

FORMULA STUDENT RC

Competition 2022



FORMULA STUDENT RC is a class of radio control car competition based on the principles and general event structure of full size Formula Student motorsport. Event organisation is by the University of Canterbury and UCM (University of Canterbury Motorsport – a UCSA club).

The activity is intended both for students that are involved, or aspire to be involved, with full size Formula Student, as well as for those that just enjoy designing and building technical things.

The purpose is to give students the opportunity to practice and demonstrate design and other engineering skills in a social but competitive environment. The size of cars is scaled down from full size Formula Student, and so is the level of required resources and personal commitment. Intended as a part time activity over a few weeks per semester, rather than a full year of work, Formula Student RC encourages entrants to move quickly and to apply pragmatic project management.

In 2022 there will be two classes of competition; Open and Standard. The Standard Class requires each team base their design around a standard radio and powertrain kit, which is provided by the organisers. All other components must either be 3D printed, laser cut MDF sheet, or standard fasteners. No other materials or parts are permitted.

The Open Class allows a wider range of materials, components and manufacturing techniques to be used. Open Class teams must however still use the same motor and battery supplied by the organisers. The open class will be limited to teams that have competed in Formula Student RC in previous years.

As with the cars themselves, the competition is a scaled down version of full size Formula Student. Teams compete with their vehicles through a number of different events, collecting points from each, to decide the overall results. This encourages teams to think strategically and also to focus on product qualities such as reliability and ease of operation, rather than only speed.

FORMULA STUDENT RC - Rules

SECTION 1 General

1. The competition is open to all University and High School students, subject to acceptance of team entry. In the case of oversubscription, selection is made by order of valid entry received.
2. Each team must consist of between 2 and 5 members.
3. Teams must perform all design and manufacturing themselves. They may receive mentoring and feedback, but not direct assistance.
4. Safety is of paramount importance. All teams are required to submit a safety plan (template supplied) to document their understanding of the inherent hazards and the controls implemented to prevent harm.
5. The intent and spirit of the rules carry the same weight as the written rules. Entrants shall approach the design and competition with an attitude of good faith and fairness.
6. Teams may choose between entering the Standard or Open class competition. The open class will be limited to teams that have competed in a Formula Student RC competition previously (first time teams may switch to open class for the second competition of 2022).
7. Teams are encouraged to select a theme for the vehicle, this can be a livery, vehicle style, or team member outfits. Points will be awarded for theme in the design section.

SECTION 2 Vehicle Design

1. Design data (CAD models) must be the work of the student teams, and not significantly based on previously generated data or downloaded from any other source.
2. Vehicles must pass a scrutineering check on the day of the competition, prior to being able to run. This will cover:
 - 2.1. Overall quality of entry. Vehicles can only compete if at a standard which reflects a high level of effort and pride from the team.
 - 2.2. Rule compliance.
 - 2.3. Good engineering practice. All components must be mounted with sufficient robustness that the vehicle could sustain a modest impact without disintegration or ejection of components.
 - 2.4. Check for robustness of components that relate to vehicle control, especially steering system and wheel mounting.
3. Vehicles must have exactly four wheels which are usually in contact with the track, at least when driving in a straight line.
4. The vehicle may have components which are adjustable during the competition, but parts may not be removed or swapped out.
5. Size, weight, and form factor of the vehicle is open, to be determined by each team.
6. Chassis, suspension, aero, drivetrain are all open, subject only to the vehicle manufacture limitations of section 3.

7. All vehicles require a group number decal to be applied. This can be in any location, as long as it is clearly visible. Group number can be chosen by the team with approval from organizers in the case of duplicates.

SECTION 3A Vehicle Manufacture (Standard Class)

All cars shall be constructed using ONLY the following

1. A standard powertrain kit (organiser supplied) comprising of:
 - Electric motor
 - Battery
 - Radio control transmitter and receiver
 - Servo for steering
 - Motor speed controller
 - Length of 30mm x 10mm EVA foam (may be cut and used for tyres or any other purpose)

Note: no modifications to the powertrain kit are permitted, with exception to a custom speed controller.

2. A standard supplied motor speed controller will be supplied but an alternative speed controller designed by the team may be used, maximum design score can still be achieved with the standard speed controller.
3. Parts produced using a consumer grade FDM 3D printer (eg PRUSA, UP BOX, MakerBot), using PLA material and break-away supports only.
4. Parts produced using a 2 axis laser cutter from 4.75mm MDF. Some finishing may be performed with *hand tools only*, but the primary process must be laser cutting. No other machining or use of power tools is permitted.
5. Any type of readily available steel fastener. This includes standard commercial grade bolts, screws, nuts (nyloc allowed), and washers. Ground, machined, or other precision fasteners are not permitted. Fasteners may be modified using *hand tools only*, but not so much as to change the original purpose of the part.
6. Any type of adhesive, used only for the purpose of bonding components. Note that relying only on adhesive to connect structural or control components is generally not good engineering practice unless significant engineering design and process controls are applied. Consider this carefully to avoid potential scrutineering issues.
7. Standard 30mm x 10mm EVA foam must be used for tyres.
8. Any paint for themed livery design, paint may only be used on 3D printed and laser cut parts. No painted electronic parts are permitted.

SECTION 3B Vehicle Manufacture (Open Class)

1. The same standard powertrain kit listed in section 3A will be supplied. Teams must use the battery from this kit. Cars may not be fitted with any additional batteries.

2. The use of any other materials, manufacturing techniques or additional parts (e.g. extra servos, fans, different/more motors) is allowed, however this will be at the teams cost.
3. No painted electronic parts are permitted.
4. Standard 30mm x 10mm EVA foam must be used for tyres.

SECTION 4 Competition

1. Event dates
 - 1.1. Venue and track announcement TBA
 - 1.2. Competition 1 date Saturday 30th July (*University students only*)
 - 1.3. Competition 2 date Saturday 17th September
 2. Each team will achieve a score out of 100 (refer appendix 1), made up from:
 - 2.1. Autocross 15 points (score = 16 - placing)
 - 2.2. Acceleration 15 points (score = 16 - placing)
 - 2.3. Skid pad 15 points (score = 16 - placing)
 - 2.4. Endurance 25 points (score = 27 – 2 x placing)
 - 2.5. Design Judging 30 points
 3. For all dynamic (driving) events the driver of the vehicle must be a member of the team, and that person must be able to show they have made a significant contribution to the design and/or build of the car.
 4. A team member may drive the car in more than one event, but cannot drive the full duration of the Endurance event.
 5. Prizes are provided to the top three teams, based on total score from all events.
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Appendix 1 Competition Events

Autocross

- Standing start, timed single lap of circuit defined by plastic cones.
- Circuit is designated by cones, within an area defined by 20m x 30m (for reference, this is 2/3 of a netball court).
- Three consecutive sessions will be held, with each team able to have one attempt per session. The best attempt for each team determines their ranking for the event.
- Timing by electronic timing, with backup manual timing by timing marshal.
- Penalties:

Hitting a cone so that it is move or toppled	1 second
Off course with no benefit	2 seconds
Off course with minor benefit	Estimated benefit + 3 seconds
Off course with significant benefit	Disqualified attempt

Acceleration

- Standing start, straight line timed run length of 15m
- Three consecutive sessions will be held, with each team able to have one attempt per session. The best attempt for each team determines their ranking for the event.
- Timing by electronic timing, with backup manual timing by timing marshal.
- Penalties:

Off course with significant benefit	Disqualified attempt
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Skid Pad

- Refer to full size Formula Student (Germany) rules for format of event. Track size is reduced to one third, so that circle inner diameter is 5m and track width is 1m
- Three consecutive sessions will be held, with each team able to have one attempt per session. The best attempt for each team determines their ranking for the event.
- Timing by electronic timing, with backup manual timing by timing marshal.
- Penalties:

Hitting a cone so that it is move or toppled	1 second
Off course with no benefit	2 seconds
Off course with minor benefit	Estimated benefit + 3 seconds
Off course with significant benefit	Disqualified attempt

Endurance

Appendix 2 Competition Schedule

9:00am	Participant briefing and induction
9:15am	Scrutineering
10:00am	Autocross, session 1-3, 20 minutes each.
11:00am	Acceleration, session 1-3, 20 minutes each.
12:00am	Lunch
12:30pm	Design, teams will be called to present throughout afternoon between sessions.
1:00pm	Skid pad, session 1-3, 20 minutes each.
2:30pm	Endurance, approx. 5 minutes per team
4:00pm	Prize giving

Appendix 3 Powertrain Kit

ITEM #	ITEM	DESCRIPTION
1	Motor	Kyosho G27 Brushed Motor
2	Battery	Li-Po 2S 7.4V 2200mAh 35-70C
3, 4	Radio Transmitter and Receiver	HK-GT2B 3CH 2.4GHz Transmitter and Receiver
5	Servo (steering)	TowerPro SG-5010
6	Motor speed controller	Hobbywing 1060 ESC
7	EVA foam (for tyres or other)	30mm x 10mm x 1m

CAD files of electrical components will be supplied.

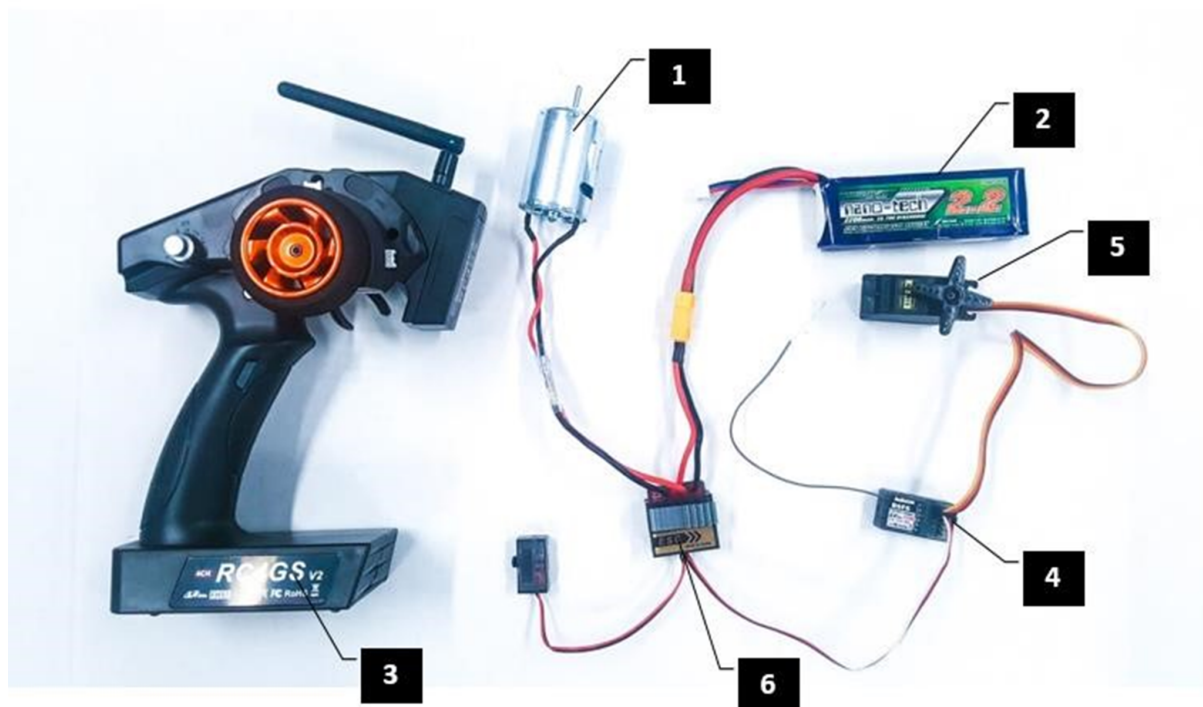


Figure 1: Electronic kit example