



AUSTRALIAN  
ROVER  
CHALLENGE

# AUSTRALIAN ROVER CHALLENGE 2025

CRITICAL DESIGN REVIEW GUIDELINES

VERSION 1.0 4 SEPTEMBER, 2024



**make  
history.**



THE UNIVERSITY  
of ADELAIDE

## About This Document

This document is to be read and interpreted together with the Rules and Requirements document for the 2025 Australian Rover Challenge. It sets out the requirements for the Critical Design Review, a deliverable of the challenge that is detailed in Chapter 5 of the Rules and Requirements document.

## Contacts

For *any* general enquiries about the challenge, please feel free to use the general inbox which is monitored by a range of the staff involved with the challenge.

### Australian Rover Challenge – General Inbox

e: [auroverchallenge@adelaide.edu.au](mailto:auroverchallenge@adelaide.edu.au)

This is the best way to connect with the judging committee who develop and manage these rules.

**David Harvey**

**Henry Lourey**

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## Changelog

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Date	Version	Change notes
04/09/2024	V1.0	V1.0 release. Please read carefully in its entirety. Future versions may be issued if any errors are found or areas of clarification are needed.

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# Requirements

1. This document sets out the requirements for the Critical Design Review (CDR), a deliverable for the 2025 Australian Rover Challenge (ARCh) specified in Chapter 5 of the overarching ARCh Rules and Requirements document.
2. The aims of the CDR are as follows:
  - 2.1. To ensure that teams are on the right track, have understood the competition tasks and their requirements, have designed the required systems, and have a plan to implement those designs for the 2025 ARCh. Your CDR report should demonstrate that the maturity of the rover design is appropriate to support proceeding with full-scale fabrication, assembly, integration, and testing, and that the technical effort is on track to complete the development of the core rover systems to meet the Rules and Requirements of the ARCh, within your team's identified cost and schedule constraints.
  - 2.2. To provide an opportunity for the judges to provide feedback and advice to support the development of each team's rover and its subsystems early in the life cycle where changes are not as costly to implement.
  - 2.3. Possibly contribute to team downselection, depending on the number of teams who wish to participate.
3. Teams will receive a mark for the CDR. This mark will contribute a maximum of **30 points** to the team's overall 2025 challenge score.
4. Each CDR report shall contain an identified and tailored systems engineering lifecycle, a clear system hierarchy, mention of identified essential requirements driving design, and indication of tasks the team intends to compete in as entry conditions for the review. Each report will undergo an initial review entry conditions check within 48 hours of the submission deadline. CDR reports addressing all expected elements will receive an "Accepted" message. Any CDR missing these elements upon first submission will receive a "Rejected" message, with the team then having a further 48 hours to update and resubmit the report. Rejected reports will incur a 20% penalty for this element.
5. NASA videos explaining key project management and systems engineering concepts created for their Lunabotics challenge, along with advice on how to apply them to a university-level design project such as this one are available at <https://www.youtube.com/watch?v=7ieMjL08cMI&list=PLStC43yAV6zRhiTcHM4x5pF1e-0DXs2Ht&index=1>. You do not have to use this specific approach, but it is expected that there is clear evidence of selection of a systems engineering approach and tailoring to your situation in your CDR report.
6. Format and submission details:
  - 6.1. CDR reports shall be limited to 15 pages with the following restrictions:
    - 6.1.1. Page 1 shall be a cover page which identifies the competing team's name, university, the student team lead(s), and an additional optional point of contact.
    - 6.1.2. Pages 2–9, the body of the report, shall contain text and graphics (images, figures, etc.) The points to cover in the report are discussed in rule 7.

- 6.1.3.** Pages 10–11 shall contain a schedule of activities (Gantt chart or similar) depicting the expected activities to be carried out by the team from the due date of the CDR until the competition. Tasks on the critical path should be highlighted.
    - 6.1.4.** Pages 12–14 may only contain supplementary graphics or tables with captions. These should still be referred to in the body of the report.
    - 6.1.5.** Page 15 shall contain a letter of endorsement from a member of academic staff indicating that the team has university support to travel and compete in ARCh 2025.
    - 6.1.6.** Pages of references in your elected referencing format do not count toward the page limit. Please only include a reference list, not a bibliography.
  - 6.2.** Pages should be A4 paper size with margins no smaller than 2cm, contain page numbers, use text in Calibri or similar 11-point font, and be single spaced.
  - 6.3.** You may choose how to structure the body of the report (e.g. style of headings, titles of sections, etc.) freely, so long as it follows some standard technical/academic practice, and your report comprehensively covers every point in rule 7. It is recommended to put considerable thought into how you present the information contained in the report as it can have a significant bearing on the readability which ultimately makes it easier for reviewers to understand your work and to award you marks.
  - 6.4.** All content and ideas not created by the submitting team must be cited in a standard referencing style (i.e. Harvard, IEEE, or similar) on the pertinent page where appropriate or in a references section. Reports must comply with expectations of academic honesty at your host university. Plagiarism concerns are taken very seriously and are grounds for disqualification.
    - 6.4.1.** Teams are reminded that self-plagiarism will also be taken seriously. The content for this report may be inspired from previous reports prepared for any competition, but the exact content must be developed specifically for this delivery.
  - 6.5.** Electronic submissions are required in PDF file format.
    - 6.5.1.** Files will be uploaded via a form on the ARCh website.
    - 6.5.2.** CDR Reports must be submitted no later than 23:59 Australian Central Daylight Saving Time (ACDT) on the due date (30 October 2024) and may be submitted at any time before this point.
    - 6.5.3.** Multiple submissions are allowed. The most recent submission before the deadline from each team will be judged.
- 7.** The report shall, in an order of your choosing:
  - 7.1.** Convince the panel that your design has met the requirements for the challenge. While your rover needs to meet *all* the rover requirements as specified in Chapter 3 in the latest version of the Rules and Requirements document, only key requirements (as identified by your team) in addition to the minimum requirements need to be directly addressed in the CDR.
    - 7.1.1.** You must address the following minimum requirements: size, weight, E-STOP, status LED, communications, and safe carry.

- 7.1.2. Failure to demonstrate adherence to the minimum requirements may result in your team's entry to the 2025 challenge being cancelled.
  - 7.1.3. You may also, as your team sees fit, identify any other requirements as key requirements for discussion.
- 7.2. Discuss your team's overall approach to the system development life cycle for your rover (e.g. understand, plan, design, manufacture, integrate, evaluate). This plan should explain how you intend to solve the problems, not necessarily the exact solution. Connecting your design process to that set out in the NASA systems engineering handbook, European Cooperation for Space Standardization equivalent, or similar with appropriate tailoring for your context would be well received. Your team's overall approach should include specifics about:
- 7.2.1. The method for determining requirements for each subsystem defined by your team.
  - 7.2.2. The approach to scheduling future activities and contingency planning, should there be modifications to the schedule (ideally in reference to the schedule on page 8 of your submission).
  - 7.2.3. Manufacturing: details about resources, facilities, and how this constrains and motivates decisions for the rover design and manufacture.
  - 7.2.4. How and when you intend to test your rover and/or its subsystems.
  - 7.2.5. Verification: how you intend to demonstrate that the rover and its subsystems have met the requirements
  - 7.2.6. Validation: how you are confident that the requirements captured by your team will produce a successful ARCh rover.
  - 7.2.7. How your team intends to operate the rover, and the need for associated infrastructure, testing, training and support.
- 7.3. Present the preliminary technical design for the rover system. This should start with a system overview, including identification of subsystems, as well as internal and external interfaces. Some example subsystems for your consideration are mobility (drivetrain), structure (chassis), perception (including visual sensing), power storage and distribution, communications, command and control, base station, payload(s) including robotic arm, space resources, construction & excavation, and mapping & autonomous if applicable. Details are encouraged where appropriate and space allows, but are not required. A successful report will include the following details for each subsystem:
- 7.3.1. The requirements you used to design the subsystem.
  - 7.3.2. An overview of the design and how it meets the requirements.
  - 7.3.3. A plan to procure or implement the design (especially considering any long lead time items).
- 7.4. Nominate the set of competition tasks in which your team intends to compete.
- 7.4.1. Teams will be required to confirm the tasks they intend to compete in at the System Acceptance Review (SAR). After the SAR no changes to task entry will be permitted.

- 7.4.2.** Weighing up your team's resources and experience, and making a judgement on which tasks to compete in will be viewed favourably.
- 7.5.** Briefly discuss the relevant finances of the team and the feasibility of completing the rover, including topics such as:
- 7.5.1.** Money procured so far, and how much money is still expected to be procured before the end of the 2025 competition to support system development and challenge participation (including challenge travel and logistics costs).
- 7.5.2.** Preliminary projections for the total monetary value of the rover (i.e. to demonstrate that the rover will come in at under the A\$35,000 maximum value), including indications of the big-ticket items already purchased and yet to be purchased.
- 8.** Detailed design such as detailed drawings, PCB layouts, and individual component choices are not required in the report, but may be included if they serve an argument, fit within the report constraints, and are referred to specifically. There is no scope for submitting further supplementary materials other than the allowances already made in rule 6.1.
- 9.** Submissions will be marked by a panel of representatives from academia and industry.
- 10.** The weighting of the relevant sections of the report are as follows:
- 10.1.** Approach to system development lifecycle: 40%. Judges are directed to consider information in the following categories with equal weighting to make up the overall section mark:
- Overall design approach / lifecycle
  - Management (including scheduling/budget)
  - Requirements analysis approach
  - Solution exploration approach
  - Procurement/manufacturing approach
  - Integration planning
  - Evaluation planning including verification/validation
  - Rover operation
- 10.2.** Preliminary technical design: 60%, Judges are directed to consider information in the following categories with equal weighting to make up the overall section mark:
- System overview (including hierarchy)
  - Interface definition (including subsystem and external interfaces)
  - Requirements analysis
  - Subsystem overview - Drivetrain
  - Subsystem overview - Chassis
  - Subsystem overview - Perception
  - Subsystem overview - Power
  - Subsystem overview - Communications

- Subsystem overview - Command and control
- Subsystem overview - Base station
- Subsystem overview - Specific payload
- Procurement/manufacturing progress

**10.3.** Please note that other sections including adherence to challenge requirements, nomination of tasks to compete in, and finances, are required in the document, however do not contribute to the amount of points received.