



# AUSTRALIAN UNIVERSITIES ROCKET COMPETITION **CHEAT SHEET**

The Australian Universities Rocket Competition (AURC) challenges university teams to design, build, and launch a single stage rocket with commercial-off-the-shelf (COTS) solid propulsion systems. These rockets will aim to reach target heights of 10,000 ft and 30,000 ft with a 4kg payload.

## **Who is Australian Rocketry**

Australian Rocketry Pty Ltd (AusRocketry) is the premier importer and provider of rocketry products and sole importer for consumer solid high power rocket motors in Australia.

AusRocketry sells all sizes of rocket components and kits, electronic packages including altimeters/tracking etc. and rocket motors which can be purchased online at <https://ausrocketry.com.au>. A number of products are also produced in house, so custom work can be requested (e.g. plates/centering rings, airframes, decals, laser cutting, CNC routing etc.). AusRocketry has everything needed to compete in the AURC.

Due to the high turnover of products, if something shows as out of stock, please contact [info@ausrocketry.com.au](mailto:info@ausrocketry.com.au) with your requirements so these can be included in a shipment and/or manufactured.

AusRocketry is also behind the international rocket event 'Thunda Down Under'. Held in QLD, TDU's launch site boasts the highest civilian air space clearance in the Southern Hemisphere and is where the biggest and fastest rockets in the country take to the skies.

The purpose of this 'cheat sheet' is not to give the specific answers, rather a foundation that will guide teams towards successful flights to achieve the necessary outcomes.

## **Part 1. Join the Australian Model Rocket Society Inc. (AMRS) (<https://rocketry.org.au>)**

The AMRS has created a specific AURC membership for teams to access technical information as well as gain access to insurance and launch sites around Australia.

The AMRS AURC membership permits one (1) person to be named as the team manager/leader (must be an adult) who will be responsible for the activities of the team. In an exception to the standard High Power Rocketry (HPR) certification process, teams can work together to achieve HPR Levels 1 and 2 certification, however only the team manager/leader will be acknowledged as having completed the certification. If individual team members wish to pursue their own HPR certification (and this is greatly encouraged), then they should join the closest AMRS club independently.

The actual rocket flown for the AURC will be used for/treated as a Level 3 certification attempt.

## **Part 2. KEEP IT SIMPLE & STRAIGHTFORWARD (KISS Principle)**

Many participants have never worked with actual rockets before and whilst it is very exciting, it can quickly lead to elaborate plans to revolutionise the aerospace industry without first understanding the complexities and challenges involved. Keep it simple and straightforward and recognise the task at hand.

### **Part 3. Checklists are your friend**

It doesn't matter whether you are planning lunch for your road trip to the launch site or flying a rocket, checklists are a critical component that will save a lot of heartache. When creating your checklist/s, consider all variables, write them in detail and have someone else review it. A trivial item such as 'include a drill bit' or 'tighten a quick link' could be the difference between success and an inability to operate.

### **Part 4. Start small and work your way up**

'Walk before you run', it is very easy to get ahead of yourself and focus purely on the rocket required to reach the competition set altitudes. Whilst it is important to continually think about how and what you are going to do to complete the task, it is imperative to work up to that point. Buying a low/mid power rocket is an excellent and cheap way to see the very basics of rocketry. It also doesn't require any licensing to possess and use.

With your AMRS Membership, you can fly at various rockets clubs across Australia who will also offer mentoring and assistance with the various steps throughout the competition.

Attempting and successfully achieving the L1 and L2 HPR certification is an invaluable component of the AURC. Through flying these smaller rockets, teams will gain intricate knowledge of how rockets perform in different environments as well as becoming familiar with a range of equipment including airframe materials, electronics (altimeters/tracking), rocket motor operations/performance and recovery techniques, just to name a few.

The HPR certification process will also test the safety and technical knowledge of participants which is a critical component of not only succeeding, but being permitted to fly at the final competition. All teams will be required to demonstrate a level of competency and rockets that are deemed unsafe will NOT be allowed to fly.

### **Part 5. Use resources already available**

Fortunately, we live in a digital world and as such, there are a number of resources available (many free) which are great tools to assist with the design, build and operational phases of the competition.

Whilst it is ideal to understand the calculations and theory behind the actual flights, it is essential to use a simulation program such as Open Rocket (<http://openrocket.info>), which will allow you to design and prove concepts and/or confirm your work. Simulations will also allow you to gage the performance characteristics of your rocket to determine if things such as stability are going to have an issue during a flight. This becomes exponentially important with faster flights. Use of a design/simulation program should be an integral part of all rocket activities irrelevant of the size.

Remember, it is easy to manipulate calculations to achieve what you want on paper, so it is important to use actual figures and data to determine the ultimate performance of any rocket.

### **Part 6. Use COTS products to achieve success**

There are many COTS materials/products available which are proven to work in harsh rocket launching environments. As you progress through L1 and L2 HPR certifications, using these COTS parts and/or kits will assist with understanding how things work and how much force they can handle.

With the competition rocket, manufacturing certain components is encouraged, e.g. rolling composite airframes and sewing parachutes, however in line with Part 2, consider using COTS materials that are already proven to work is highly recommended. Even with significant testing of custom made products on the ground, the high G loading, thrust, vibration and lower air density can cause unforeseen issues. (For this reason, if custom electronics are the desired outcome e.g. deployment altimeters, using COTS electronics may be required as a backup for safety.)

Some of the components that should be considered for COTS are listed below. COTS items also already meet international sizing standards so replacement parts will be much easier to come by.

Electronics, Components, Parachutes, Shock Cord, Nose Cones, Motor Retention etc.

### Part 7. Understand the rules and regulations

Flying HPR rockets is governed by various state and federal regulations. It is imperative that the various legislation and rules are followed for the safety and compliance of all participants.

All HPR rockets require an 'area approval' from CASA to fly. This is per the CASR Part 101. As an AMRS AURC member, you will have access to flying with clubs who already have the necessary approvals in place. Not all sites will permit the competition altitudes, so make a plan with your local club before showing up to attempt any flights.

Possession, transport, storage and use of HPR rocket motors is managed state by state, generally requires licensing/permits and are to be handled by adults. As the competition is run during a limited time frame, it may be possible to have an AMRS club mentor 'sponsor' the rocket motor activities, however as a member of AMRS, you can receive a letter of verification, which is often required to obtain the necessary licenses.

### Part 8. Choose your motor

Most of the COTS rocket motor data is available on simulation programs such as Open Rocket which will allow you to simulate flights and determine the performance characteristics. Whilst attempting your L1 and L2 HPR certification, it may be prudent to try different propellant formulas available to understand how they will affect your flight e.g. fast vs long burning propellant.

Based on the competition altitudes set, the size of the motor required will be at a minimum a 'M' impulse (>5,120Ns). These motors generally come in 75, 98 and 152mm sizes.

### Part 9. Plan Ahead!

Rocketry in general has unique challenges which means products aren't always immediately available. Plan wisely and consider each product carefully.

Since propellant is classed as an explosive, there can be challenges with supply, so it is important to promptly choose and commit to your motor preferences in order to guarantee availability leading up to and at the competition. Remember, you must either have a valid license or appropriate sponsorship to take possession of HPR rocket motors.

For all of your rocketry needs, visit <https://ausrocketry.com.au>

If you have other questions, please direct these to [info@ausrocketry.com.au](mailto:info@ausrocketry.com.au) and identify they are for AURC

