consult the assembly instructions to ensure the brand/manufacturer of hybrid being used, requests a differing size per-heater grain, in which case instruction should be followed.

9.4.2 29mm Hybrid motor systems;
Outer Diameter 24mm
Grain Length 10mm
C-slot size 08mm

9.4.3 38mm Hybrid motor systems;
Outer Diameter 29mm
Grain Length 12.5mm
Core hole size 10mm

9.4.4 54mm Hybrid motor systems;
Outer Diameter 29mm
Grain Length 15mm
Core hole size 12mm

9.4.5 75/98mm Hybrid motor systems;
Outer Diameter 54mm
Grain Length 19mm
Core hole size 15mm

9.5 The following pre-manufactured reload kits may be used for this procedure;

9.5.1 29mm Hybrids; Any 24mm reload kits

9.5.2 38mm Hybrids; Any 29mm reload kits

9.5.3 54mm Hybrids; Any 29mm reload kits

9.5.4 75/98mm Hybrids; Any 54mm reload kits

9.6 Disposal of reload kits

9.6.1 The propellant grains in reload kits shall be all used with no part of grain remaining.

9.6.2 Black powder from ejection charge shall be transferred into a sealed plastic container.

9.6.3 Delay trains shall be transferred into another container to be used for spare parts or alternatively donated to another member for their use.

9.6.4 Igniters shall be kept for future use.

9.6.5 Any other items such as o rings spacers and miscellaneous items not needed may be disposed of in bin or donated to another member.

9.7 Records

9.7.1 Records shall be kept by member of what reload kits were used for the procedure.

9.8 Launch site

9.8.1 This procedure may only be done at the launch site on the day of launching in the prep area.

9.9 ARA Certification

9.9.1 Commercially manufactured hybrid motors using the above procedure are considered certified by the ARA.

Chapter 8 Model Rocketry Safety Code

April 2008 Edition

1 Materials. My model rocket will be made of balsa, wood, paper or plastics or a combination of those materials, but contains no metal as structural parts.

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 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 meters away when I launch rockets with D motors or smaller, and 10 meters 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 motors 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 weight 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. If my model rocket weights more than 500 grams at lift off or produces more than 20 n-sec of total impulse or contains more the 25grams propellant I will check and comply with Civil Aviation Safety Regulations (CASRs) before flying.

8 Flight safety. I will not launch my rocket at targets, into clouds, or in a manner that is hazardous to persons or property, or near airplanes, or in the approach or departure paths of aerodromes or airports, and will not put any flammable or explosive payload in my rocket. **WARNING Large fines apply by CASA for non-compliance.**

9 Launch site. I will launch my rocket outdoors, in an open area at least as large as shown in the accompanying table, and in safe weather conditions with wind speeds no greater than 32 kilometers 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.

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.

Launch site dimensions

INSTALLED TOTAL IMPULSE	EQUIAVALENT MOTOR TYPE	SITE DIMENSION
(Newton-seconds)		(Meters)
0-1.25	1/4A&1/2A	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	2G	460

Chapter 9 High Power Safety Code

April 2008 Edition

1 Certification. I will fly high power rockets only when certified to do so by the Australian Rocketry Association. I will only fly high power rockets or possess high power motors that are within the scope of my user certification and required licensing.

2 Operating clearance. I will fly high power rockets only in compliance with Civil Aviation Safety Regulations (CASRs) and all other federal, state, territory, and local laws, rules and regulations.

3 Materials. I will only use lightweight materials such as paper, wood, rubber, plastic, fiberglass, or when necessary ductile metal, for the construction of my rocket.

4 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 meters of these motors.

5 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. If my rocket has onboard ignition systems for motors or recovery devices, these will have safety interlocks that interrupt the current path until the rocket is at the launch pad.

6 Misfires. If my rocket does not launch when I press the button of my electrical launch system, I will remove the launchers safety interlock or disconnect its battery, and will wait 60 seconds after the last launch attempt before allowing anyone to approach the rocket.

7 Launch safety. I will use a 5-secound countdown before launch. I will ensure that no person is closer to the launch pad than allowed by the accompanying minimum distance table, and that a means is available to warn participants and spectators in the event of a problem. I will check the stability of my rocket before flight and will not fly it if it cannot be determined to be stable.

8 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/h. 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 motors 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 if the rocket motor being launched uses titanium sponge in the propellant.

9 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 weight 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.

10 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 kilometers per hour. I will comply with Civil Air 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.

11 Launch site. I will launch my rocket outdoors, in an open area where trees, power lines, buildings, and persons not involved in the launch do not present a hazard, and that is as large on its smallest dimension as one-half of the maximum altitude to which rockets are allowed to be flown at that site or 460 meters, whichever is greater.

12 Launcher location. My launcher will be at least one half the minimum launch site dimension, or 460 meters (whichever is greater) from any inhabited 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 personal distance from the accompanying table from any boundary of the launch site.

13 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.

14 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.

Safe distance table in meters

Installed Total Impulse (Newton-Seconds)	Equivalent High Power Motor Type	Minimum Diameter of Cleared Area (mtr)	Minimum Personnel Distance (mtr)	Minimum Personnel Distance (Complex Rocket) (mtr)
160.01 -- 320.00	H	15	30	60
320.01 -- 640.00	I	15	30	60
640.01 -- 1,280.00	J	15	30	60
1,280.01 -- 2,560.00	K	25	60	90
2,560.01 -- 5,120.00	L	30	90	150
5,120.01 -- 10,240.00	M	40	150	300
10,240.01 -- 20,480.00	N	40	300	460
20,480.01 -- 40,960.00	O	40	460	610

Note: A complex rocket is one that is multi-staged or that is propelled by two or more rocket motors.

CHAPTER10 –High Power Rocketry Certification Procedures

INTRODUCTION

High Power Certification provides model rocket flyers a means to progress to larger rockets using more powerful motors. It aims to promote good modeling practices and safe operating procedures.

This procedure does not replace local, state, and federal laws, and additional permits/licenses for the use of high power motors may be required.

This study guide is available to all ARA members on request. A small fee is charged to cover printing and binding costs, or the document can be downloaded free from the ARA web site.

IMPORTANT - A ONE YEAR LAPSE IN MEMBERSHIP VOIDS CERTIFICATION AT ANY AND ALL LEVELS.

CERTIFICATION IS ONLY VALID WHILE BEING A CURRENT FINANCIAL MEMBER

ARA CERTIFICATION LEVELS

The following table lists the levels available to ARA Members and a summary of the requirements:

Level	Requirements	Flight Test	Certification will allow you to fly
1	ARA membership. Permits at state level if required. Experience in flying model rockets.	Fly an H or I powered rocket successfully.	H & I motors Total launch impulse up to 640Ns
2	Level 1 certification. ARA membership. Permits at state level if required.	Level 2 Exam. Fly a J, K, or L powered rocket successfully.	J, K, & L motors Total launch impulse up to 5,120Ns
3	Level 2 certification. ARA membership. Permits at state level if required.	Project file. Fly a M, N, or O powered rocket successfully.	M, N, & O motors Total launch impulse up to 40,960Ns

MINIMUM REQUIREMENTS FOR HPR CERTIFICATION

A person seeking HPR Certification must be over 18 years of age. A current Drivers License, Passport, or Birth Certificate are acceptable to use as proof of age if required. It is required and assumed that the individual applying for certification has had sufficient experience building and flying model rockets. (Note: The term 'sufficient experience', means that the individual has successfully flown more advanced model rockets in the mid-power range. Mid-power meaning E to G impulse class.)

The individual must be a member in good standing with the Australian Rocketry Association (ARA) at the time of certification. If requested by the ARA Section Delegate, proof of membership must be shown prior to the certification attempt.

Motors used for certification attempts must be currently certified by a reputable organisation with a recognized certification program. (eg; ARA, foreign NAR, TRA, NZRA, UKRA or CAR) Single-use, Re-loadable, and Hybrid motors may be used. The rocket must be launched in a single-motor configuration.

EXEMPTIONS

ARA members who are members of a foreign rocket club such as NAR, CAR, UKRA, NZRA or TRA and are level 1 certified or above will have their certifications honored at the ARA level via administrative means. Upon completing the identification procedure the member shall attach proof of current foreign membership certification (e.g.; photocopy of NAR or consumer confirmation card) to ARA headquarters with a request their certification level be updated.

DUTIES OF INDIVIDUALS

ARA SECTION DELEGATE

The Section Delegate is a section member who performs official administrative duties in relation to certifications and other official business of the ARA, who is delegated this authority by the Section Head. A section may have several section delegates to give flexibility.

The ARA Section Delegate must approve all certification attempts. Their task is to ensure that the certification attempt is genuine and to ensure that the necessary records are maintained. The ARA Section Delegate can liaise between the member, the ARA section Head, and Flight Test Officer to find the most suitable Flight Test Officer for the certification. A list and contact details of Flight Test Officers is available from the ARA on request. The ARA Section Delegate will give the final authorization upon a successful certification attempt.

FLIGHT TEST OFFICER

The duties of the Flight Test Officer include administering flight tests, administering Level 2 exams, and mentoring individuals applying for certification.

Only current ARA members who themselves are certified to the same level as the certification level required are qualified to administer the flight test. The Flight Test Officer must also be knowledgeable in the motor being flown. For example, if a hybrid motor is being used for the certification attempt, the Flight Test Officer must themselves have had a hybrid certification with experience in the assembly and flying of these motors. Hybrid Flight Test Officers have a H next to their certification level to distinguish them from others. It is the responsibility of the member requiring certification to contact both the ARA Section Delegate and a Flight Test Officer to confirm their availability at a launch to conduct the flight test. Members should be understanding and patient with scheduling. Flight Test Officers should especially make themselves available at launches to conduct the flight test.

Unavailability of Flight Test Officers

In the case of a Level 3 certification flight, if a Level 3 Flight Test Officer is unavailable, two Level 2 Flight Test Officers can substitute. Provided the ARA executive committee is satisfied the level 2 flight test officers have the necessary skills for this function.

In the case of a Level 2 certification flight, if a Level 2 or 3 Flight Test Officer is unavailable, two Level 1 Flight Test Officers can substitute. Provided the ARA executive committee is satisfied the level 1 flight test officers have the necessary skills for this function.

EXAM ADMINISTRATOR

A Flight Test Officer or Section Delegate may administer the Level 2 written exam. It is the responsibility of the member requiring certification to contact either the Flight Test Officer or the Section Delegate to determine a convenient time for both to take the exam. Members should be understanding and patient with scheduling. Section Delegates and Flight Test Officers should especially make themselves available by appointment, at launches or at meetings to administer the exam.

HPR FLIGHT TEST PROCEDURE (All Levels)

1. A flight test may be attempted at any ARA launch where a Flight Test Officer is available.

2. The ARA High Power Rocketry Safety Code must be adhered to as a minimum.

3. The individual attempting certification must complete an ARA High Power Certification Application form prior to their certification attempt and have all current permits/licenses or the supervision of a license holder to suit the state where the launch is to occur, if required by that states law. This includes (but is not limited to) pyrotechnics license for the state where the launch is to take place, air space clearance from CASA, council approvals, fire permits if required, and landowner's consent. In the case of a Level 2 attempt, the individual must pass the exam before attempting the flight test.

4. If certification to a level other than Level 1 is desired, the individual must provide proof of previous certification(s) at the discretion of the flight test officer.

5. The rocket will be subjected to a safety inspection prior to flight. The safety inspection form is on the back of or attached to the ARA High Power Certification Application form.

6. During the safety inspection the individual will be expected to answer oral technical questions related to the safety and construction of their rocket. The questions may include (but are not limited to) identification of the rocket's centre of gravity and centre of pressure, methods used to determine rocket stability, and interpretation of the rocket motor's designation. The Flight Test Officer will tick the appropriate boxes in the "pre-flight" section of the High Power Certification Application form.

7. The individual will construct and fly their own rocket.

8. The Flight Test Officer must witness the flight.

9. Stability, deployment of the recovery system, and safe recovery should be considered when evaluating safety of the flight.

10. Models experiencing a catastrophic failure of either the airframe, rocket motor and/or recovery system (e.g. shock cord separation) will not be considered as having a safe flight. The condition of the rocket should be that no repairs are needed to re-launch the rocket. This excludes cosmetic damage, damage caused by colliding with objects on landing, getting dragged by the chutes, or damage to the chutes after landing.

11. The model must be returned to the Flight Test Officer immediately after the flight and be inspected to verify motor retention and for evidence of flight-induced damage.

12. The Flight Test Officer will complete the relevant section of the High Power Certification Application form indicating that a safe flight was made and that the post-flight inspection was satisfactory. The Flight Test Officer will sign the certification application and forward the document to the ARA Section Delegate for processing.

13. The ARA Section Delegate will endorse the certification by signing the document. A copy of this document will be retained by the ARA section (state or local rocketry club or incorporation). The original document is kept by the individual as proof of certification.

14. The ARA Section Delegate forwards a summary of the details of the certification to the ARA Secretary who updates the ARA records.

LEVEL 2 CERTIFICATION - ADDITIONAL REQUIREMENTS

Flyer Requirements

Any individual attempting ARA Level 2 Certification must have a valid Level 1 certification and must be an ARA member in good standing.

It is a requirement that the Level 2 Certification Exam is successfully completed before a Level 2 certification flight is attempted.

Level 2 Certification Exam

The Level 2 certification exam is made up of twenty (20) Technical questions and ten (10) Safety Code questions. This is a closed-book written exam to be completed in the presence of the Flight Test Officer or ARA Section Delegate. People with a disability may request alternative arrangements where these do not conflict with the inherent requirements of the task being assessed, provided that these are reasonable adjustments. This may include such things as an oral exam, or the assistance of a person to physically write answers etc.

A passing score is 90% - no more than 3 missed questions out of 30. Upon successful completion of the Level 2 Certification Exam, the Flight Test Officer will keep the exam with the certification application.

Members who fail an exam shall not be allowed to re-take the exam for a minimum of seven (7) days. Failed exams shall not be kept on file.

LEVEL 3 CERTIFICATION – ADDITIONAL REQUIREMENTS

Flyer Requirements

Any individual attempting ARA Level 3 Certification must have a valid Level 2 certification and must be an ARA member in good standing.

A project file must be presented to the Flight Test Officer before the certification flight with sufficient time for the Flight Test Officer to analyse the information. This will include (but not limited to):

- Drawings of the rocket showing airframe components, fins, bulkheads, longerons, adhesive joints, recovery system components, payloads, etc.
- Stability calculations/simulations.
- Flight simulations.
- A parts listing that includes material descriptions, adhesive types, screw sizes, gauges, thicknesses, etc.
- Schematics of recovery system electronics that show batteries, circuit designs, wiring diagrams, etc.
- Pre-flight checklist describing field assembly of the rocket, motor installation, recovery system preparation, launcher installation, system arming, etc.

Rocket Requirements

1. The certification rocket must be substantially built by the individual applying for certification. "Substantially built" will be defined, as a minimum, as:

   a) Fabrication of the engine mount with centering rings (if applicable).
   b) Alignment and mounting of the individual fins (prefabricated fin canisters are specifically disallowed).
   c) Installation of attachment points for the recovery system.
   d) Mounting and installation of airframe electronics.
   e) Final flight preparations including pyrotechnics installation, recovery system packing, motor assembly (as required) and motor installation.

Only the builder of the rocket may use that rocket for a certification attempt – anything outside this is specifically disallowed. Certification rockets may be built from commercially available kits and may contain components built to the specifications of the individual but fabricated by others.
For example, fins can be fabricated by someone else, however, they must be mounted by the individual applying for certification.

2. The recovery system must have a backup method of deployment. Redundancy must be present in the power sources, recovery control electronics and output devices (e.g. bridge wires, electric matches). Redundancy is not required in the pyrogen materials, parachutes, attachment points, risers, and disconnects.

   All attachment points of the recovery gear must be secured to prevent unplanned detachment during flight, that is to say any bolts are to be prevented from spinning, rope attachments especially knots are to be held tight using tape, shrink on, laced etc.

   Rockets recovered by alternate methods, e.g. glide or autorotation, must be reviewed by a Flight Test Officer on a case-by-case basis.

   Motor ejection charges may be used as part of a redundant system but not as the primary ejection for any recovery event.

   All chutes, electronics, and ropes of recovery system are to be protected from heat damage (not including cosmetic damage) that arises from pyrogen ejection charges.

   A safe rate of descent of 20ft/sec (or 6m/sec) or slower is recommended within 2,000 feet (600m) of landing for any component weighing in excess of 22.6 grams.

3. External safe and arm provisions must be installed on a rocket for any items that have onboard control of an explosive charge, projectile or motor. This means the ability to physically break the connection between a pyrotechnic device and its power source.

4. The rocket must conform in all respects to any restrictions imposed by the ARA.

LEVEL 2 CERTIFICATION QUESTIONS

PART A (Technical Questions)

1. How does Newton's Third Law "To every action there is always an equal and opposite reaction" relate to rocketry?

a. That the blast deflector must be strong enough to push the rocket off the launch pad at ignition.
b. That a rocket flies because the rocket motor "pushes" the rocket in a direction opposite of the exhaust jet.
c. That the thrust of a rocket motor is proportional to the air density at the launch site.

2. What are the three forces acting upon a rocket during the course of its flight?

a. Thrust, rocket diameter and finish.
b. Nose cone shape, thrust and drag.
c. Gravity, thrust and aerodynamic drag.

3. What are the major factors that determine the maximum altitude of a high power rocket in vertical flight?

a. Lift-off weight, propellant weight and motor thrust.
b. Fin size, propellant weight and motor thrust.
c. Motor thrust, weight and aerodynamic drag.

4. For an inherently stable rocket, what is the relationship of center of gravity (CG) to the center of pressure (CP)?

a. The CG must be behind the CP relative to the desired direction of flight.
b. The CG must be forward of the CP relative to the desired direction of flight.
c. The CG must be in front of the fins of a rocket.

5. The centre of pressure (CP) of a rocket is generally defined as:

a. The balance point of the rocket without the motor.
b. The total area of the fins, airframe and nose cone divided by two.
c. The point at which aerodynamic lift on a rocket is centred.

6. What is the "rule-of-thumb" for a stable rocket?

a. That the centre of gravity is one body diameter in front of the centre of pressure.
b. That the centre of gravity is at the same point as the centre of pressure.
c. There is no rule-of-thumb because there are too many variables.

7. When determining the center of gravity (CG) of a rocket with a heavier motor at the launch site, one can:

a. Install the motor, recovery system and payload and determine the balance point of the rocket as it is ready for flight.
b. Balance the rocket with an empty motor because that is the condition of the rocket after motor burnout.
c. It is not necessary to test for the centre of gravity when using a more powerful motor because it has more thrust.

8. What happens to the center of gravity (CG) of a rocket during a solid rocket motor's thrusting phase?

a. The Centre of gravity stays the same.
b. The Centre of gravity shifts forward.
c. The centre of gravity shifts aft.

9. How can a statically unstable rocket be made stable?

a. Using a heavier motor.
b. Adding weight to the nose.
c. Making the rocket shorter.

10. What are three methods used to shift the center of gravity (CG) of a rocket forward?

a. Add weight to the nose, make the rocket longer, install larger fins.
b. Add weight to the nose, make the rocket longer, use a smaller (or lighter) motor.
c. Add weight to the nose, make the rocket shorter, use a smaller motor.

11. What are three methods used to shift the center of pressure (CP) aft?
a. Make the rocket shorter, use larger fins, increase the number of fins.
b. Make the rocket shorter, use smaller fins, add weight to the nose.
c. Make the rocket shorter n change the number of fins, use a longer launch rod,

12. What is the definition of coefficient of drag (Cd)?
a. A dimensionless number that represents the effect of gravity and Mach number of the rocket.
b. A dimensionless number representing the rocket configuration, Mach number and angle of attack.
c. A dimensionless number that represents the friction of the launcher and launch velocity.

13. What happens to the coefficient of drag (Cd) as the rocket approaches the speed of sound?
a. The Cd decreases.
b. The Cd stays the same.
c. The Cd increases.

14. For a subsonic rocket, what major factors affect the coefficient of drag (Cd)?
a. Motor thrust, body diameter, nosecone shape and fin shape.
b. Speed, airframe dimensions, nosecone shape and fin shape.
c. Gravity, airframe dimensions, nosecone shape and fin shape.

15. The flight of a high power rocket can be separated into three portions; they are:
a. Ignition, burnout and peak altitude.
b. Powered flight, un-powered ascent and peak altitude.
c. Powered flight, un-powered ascent and descent.

16. What is the function of a motor liner and the O-ring seals in a solid rocket motor?
a. To hold all of the parts in place prior to ignition of the rocket motor.
b. To make the motor easier to clean if it is a reloadable motor.
c. To keep the hot gasses of the motor from burning or melting the motor case.

17. What is the most common oxidizer in commercially available high power composite solid rocket motors?
a. Ammonium Perchlorate.
b. Ammonium Nitrate.
c. Ammonium Chlorate.

18. A small hole is typically recommended near the top, but below the nosecone or payload section, of a high power rocket's booster section. Why?
a. This hole allows excessive ejection charge pressures to vent to reduce shock cord stress.
b. The hole is used to give air pressure readings for on-board altimeters.
c. The hole vents internal air pressure as the rocket gains altitude to prevent premature separation.

19. A rocket with a motor cluster consisting of a central composite motor and four black powder motors using thermalite igniters or electric matches:
a. will result in all motors starting about the same time.
b. will result in the composite motor starting first followed by the black powder motors.
c. will result in the black powder motors starting first followed by the central composite motor.

20. In general terms, the specific impulse of a rocket motor is:
a. The total thrust force of a motor throughout its action time.
b. The total impulse divided by unit weight of propellant.
c. Dependent on the diameter and length of the propellant grain.

21. In general terms, the total impulse of a rocket motor can be described as:
a. The product of the average motor thrust and its burn time.
b. The product of the propellant weight and its burn time.
c. The product of the propellant weight and the motor thrust.

22. The average thrust of a rocket motor is 100 Newtons and the burn time is 4 seconds, what is the total impulse?

a. 25 Newton-seconds
b. 400 Newton-seconds
c. 400 Newton's

23. Which motor has a higher total impulse?

a. J200
b. J400
c. K200

24. Which motor has a higher average thrust?

a. J200
b. J400
c. K200

25. What is the difference between a J640 and a J320 high power rocket motor (assume full 1280 Newton-second J motors)?

a. The J320 burns out twice as fast as the J640.
b. There is no difference between the motors, the numbers are manufacturer reference only.
c. The J640 burns out twice as fast as the J320.

26. Which of the following has a total impulse in the J motor range?

a. It = 600 Newton-seconds
b. It = 1000 Newton-seconds
c. It = 1290 Newton-seconds

27. What is a Newton?

a. The amount of force required to accelerate one pound one foot per second per second.
b. The amount of force required to accelerate one kg, one foot per second per second.
c. The amount of force required to accelerate one kg, one meter per second per second.

28. What does the motor designation I220-8 mean?

a. The motor is in the I impulse range with an average thrust of 220 Newton's and an 8 second delay from motor ignition.
b. The motor is in the I impulse range, having a total impulse of 620 Newton-seconds with an average thrust of 220 Newtons and an 8 second delay from motor burn-out.
c. The motor is in the I impulse range with an average thrust of 220 Newtons and an 8 second ejection delay from motor burn-out.

29. What is the purpose of a launch rod, rail or tower?

a. To keep the rocket pointing in the right direction prior to flight.
b. To control the rocket's flight long enough to allow aerodynamic stability.
c. Both a and b.

30. What is the purpose of a launch lug?

a. To add drag to the rocket at launch.
b. To guide the rocket along the launch rod or rail.
c. Both a and b.

31. A rocket with a motor cluster consisting of a central composite 54mm J415 motor and four 29mm G80 composite motors using thermalite igniters or electric matches:

a. will result in all motors starting about the same time.
b. will result in the J415 motor starting first followed by the G80's.
c. will result in the G80's starting first followed by the J415.

32. What can happen if all the motors of a cluster do not ignite at launch?

a. Nothing, the rocket is inherently stable.
b. The rocket may not fly straight.
c. The rocket will shred.

33. What is a shred?

a. A failure of the rocket air frame during boost resulting in destruction of the rocket.
b. A failure of the recovery system during boost.
c. A failure of the motor causing early ejection.

34. What is a Cato?

a. A failure of the rocket resulting in failure of the air frame during boost.
b. A failure of the recovery system during boost.
c. A failure of the motor causing flight termination.

35. What is the primary requirement for a rocket motor igniter?

a. It must transfer sufficient heat to the propellant to assure ignition.

b. It must produce hot, high velocity gasses to assure ignition.
c. It must have a high resistance to be reliable.

PART B (Safety Code)

1. What is a complex high power rocket?
a. A rocket having more than one stage.
b. A rocket having a cluster of rocket motors.
c. Both a and b.

2. What are the rocket motor criteria (minimum) that defines a high power rocket?
a. A rocket with a single motor with more than 160 Newton-seconds total impulse or an installed impulse of 320 Newton seconds and no more than 40,960 Newton-seconds.
b. A rocket with a single motor having an average thrust in excess of 80 Newton's.
c. Both a and b.

3. What is the lower weight limit of a high power rocket?
a. A rocket weighing more than 1500grams.
b. A rocket weighing less than 20kg.
c. Both a and b.

4. When is a recovery device not necessary in a high power rocket?
a. When the high power rocket is intended for ballistic flight.
b. When the rocket has a bursting charge.
c. A recovery device is always necessary.

5. A high power rocket may be constructed of what materials?
a. Paper, wood, rubber**,** fiberglass or plastic with a minimum amount of metallic parts.
b. Paper wood, fiberglass, plastic and aluminum.
c. There are no restrictions on construction materials.

6. What is a high power rocket motor?
a. A rocket motor with more than 80 Newton-seconds of total impulse and 80 Newton's average thrust.
b. A rocket motor with more than 160 Newton-seconds of total impulse or 80 Newton's average thrust.
c. A rocket motor with more than 160 Newton-seconds of total impulse and 160 Newton's average thrust.

7. What are the structural or load-bearing parts of a high power rocket?
a. Nose cone, body tube and motor mount.
b. Nose cone, body tube and fins.
c. Nose cone, motor mount and fins.

8. Who may operate a high power rocket?
a. Any member of a nationally recognized rocketry organization.
b. Only those licensed by the federal government.
c. A person that is a member of a rocketry club and is certified to fly high power rocketry.

9. What criteria apply to the construction of a high power rocket?
a. Use suitable materials to withstand operating stresses and retain structural integrity in flight.
b. Use only the lightest weight materials for the construction-of high power rockets
c. Use materials that allow minimal flex of the rocket in flight.

10. When must the stability of a rocket be determined?
a. If the safety monitor requests it.
b. When designing a new rocket.
c. Before its first flight, except when launching a rocket of already proven stability.

11. What is the maximum weight of a high power rocket?
a. Less than maximum weight recommended by the motor manufacturer for a given motor.
b. Less than 50kg.
c. There is no maximum high power rocket weight.

12. When is it permissible to catch a high power rocket?
a. If the rocket weights less than 2.2 pounds or 1 kg.
b. It is never permissible to catch a high power rocket.
c. Neither a or b.

13. What payloads are not permitted in a high power rocket?
a. Payloads that are flammable or explosive or intended to cause harm.

b. Vertebrate animals.
c. Both a and b.

14. When must a high power rocket launching device incorporate a blast deflector?

a. When necessary to prevent the rocket motor's exhaust from impinging on flammable materials.
b. All launch systems must incorporate a blast deflector.
c. When the design of the launch device requires it.

15. What is the maximum launch angle from vertical for a high power rocket?

a. 30°
b. 20°
c. There is no maximum launch angle.

16. What are the elements of an ignition system?

a. Remotely controlled, electrically operated, a launch switch that returns to OFF when released.
b. Remotely controlled, electrically operated and a removable safety interlock in series with the launch- switch.
c. Remotely controlled, electrically operated, a launch switch that returns to OFF when released and a removable safety interlock in series with the launch switch.

17. When can a high power rocket be flown through cloud?

a. When authorized to do so by the Range Safety Officer (RSO).
b. When authorized to do so by the Range Safety Officer (RSO) and with written permission from CASA.
c. Neither a or b.

18. What is the limit of surface wind for launching a high power rocket?

a. 42kph.
b. 32kph.
c. 22kph.

19. When/What is the minimum distance from an occupied building or public highway for a launch site?

a. 260 meters.
b. 460 meters.
c. No Minimum distance.

20. When may a high power rocket be launched?

a. After warning the spectators and giving a 5 second countdown.
b. When all systems are ready and after a 5 second countdown.
c. After informing & getting permission and attention from the RSO.

21. What permit must be obtained to purchase high power rocket re-load engines?

a. Blasting Permit from authorized blasting operator.
b. No Permit required.
c .Permit at a state level if required.

22. What is the storage requirements of rocket motors, motor reloading kits and pyrotechnic modules in your state or territory jurisdiction?

a. None.
b. Not in a dwelling.
c. As described by local jurisdiction regulations.

23. When may a solid propellant high power rocket motor be shipped and stored with the igniter installed?

a. It is never permissible to ship or store a solid propellant high power rocket motor with the igniter in place.
b. When the rocket will be launched within 48 hours of igniter installation.
c. Neither a or b.

24. What is the age limit Australian Rocketry Association recognizes for a certified solid propellant high power rocket motor user?

a. 21 years of age.
b. 18 years of age.
c. There is no age limit.

25. What is the maximum altitude allowed for flying HPRs if there is a cloud ceiling of 3000ft

a. 3500ft.
b. To the limit of the CASA permission
c. Neither a or b.

LEVEL 2 EXAM QUESTION ANSWERS

Answers: Part A (Technical)

1. **b**. The rocket motor's thrust causes the rocket to accelerate in the direction opposite the motor's thrust. Thus a rocket motor pushes only on the rocket, not on the air or launch pad.
2. **c**. Gravity, thrust and drag are the forces acting on a rocket.
3. **c**. The motor thrust, weight and aerodynamic drag are the primary forces considered when determining the altitude of a rocket. Please note that the weight of the rocket must consider the lift-off weight and the weight at burn-out to be complete.
4. **b**. The centre of pressure (CP) is where the aerodynamic lift, due to the rocket being at a non-zero angle of attack, is centred. For an aerodynamically stable rocket with the CP behind the centre of gravity(CG)n the lift which is centred aft of the CG will create a corrective moment to return the rocket to zero degrees angle of attack. Conversely, if the CP is ahead of the CG the lift will attempt to turn the rocket around so that the CP will again be behind the CG. This resultant "tumbling" is characteristic of an unstable rocket.
5. **c**. The centre of pressure (CP) is the point on the rocket where the aerodynamic lift is centred, This means that aerodynamic lift, if the rocket is at a non-zero angle of attack, forward of this point is balanced by the aerodynamic lift aft of that point.
6. **a**. Keeping the centre of gravity (CG) one body diameter in front of the centre of pressure (CP) typically allows an adequate margin for rocket stability.
7. **a**. Measuring the centre of gravity (CG) by balancing the rocket requires that the rocket be prepared as though ready for flight. It is especially important to check when using a heavier motor than previously flown.
8. **b**. As the propellant burns the motor gets lighter and thus moves the balance point or centre of gravity (CG) forward, This is why a marginally stable rocket will "act squirrelly" at launch, then stabilize and fly straight.
9. **b**. Adding enough weight to the nose will shift the centre of gravity (CG) forward of the centre of pressure (CP).
10. **b**. Moving the CG forward requires judicious design changes. The following are given as "rules-of-thumb," n Adding weight to the nose moves the CG forward by counterbalancing the rocket. Think of the rocket as a lever' making the rocket longer shifts the CG forward by making the lever longer. Using a smaller (or lighter) motor reduces the weight aft thus shifting the CG forward.
11. **a**. Moving the CP aft requires judicious design changes. The following are given as "rules-of-thumb." increasing the total fin area will move the CP aft. This can be accomplished by increasing the area on each fin and/or increasing the number of fins. The CP can also be shifted aft by making the rocket shorter. This alone is generally not preferred because the CG is also shifted aft and CP/CG stability relationship may be compromised.
12. **b**. The coefficient of drag (Cd) is a number that is used in equations for calculating the aerodynamic performance of a rocket. Values that make up the Cd are the rocket configuration (nose cone shape, airframe diameter(s), transition sections, fin size and sharpen etc.), the rocket velocity as Mach number and the angle of attack.
13. **c**. The coefficient of drag (Cd) increases and can be greater than 1 as the rocket exceeds Mach 1.
14. **b**. As speed increases, the drag number changes. The length and diameter of the rocket factors into the total surface area, The nose cone shape effects the airflow over the front of the nose cone. The fin shape and fin area factor into the total surface area.
15. **c**. The three phases of flight of a high power rocket: (1) Powered flight - the period of time when the rocket motor is producing thrust against gravity and drag. (2) Un-powered ascent - the period after powered flight where the rockets momentum allows the rocket to coast to peak altitude and is effected by gravity and drag, (3) Descent - the return of the rocket to earth effected by gravity and drag.
16. **c**. The liner serves to keep the burning propellant (typically >5000°F) from touching the motor case (aluminum melts at 1075-F) while the O-rings seal the ends to keep the hot gasses where they belong, that is going out of the nozzle.
17. **a**. Ammonium Perchlorate is NH4CIO4 and is used in practically all modern solid rocket motors.
18. **c**. Air pressure external to the rocket decreases as the rocket ascends. Trapped (higher) pressure within the rocket can prematurely separate the rocket. The hole vents this internal pressure to prevent separation. Note: The hole size is dependent on the size of the rocket and volume of air to be vented; larger airframes require larger holes. Use caution in locating the hole so the nose cone or payload coupler does not block the hole. Be sure to position the hole such that ejection charge pressure is not vented before recovery system deployment.
19. **c**. black powder motors do not have a significant start up time and will ignite as soon as a flame front is encountered. Ammonium perchlorate based composite motors require heat and pressure to start the

combustion process and generally require at least a half-second before ignition occurs.

20. **b**. specific impulse is a term used to define the efficiency of a rocket propellant and is the total impulse derived from a given mass of propellant.
21. **a**. Total impulse is the amount of thrust produced by a motor over its action time. For instance, a motor may produce 10 pounds of thrust for 4 seconds resulting in a total impulse of 40 pound-seconds.
22. **b**. Multiply the average thrust (100 Newton's) by the burn time (4 seconds) to get the total impulse of 400 newton-seconds.
23. **c**. The J motor has a range of 641 to 1280 Newton-seconds and the K motor has a total impulse range of 1281 to 2560 newton-seconds.
24. **b**. Even though the total impulse of the K motor is greater than the J motor, the J motor's average thrust is 400 Newton's versus the K motor's 200 Newton's.
25. **c**. The burn time is determined by dividing the total impulse (J = 1280) by the average thrust of each motor. The burn time for the J640 is: 1280 Newton-seconds divided by 640 Newton's = 2 seconds, and for the J320 is: 1280 Newton-seconds divided by 320 Newton's = 4seconds.
26. **b**. A J motor is in the range of 640.01 to 1280 Newton-seconds. Therefore, a 1000 Newton-second motor is a midrange J. The 600 Newton-second motor is an I motor and the 1290 Newton-second motor is a K motor.
27. **c**. The Newton is an international (metric) unit of force and is the force required to accelerate one kg (2.2 lbs) one meter (39 inches) per second per second.
28. **c**. This is an I motor with a total impulse range of 320.01 to 640 Newton-seconds, an average thrust of 220 Newton's and an ejection delay of 8 seconds from burn-out.
29. **c**. The purpose of the launch rod, rail or tower is to guide the rocket at the beginning of its flight to allow it to gain sufficient velocity for a stable flight. This is achieved when the air flowing over the rocket and its fins allows the rocket to correct its flight by forcing rotation around the rocket's centre of gravity,
30. **b**. The launch lug attaches the rocket to the launch rod or rail allowing the rocket to be guided by the rod or rail at launch.
31. **c**. Composite (Ammonium Perchlorate) motors require heat and pressure to ignite. The motor core diameter is smaller in the 29mm G80 motors and heat and pressure is more concentrated resulting in faster ignition of the motors.
32. **b**. Not having ignition of all clustered motors results in the thrust being unsymmetrical. This unbalanced thrust may force the rocket to fly in an unanticipated arc that will not achieve a vertical flight.
33. **a**. A shred happens when the rocket is improperly built or has a rocket motor too powerful for that particular rocket. The typical shred sequence is that the velocity of the rocket has increased to a point where airframe, fins or other structural parts cannot take the loads. When that part fails, it typically causes the rocket to become unstable resulting in the rapid destruction of the rocket.
34. **c**. A Cato is short for catastrophic motor failure. This occurs when the nozzle, forward bulkhead or casing fails. The immediate result is abrupt termination of thrust which results in the rocket failing.
35. **a**. A motor igniter must deliver sufficient heat to the propellant to get it ignited. This may be in the form of hot gas, hot burning particles, a hot wire or a combination of all three.

Answers : Part B (Safety Code)

1. c.
2. c.
3. a.
4. c.
5. a.
6. b.
7. b.
8. c.
9. a.
10. c.
11. a.
12. b.
13. c.
14. b.
15. b.
16. c.
17. c.
18. b.
19. b.
20. c.
21. c.

22. c.
23. a.
24. b.
25. c.

ARA High Power Certification Application updated 2/2012

Personal Details (Completed by applicant)

Surname : _____ First Name : _____

Address : _____

D.O.B : _____/_____/_____ Contact Phone : _____

ARA # : _____ Expiry : _____

I, _____, certify that I am a member in good standing of the Australian Rocketry Association. I am 18 years of age or older. I understand that I must comply with all applicable federal, state, and local laws or regulations during and after this certification attempt.

Signed: _____, Date: _____/_____/_____

Certification Details

Certification Level: _____ Motor(s) Used: _____ Manufacturer: _____

☐ 1st Time Certification ☐ Re-Certification (Not required to pass written test again)

Practical Certification Examination (Performed by certification officer(s))

Pre-Flight

☐ Certification Exam Passed (See reverse for details)

☐ Minimum Experience for Required Certification

☐ CASA permission for expected Alt (If required)

☐ Motor Certified

☐ Safety Checklist completed (See reverse of this form)

Launch/Flight/Recovery

☐ Stable flight

☐ Successful Chute Deployment

☐ Recovered safely

Post Flight

☐ Model recovered without major Damage

☐ Motor(s) retained

☐ Attempt successful

☐ Attempt NOT Successful

Reason : _____

Certification Statement (Completed by certification officer(s) if attempt successful)

I/we the undersigned, being financial members of ARA and duly qualified to supervise this level ___

Attempt, have witnessed _____ARA #: _____ demonstrate skills required to successfully build, prepare, launch and recover a High Power Rocket.

This member is deemed qualified to build and launch High Power Rockets with a total installed impulse up to **640NS / 5120NS / 40,960.00** at ARA and/or CASA approved launch sites.

Full Name (Print) : _____ ARA #: _____

Body Tube : Is the body tube thickness adequate to withstand high power flight (typically 1.25mm / 0.05 inch walls or thicker)? Is there signs of pre-existing damage which may weaken the model structure (eg. tube crimps)? Are screws and fasteners tight, if used?	

Launch Lugs : Are the launch lugs securely fastened to the model?. Verify no cracking of adhesive joints. Is/are the launch lug(s) appropriately sized for the model, typically 1/4 inch or larger diameter? Will the launch lugs bind on the launch rod? Taped on launch lugs are not permitted.	
Motor Selection : Is the motor chosen for the certification flight sufficient to safely fly the model? Is the delay time suitable for the flight (i.e., is the predicted ejection charge time on or around apogee?).	
Motor Retention : Is the motor suitably retained in the rocket (i.e. motor hook or other system required to prevent motor ejection)? Is an engine mount used? What adhesives were used to fix the engine mount? Check friction fit motors for tightness.	
Fin Section : Are the fins fully secured to the model? Check for looseness or cracking at the fin to body tube junction. "Through the wall" construction is recommended for high power models. How are the fins mounted, what adhesives were used (epoxy is preferred), and what fin material was used. Are the fins mounted parallel to the roll axis of the model? Are any significant warps present, which may cause erratic flight?	
Stability : Is the rocket stable? If stability is in doubt, ask for verification of CG and CP locations (remember CG should be forward of the CP by approximately 1.0 body tube diameters). If required, how were CG / CP locations calculated? Confirm that CG/ CP locations were calculated with model in "ready to fly" configuration (i.e. motor inserted, and recover system loaded).	
Predicted Height : What is the predicted altitude of the rocket, and how was this calculated. Will the rocket fly within the CASA permission allocated for the launch time and location?	
Recovery System : Inspect the recovery system. Check that the shock cord is adequate (with no fraying or burns), and that the shock cord mount is sufficient to withstand the recovery load. If in doubt, do a "pull test" on the recovery chute and cord. Confirm that there is chute protection (i.e. Baffle, wadding, piston, etc.).	
Electronics : If on-board electronics are used to ignite main engine and/or recovery, confirm that the battery, circuit board and connections are adequate to withstand "g" loads during acceleration. Supervise and confirm arming of electronics immediately prior to launch.	
Pre Flight Minimum Flight Requirement (EXAMPLE 5 x Re-Loads) :	

Certification Exam Details :

Score : _____% Administrator (Print) : _____ ARA # ___

Signature : _____ Date : _____/_____/_____

Safety Checklist

CHAPTER 11 – Sporting Codes

Model Rocket and High Power Motor Standards

4.1 Definition
Model Rocket and High Power motors shall meet the requirements of the ARA / NAR Standards and Testing Committee and NFPA 1125 code for the manufacture of Model Rocket and High Power Motors (2012 edition) .

4.2 Reloadable Motors
Only reload kits that are presented in factory, new, unopened packages may be used. As part of the check-in procedure, the contestant must present the reloadable motor and reload kit for inspection to determine proper type and tampering. The type of reload kit, the motor case designation, and the letters “RMS” must be recorded on the flight card. The reload kit and motor case will then be returned to the contestant for normal prepping and check-in. In the case of multiple reloads in a single kit, the contestant will remove the required components from the kit for prepping and the remaining items in the kit will be impounded at check-in for further use and returned at the end of the competition.

4.3 Limits

A single solid propellant model rocket motor shall contain no more than 62.5 grams of propellant, and shall produce no more than 160.0 Newton-seconds of total impulse. Exception; Model Rocket Motors shall be permitted to contain 125grams propellant and have a total impulse of 320 Newton Seconds as described in CASA part 101 legislation but shall not be permitted to have an average thrust exceeding 80 Newton Seconds with such motors only available to certified persons over 18 years old.

4.4 Certification
All motors used in a model rocket in ARA sanctioned competition, or for the purpose of establishing a Performance Record, shall be of a type currently holding ARA Contest Approval. No model rocket motor shall be flown at any ARA Sanctioned activity unless that motor holds current ARA Certification.

4.5 Alterations
A model rocket motor shall not be altered in any manner that changes its dimensions and/or its performance characteristics. No material shall be affixed to the motor in a permanent fashion (e.g., via glues or epoxies).

4.6 Classification
An ARA-certified model rocket motor is assigned a type classification based on its mean sea total impulse at a temperature of 20 degrees Celsius as determined in static tests conducted by the ARA Standards and Testing Committee. ARA-certified model rocket motor classifications are as follows:

Motor Class	Total Impulse (N-sec)
1/8A	0.00 – 0.3125
1/4A	0.3126 – 0.625
1/2A	0.626 – 1.25
A	1.26 – 2.50
B	2.51 – 5.00
C	5.01 – 10.00
D	10.01 – 20.00
E	20.01 – 40.00
F	40.01 – 80.00
G	80.01 – 160.00

4.7 Published Values
The total impulse values measured and published by the ARA Standards and Testing Committee shall be the values used in all ARA sanctioned competition and for Australian Model Rocket Performance Record attempts.

4.8 Total Impulse
When multiple motors are used in a single model rocket (e.g., clustering and staging), the total impulses of the individual motors shall be summed to compute the total impulse of the configuration and to determine the impulse class of an event for which the model qualifies. Only those motors actually intended to ignite and produce useful thrust are to be included in this total.

4.9 Contest Approval
ARA Contest Approval shall be granted only to model rocket motors that are currently and readily available commercially, and that also meet the requirements of Rule 4.1 through Rule 4.8.

4.10 Contest Use
All Contest Approved motors shall be permitted in any ARA sanctioned competition for which the total impulse of the motor is appropriate for the event and in compliance with state and local laws.

REQUIREMENTS

5.1 Range Safety Officer
During all operations concerned with the launching and flight of model rockets, all authority for the safety of operations on the flying field shall be vested in a Range Safety Officer (RSO) who must be a Senior member of the ARA in good standing.
Deputy Range Safety Officers who are Senior members of the ARA in good standing may have this authority delegated to them by the RSO, but this delegation of partial authority does not relieve the RSO of the overall responsibility and authority on the flying field. If the RSO leaves the flying field, he must relinquish his/her duties and responsibilities to a new RSO who must be a Senior member of the ARA.

5.2 Flying Field
The flying field shall have a ground area whose shortest dimension is no less than one-fourth (1/4) the anticipated maximum altitude of the rockets to be flown. The flying field should not contain or be adjacent to high voltage lines, major highways, multi-story buildings, or other obstacles. The launching location shall be no closer than 10 meters to the boundaries of the flying field.

5.3 Safety Check
All model rockets presented for operation on the flying field shall be permitted or denied flight by the Range Safety Officer or their duly authorized deputy on the basis of his/her considered judgment with respect to safety.

5.4 Launching Device
A launching device or mechanism must be used that shall restrict the horizontal motion of the model until sufficient flight velocity is attained for reasonably safe, predictable flight. A launch rod composed of approximately one meter of 1/8" diameter rod is suggested for light models and models using less than 20 Newton-seconds of impulse. For heavier or higher powered models, a launch rod composed of approximately one meter of 3/16" or 1/4" diameter rod is recommended. A launching angle of less than thirty degrees from the vertical must be used.

5.5 Momentum
A launcher must not impart to the model any velocity or change of momentum except that caused by the model rocket motor(s) contained in the model.

5.6 Ignition
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 fully under the control of the person launching the model. All persons in the vicinity of any launching must be advised that a launching is imminent before a model rocket may be ignited or launched. A minimum five second audible countdown must be given before ignition or launching of a model rocket. Contestants will always be allowed to use their own launchers, and to launch at the time of their choice, within limits placed by the RSO.

Sanctioned Competition

6.1 ARA Contest Board

The **ARA Contest Board** will sanction competition, which is conducted in accordance with the rules set forth Model Rocket Sporting Code. See Rule 6.8.

6.2 Contest Year
The Contest Year shall begin on July 1, end on June 30 of the following year, and include the National Meet immediately following.

6.3 Sanctions
Competition sanctioned by the ARA shall be classified as follows:

6.3.1 Section Meet
This is a competition among the members and guests of a chartered section of the ARA. Competition points awarded at a Section Meet may not be credited to a chartered section other than the section sponsoring the meet. Section Meets have a Contest Factor of 1.

6.3.2 Local Meet
This is a competition in which either:
a) Two or more chartered ARA sections compete against one another; or
b) Participation is open to all ARA members in a geographical area determined by the sponsor.
A Local Meet may be sponsored by either a chartered section of the ARA, or by an individual member of the ARA. Local Meets have a Contest Factor of 1.

6.3.3 Open Meet
This is a competition in which either:
a) Two or more chartered ARA sections compete against one another; or
b) Participation is open to all ARA members in a geographical area determined by the sponsor.
An Open Meet may be sponsored by either a chartered section of the ARA, or by an individual member of the ARA.
No fewer than five **contestants** must be present. No more than 3/4 of the contestants may enter as members of the same chartered section of the ARA. Open Meets have a Contest Factor of 2.

6.3.4 Regional Meet
This is a competition that is both open to and attended by ARA members from a wide geographic region. A Regional Meet must satisfy one or more of the following criteria:
a) The contestants represent two or more states;
b) One or more contestants are represented from a distance of at least 100 Kilometers from the site of the meet; or
c) One or more contestants are represented from an area that is sufficiently large that the National Contest Board gives a Contest Director explicit approval to hold a Regional Meet.
A Regional Meet may be sponsored by either an ARA chartered section, or by an individual ARA member. No fewer than ten contestants, including proxy-flown contestants, must be represented. No more than 2/3 of the contestants may enter as members of the same chartered section of the ARA. The Contest Director may set a maximum number of contestants that are to be allowed at a Regional Meet. If such a limit is imposed, it must be stated on the Application for a Contest Sanction. Applicants shall not be denied the right to compete on any other basis, with the exception of previous misconduct as specified in Rule 11.4. Regional Meets have a Contest Factor of 3.

6.3.5 National Meet
Only one National Meet shall be held each year. The National Meet will be held at such time and place and with such entry requirements as shall be determined by the ARA Contest Board. The National Meet shall have a Contest Factor of 8.

6.3.6 Record Trial
This type of meet is conducted for the purpose of providing an opportunity and facilities for attempts to establish or surpass official Australian and FAI model rocket performance records. No ARA contest points shall be awarded.
Events to be flown must be indicated on the application for sanction. Any number or combination of events may be flown. In a Record Trial, an ARA member duly entered in the meet may have as many opportunities as time and weather permit to make a record flight. Record Trials have no Contest Factor.

6.4 Time
All contests other than the National Meet must be scheduled on and completed within no more than three consecutive days, except as stated in Rule 6.5.

6.5 Suspending Competition
The Contest Director may suspend competition with the concurrence of a majority of the participating competitors present and a may set a new date acceptable to a majority for the completion of the contest. The Contest Director shall advise the Regional Contest Board regarding the rescheduling of the contest, and the reasons

6.6 Weighting Factor
Each competition event has a Weighting Factor that shall also be used in determining the maximum number of competition events that can be sanctioned for a particular contest. Any number of competition events may be sanctioned for a contest, provided that the sum of the Weighting Factors of all the competition events sanctioned for the contest does not exceed the Total Weighting Factor allowed for its contest classification. The schedule of Total Weighting Factors permitted for each contest classification is as follows:

Event Type	Total Weighting Factors
Section Meet	40
Local Meet	40
Open Meet	60
Regional Meet	80
National Meet	Set by ARA Contest Board
Record Trial	No Limit

6.7 Contest Factor
Each competition classification (Rule 6.3) has a Contest Factor which shall be used in determining the maximum number of sanctioned contests in which an ARA member, team, or chartered ARA section may enter and compete during the Contest Year. No member, team, or section may officially enter a sanctioned contest and be awarded competition points if the Contest Factor of that contest, when summed with the Contest Factors of all the contests previously entered in the current Contest Year by the member, team, or section, would exceed 12 (twelve). The National Meet shall not be included in this total. A contestant, team, or section may withdraw from a meet at any time prior to its conclusion, upon presenting valid cause to the Contest Director, and that meet shall not count towards their Contest Factor sum for the Contest Year. In addition, a

chartered ARA section may not sponsor more than five section and/or local meets during a Contest Year. A contestant, team, or section may not withdraw from a meet after its conclusion, or prior to its conclusion based on poor score as the valid cause.

6.8 Sanction
Application for sanction of a model rocket competition shall be made to the ARA Regional Contest Board at least thirty days in advance of the date of the competition, on the standard form Application for a Contest Sanction, which is available from the ARA Regional Contest Board. If necessary, a reproduction of the form may be used when none can be secured from the ARA. The thirty-day advance notice requirement may be waived at the discretion of the ARA Regional Contest Board. The Senior Member of the ARA who will serve as the Contest Director must sign the application. The correct sanction fee must be included with the form mailed to the ARA Regional Contest Board. Contest Directors must obtain an adequate supply of contest forms, flight cards, etc. in advance of any competition, since this material will not be sent with the sanction for competition.

6.9 Results
The ARA Senior Member who serves as the Contest Director for a sanctioned competition must report the competition results to the ARA Contest Board on the standard forms, and must include all the competition entry blanks, flight cards, and other contest record materials used.* The report must be postmarked within fourteen days following the completion of the competition, but this requirement may be waived at the discretion of the ARA Regional Contest Board. If an unusual question arises, the Contest Director may request a ruling on the matter from the ARA Contest Board. In this case, the Contest Director should make every effort to include complete and impartial details on the situation. The ARA Contest Board may refuse to accept the results of a competition if all the contest record materials are not included, if the data is not legible or accurate, or if there has been an unreasonable delay in reporting results. All competition results shall be compiled and reported by the Regional Contest Board Chairman at least monthly. The National Contest Board Chairman shall compile and report current standings to the ARA webmaster at least monthly during the contest year. The ARA webmaster should post the current AUS Point Standings at least once a month during the contest year. Final official results for the year should be posted to the website no later than one month following the conclusion of National meet

6.10 Rejection
The ARA Contest Board may refuse to accept the results of a competition if evidence is presented that the competition was not conducted within the scope or intent of this ARA Model Rocket Sporting Code.
Contest results may be submitted electronically in Contest Manager format, or other formats as approved by the Contest Board.
Competition entry blanks must still be sent to the Contest Board. Flight cards for any new Australian Model Rocket Performance Records should also be submitted.

6.11 Deadline
In all cases, contest results must be in the hands of the ARA Contest Board at least fourteen days prior to the opening day of the National Meet.

6.12 Advisory Rulings
In cases where a modeler is uncertain of the application of a rule contained in the ARA Model Rocket Sporting Code, he/she may ask for a ruling by the Regional Contest Board Chairman. The Regional Contest Board Chairman may rule or pass the request to the National Contest Board Chairman. This process should proceed in a timely manner so as to allow modelers time to react to the ruling.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7.1 Contest Director
A Contest Director who is a Senior member of the ARA in good standing shall: apply for contest sanction; receive and be responsible for all contest material; ensure that the competition is properly arranged and functions within the intent and specifications of this Model Rocket Sporting Code; and report the results of the competition.
The duties of the Contest Director and the Range Safety Officer may be combined. The Contest Director appoints the Range Safety Officer, Contest Jury, Judges, Trackers, and Timers.

7.2 Range Safety Officer
A Range Safety Officer (RSO) shall preside over the conduct of the competition in accordance with Rules 3 and 5. In no case may the Contest Director, Contest Jury, or any other official override a safety ruling of the RSO. Only the Contest Jury may relieve the RSO of his/her duties.

7.3 Safety Check Officer
The RSO may appoint Deputy Range Safety Officer(s) to function as Safety Check Officer. The Safety Check Officer shall be qualified to rule in accordance with Rule 5.3. The duties of the Safety Check Officer and the RSO may be combined.

7.4 Contest Jury
There shall be a Contest Jury of three persons for each contest. The Contest Jury is empowered to make all decisions concerning any interpretation of the Sporting Code and to decide any disputes and protests, except those decisions related to safety considerations in accordance with Rule 7.2. At least one jury member must be a Senior member of the ARA. The other jury members may be Senior, Leader, or Junior members of the ARA. The Contest Director may act as one of the jury members. The Contest Director shall appoint the Contest Jury prior to the first official flight. No juror shall rule or vote on any decision that could alter the award of contest points to his/her entry. Where a decision involving the entries of two jurors is involved, the ruling of the third juror shall be the determining factor. In the case of disputes, the ruling of two of the jurors present and acting shall be the determining factor. Any decision of the Contest Jury except for a safety ruling as stated in Rule 11.1 may be protested as described in Rule 12. The Contest Jury may not override a safety ruling of the RSO. No Contest Juror may be relieved of his/her duties by the Contest Director.

7.5 Judges
The Contest Director shall appoint teams of Judges for events requiring static judging (e.g., Research and Development,
Scale, Plastic Model Conversion). At least half of the judges on each Judging Team must be members of the ARA, allowing for Guest Judges. At least one member of each team of Judges must be a Senior or Leader member of the ARA.

7.6 Trackers and Timers
The Contest Director may appoint any capable person as a Tracker or Timer. Any glasses or aids necessary for that person to have normal vision must be worn. Any person not having correctable vision (e.g., cannot obtain a drivers license due to vision) is not eligible to time or track.

7.7 Fitness
No person may serve in any Contest Official position where the safety of a flight of a model rocket is concerned (RSO,
Check-in, LCO) while under the influence of intoxicants. Anyone so caught will be removed from the position and may be expelled from the meet under the provision of Rule 11.4.

8.1 Entering Competition
All contestants entering model rockets and competing in ARA sanctioned competition shall be members of the ARA in good standing. They are required to sign an official entry blank. Upon entering a competition, contestants must present for verification their ARA Sporting License to the Contest Director or his/her deputy, at the Contest Director's request.

8.2 Age Division
The Competition Divisions are as given in the following schedule:

A Division	7 - 13 years old
B Division	14 - 18 years old
C Division	19 years old and older
T Division	Registered ARA Teams

All divisions are to be flown separately at any sanctioned meet, unless they must be combined in accordance with Rule 9.6.
The division in which an ARA member will compete during a Contest Year is determined by the member's age/status as of July 1, the start of the Contest Year. If the member turns 7 years of age during the contest year, he/she may compete after his/her 7th birthday.

8.3 New Members
Newly joined ARA members who have not yet received their Sporting License and wish to compete in sanctioned competition shall be recorded as pending. The Contest Director may require a pending member to show proof of his/her application for membership.

8.4 Proxy
A contestant properly entered in sanctioned competition may have his/her models flown by proxy by another ARA member, except in the following events:
Drag Race Research
Development Spot Landing
National Performance Records writing evidence satisfactory to the Contest Director of his inability to be present. This statement shall be forwarded to the ARA Contest Board with the meet results. Contestants having official duties at the contest may have their models proxy flown for them with the approval of the Contest Director. An entry shall not be proxy-flown by a member whose Competition Age Division is older than that of the contestant.
In the event that the Contest Director disallows a proxy entry, this decision may be protested to the Contest Jury under the provisions of Rule 12. If the Contest Jury rules against the contestant, the decision may be appealed to the ARA Contest Board. In this instance, the contestant shall be allowed to fly, pending the decision of the ARA Contest Board; but his/her flight records shall be kept separate and shall not be considered official until the ARA Contest Board rules in favor of the Contestant, if it so rules.

8.5 Teams
Two or more ARA members may enter competition as a team. Teams must be registered with the ARA Contest Board each year. Team renewals are due July 1 of each Contest Year. Membership of a team cannot be changed during the Contest Year. Such a change must be registered as a different team. Teams shall compete for competition points in a separate Team
Division. One or more members of the team shall prepare entries for flight, except if they are to be proxy-flown under the provisions of Rule 8.4. Entry blanks shall carry the number of the team, with all individual team members' names and license numbers listed. All points earned and records established are credited to the team. Points earned in team competition are not entered in the individual's record of contest points, and may be used only for the team. No ARA member may enter a meet as both an individual and as a team member, and no ARA member may enter a

meet as a member of more than one team; however, neither of these restrictions shall apply at Record Trials.

8.6 Sections
Where a group of ARA members enter competition as a chartered ARA section, all members of the group shall be bona fide members in good standing of that section, as indicated by the section number on their ARA membership card. Entry blanks shall carry the name of the section to which the member's points are to be credited.
An ARA member or team may not enter competition as a member of more than one section during the course of a single Contest Year unless such a change is applied for and approved by the ARA Contest Board; however, any ARA member or team may enter a competition as an Independent competitor regardless of actual section affiliation.

8.7 Fitness
No contestant may fly model rockets while under the influence of intoxicants. Anyone so caught will not be permitted to fly and may be expelled from the meet under the provisions of Rule 11.4.

9.1 Total Impulse Limit
No entry in sanctioned competition shall be powered by a motor or combination of motors with total impulse greater than 160.00 Newton-seconds.

9.2 Ejected Motors
No entry in sanctioned competition shall eject its motor or motors in flight in such a manner that the spent motor casing or casings fall freely apart from the model. Ejected motor casings must descend with an attached and fully deployed streamer or parachute. The streamer area must be no less than 10 square centimeters for each gram of jettisoned mass; the parachute area must be no less than 5 square centimeters per gram of jettisoned mass.

9.3 Flight Characteristics
During the powered phase of flight, spinning of the entry is permitted only around the **roll axis**. Entries that spin or loop around the **pitch axis** or **yaw axis** under power shall be disqualified.

9.4 ARA Number
Each entry shall carry, legibly displayed upon its exterior surface as the model rocket appears in flight readiness, the contestant's name or ARA license number. In the case of a team entry, the entry shall carry the team name or number.

9.5 Safety Check
Each entry shall pass a safety inspection given by the Safety Check Officer before each flight to ascertain that it meets the standards of this Sporting Code, and that it will be reasonably safe in its operation, .This inspection shall include any launching device and auxiliary equipment provided by the contestant to assist the launch.
The pre-flight safety inspection shall include a visual check of the markings on the motor(s) for proper impulse and delay.
At the request of the contestant, the motor inspection may be postponed until after the flight. However, if it is postponed, the part of the model containing the motor must be returned and the motor class determined by visual inspection and if the motor type cannot be determined, then the flight is not official.

9.6 Minimum Entries
At least two official entries in an event must be passed by the Safety Check Officer and must attempt to make official flights before points can be awarded in the event. This applies also where an event is flown in competition divisions; i.e., two entries for each division. If an event must be flown in combined competition divisions because of insufficient entries, only adjacently entered divisions may have their flight records combined. For this purpose, a Team shall compete in the division of its oldest member.

9.7 Substitution of Models
Substitution of models between official flights of an event is allowed, unless disallowed by the rules for a specific event.
When the rules for a specific event disallow substitution between official flights, only recovery devices and minor lost or damaged parts necessary to make the model flight worthy may be changed for subsequent flights. In these circumstances, a replacement for a minor lost or damaged part shall be identical to the part that it replaces.

9.8 Simultaneous Events
Two or more competition events may not be flown simultaneously by the same model rocket on the same flight.

9.9 Construction
The RSO or his/her deputy shall make every reasonable effort to ensure that each contestant has completely constructed the model rocket(s) he/she uses in competition. Model rockets not requiring construction shall be excluded from competition.
Materials and design may be obtained from any source, including kits.

9.10 Impound
The Contest Director or any of his/her appointed officials has the authority to require that any model having made an official flight be returned and impounded for a reasonable length of time for inspection if there is serious question regarding the adherence of the model to the Sporting Code. This must be stated during or immediately after the flight in question. When the model or part cannot be returned to the officials within a reasonable time, the officials may disqualify that flight.

9.11 Gross Launching Mass
All entries in model rocket competition shall not exceed a maximum GLM of 1,500 grams. Booster stage, single stage, and upper stage motors may be used in locations other than their primary intended stage.

Official flights

10.1 Number of Fights

Time and weather permitting, each contestant shall be given an opportunity to make no more than two official flights in each competition event unless otherwise specified in the rules for a specific event. This limitation shall not apply at Record Trials. Unless otherwise specified in the rules for a specific event, a contestant in a duration event shall receive as his/her official score, the sum of the durations achieved by the contestant on all official flights.

It is suggested that the Contest Director carefully consider constraints imposed by the time and weather when deciding on the number of flights that is to be allowed each contestant in an event, since in many events a contestant who cannot make both flights will be at a severe disadvantage. In such cases, it is preferable to limit contestants to one flight in one or more events than to impose a hardship on contestants who could not make both flights due to lack of time or inclement weather. If such a limitation is necessary, it should be announced prior to any official flight by any contestant in the event being so limited. In circumstances where it is necessary to enact such a limitation after official flights have been made in an event,

i.e., a sudden weather change, all contestants, regardless of how many official flights they have already made shall be bound by the new limits. In these circumstances, the Contest Director shall select for consideration only those flights of a contestant that would be qualified under the new limitation, and shall then choose the best of the selected flights as the official flight of that contestant in that event.

For example, if the Parachute Duration event must unexpectedly be limited to one flight per contestant, and a contestant has already made two flights, the Contest Director must first select only the flights that were returned, (since in single-flight

Parachute Duration, the flight must be returned). If both flights were returned, the Contest Director shall select the better of the two flights as the official flight of the contestant.

10.2 Record Attempts

At the discretion of the Contest Director, any ARA member or Team may be allowed to attempt to set or surpass a Australian Model Rocket Performance Record in any class of any event allowed

10.3 Official Flight Requirements

A flight is official if any part of the model leaves the launcher; except in the case of a **catastrophic failure** subsequent to motor ignition shall not be considered as having made an official flight unless they are disqualified by the RSO for safety reasons. If the power pod or motor of a Boost Glider model disengages and proceeds into the air under power without the glider portion, the attempt shall be considered a disqualified official flight. A model that does not ignite enough motors to be in the proper total impulse class shall not be considered as having made an official flight unless its flight is disqualified for other reasons.

10.4 Return of Inaccessible Models

When the return of a model is required, and the contestant cannot return his/her model, but can point out (to a qualified official) the model, visible in an inaccessible place such as a tree, power line, lake, or rooftop where recovery would pose a personal hazard to the contestant, the Contest Jury has the option of scoring the model as having been returned. The Range Safety Officer, the Contest Director, members of the Contest Jury, or Timers or Trackers assigned to follow the contestant's model are qualified officials for the purposes of this rule. The Contest Director shall state prior to the start of competition what distance limits such officials may travel to act as observers under this rule. This rule may be superseded by the rules of a specific event.

10.5 Recording of Returns

It is the responsibility of the contestant to ensure that the officials have noted on the entry card that the model has been returned, where it is so required.

Disqualification

11.1 Officials
The Contest Jury and/or the Range Safety Officer or his/her deputies may disqualify any entry that in their opinion did not comply with the competition rules or which in their opinion was not reasonably safe in operation.

11.2 Scope
An entry may by reason of flight characteristics be disqualified for that flight, but it is not necessarily disqualified for the entire event.

11.3 Scoring
For the purposes of events in which a total score is computed from the sum of the performances of two or more flights, a disqualification shall result in a score of zero for that flight. This rule may be superseded by the rules of a specific event. A disqualified flight may not be considered as a return in any event where at least one return is required. If a contestant flying in an event requiring at least one returned flight has one disqualified flight and another not returned, the contestant shall receive only flight points for the event.

11.4 Expulsion
The Contest Director may disqualify any contestant from an event or from the entire meet on the grounds of failure to practice or observe reasonable safety measures, published or otherwise; for poor sportsmanship; for failure to abide by the orders of the Range Safety Officer or his/her deputies; whose ability to safely fly model rockets is, in the opinion of the Contest Director or Range Safety Officer, impaired by alcohol, drugs, or condition; or for misconduct in general.

11.5 Catastrophic Failure
A model rocket experiencing a catastrophic failure shall not be given a disqualification. The flight may or may not be considered as an official flight, only if in the opinion of the Range Safety Officer the model performed a safe and stable flight, and at least nominally complied with the competition rules (e.g., a glider glided). The contestant shall in this situation have the option of having such a flight ruled as either official or unofficial. If the model did not meet these requirements, then it shall be ruled an unofficial flight.
When he has the option, the contestant shall inform the applicable Contest Official of his/her decision to accept or reject the flight as an official flight as soon as possible; but in any case, prior to any subsequent flight by the contestant in that event.
The contestant shall be permitted to substitute another model; in the case of craftsmanship events, or other events as specified, an identical model must be substituted, although it does not have to exhibit the craftsmanship and detail of the original.

11.6 Recording Data
Performance data on an entry that has been disqualified during or after its flight shall be recorded, even though the flight may not at that time be considered official, in case of later reversal of the disqualification ruling

11.7 Shock Cord
A broken shock cord shall not cause a disqualification of the entry's flight unless a part of the entry falls to the ground and lands in a manner that the Range Safety Officer considers hazardous. This rule may be superseded by the rules for a specific event.

11.8 Correctable Conditions

Disqualifications for static conditions are not permitted. In this case the modeler shall be instructed to correct the condition prior to the official flight. If the contest officials do not discover a condition until during or after the flight is made, such as flying with the wrong motor type, the flight will not be considered official. *Ex post facto* disqualifications are prohibited.

11.9 Self-Penalizing Flights
Models whose flights are safe, but do not recover in the manner they were designed to (refer to Rule 15.3), are not necessarily disqualified. If the recovery problem was of a safe nature and did not tend to give the model a performance advantage contrary to the event and the model still performs the basic requirement of the event, then the flight is qualified.
For example, parachute duration models whose chute does not deploy, a glider with a streamer hung onto it (while still gliding stably), or a helicopter model which flips multiple times (while primarily autorotation about the vertical axis) are penalizing their flight performances.

12.1 Protests
Protests will be considered only when presented in writing to the Contest Jury no later than one hour after the end of the competition, and when accompanied by $5.00 in cash.

12.2 Details
The protesting competitor must report in full the action or decision under protest, the names of the contestants and officials involved, and other substantiating details. All sides of a protest shall have the right to be heard by the Contest Jury and/or ARA Contest Board.

12.3 Decision
The Contest Jury shall give to the Contest Director, and all parties involved in the protest, a brief written statement of the situation and their decision. This statement shall be included with the contest results. If the protest is upheld, the protest fee shall be returned to the contestant. If the protest is denied, the protest fee shall also be included with the contest results forwarded to the ARA Contest Board. A decision is required within 24 hours of filing of the protest.

12.4 Appeal
A contestant may appeal a decision of the Contest Jury to the entire ARA Contest Board. Such appeals, written legibly or typed, must be postmarked within three days following the receipt by the contestant of the decision from the Contest Director on the original protest. If the Contest Board upholds the appeal, the protest fee paid at the meet shall be returned to the competitor.
The decision of the Contest Board on a protest is final.
The Contest Board must rule on the appeal, in writing, within 21 days from receipt of the appeal and all necessary documents required to make the ruling.

13 COMPETITION POINTS AND CHAMPIONSHIPS

13.1 Competition Points
Competition points shall be awarded to each contestant on the basis of the following schedule:
10 points per event for placing first
6 points per event for placing second
4 points per event for placing third
2 points per event for placing fourth
1 point per event for making at least one qualified, official flight (flight points)
Note that “Track Lost”, “Track Not Closed”, and “No Return”, if not disqualified for other reasons, may not place in an event, but still receive flight points.

13.2 Ties

In case of a tie in any of the four places, duplicate points shall be awarded. This rule may be superseded by the rules for a specific event.

13.3 Weighting Factor
Each event is assigned a Weighting Factor that is based on the difficulty of the event. These Weighting Factors are listed under the rules for each event and summarized in the Weighting Factor Chart in Appendix B.

13.4 Contest Factor
Each competition classification as listed in Rule 6.3 has a Contest Factor as reiterated below:

Event Type	Contest Factor
Section Meet	1
Local Meet	1
Open Meet	2
Regional Meet	3
National Meet	8
Record Trial	None

13.5 Scores
Scores are calculated in the following way: Competition Points are multiplied by the Weighting Factor for each event. The result is then multiplied by the Contest Factor to produce the contestant's total score for the event. For example, a contestant places first in Scale Competition at an Open Meet. First place gives the contestant 10 points; Scale has a Weighting Factor of 32; and an Open Meet has a Contest Factor of 2. Multiply 10 x 32 x 2 to obtain the number of competition points to be awarded to the contestant for the event: 640 points.

13.6 Acceptance
Points scored in competition shall be official only when the ARA Contest Board accepts the contest results.

13.7 Competition Division
An event flown in competition divisions shall be scored and points shall be awarded as if separate events had been flown.

13.8 Contest Year
Competition points shall be cumulative for each ARA member, team, or section that enters and flies in sanctioned competition during each Contest Year.

13.9 National Championships
National Championship Awards for a Contest Year shall be given in the following categories to the contestant, team, and section that has compiled the largest number of contest points in that category during the Contest Year. At least the top four places in each category shall be recognized with these awards. Each place across all categories shall receive equivalent awards. To be eligible for any of these awards, individuals, teams, or sections must enter and fly in the National Meet at the close of the Contest Year.
A Division;
B Division;
C Division;

T Division; Team awards shall be given in pairs.
Sections; The National Championship Section shall also receive the rotating pennant.
Proxy-flown entries shall not be permitted to earn National Championship Awards in individual or team categories or be the sole entries in the Section category. may be given to the top places in each of the above 5 categories at the option of the National Meet Contest Director.

14.1 Theodolites
All entries in any event for which an achieved altitude figure is scored shall be tracked in flight by theodolites of a design approved by the ARA Contest Board. Any tracking theodolite that:
• Is equipped with both azimuth and elevation axes at right angles to each other
• Can be leveled or adjusted to an otherwise proper plane before use
• Has an accuracy of 0.5 degrees in both azimuth and elevation
• Uses a rifle-sight or equivalent optical sight with or without lenses, or uses a pair of open sight mounted at least twenty centimeters apart
• Uses crosshairs in the optical or open sight
• Is mounted on a sturdy tripod or other solid base in a manner that does not permit the tracking head to wobble or otherwise lose its zero-reference under normal use
• Has a provision for securely holding the sights firmly in any desired position, so that the operator may accurately record the tracking data associated with a flight
• Is capable of tracking to an azimuth of ±180 degrees and an elevation from 0 degrees to 90 degrees shall be acceptable for ARA contest use.
The Contest Board must approve theodolites that do not meet all of the above requirements before they may be used in a sanctioned activity.

14.2 Baseline
Two or more tracking theodolites shall be used on appropriate baselines. The baseline should be between 50% and 400% of the expected altitudes to be tracked. Thus a 300-meter baseline would be appropriate for 75-600 meter flights. While very low power events may require a baseline under 300 meters, proper care and judgment should be used before this is done.
Longer baselines are strongly encouraged for high-powered or high-performance models. Proper baselines must be used to track any record setting flight.

14.3 Tracking
Models shall be tracked to apogee if practical. When apogee tracking is used, one person shall be designated to give a mark to the theodolite operators at precisely the instant the entry appears to reach apogee, and the theodolites shall be locked at the mark. At the discretion of the Contest Director, models may be tracked to ejection instead of apogee. When ejection tracking is used, it is recommended that the models to be tracked contain colored tracking powder to create a visible cloud at ejection, and that the theodolite operators lock their theodolites at the appearance of the tracking powder cloud. It is further
Recommended that all entries that are to be tracked be painted in colors or patterns that will aid tracking. All entries in an event shall be tracked using the same tracking method (either apogee or ejection).

14.4 Communication System
A reliable voice communication system shall be used to link both trackers and the launch control area, for the purpose of calling marks and for the transmission of tracking data.

14.5 Data Reduction
Angular data obtained from theodolite tracking shall be reduced to an achieved altitude figure by means of a standard system of equations approved by the ARA Contest Board. Samples are included in Appendix E. All data shall be recorded for all altitude events and flights, including

those flights that may be disqualified; this permits the altitude data to be available in case the disqualification ruling is later reversed.

14.6 Error Check
The error figure as computed by the approved equations must be less than or equal to 10% to be considered valid and acceptable for competition and record flights. Flights whose reduced altitudes do not satisfy this constraint shall be scored as Track Not Closed. Flights whose data is incomplete, preventing calculation of their altitude, shall be scored as Track Lost. All altitudes shall be rounded off to the nearest meter. Fractions of a meter less than 0.5 must be rounded to the next lower meter; fractions 0.5 or above must be rounded to the next higher meter. The rounded altitude shall be the official scored altitude.

14.7 Multiple Stations
When multiple-station or parallel systems are used, it is only necessary that one pair of trackers (one at each station) close.
In the case that more than one pair of trackers close, the official altitude shall be computed by averaging all closed tracks, and then rounding them as above. The averaged rounded altitude shall be the official scored altitude.

14.8 Novel Methods
The ARA Contest Board must approve novel altitude determination methods before the results are accepted for competition.

14.9 Untracked Flights
Track Lost or Track Not Closed, if it is not disqualified for any other reason, is considered an unofficial flight. In this case the contestant is entitled to an additional flight, to be made during the period allocated for tracked flights. At the option of the contestant, Track Lost or Track Not Closed may be considered an official flight if it is not disqualified for any other reason. In this case the flight cannot place but shall receive flight points; except in an event where the score is the sum of several factors, in which case the flight shall be scored as having an altitude of zero.

15.1 Timers
In all events for which a time-of-flight figure is scored, one or more Timers shall be stationed in the launching area with stopwatches and may not leave the launching area in order to keep the model in sight. Meet officials will provide the same number of timers to all contestants; any additional official timers must be provided by the contestant. Optical aids, other than sunglasses or eyeglasses to correct to normal vision, may not be used by the Timers, except in FAI class events, where optionally, Timers may be equipped with binoculars.

15.2 Separation
Unless specifically allowed by the rules of that event, no timed entry may separate into two or more unattached parts, or eject its motor.

15.3 Deployment
The recovery system of any duration model need not deploy fully and correctly, as long as the model descends in a safe manner and the recovery system action remains within the requirements of the particular event.

15.4 Conflict of Interest
A Timer shall not time his/her own entry.

15.5 Stopwatches

Stopwatches used for timing shall have a resolution no coarser than 1/10 second; shall have (at the minimum) standard start, stops, and reset capabilities, and shall be capable of being restarted from a stopped state without being reset. A stopwatch with split-time (or lap accumulate) capabilities (i.e., one which continues to record time internally after being stopped; and which can display at any time, on demand, the total elapsed time since the watch was started) may be used for competition, provided that if it is used to time any entry, it shall be available for use to time any other entry in competition with it.

15.6 Timed Interval
All entries shall be timed from the instant of **first motion** on the launcher until the part to be scored for time of flight touches the ground, is caught in a tree, power line, or otherwise stopped, or drifts out of sight of the timer. As specified in Rule 1.1, motors, recovery system protectors, and wadding are not to be timed as portions of an entry.

15.7 Averaging
The official time of flight shall be computed by averaging the elapsed times of flight recorded by each Timer, then rounding to the nearest whole number of seconds. The individual elapsed times recorded by the Timers shall not be rounded before summing. After averaging the times, fractions of a second less than 0.5 shall be rounded to the next lower second; fractions of 0.5 or above shall be rounded to the next higher second.

15.8 Disappearance
If the model disappears behind an obstacle to vision in such a manner as to lead the Timers to believe that it touched the ground very shortly thereafter, stopwatches shall be stopped when the model disappears; however, they may be started again if the model reappears. If the model drifts out of sight in the sky, the Timers shall stop their watches individually when they lose sight of it.

15.9 Recording Data
All data shall be recorded for all timing events and flights, including those flights that may be disqualified. This permits the timing data to be available in case the disqualification ruling is later reversed.

15.10 Return
Unless otherwise specified by the rules of the event, the contestant must return his entry to the officials after at least one of his/her qualified flights, except as specified by Rule 10.4. Contestants failing to satisfy this requirement cannot place in an event, but shall receive flight points, except in an event where the score is the sum of several factors, in which case the flight shall be scored as having a duration of zero.

15.11 Malfunction
When a malfunction of a stopwatch or Timer occurs such that any elapsed time measurement is not available, the elapsed time(s) recorded by the remaining Timer(s) shall be used as the official time. When all stopwatches or Timers malfunction, the flight shall not be considered an official flight unless the flight is disqualified on other grounds. Alternately, at the option of the contestant, he/she may choose to consider the flight as an official flight with a time of zero; in which case the flight cannot place but is eligible for flight points; except in an event where the score is the sum of several factors, in which case the flight shall be scored as having a time of zero.

15.12 Multi-Round Events
Any duration event listing a multi-round maximum may be flown as a multi-round event. This must be indicated on the contest sanction. The weighting factor for the event shall be increased by 4 (four) in this case.

15.12.1 Number of Flights
Each contestant is initially allowed three official flights in a multi-round event. The Contest Director may designate that each flight must be flown in the time interval (round) designated by the Contest Director. Any model not flown in its designated round shall receive a zero score.

15.12.2 Number of Models
A contestant may enter no more than two models in a multi-round event for the purpose of making all official flights, including any necessary additional flights, except as stated in Rule 11.5.

15.12.3 Maximum Time
The official duration of each flight shall be calculated as follows: if the duration achieved exceeds the maximum time limit defined for that flight, the entry shall be awarded the maximum time limit; otherwise the entry shall be awarded its achieved duration in seconds. Timers may stop timing the flight after it has achieved the maximum time.

15.12.4 Scoring
Multi-round events shall be scored as follows: the official durations achieved by the contestant on the initial three official flights in the event shall be summed. If there is no tie for first place, then the contestant achieving the highest score is the winner. If there is a tie, contenders for first place shall be given the opportunity to make additional official flights (fly offs) to determine the winner. The maximum time limit for a contestant's first additional flight shall be computed by adding a one minute increment (or, at the discretion of the Contest Director, a greater increment) to the maximum time limit for the event. For each subsequent additional flight made by a contestant, one additional increment shall be added to the previous maximum time limit. Additional flights shall be held in this manner until a winner is determined. Second through fourth places shall be distributed first among the other contenders in the fly offs, and then among any other contestants having made qualified flights, on the basis of total computed score.

15.12.5 Return
The models in multi-round duration events need not be returned to the officials except as required by Rules 9.10 and 15.12.2.

15.12.6 Reduced Maximum Time
If unusual weather or field conditions are encountered, the Contest Director, with the concurrence of a majority of the contestants entered in the event, may lower the maximum time to a more reasonable value. The Contest Director must advise the Regional Contest Board that this has been done and the reasons for doing so.

16.1 Judging
In events that require static judging (e.g., Research and Development, Scale, Plastic Model Conversion) all entries in an event that are in competition with one another must be judged by the same team of one or more Judges. Several teams of Judges may be used for events conducted in age divisions, provided all entries in each event in each division are judged by the same Judges.

16.2 Conflict of Interest
No Judge entered in an event shall judge his/her own entry, nor any entry in competition with it.

16.3 Viewing Period
At any meet holding events requiring static judging, it is recommended that the Contest Director officially set aside a period of time between judging and launching during which the models can be viewed by the competitors and guests. The intent of this practice is to stimulate interest in

craftsmanship events in modelers who may not otherwise enter such events, and improve the craftsmanship of those modelers who regularly do.

16.4 ARA Number
The name or ARA number required to be on the model by Rule 9.4 shall be judged for craftsmanship along with the model.

16.5 Judging Condition
Models shall be judged for points in flight condition, with the exception that motor(s) and recovery system need not be present. Any clear plastic fins, launching lugs and fittings, and other exterior flight items must be attached to the model during judging. Pop lugs are considered part of the launcher, not of the model. Nothing may be added to the model, or taken off the exterior of the model, between judging and flight, except the motor(s) and recovery system(s). If unusual launching or recovery devices are to be used it should be so noted in the data presented.

16.6 Accidental Damage
Any damage to an entry while it is in the custody of the judges or meet officials shall not be held against the contestant, and the contestant shall have the opportunity to repair the model without penalty.

16.7 Human Intervention
For any model being judged for damage, no human intervention (e.g., catching the model or cushioning its landing) shall be allowed between launch and touchdown. However, with the exception of the egg lofting events, contestants may choose to catch their models. In this case, models that are caught shall be judged as if they had sustained maximum damage on landing, but shall not be disqualified. Any egg lofter that is caught or cushioned shall be disqualified. If the intervention was accidental and/or inadvertent, in the opinion of the Range Safety Officer, the flight may be judged as having sustained maximum damage points or an unofficial flight, at the option of the contestant for all events except egg lofting which shall be an unofficial flight. The contestant shall inform the applicable Contest Official of his/her decision to accept or reject the flight as an official flight as soon as possible; but in any case, prior to any subsequent flight by the contestant in the event.

16.8 Lost Models
Any model being judged for damage that cannot be returned to the Judges shall be judged as if it had sustained maximum damage on landing, but shall not be disqualified, except as per Rule 9.10. Rule 10.4 shall not apply.

ALTITUDE EVENTS

20.1 Scope
Altitude Competition comprises nine events open to any model rocket. The purpose of this competition is to achieve the highest altitude.

20.2 Classes
This competition is divided into classes based on the permissible total impulse of the motor(s). The following classes of Altitude Competition are established:

Motor Class	Weighting Factor
1/8A	9
1/4A	9
1/2A	9
A	10
B	11
C	12
D	13
E	14
F	15
G	16

SUPER-ROC ALTITUDE COMPETITION

21.1 Scope
Super-Roc Altitude Competition comprises nine events open to single-staged model rockets whose body length is no less than the minimum allowed for the classes of the event. The purpose of this competition is to achieve the greatest altitude possible with the longest rocket possible without impairing the structural integrity of the rocket.

21.2 Structural Failure
An entry that comes apart, bends so as to crimp the body, or has a similar structural failure prior to ejection shall be disqualified.

21.3 Separation
The model is allowed to separate into two or more unattached parts after ejection, provided that each part conforms to the provisions of Rule 3.5. The recovery system shall be enclosed totally within the model until ejection.

21.4 Construction
Entries with bodies or significant structural parts made from hard or potentially unsafe material (e.g., hardwood doweling or fiberglass shafts) shall not be allowed, under the provisions of Rule 1.1.

21.5 Scoring
Super-Roc Altitude Competition shall be scored as follows: the length in centimeters of the model, as measured from the tip of the nose cone to the aft most end of the motor nozzle, up to the maximum length for that category, shall be awarded as static points. No additional points are awarded for any length beyond the maximum. The altitude of the model in meters, as tracked and reduced, shall be awarded as flight points. The static points and flight points thus obtained shall be multiplied to determine the score. The contestant achieving the highest score shall be declared the winner.

21.6 Classes

This competition is divided into classes based on the permissible total impulse of the motor(s). The following classes of Super-Roc Altitude competition are established

Motor Class	Minimum Length (centimeters)	Maximum Length (centimeters)	Weighting Factor
1/8A	12.5	25	13
1/4A	25	50	14
1/2A	50	100	14
A	75	150	14
B	100	200	15
C	125	250	16
D	150	300	17
E	175	350	18
F	200	400	19
G	225	450	20

Precision Altitude Competition

22.1 Scope
Precision Altitude Competition comprises three events open to any model rocket. The purpose of this competition is to accurately predict the altitude that a model will attain.

22.2 Classes
The three classes of Precision Altitude shall be:

22.2.1 Predicted Altitude
The contestant must predict the altitude in meters to which the model will be flown. This Predicted Altitude shall be recorded on the flight card and given to the Contest Director or his/her deputy prior to any official flight by the contestant at the meet. The minimum altitude prediction allowable is 100 meters. Weighting Factor 8

22.2.2 Set Altitude
The Contest Director shall set the target altitude when the meet is sanctioned. This value shall appear in the sanction form and all appropriate contest information. The target altitude shall be a multiple of 5 meters between 100 and 300 meters. All contestants shall attempt to achieve this same Set Altitude. Weighting Factor 8

22.2.3 Random Altitude
The Contest Director shall randomly select the target altitude just prior to when the event is flown, by draw, dice, or other random device. The target altitude shall be a multiple of 5 meters between 100 and 300 meters. All contestants shall attempt to achieve this same Random Altitude. Weighting Factor 10

22.3 Order
A contestant entered in Precision Altitude Competition shall make all official flights in Precision Altitude before flying any other event requiring tracking.

22.4 Number of Flights
Entries shall be allowed only one official flight in Precision Altitude Competition. In the case of a track not closed or a track lost, any flight allowed under Rule 14.9 shall be made by the same model, and no changes in configuration, motor type, or prediction shall be allowed.

22.5 Control
The entry shall not be radio-controlled or contain any device whose purpose is to limit the altitude of the model (e.g., a wire or string).

22.6 Scoring
Precision Altitude Competition shall be scored as follows: the achieved altitude of the model shall be divided by the target altitude, and the result multiplied by 100. This figure shall then be rounded to the nearest 0.1%. If the result is greater than or equal to 100, subtract 100 from it; otherwise, subtract it from 100. The contestant whose score comes closest to zero shall be declared the winner.

22.7 Weighting Factor
The Weighting Factor for Predicted Altitude and Set Altitude is 8. The Weighting Factor for Random Altitude is 10.

Cluster Altitude

23.1 Scope
Cluster Altitude (CA) is comprised of five events open to single staged model rockets.

23.2 Purpose
The purpose of this event is to foster the understanding and execution of a fundamental model rocket skill: clustering. The purpose of the competition is to achieve the highest altitude.

23.3 Retained Motors
All motor cases are to be retained in the model. Following an official flight, a contestant must present his/her model as recovered to a contest official for verification of motor casing retention or the flight will be disqualified.

23.4 Winner
The person achieving the highest altitude is the winner.

23.5 Classes
The following five classes of Cluster Altitude are established:

Class Name	Weighting Factor
1/8A x 2 Motor CA	12
1/4A x 2 Motor CA	12
1/2A x 3 Motor CA	14
A x 4 Motor CA	16
B x 5 Motor CA	18
C x 6 Motor CA	20

23.6 Simultaneous Ignition
All motors of Cluster Altitude event models shall be ignited on or instantaneously after the model's first motion (i.e.," Simultaneous Ignition").
Partial cluster ignition shall be deemed a qualified flight unless disqualified for other safety reasons by the RSO. Unignited motors carried aloft shall be retained within the model.

23.7 Partial Ignition
Models that do not ignite all motors in flight will be considered official flights. An entry which fails to ignite all of its motors is considered a qualified flight unless it is unsafe (Rule 11.1), experiences a catastrophic failure (Rule 11.5),

PAYLOAD EVENTS

25.1 Scope
Payload Competition comprises seven events open to model rockets that carry one or more standard ARA model rocket payloads. If the model is staged, the payload(s) must be enclosed in the uppermost stage of the model. The purpose of this competition is to carry a payload of given mass and dimensions to as high an altitude as possible and to recover the payload.
The standard ARA payload is intended to represent an instrument package whose dimensions and mass cannot be modified, but must be accepted as a design constraint.

25.2 Payload Specifications
The standard ARA model rocket payload is a non-metallic cylinder containing fine sand, with a mass of no less than 28.0 grams. This cylinder shall be 19.1 ± 0.5 millimeters in diameter, and 70.0 ± 10.0 millimeters in length. The payload may be permanently sealed to prevent the loss of the sand. No holes may be drilled into it, no changes made in its shape, and no other material may be affixed to it.

25.3 Enclosed Payloads
The standard ARA model rocket payload or payloads carried in a model shall be completely enclosed and contained within the model, shall not separate from the model in flight, and shall be removable from the model.

25.4 Recovery
Models in the competition must contain for payload recovery purposes one or more parachutes of sufficient size to allow a safe landing

25.5 Separation
The payload(s) shall not become separated from the portion of the entry intend to contain it during flight or upon landing, and the flight shall be disqualified if this occurs.

25.6 Return
Following the flight, the contestant shall present his/her entry as recovered and, in the presence of an official, shall remove the payload(s). If the official cannot examine the payload(s), the entry shall be disqualified. If the contestant removes the payload(s) in the absence of officials, the entry shall be disqualified. The official may require that the payload(s) be rechecked if there is any question as to whether or not mass may have been lost from any payload, and shall disqualify the entry if it no longer complies with Rule 25.2.

25.7 Classes
This competition is divided into classes based upon the permissible total impulse of the motor(s). The following classes of Payload Competition are established:

Motor Class	Payloads Carried	Weighting Factor
A	1	16
B	1	15
C	1	16
D	1	17
E	2	18
F	3	20
G	4	22

25.8 Non-Return
If the portion of the model containing the payload cannot be returned to the officials, the entry shall be disqualified.

Egg Lofting Altitude Competition

26.1 Scope
Egg Lofting Altitude Competition comprises six events open to model rockets that carry, as a totally enclosed payload, one raw Large hen's egg, with a mass of no less than 57 grams and no more than 63 grams, and measuring no more than 45 millimeters in diameter. If the model is staged, the egg must be enclosed in the uppermost stage of the model. The purpose of this competition is to carry an exceedingly fragile payload to as high an altitude as possible and to recover the payload without damage. The egg is intended to simulate (in miniature) an astronaut, who must be properly cushioned and restrained to withstand the forces of acceleration and the shock of landing. No material may be affixed to the egg (e.g., glue or tape).

26.2 Eggs
The Safety Check Officer or other official shall provide the egg to each contestant presenting his/her entry for pre-launch safety check. Each egg shall be numbered, and that number shall be recorded on the contestant's flight card. A contestant shall not be required to use an egg that has been previously lofted by another contestant.

26.3 Return
Following the flight, the contestant shall present his/her entry as recovered and, in the presence of an official, shall remove the egg. The official shall determine the extent of damage to the egg. If the official cannot examine the egg, the entry shall be disqualified. If the contestant removes the egg in the absence of officials, or breaks the egg in the process of removing it from the model, the entry shall be disqualified. If the shell of the egg is broken or cracked, the entry shall be disqualified. All entries must comply with the provisions of Rule 16.7

26.4 Classes
This competition is divided into classes based on the permissible total impulse of the motor(s). The following classes of Egg Lofting Altitude Competition are established:

Motor Class	Weighting Factor
B	19
C	18
D	19
E	20
F	22
G	24

26.5 Non-Return
If the portion of the model containing the egg cannot be returned to the officials, the entry shall be disqualified.

DURATION EVENTS

30.1 Scope
Parachute Duration Competition comprises five events open to single-staged entries containing one or more parachutes for recovery purposes. The purpose of this event is to achieve the longest flight duration time.

30.2 Classes
This competition is divided into classes based on the permissible total impulse of the motor(s). The following classes of Parachute Duration Competition are established:

Motor Class	Weighting Factor	Multi-Round Maximum
1/8A	7	40 sec
1/4A	7	60 sec
1/2A	7	120 sec
A	7	180 sec
B	8	240 sec
C	9	300 sec

Streamer Duration Competition

31.1 Scope
Streamer Duration Competition comprises nine events open to single-staged entries that contain a single streamer as the only recovery device. The purpose of this event is to achieve the longest flight duration time.

31.2 Streamer Specifications
A streamer is defined for this event as a piece of cloth, plastic film, or paper, whose shape is approximately rectangular. The streamer must have a length- to-width ratio of five to one (5:1) or greater and have a minimum area of 100 square centimeters. The streamer and model must be connected by only a single line or cord, attached at the narrow end of the streamer. The cord may not be connected to either the streamer or the model at more than one point (e.g., no yokes are permitted). The streamer may not be cut, slit, or otherwise altered in such a manner as to affect its nature as a simple connected plane.

31.3 Assembly
Several pieces of material may be assembled into a single streamer to overcome length restrictions imposed by the length of commercially available material. All pieces of the streamer shall consist of identical material (e.g., the same type of crepe, plastic, or so on). Lengths of streamer material assembled in this manner must be joined in a manner so as to keep the aerodynamic effects of the joint as small as possible. All such joints shall be parallel to the narrow axis of the streamer.

31.4 Classes
This competition is divided into classes based on the permissible total impulse of the motor(s). The following classes of Streamer Duration Competition are established

Motor Class	Weighting Factor	Multi-Round Maximum
1/8A	8	20 sec
1/4A	8	30 sec
1/2A	8	60 sec
A	8	120 sec
B	9	180 sec
C	10	240 sec
D	11	300 sec
E	12	300 sec
F	13	300 sec
G	14	300 sec

Helicopter Duration Competition

32.1 Scope
Helicopter Duration Competition comprises nine events open to any single-staged model rocket that uses the principle of autorotation as the sole means of recovery. The purpose of this competition is to achieve the longest flight duration using an auto rotating recovery system.

32.2 Autorotation
Each entry must be decelerated during descent by its auto rotating recovery device. The resulting autorotation must be around the vertical axis. A model that descends nose first, or flips over once during descent is permitted. A model that flips over more than once shall be disqualified.

32.3 Recovery
Recovery devices employing flexible (e.g., plastic film or cloth) surfaces are prohibited. Entries using a recovery system that is designed to act (or that actually acts) in a manner similar to a parachute, a rigid inverted bowl, or similar techniques are specifically excluded from this competition.

32.4 Classes
This competition is divided into classes based on the permissible total impulse of the motor(s). The following classes of Helicopter Duration Competition are established:

Motor Class	Weighting Factor	Multi-Round Maximum
1/8A	21	20 sec
1/4A	20	30 sec
1/2A	19	60 sec
A	20	120 sec
B	21	180 sec
C	22	240 sec
D	23	300 sec
E	24	300 sec
F	26	300 sec
G	27	300 sec

Super-Roc Duration Competition

33.1 Scope
Super-Roc Duration Competition comprises nine events open to single-staged model rockets whose body length is no less than the minimum allowed for the classes of the event. The purpose of this competition is to achieve the greatest duration possible with the longest rocket possible without impairing the structural integrity of the rocket.

33.2 Structural Failure
An entry that comes apart, bends so as to crimp the body, or has a similar structural failure prior to ejection shall be disqualified.

33.3 Construction
Entries with bodies or significant structural parts made from hard or potentially unsafe material (e.g., hardwood doweling or fiberglass shaft) shall not be allowed

33.4 Scoring
Super-Roc Duration Competition shall be scored as follows: the length in centimeters of the model, as measured from the tip of the nose cone to the end of the motor nozzle, up to the maximum length for that category, shall be awarded as static points. No additional points are awarded for any length beyond the maximum. The achieved duration of the model in seconds shall be awarded as flight points. The static points and flight points thus obtained shall be multiplied to determine the total points for each flight. The contestant achieving the highest score is the winner.

33.5 Classes
This competition is divided into classes based on the permissible total impulse of the motor(s). The following classes of Super-Roc Duration Competition are established:

Motor Class	Minimum Length (centimeters)	Maximum Length (centimeters)	Weighting Factor
1/8A	12.5	25	12
1/4A	25	50	13
1/2A	50	100	13
A	75	150	13
B	100	200	14
C	125	250	15
D	150	300	16
E	175	359	18
F	200	400	19
G	225	450	20

Boost Glider Duration Competition

36.1 Scope
Boost Glider Duration Competition comprises nine events open to any model rocket, one portion of which returns to the ground in stable, gliding flight supported by aerodynamic lifting surfaces which sustain that portion against gravity. If the entry is staged, the gliding portion must be part of the uppermost stage, and must not be deployed until that stage has burned out. The entry may separate into multiple pieces; only the gliding portion is timed. Models whose gliding surfaces are made of flexible materials (e.g., plastic film or cloth) are prohibited from this event. The purpose of this competition is to achieve the longest flight duration time.

36.2 Disqualifications
An entry that descends with parachute and/or streamer recovery device(s) permanently attached to the gliding portion of the model shall be disqualified. However, other portions of an entry may deploy parachutes and/or streamers for recovery purposes.
If the glider entry accidentally rips the motor pod's recovery streamer and the streamer attaches itself to the glider, the entry may be qualified depending on the RSO ruling that the entry still glided and was not disqualified for other reasons.

36.3 Classes
This competition is divided into classes based on the permissible total impulse of the motor(s). The following classes of Boost Glider Duration Competition are established:

Motor Class	Weighting Factor	Multi-Round Maximum
1/8A	19	30 sec
1/4A	18	45 sec
1/2A	17	90 sec
A	18	120 sec
B	19	240 sec
C	20	270 sec
D	22	270 sec
E	23	300 sec
F	25	300 sec
G	26	300 sec

Rocket Glider Duration Competition

37.1 Scope
Rocket Glider Duration Competition comprises nine events open to any single-staged model rocket that returns to the ground in stable, gliding flight supported by aerodynamic lifting surfaces which sustain it against gravity. Models whose gliding surfaces are made of flexible materials (e.g., plastic film or cloth) are prohibited from this event as also radio control rocket gliders. The purpose of this competition is to achieve the longest flight duration time.

37.2 Disqualification
Any entry that descends with parachute and/or streamer recovery device(s) attached shall be disqualified.

37.3 Classes

This competition is divided into classes based on the permissible total impulse of the motor(s). The following classes of Rocket Glider Duration Competition are established:

Motor Class	Weighting Factor	Multi-Round Maximum
1/8A	21	30 sec
1/4A	20	45 sec
1/2A	19	90 sec
A	20	120 sec
B	21	180 sec
C	22	240 sec
D	24	270 sec
E	25	300 sec
F	27	300 sec
G	28	300 sec

Flex-Wing Boost Glider Duration Competition

38.1 Scope
Flex-Wing Boost Glider Duration Competition comprises nine events open to any model rocket, one portion of which returns to the ground in stable, gliding flight supported by flexible aerodynamic lifting surfaces which sustain that portion against gravity. If the entry is staged, the gliding portion must be part of the uppermost stage, and must not be deployed until that stage has burned out. The entry may separate into multiple pieces; only the gliding portion is timed. The purpose of this competition is to achieve the longest flight duration time.

38.2 Disqualification
Any entry that descends with parachute and/or streamer recovery device(s) attached to the gliding portion of the model shall be disqualified. However, other portions of an entry may deploy parachutes and/or streamers for recovery purposes.

38.3 Classes
This competition is divided into classes based on the permissible total impulse of the motor(s). The following classes of Flex-Wing Boost Glider Duration Competition are established:

Motor Class	Weighting Factor	Multi-Round Maximum
1/8A	19	30 sec
1/4A	18	45 sec
1/2A	17	90 sec
A	18	120 sec
B	19	180 sec
C	20	240 sec
D	22	270 sec
E	23	300 sec
F	25	300 sec
G	26	300 sec

CRAFTSMANSHIP EVENTS

50.1 Scope
Scale Competition comprises a single event open to any model rocket that is a true scale model of an existing or historical guided missile, rocket vehicle, or space vehicle. The purpose of this competition is to produce an accurate, flying replica of a real rocket vehicle that exhibits maximum craftsmanship in construction, finish, and flight performance.

50.2 Exclusions
Scale models of amateur rockets or missiles are specifically excluded from this competition, except when the prototype is of obvious historical significance.

50.3 Non-Flying Prototypes
Entries in Scale Competition may model non-flying or inert prototypes.

50.4 Plastic Models
Entries that qualify for Plastic Model Conversion Competition under Rule 55 are specifically excluded from this event. Parts from commercial plastic kits may be used on scale models provided this is pointed out in the data presented with the model for judging.

50.5 Kits
Commercially available flying scale model rocket kits are acceptable for entry only if accompanied by additional substantiating data other than that contained in the kit. The contestant shall be responsible for ascertaining the correct scale qualities of the kit, and must present satisfactory evidence that the kit model is to correct scale.

50.6 Serial-Numbered Prototype
The contestant should model one particular serial-numbered prototype (or round), except in the case where the prototype is in such extensive mass production that no single individual vehicle can be singled out for scaling. However, the contestant shall make every reasonable attempt to model a specific prototype, since any generalization may detract from his/her score.

50.7 Data
The contestant must supply data to substantiate their model's adherence to scale in dimension, shape, color, and paint pattern.

50.8 Stages
If the prototype is a multi-staged vehicle, the scale model may be designed so that some or all of the upper stages are inoperable dummies. However, a scale model of only the upper stages of a multi-staged vehicle may not be entered without
the operable lower stage(s) unless specific data is furnished to prove to the judges that the upper stage configuration has flown separately, alone, and as a vehicle itself.

50.9 Transparent Fins
If the prototype is not stabilized by means of fins, or if the scaled fins are not of sufficient size to ensure the stable flight of the model, the scale model may be fitted with transparent plastic fins to make it stable in flight. However, the transparent fins and their attachment shall be judged for craftsmanship along with the model.

50.10 Flight
Each entry must make a safe, stable flight. If the entry does not make a safe, stable flight, it shall be disqualified.

50.11 Judging
Each entrant shall be judged using the standard form Scale Model Judging Sheet that is available from the ARA Contest Supplies Subcommittee. At the conclusion of a scale craftsmanship event, each entry shall receive a copy of the judging worksheet for his/her entry as a part of the official contest results from the CD.

50.12 Static Points
Static points shall be awarded according to the following schedule:

50.12.1 Scale Data: 50 points
Points shall be awarded for data that exceeds the minimum requirements; however, data will be judged on quality, not quantity. All data presented should apply to the particular prototype that is being modeled. Minimum allowable data consists of:
• Scale factor
• Overall length
• Significant body diameter(s)
• Nose cone length
• Fin length and width (if applicable to the prototype)
• Length of transition pieces (if applicable)
• Color pattern (documented either in writing or by photographs)
• One clear photograph, halftone, or photo-reproduction
• For at least all required dimensions listed above, both the actual (prototype) dimensions and the scaled (model) dimensions presented in a table or on a drawing
Dimensional data must be from an accurate source, such as magazines, books, the prototype manufacturer's specifications or data sheets, and so on. Dimensions for which explicit data cannot be found may be calculated by proportioning drawings or photos; dimensions obtained in this manner must be so identified in the data. Drawings prepared by the modeler to facilitate judging must be accompanied by substantiating data or drawings. Photographs from any source are acceptable. The photograph requirement may be satisfied by reproductions of pictures from books and other printed material only if the reproduction is equal in clarity to the original. Any entry not accompanied by the minimum allowable data as listed above shall be disqualified. In addition, the modeler should make an effort to include in the table (or drawing) any additional dimensions (both prototype and scaled) that he/she has tried to accurately scale.
Points may be deducted if the scale packet contains data not pertinent to the prototype model, or is presented in such a manner as to complicate judging. The entry shall be judged by the data presented in the scale packet.

50.12.2 Accuracy of Major Dimensions: 200 points
Major dimensions include dimensions required under Rule 50.12.1, as well as dimensions of subassemblies, location of details, location of paint pattern, and so on. At least 5 dimensions shall be checked for accuracy. It is recommended that calipers be used to check small scale dimensions and that Judges attempt to measure the main model dimensions to at least 0.5 millimeters. Points shall be deducted according to the percentage of deviation from the scale dimensions. Model dimensions so small that they cannot be measured to better than a 1% tolerance should not be measured by the judges, but should appear scale-like.

50.12.3 Accuracy of Color and Markings: 100 points

The color and texture (e.g., flat, glossy) of the paint should conform to the data and photographs. Lettering and insignia, if applicable, should be scaled and properly reproduced. Paint patterns should be properly proportioned.

50.12.4 Accuracy of Details: 50 points
Details such as antennas, rivets, cover plates, bolts, prototype imperfections, and so on that appear in the data should be present and properly scaled.

50.12.5 Craftsmanship: 300 points
Points will be awarded for neatness, care in construction, craftsmanship of details, and quality of finish. Consideration should be given to the invisibility of body seams and wood grain, the proper curving of curved lines, and edges made properly sharp or rounded as shown in the substantiating data. The finish should be free of fingerprints, brush strokes, runs, or other unintentional blemishes, and the paint pattern should be well defined. The details should be precise, and neither more nor less obvious than on the prototype.

50.12.6 Degree of Difficulty: 200 points
Points shall be awarded according to the difficulty experienced by the modeler in building the model and adapting it for flight. Consideration should be given to whether the model was built from a kit. Points should be awarded for parts and details that were individually constructed by the modeler. (To facilitate judging, the contestant should point out difficult assemblies or construction problems in his/her scale packet.)

50.13 Flight Characteristics: 300 points
Points for Flight Characteristics shall be awarded as follows:

50.13.1 Mission: 200 points
Mission points are awarded for appropriate and scale-like operation of the model during flight. Examples of such operations are staging, simulated cloud seeding, operation of electronic payload, and smoke ejection. Any such operation must comply fully with the safety standards set forth in this ARA Sporting Code. If it does not, the entry shall be disqualified. The RSO is the only official who may judge the safety qualities of the operation.

50.13.2 General Flight: 100 points
General flight points are awarded for proper operation of the model during flight, including launch, lack of misfires, stability, recovery, and lack of damage on landing. No consideration should be given to staging or scale-like flight characteristics, as these are covered under Mission points. However, if the general flight performance of the model is adversely affected by the failure of one or more of these aspects, points may be deducted from General Flight.

50.14 Scoring
Scale Competition shall be scored as follows: the points awarded to the entry in static judging shall be added to the points awarded to the entry in flight. The contestant receiving the highest score is the winner.

Scale Altitude Competition

51.1 Scope
Scale Altitude Competition comprises nine events open to any model rocket that is a true scale model of an existing or historical guided missile, rocket vehicle, or space vehicle. The purpose of this competition is to produce an accurate, flying replica of a real rocket vehicle, that exhibits maximum craftsmanship in construction, finish, and flight performance; and to achieve the greatest possible altitude with the model.

51.2 Judging
The model rocket and its flight must comply with the rules of the Scale Competition (Rule 50) and shall be judged for scale qualities and awarded scale points according to the rules for Scale Competition.

51.3 Disqualification
The Judges may disqualify any model that, in their opinion, does not show sufficient scale substantiation or evidence of the normal level of workmanship required for a scale model under the provisions of the Scale Competition. The intent of this rule is to eliminate from competition any entry for which scale qualities have been grossly subordinated in favor of altitude performance characteristics.

51.4 Scoring
Scale Altitude Competition shall be scored as follows: the total number of scale points awarded to the entry shall be added to the altitude in meters achieved by the entry. The contestant achieving the highest score shall be declared the winner.

51.4.1 Return of Judging Worksheet
At the conclusion of a scale craftsmanship event, each entry shall receive a copy of the judging worksheet for his/her entry as a part of the official contest results from the CD.

51.5 Classes
This competition is divided into classes based on the maximum permissible total impulse of the motor(s). The following classes of Scale Altitude Competition are established:

Motor Class	Weighting Factor
1/8A	25
1/4A	26
1/2A	27
A	28
B	29
C	30
D	31
E	32
F	33
G	34

Super Scale Competition

52.1 Scope
Super Scale Competition comprises a single event open to any entry consisting of: A model rocket that is a true scale model of an existing or historical guided missile, rocket vehicle, or space Vehicle; and
A launching complex that is a true scale model of the launching complex used by the prototype of the scale model rocket. Launching complex elements that do not directly support or guide the rocket (e.g., umbilical towers or buildings) do not have to be modeled. Their inclusion would, however, contribute to the score.

52.2 Purpose
The purpose of this competition is to produce an accurate flying replica of a real rocket vehicle, and an accurate working replica of its actual launching complex; both of which exhibit maximum craftsmanship in construction, finish, and performance.

52.3 Judging
The model rocket and its flight must comply with the rules of the Scale Competition (Rule 50) and shall be judged for scale qualities and awarded scale points according to the rules for Scale Competition.

52.4 Launching Complex Judging
The launching complex and the model rocket shall be judged for scale qualities at the same time.

52.5 Launching Complex Modeling
The launching complex shall be of the same prototype (or round) as that used to launch the particular serial-numbered prototype rocket entered by the modeler.

52.6 Launching Complex Safety
A model rocket launching device satisfying the requirements of Rules 5.4, 5.5, and 5.6, shall be built as an integral part of the scale launching complex.

52.7 Points
Scale points shall be awarded to the launching complex according to the following schedule:

52.7.1 Scale Data: 50 points
Points will be awarded for data that exceeds the minimum requirements; however, data will be judged on quality, not quantity. All data presented should apply to the particular prototype that is being modeled. Minimum allowable data consists of:
• Scale factor
• Color pattern (documented either in writing or by photographs)
• One clear photograph, halftone, or photo-reproduction
• Substantiation that the particular launcher modeled was indeed used to launch the prototype rocket chosen
• For all dimensions that the modeler has attempted to accurately scale, both the actual (prototype) dimensions and the scaled (model) dimensions, presented in a table or on a drawing
Dimensions for which explicit data cannot be found may be calculated by proportioning drawings or photos; dimensions obtained in this manner must be so identified in the data.
Any entry not accompanied by the minimum allowable data as listed above shall receive zero scale points for the launching complex. In addition, the data presented should show the details of the launch complex in order to receive maximum points. Points may be deducted if the scale

packet contains data not pertinent to the prototype launcher, if the data is presented in such a manner as to complicate judging, if the scale indicated on the data does not match the scale of the model launching complex, or if the launching complex is not to the same scale as the model rocket.

52.7.2 Accuracy of Major Dimensions: 200 points
Major dimensions include dimensions of subassemblies, location of details, location of paint pattern, and so on. At least 5 dimensions shall be checked for accuracy. It is recommended that calipers be used to check small scale dimensions and the judges attempt to measure the main launcher dimensions to at least 0.5 millimeters. Points shall be deducted according to the percentage of deviation from the scale dimensions. Launcher dimensions so small that they cannot be measured to better than a 1% tolerance should not be measured by the judges, but should appear scale-like.

52.7.3 Accuracy of Color and Markings: 50 points
The color and texture (e.g., flat, glossy) of the paint should conform to the data and photographs. Lettering and insignia, if applicable, should be scaled and properly reproduced. Paint patterns should be properly proportioned.

52.7.4 Accuracy of Details: 50 points
Details such as rivets, cover plates, bolts, cables, prototype imperfections, and so on, that appear in the data should be present and properly scaled.

52.7.5 General Appearance: 100 points
The launch complex should look like the photo(s) of the prototype launcher. No points shall be deducted for neatly constructed modifications to the launching complex that are necessary to effect the safe and proper launching of a model rocket.

52.7.6 Craftsmanship: 250 points
Points will be awarded for neatness, care in construction, craftsmanship of details, quality of finish, and construction of movable parts (if applicable). Consideration should be given to the invisibility of wood grain and the proper curving of curved parts. The finish should be free of fingerprints, brush strokes, runs, or other unintentional blemishes; and the paint pattern should be well defined. The details should be precise, and neither more nor less obvious than on the prototype. In addition, consideration should be given for the ingenuity and care with which the launching device is built into the launching complex.

52.7.7 Degree of Difficulty: 200 points
Points shall be awarded according to the difficulty experienced by the modeler in building the launching complex and adapting it for the launching of the scale model rocket. Points to be considered by the Judges include the use of prefabricated parts and details, intricacy of the complex, number of detailed components, difficulty of detailing, difficulty of finishing, parts and details that were individually constructed by the modeler, and difficulty in adapting the complex to launch model rockets. (To facilitate judging, the contestant should point out difficult assemblies or construction problems in his/her scale packet.)

52.7.8 Operation: 100 points
Points shall be awarded for success of operation under launch conditions, lack of damage under launch, and realism. In addition, points shall be awarded for working parts operated manually or by automatic or remote control under launch conditions.

52.8 Scoring

Super Scale Competition shall be scored as follows: the points awarded the model rocket in static judging, the points awarded the model rocket in flight, and the points awarded to the launching complex shall be summed. The contestant receiving the highest score is the winner.

52.9 Return of Judging Worksheet

At the conclusion of a scale craftsmanship event, each entry shall receive a copy of the judging worksheet for his/her entry as a part of the official contest results from the CD.

Weighting Factor 40

MISCELLANEOUS EVENTS

Spot Landing

60.1 Scope
Spot Landing Competition comprises three events open to single-staged entries. The purpose of this competition is to land the entry so that the tip of its nose cone is closest to a predetermined spot on the ground.

60.2 Control
The entry may not be remotely controlled or remotely guided.

60.3 Recovery
Each entry must deploy its recovery device fully and completely before touching the ground. Each entry must comply fully with the provisions of Rule 3.5.

60.4 Separation
An entry must not separate into two or more unattached pieces.

60.5 Number of Flights
Each entry shall be allowed only one official flight. No practice flights may be made.

60.6 Scoring
Spot Landing Competition shall be scored as follows: the distance between the tip of the nose cone (or motor nozzle if the model has no nose cone) of the model and the target spot shall be measured by the officials. If the tip of the nose cone lands more than 50 meters from the spot, the model shall not place, but shall receive flight points; otherwise, the model shall be given a score equal to its distance in meters. The contestant achieving the smallest score shall be the winner.

60.7 Classes
Spot Landing Competition shall be divided into three classes:

60.7.1 Parachute Spot Landing
Each entry must deploy a parachute, with dimensions no less than 15 centimeters square or 15 centimeters in diameter for recovery purposes.

60.7.2 Streamer Spot Landing
Each entry must deploy a streamer with dimensions not less than 25 millimeters by 300 millimeters.

60.7.3 Open Spot Landing
Any type of recovery device allowed, provided it conforms to the provisions of Rule3.5

60.8 Non-Return
Any model that cannot be returned to the officials shall be scored as if it had landed over 50 meters from the spot. Weighting Factor 4

Drag Race Competition

61.1 Scope
Drag Race Competition comprises a single event open to single-staged entries. The purpose of this competition is to determine which entry is most successful at meeting the triple criteria of quick ignition and lift-off, low altitude, and long duration.

61.2 Flyoffs
The event is a series of flyoffs (heats) between pairs of entries. The winner of each heat flies against the winner of another heat until the overall winner is determined. An additional flyoff between the losers of the semifinal rounds is to be made to determine third and fourth places.

61.3 Substitution
No substitution of models is permitted during the course of this event, except as specified under the provisions of Rule 11.5.

61.4 Choosing Competitors
The officials shall choose competitors for each flyoff by lot.
2009 Australian Model Rocket Sporting Code.

61.5 Launching
The model may be launched by either of the following methods:
• Through a common ignition switch operated by the Launch Control Officer; or
• By the contestants themselves, using separate ignition systems.

61.6 Ignition System
Any type of electrically initiated ignition system may be used, provided that it meets the requirements of Rule 9.5.

61.7 Disqualification
An entry that does not fly successfully shall be disqualified.

61.8 Early Start
When a model is launched with a separate ignition system under the control of the contestant, the model must achieve first motion on or after T-0. A model achieving first motion before T-0 shall be disqualified.

61.9 Late Start
A model that does not achieve first motion before T+2 shall be disqualified.

61.10 Scoring
Drag Race Competition shall be scored as follows: the winner of each heat shall be that entry which receives the higher number of points according to the following schedule:
• One point for the first entry to achieve first motion;
• One point for the entry achieving the lower altitude; and
• One point for the entry that touches the ground last. If the entry separates into two or more pieces, the first piece to touch the ground is counted.
The winner of the last heat shall be declared the winner. The loser of the last heat shall receive second place. There shall be a fly off for third and fourth places between the losers of the semifinal heats.

61.11 Return

The model is not required to be returned to the officials, except as stated in Rule 9.10, and Rule 61.3.
Weighting Factor 2

References

The ARA would like to thank the following:

Aerotech, Inc., Utah. U.S.A

Air Sevices Australia

Australian Forum of Explosives Regulators (AFER) Canberra.

Fire Protection Association of Australia, Nth Melbourne, Vic.

California State Fire Marshall, Sacramento, CA 95823. U.S.A.

Canadian Association of Rocketry , Ottawa, Ontario, Canada.

Civil Aviation Safety Authority, Canberra, Perth and Adelaide.

DOCEP, Western Australia Dangerous Goods Branch.

Estes Industries. Penrose USA.

Federal Aviation Authority of the USA, Washington, DC

Federal Institute for Materials Research and Testing (BAM), Berlin, Germany

Federation Aeronautique Internationale, Paris, France

G. Harry Stine, "40 Year Safety Report of Model Rocketry", 1997

G. Harry Stine & Bill Stine, "Handbook of Model Rocketry", Seventh Edition, 2004

Model Aeronautic Association of Australia, Melbourne, Vic

National Association of Rocketry, Elizabeth, PA, U.S.A.

Natural Resources Canada, Explosives Branch, Ottawa, Canada

National Fire Protection Agency, Boston, Massachusetts. U.S.A. (NFPA 1122 2013, 1127 2013 &1125 2012)

National Transport Commision, Canberra

Safework Australia Canberra

Safework SA, Dangerous Goods Branch, Adelaide.

U.S. Consumers Product Safety Commission, Maryland. U.S.A.

Australian Rocketry Association Inc. Constitution

CHAPTER 1

ARTICLE 1-1 NAME: This body shall be known as the Australian Rocketry Association, hereinafter in this constitution as the service.

ARTICLE 1-2 USE: The name shall be limited to this service and its auxiliary services or sections with permission of the council, or executive committee appointed by the council.

ARTICLE 1-3 OFFICE: The office of the service shall be that of the secretary of the service. Not withstanding the contract for the running of the headquarters of the service to be tendered every five years by the executive committee.

ARTICLE 1-4 FISCAL YEAR: The financial year shall be from 1st July to 30th June.

CHAPTER 2

ARTICLE 2-1 PURPOSE: The service shall be to aid and encourage by all suitable means all people interested in hobby rocketry and its related sciences, the service shall;

(a) Promote the safe pursuit of rocketry;
(b) Establish, enforce, modify and publish standards and rules relating to the construction, operation, and safety of consumer rockets and rocketry products;
(c) Establish and define key safety parameters pertaining to hobby rocketry in the safety code(s) of the service;
(d) Strive to promote and improve the image of hobby rocketry with the general public and with all levels of government, and shall co-operate with all levels of government to the end that hobby rocketry activities may be conducted without undue restriction;
(e) Encourage membership in the service, establish sporting rules and sporting competition, and promote the growth of the service;
(f) Engage in and encourage organised hobby rocket activities as the service or the council may from time to time deem necessary or desirable in connection with this article;
(g) Strive to co-operate with clubs, bodies, organizations and any interested parties, for the purpose of furthering the interests of hobby rocketry and promoting good fellowship and sportsmanship;
(h) Raise, borrow or lend funds in any manner, to further the purposes of the service;
(i) Acquire, own, lease, or otherwise deal with any real or personal property for the purposes of the service;
(j) Do all such other activities and things that are incidental or conductive to the above, or any of them.

ARTICLE 2-2 ASSETS AND INCOME: The assets and income of the service shall be applied solely in furtherance of its above mentioned purpose and no portion shall be distributed directly or indirectly to the members of the service except as bona fide compensation for services rendered or expenses incurred on behalf of the service.

CHAPTER 3

ARTICLE 3-1 MEMBERSHIP: The membership of the service will be comprised of;

(a) Citizens of Australia regardless of where they may be residing;
(b) Organised groups or sections of Australian citizens

ARTICLE 3-2 CLASSES: The membership of the service shall comprise the following classes;

(a) Senior membership
(b) Junior membership
(c) Family membership
(d) Honorary membership
(e) Manufacturer and Corporate Supporting membership
(f) Affiliate membership
(g) Such adititional classes as the council may deem it appropriate to create.

ARTICLE 3-3 SENIOR MEMBERSHIP: Senior members shall be 18 years of age or older. Senior members may vote, hold office, chair committees, and serve as executive committee members and council members.

ARTICLE 3-4 JUNIOR MEMBERSHIP: Junior members shall be under the age of eighteen years old. Junior members may not vote, hold office, chair committees, or serve as executive committee members or council members.

ARTICLE 3-5 FAMILY MEMBERSHIP: Family members shall comprise of at least one senior member and shall include that member's spouses and/or dependent children under the age of eighteen years old. Only one person from a family membership may vote, hold office, chair committees, and serve as executive committee members or council members.

ARTICLE 3-6 HONORARY MEMBERSHIP: Honorary members shall be those persons who, by their contribution to the service and/or achievement in the field of hobby rocketry, shall be deemed eligible for such membership by a vote of the council. No more than one honorary membership shall be eligible in any one year.

ARTICLE 3-7 MANUFACTURER AND CORPORATE SUPPORTING MEMBERSHIP: Manufacturer and corporate supporting members shall be limited to those firms who manufacture, produce, distribute, or sell hobby rocket motors, kits, parts, components, accessories, and/or equipment and those firms or organizations who are interested or involved in rocketry, or their allied fields, including the educational aspects thereof. Manufacturer and corporate supporting members may vote, but cannot hold office, chair committees, or serve as executive committee members or council members.

ARTICLE 3-8 AFFILIATE MEMBERSHIP: Affiliate members shall be those persons who are members of another hobby rocketry body. They include local and regional clubs within the commonwealth of Australia.

ARTICLE 3-9: A person or organization having expressed his/her (its) desire for membership shall become a member of the appropriate class upon satisfaction of the executive committee as to his/her (its) sincerity of purpose and good reputation, upon affixing his/her (its) name to a statement pledging to serve and abide by the safety codes of the service in all hobby rocket activities, upon payment of dues required by these by-laws to the secretary.

ARTICLE 3-10: Members of all classes shall be entitled to attend all business and other meetings of the service. However, as later provided herein, only voting members of the service need be formally notified of meetings.

ARTICLE 3-11 NOMINEE MEMBER: Any senior, honorary, affiliate or manufacturer and corporate member shall be entitled to nominate in writing one person as his nominee to attend and vote on his behalf at meetings of the service.

ARTICLE 3-12 VOTING: Voting on all matters related to the business of the service shall be restricted to senior, honorary and affiliate members of the service having had membership in the service for at least one full year, as well as a single vote from each manufacturer member and each corporate supporting member. Voting by proxy shall be permitted however no member shall be permitted to have more than three proxy votes. Voting shall be permitted to be cast by mail or Internet subject to provisions made elsewhere in these by-laws.

ARTICLE 3-13 FEES: The annual subscription fee shall be such sum determined from time to time at a meeting of the council and payable in advance on or before the 1st July in each year or by a new member within fourteen days after notification of his acceptance as a member for the year ending on the next ensuing 30th June.

ARTICLE 3-14: Every candidate for membership shall apply for membership to the secretary or any person appointed by the council to process applications, who shall notify the executive committee at his earliest convenience of the application. The applicant will then be duly notified, and if accepted will become a member upon payment of his/her annual subscription.

ARTICLE 3-15: Any member may resign his/her membership at any time by giving notice in writing to the secretary who will notify the executive committee at his earliest convenience.

ARTICLE 3-16: Upon any person ceasing to be a member of the service for any reason he/she shall not be entitled to the return of his membership subscription or any portion thereof.

ARTICLE 3-17: Members defaulting in payment of dues will be dropped from the membership rolls after a one-month period of grace.

ARTICLE 3-18 ROLL OF MEMBERS: A roll of members shall be kept by the secretary and any person whose name appears on the said roll shall be entitled to attend any meeting of the service.

ARTICLE 3-19 EXPULSION: For conduct prejudicial to the objectives, reputation, or property of the service, or for failure to observe and abide by the safety code(s) of the service in any rocket activities, a member of any class may be censured, suspended, or

expelled by a committee of any three senior members in good standing appointed by the president. Notice of all charges against such member and of the time and place of the meeting at which they are to be presented shall be sent to the member by mail not less than thirty (30) days prior to such a meeting. A written summary of all evidence to be presented shall be sent to the member by mail not less than twenty-one (21) days prior to such a meeting. Such member shall be given the opportunity to be heard at the meeting in his/her own defence. Such member in addition to, or in lieu of a personal appearance, may present a written defence; an address to which such written defence is to be sent must be provided to the member not less than twenty-one (21) days prior to such meeting. Any member of any class charged with violation of the safety code (s) of the service shall automatically be suspended from membership until the meeting of the committee at which his/her case is to be decided, providing the time of suspension is not longer than one (1) year from the date of suspension until the date of the hearing. No person, once having been admitted in good faith as a member of the service, shall be denied the right to continued membership except for the above reasons and through the above procedure, or except for non-payment of dues or other debts owed the service.

CHAPTER 4

ARTICLE 4-1 COUNCIL: The governing body of the service shall be a council consisting of eight council members who shall be senior or honorary members of the service having had membership in the service for at least one full year.
ARTICLE 4-2: Each council member shall represent the interests of each Australian state and territory. Each council member shall be nominated or elected from the membership of each state or territory for a term of two years. At no time can a council member represent more than one state or territory. Each council member must disclose all their financial or monetary interests in hobby rocketry to their members who they represent in each state or territory.
ARTICLE 4-3 QUORUM: three to four members of the council shall constitute a quorum at meetings of the council.
ARTICLE 4-4 MEETINGS: Meetings of the council shall be held at least once a year either in person or by technological means via computer or teleconferencing. The chairman of each council meeting shall be based on a rotation basis. The secretary shall send notice of all meetings of the council to each council member at least thirty days in advance.
ARTICLE 4-5 VACANCY: In the case of vacancy in the council by death, resignation, removal or failure of election, the president may appoint any senior or honorary member of the service otherwise eligible to run for election to the council to fill the unexpired term subject to a ratification vote of a majority of the council present and voting at the next regular meeting of the council following such appointment.
ARTICLE 4-6 MINUTES: The council shall cause minutes to be kept of their meetings and of all actions taken by them which involve the expenditure of funds of the service. Such minutes shall be kept by the secretary and shall be made available to the membership via service newsletter within sixty days of such meetings or such actions.
ARTICLE 4-7: Failure to attend at least half of the regular meetings of the council in any given year shall be cause for removal of a council member upon vote of more than one half

of those council members present and voting at any meeting of the council.
ARTICLE 4-8 EXPULSION: For conduct prejudicial to the objectives, activities, property, or reputation of the service, a council member, either elected, appointed, or honorary, may be removed from office by a two thirds vote of those council members present and voting at any meeting of the council after notice of the charges against him/her and an opportunity to be heard in his/her own defence.
ARTICLE 4-9: At all meetings of the council, the conduct of the meeting shall be governed by article
ARTICLE 4-10: The council may from time to time authorise the bestowal of any appropriate honours or recognition in the name of the service to any person whom the council may deem deserving.

ARTICLE 4-11 PUBLIC OFFICER: At the councils annual meeting members of the council shall elect the public officer, whose name and address must be duly lodged with the office of consumer and business affairs in South Australia.
ARTICLE 4-12 SUB-COMMITTEES: The council may from time to time appoint any such sub-committees from service members, and allot them such duties and responsibilities as may be deemed necessary for carrying on the work of the service. The members of any such sub-committees shall remain in office for such a period as determined by the council.
ARTICLE 4-13 COMPENSATION: The members of the council, members serving on any sub-committees, any members charged with any specific duties or responsibilities shall all serve without compensation but shall be reimbursed for expenses incurred on behalf of the service and authorised by the council.

CHAPTER 5

ARTICLE 5-1 EXECUTIVE COMMITTEE: The executive shall carry on the administration of the service between meetings of the council and shall, be subject to such limitations as they may not be elected members of any overseas rocketry club be it operating locally or not other restrictions as the council may from time to time impose, exercise and carry out the powers and functions of the service.
ARTICLE 5-2: The members of the executive committee shall retire or deemed to retire at each annual meeting of the council and shall be respectively be eligible for re-election or re-appointment by the council.
ARTICLE 5-3: The executive committee shall consist of the following office bearers;

(a) President
(b) Vice President
(c) Secretary
(d) Treasurer

ARTICLE 5-4 PRESIDENT: The president shall preside at all meetings of the membership and the executive committee. The president shall represent the service in all dealings with outside organizations and agencies, and transact business and perform duties on day-to-day basis on behalf of the executive committee. The president shall at all times be subject to the directions of the executive committee.
ARTICLE 5-5 VICE PRESIDENT: The vice president shall act as president in the absence

of that officer. In the event of the absence of both president and vice president at any meeting of the membership or executive committee, another officer, respectively, shall be chosen to preside at the meeting.

ARTICLE 5-6 TREASURER: The treasurer shall keep a record of the property and assets of the service and shall assist the secretary where practical in carrying out his/her duties. The treasurer shall submit a report of the financial affairs of the service at the annual general meeting.

ARTICLE 5-7 SECRETARY: The secretary shall keep the minutes of all meetings of the membership of the service, compile records, conduct correspondence, record the use of the common seal of the service, and perform other duties as required; shall be responsible for maintaining a current list of the financial and active members of the service; shall receive applications for membership and resignation. The secretary and the treasurer shall receive and disburse all moneys and maintain service bank account and make proper financial reports to the executive committee and council and the membership. Shall make available to each member copies of the constitution and amendments thereto, operating rules and other matters as directed by the executive committee and council.

ARTICLE 5-8 FINANCE: The secretary and the treasurer shall be the authorised signatories of the service cheque account and all cheques drawn on the bank account of the service shall be signed by two authorised signatories. No cheque shall be signed or money withdrawn unless such withdrawal has been approved by the council or in case of urgency, by the executive committee.

ARTICLE 5-9 LIMITED AUTHORITY: No officer or member of the service, may act in the name of or on behalf of the service, except when specifically authorised to do so by the executive committee. No person authorised to perform an act in the name of or on behalf of the service may exceed the authority granted to that person to perform the said act, except in circumstances where the said act is clearly in the benefit of the service interest.

ARTICLE 5-10: Any person who is a financial member of the service shall be eligible for election to the executive under clause 5-3 hereof except as defined in membership classes.

ARTICLE 5-11: At any executive meeting 2/3 executive members shall constitute a quorum and the president or in his absence the vice-president or in the absence of both, a member appointed by other members of the executive who are present shall act, as chairman and the chairman shall have a deliberate vote as well as a casting vote.

ARTICLE 5-12: The executive may appoint any member to fill any casual vacancy in respect of any elected member of the executive from time to time, provided that the member so appointed would have been eligible for election to such office at the last Annual General Meeting. Such appointee may hold office on the executive until the retirement of that executive at the next Annual General Meeting.

ARTICLE 5-13: The executive has power to act notwithstanding any vacancy thereon.

ARTICLE 5-14 EXPENSES: No officer or member of the service shall incur any expenses in the name of or on behalf of the service except with the authorisation and approval of the executive committee or council.

CHAPTER 6

ARTICLE 6-1 ANNUAL GENERAL MEETING: An annual general meeting of the service shall be held once in every calendar year and within five months of the end of financial year. This annual general meeting shall include all members of the council.
ARTICLE 6-2: A notice of the annual general meeting shall be served upon each member of the service at his address on file with the secretary, at least twenty one days prior to the date of such meeting, specifying the time and place of the meeting. This meeting can be held in cyberspace.
ARTICLE 6-3: A quorum for the annual general meeting shall be the presence of one third of the total membership of the service. All eligible registered financial members of the service shall be entitled to vote and nominate for office. Should the quorum not be met, the meeting shall be adjourned, and a new date set as soon thereafter as is practical.
ARTICLE 6-4: The agenda for the annual general meeting shall be as following;

(a) Presentation of the annual report by the president
(b) Presentation of the financial report by the treasurer, to include balance sheet and detailed statement of all income and expenditure for the financial year immediately preceding the date of the meeting.
(c) Election of the executive committee officers and a public officer.
(d) Appointment of an auditor to audit the financial records of the service.
(e) Setting of the annual membership fee of the various classes.
(f) If due election of council members for each state and territory.
(g) Updating of the blue book.

ARTICLE 6-5 SPECIAL GENERAL MEETING: The council shall convene a general meeting upon a requisition in writing under the hands of no fewer than ten members of the service. Such a requisition shall clearly set forth the time, place, and subject matter of the special meeting, and shall be served upon the secretary with at least fourteen days notice prior to such a meeting-taking place. No less than seven days notice shall be given to all members of the service, prior to such a meeting being convened by the council.
ARTICLE 6-6 QUORUM: A quorum for a special general meeting shall be the presence of no less than ten members of the service, at least two of those members present shall be office bearers.
ARTICLE 6-7 DISSOLUTION: A special general meeting may be convened to dissolve the service. Such a meeting shall require the presence of seventy-five percent of all service members eligible to vote and shall require a unanimous resolution of all members present. If such a resolution shall be passed, then all moneys, assets or property held by the service shall be applied in payment of its debts and liabilities, and any surplus moneys, assets or property shall be transferred to another organisation with similar purposes which is not carried on for the profit or gain of its individual members.

CHAPTER 7

ARTICLE 7-1 AUXILIARY SERVICES OR SECTIONS: The executive may authorise the formation of such auxiliaries or sections as are required for the service.

ARTICLE 7-2: Auxiliaries or sections shall be conducted with the advice of the executive for the general welfare and benefit of the service.

ARTICLE 7-3: Auxiliaries or sections shall elect their own officers and the objects and activities of auxiliaries or sections shall be in accordance with such standard form of constitution as shall be authorised by the executive.

ARTICLE 7-4: Headquarters of the service shall be a five-year contract awarded to any member who has been financial with the service for a minimum of two years, the executive committee shall call for tenders every five years and award the contract based on ability to run all services for the service. It is the responsibility of headquarters to hold records of the service, collect dues for the service this also includes collection for any projects, banquets, legal funds and all assessments deemed necessary by the executive committee.

CHAPTER 8

ARTICLE 8-1 AFFILIATIONS: The service may be affiliated with any profit or non-profit organization, person, body of persons, company, firm, or association necessary or desirable to effect the purpose of the service. The president of the service shall, upon ratification by the council, enter into any affiliation with any such organization, person, and body of persons, company, firm, or association

ARTICLE 8-2 AMENDMENTS: The power to adopt, alter, amend or repeal any article or articles of this constitution shall be vested in the council and a unanimous resolution.

ARTICLE 8-3 DISPUTE RESOLUTION: The procedure for resolving disputes, which may arise between a member and another member or a member and the service, shall be as follows;

(1) The parties to the dispute must meet and discuss the matter in dispute, and, if possible resolve the dispute within fourteen days the dispute comes to the attention of all of the parties.
(2) If the parties are unable to resolve the dispute at the meeting the parties may choose to meet and discuss the dispute before an independent third person agreed by the parties.
(3) In this rule “member” includes any person who was a member not more than six months before the dispute occurred.

ARTICLE 8-4: All meetings shall be conducted under procedures as outlined in the “standing orders for the conduct of all meetings” ARTICLE 8-5.

ARTICLE 8-5 STANDING ORDERS FOR THE CONDUCT OF ALL MEETINGS:

(1) <u>THE AGENDA AND ORDER FOR ALL MEETINGS SHALL BE AS FOLLOWING:</u>

(4) Opening
(5) Apologies
(6) Welcome to visitors
(7) Minutes of previous meetings
(8) Matters arising from minutes
(9) Correspondence
(10) Reports
(11) Motions on notice
(12) Notice of motion
(13) General business
(14) Date of next meeting
(15) Closure

(ii) <u>THE RULES OF DEBATE SHALL BE AS FOLLOWING;</u>
<u>MOTION PROCEEDURE</u>

(a) Single motion (prior notice in writing may be given of intention to move this motion)

Mover of motion;	rises, announces motion
Chair	asks for a seconder
Seconder of motion	rises, seconds motion
Seconder of motion	Speaks to motion if they wish to
Speakers from floor	Speak in favour of, or against
Mover of motion	has right of reply
Secretary	reads exact wording
Chair	puts the vote and announces results (CARRIED or DEFEATED)

(2) MOTION WITH AN AMENDMENT Same step by step procedure as in single motion except as soon the secretary reads the exact wording, any person entitled to vote may rise and move an amendment to the original motion, in the following manner;

Mover of amendment	***rises, announces amendment***
Chair	asks for seconder (if no seconder, then original motion is voted on)
Seconder of amendment	rises, seconds amendment
Mover of amendment	speaks to amendment
Seconder of amendment	speaks to amendment
Speakers from the floor	speak in favour of, or against amendment
Mover of motion	has right of reply
Secretary	records and reads exact words of motion and amendment
Chair	puts amendment to the vote- if the amendment is CARRIED, then takes votes on motion as amended

Secretary	records motion, amendment and result- if amendment is DEFEATED
Chair	takes vote on the original motion
Secretary	records motion, amendment and result

CHAIRMAN

When chairing a meeting, the president shall be addressed as “Mister/Madam Chairman”. The meeting shall continue along the lines of the chairman’s ruling unless a motion of dissent challenges it. The procedure for motion of dissent shall be the same as for single motion, and if CARRIED, the chairman’s ruling is then overruled.

RULES OF DEBATE

(1) Any person may rise to a point of order at any time when he/she deems that the standing orders have been violated.

(2) The point of order must be addressed to the chairman. The procedure shall then be the same as for a single motion, and if CARRIED, the standing orders shall be adhered to.

VOTING

All questions shall be determined on a show of hands and by a simple majority of those present and eligible to vote unless the articles of association override.