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## 1. Overview

Introducing the 2020-21 UKSEDS Orbex National Rocketry Championship (NRC). Teams are challenged with designing, building and launching a mid-power rocket with the primary goal of reaching the greatest apogee possible. Motor selection will be limited to ensure fair competition between teams.

Teams wishing to enter the competition must [register](#). Please direct any enquiries to [rocketry@ukseds.org](mailto:rocketry@ukseds.org).

### 1.1. Scoring Criteria

Teams will be scored on the following criteria:

- Flight Performance
- Payload
- Reports, pictures and videos documenting the project's entirety

### 1.2. Updates

This year's championship will have a few changes to the brief:

- A payload is now a required component
- Bonus points are available for teams who can measure how far away their rockets land from the launchpad.

More details can be found in the following sections.

### 1.3. Key Dates

Registration Deadline	Monday 16 <sup>th</sup> November 2020
Design and build report	Monday 29 <sup>th</sup> March 2021
Launch deadline	Monday 12 <sup>th</sup> July 2021
Launch report	Monday 26 <sup>th</sup> July 2021

## 2. Flight Performance

### 2.1. Rocket Motor Selection

Motor selection is limited to any '[2 Grain 29mm Cesaroni reloads](#)'. Due to the possibility of different grain lengths, altitude will be normalised to total impulse based on the normalisation function

$$y\% = \frac{30 \times \text{Raw Altitude}}{(175.6x^{0.3314} + 31.4x^{0.5849})(\text{Max Score})}$$

Where  $y\%$  = percentage towards your overall score (0% - 30 %)

Raw altitude = apogee altitude in meters

$x$  = total impulse of rocket motor in Ns

Max Score = highest value of  $(\text{Raw Altitude}) / (175.6x^{0.3314} + 31.4x^{0.5849})$

## 2.2. Recovery Distance

Bonus points will be rewarded to teams based on the distance their rocket lands from the launchpad. This will be assessed via teams submitting GPS data from their rocket flight. Currently, any team who wants to qualify for these bonus points are required to have a functioning GPS module onboard their rocket.

We may accept alternative methods for reliably calculating the distance from the launchpad but we will have to assess and approve this beforehand, please email [rocketry@ukseds.org](mailto:rocketry@ukseds.org) to discuss further.

## 3. Payload

The purpose of a rocket is to transport a payload to an altitude; therefore, all entries are required to carry a payload of at least 100 grams. Structural or standard recovery components cannot be included in this mass requirement.

The integration and function of the payload are down to the individual team's discretion, given it complies with the United Kingdom Rocketry Society Safety Code and National Rocketry Competition Rules.

The payload will be judged on:

- System Integration
- Application & Usefulness
- Novelty & Innovation

For a breakdown of points see the points table under the scoring section

Interesting examples of payloads:

- Audio Doppler effect
- Measuring vehicle dynamics with an IMU
- Measuring structural loads
- Measuring external environment properties
- Carrying a mascot or messages for public engagement

## 4. Documentation & Deliverables

### 4.1. Submission

The format required for each deliverable is specified in the deliverables table below.

All deliverables are to be sent as a .zip file to [rocketry@ukseds.org](mailto:rocketry@ukseds.org), large files (>25MB) can be shared via Google Drive, Dropbox, OneDrive, WeTransfer etc.

When submitting please clearly state who you are submitting on behalf of and what you are submitting plus any relevant notes for competition organisers. We provide folder templates and a submission email template on our [resources](#) page.

### 4.2. Reports

Reports are recommended to be no more than 3000 words.

We have provided report templates:

- [Design and Build Report Template](#)
- [Launch Report Template](#)

Each template breaks the report down into sections and briefly expands on what is expected plus an example of how the judges will assess how well you have met that criteria.

### 4.3. Images and Videos

Images and videos should be put into subfolders related to the deliverable e.g. images of rocket simulations should be in the folder 'DRB2'. We have provided [template folder structures](#) for you to use.

## 4.4. Deliverables Tables

### 4.4.1. Design & Build Deliverables Table

Deliverable	Document #	Requirements	Format
Rocket design drawings	DBR 1	Please submit design drawings of your rocket. Images from Rocksim or OpenRocket or any other rocketry simulation software are suggested. Drawing from CAD software is also accepted	Images
Launch simulations	DBR 2	Please submit launch simulations of the rocket's predicted flight. Including data and graphs of altitude, speed and acceleration vs. time with clear scales and units, plus time to apogee and velocity at parachute deployment.	Images
Recovery system schematics	DBR 3	Please submit details of any electrical onboard recovery systems.	Include in the report (DBR5)
Payload system schematic	DBR4	Please submit details of your payload such as its function, how you designed and integrated it into your rocket etc.  Include an image of your payload being weighted for minimum mass verification.	Images  Include details in the report (DBR5)
Design and build process validation	DBR 5	Please submit a document detailing your design decisions and build process of your rocket i.e. what you did and how you did it.  Include details of the construction of the motor mount, fins, payload bay, and airframe. Pictures and videos are recommended.	Report, Images & Videos
Launch Ready Rocket	DBR 6	Please submit pictures of your rocket showing construction is complete.	Images & Videos

#### 4.4.2. Launch Deliverables Table

Deliverable	Document #	Requirements	Format
Launch summary	LR 1	<p>Please provide details of your launch flight and experience i.e. discuss flight data, what when well? What did not? Improvements you would make.</p> <p>Include any key data such as maximum altitude reached etc.</p>	Report
Flight Data	LR 2	<p>Please submit raw and/or post-processed data of your flight data.</p> <p>Include maximum altitude, GPS (if applicable) and any other dRecoveryata recorded during the flight.</p>	<p>Images .csv .xls*</p>
Rocket Preparation Summary	LR 3	Images of rocket preparation before launch such as engine retention with the loaded motor, payload, packing of the recovery systems and rocket on the launch pad.	Images & Videos
Recovery Operations Summary	LR 4	Images of the undisturbed rocket at the landing site, deployed parachutes, airframe, & any damage.	Images & Videos
Flight Verification Form	LR 5	The person certifying your flight must be a registered Range Safety Officer (RSO) and sign the flight verification form, found <a href="#">here</a> .	Image

## 5. Scoring

### 5.1. Scoring Breakdown Table

Scoring Component	Points	Percentage
Flight Performance	300	50.00%
Launch	50	8.33%
Maximum altitude	100	16.67%
Successful parachute deployment	50	8.33%
Successful recovery with minimal damage*	50	8.33%
Recovery distance from launchpad**	50	8.33%
Payload	120	20.00%
Novelty & Innovation	40	6.67%
System integration	40	6.67%
Application & Usefulness	40	6.67%
Documentation	180	30.00%
Design & Build Report	80	13.33%
Launch Report	50	8.33%
Videos and Picture	50	8.33%
Total	600	100%

\* Minimal damage shall be defined as being able to be flown again on the same day with minor repairs and effectively 'motor ready'. The team and the certifying person (RSO) must document successful recovery.

\*\* GPS required

## 6. Rules & Regulations

*The UKSEDS Orbex NRC is organised in the spirit of healthy competition. Rules & regulations have been drawn up to maintain a high standard of safety and fairness for all participants.*

1. This competition is open to all UK Students for the Exploration and Development of Space branches. Other teams wishing to participate are welcome but must get consent by emailing [rocketry@ukseds.org](mailto:rocketry@ukseds.org).
2. All rocketry activities must abide by the United Kingdom Rocketry Association (UKRA) Safety Code, which can be found [here](#).
3. All rockets must be original designs and scratch built by members of the team. Commercial kits are not permitted.
4. All designs must be capable of measuring altitude. The altimeter needs to be tested and calibrated prior to installation to ensure it is in working condition. This process should be documented in the build and design report. Teams can make their own altimeter or buy a commercially available device. Contact us if you need any assistance.
5. The competing team is responsible for organising a suitable launch venue. It is required to have a Range Safety Officer (RSO) present at any launch, the easiest way to meet this condition is to attend one of the [UKRA affiliated rocketry club](#) launch days. Teams should contact UKSEDS at [rocketry@ukseds.org](mailto:rocketry@ukseds.org) if they require assistance in identifying a suitable site.
6. A certified Range Safety Officer (RSO) must certify any launches. Should one not be available. The competing team is responsible for having the launch certified.
7. All launches must be performed entirely through the motor's own power. No speciality launch systems (i.e., Rockoon, projectile launching) are permitted.
8. All rockets must be successfully recovered with minimal damage. Minimal damage shall be defined as being able to be flown again and effectively 'motor ready'. The team and the certifying person (RSO) must document successful recovery.
9. All teams must take video and/or photographs of the design and construction of their vehicle, as well as its launch, which should be submitted with the relevant documentation.
10. All teams and launches must abide by local laws and CAA regulations for unmanned rocket launches. Safety must take the highest priority in launch preparations and flight operations. UKSEDS retains no responsibility for the launch rules and regulations that the competing teams shall be required to follow.



11. If a group wishes to use their own telemetry system, then the equipment to be used at the launch site must be certified by the Radio Standards Authority and subsequent documentation submitted to the RSO on the day of the launch as part of the pre-launch checklist.
12. No external structural metal components to be placed on the rocket.