UKSEDS
COMPETITIONS

NATIONAL ROCKETRY CHAMPIONSHIP 2024-25

Mission Requirements Document

Document Information

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Version	Changes	Date
NRC-MRD-001	Initial Release	5/10/2024

Table of Contents

1   Introduction

1.1   Scope

This document outlines the requirements for the 2024/25 edition of the UKSEDS National Rocketry Championship. It includes requirements for your launch vehicle, "The Customer's" payload and the rideshare payload.

"The Customer's" payload will be provided by UKSEDS, the rideshare payload should be provided by the participating team.

2   Acronyms & Reference Documents

2.1   Acronyms

Acronym	Description

2.2   Reference Documents

2.2.1   Documents Referenced

No.	Document ID	Description
1	NRC-TSN-001	NRC Technical Specification
2		

2.2.2   Useful Reference Documents

No.	Document ID	Description
1	ECSS-M-ST-10C Rev. 1	**Space project management** - Project planning and implementation
2	ECSS-S-ST-00-01C	**Glossary of Terms** - A list of commonly used terms in ECSS documents

2.3   Requirement Numbering Definition

The following describes the layout of the requirements within this document.

NRC MRD-<A>-<n> | Rev: <R>

<Title>

<text>

VV Method: <v>

Parent: <p>

Where:

<A>: Acronym for the section the requirement falls under.

<n>: Requirement number of 3 digits, starting from 001.

Note: <A> and <n> combine with the competition and document name acronyms to create the requirement ID.

<R>: Revision indicator, with "A" denoting the first version, "B" the second and so forth.

<Title>: Requirement title.

<text>: Requirement text.

<v>: the verification method(s) needed to demonstrate compliance to each requirement. The letters shall be only the following:

I: Inspection

D: Demonstration

A: Analysis

T: Test

<p>: Denotes if a requirement is derived from another requirement. Parent requirements shall be listed by the Requirement ID. If no Parent Requirement exists, the value shall be N/A.
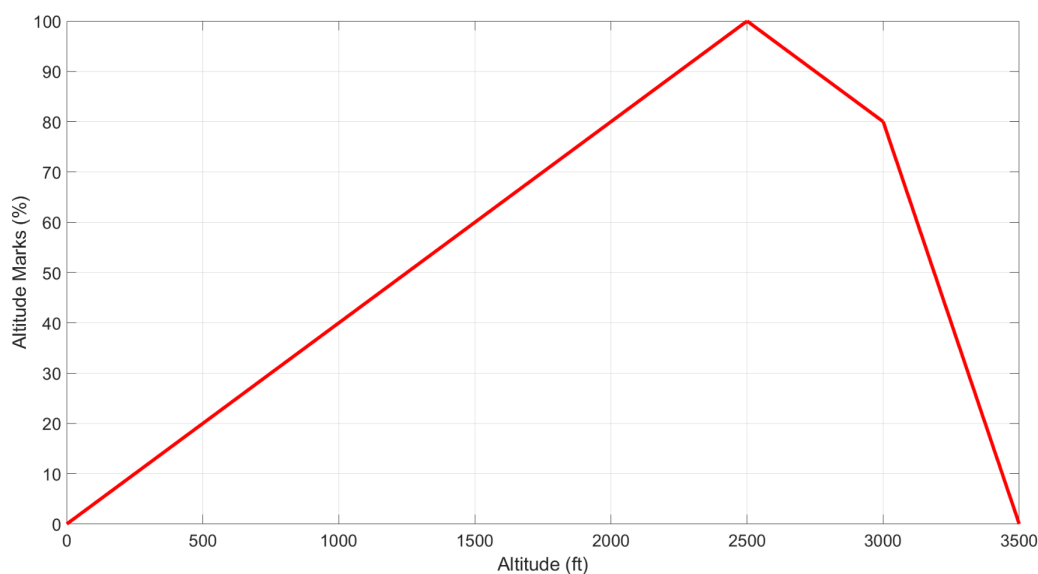
3 Mission Requirements [MIS]

NRC MRD-MIS-001 | Rev: A

The launch vehicle should reach an apogee of 2500ft.

Below is a table outlining the mark distribution with respect to altitude.

VV Method: *A*

Parent: *N/A*

NRC MRD-MIS-002 | Rev: A

The launch vehicle shall not fly above 3000ft without a dual-deployment recovery system.

Rockets achieving an apogee above 3000ft are required to incorporate a dual deployment recovery system onboard as per Midlands Rocketry Club rules. Rockets designed by teams for NRC are not *required* to incorporate dual

deployment, due to the design altitude being 2500ft. As such, any rocket exceeding 3000ft will be penalised heavily.

VV Method: A

Parent: NRC MRD-MIS-001

NRC MRD-MIS-003 | Rev: A

The launch vehicle shall not fly above the Midlands Rocketry Club's NOTAM limit.

NRC's launch site is overseen by the Midlands Rocketry Club, which can only secure a maximum altitude for the day of 3500ft. Rockets are NOT permitted to fly beyond this altitude, and this is a hard-and-fast rule. As such, any rockets breaching this maximum altitude will automatically achieve 0 marks.

VV Method: A

Parent: NRC MRD-MIS-001

NRC MRD-MIS-004 | Rev: <A>

The launch vehicle shall be powered by a 2-grain 29mm G class ammonium perchlorate solid rocket motor with a total impulse under 130Ns.

Due to safety and competition restrictions, only approved motors can be used in the NRC. UKSEDS will not allow self-made motors or motors from unlicensed manufacturers. As standard, we approve Cesaroni and AeroTech motors as these are the standard ones used in the UK market. In previous competitions we have had significant issues with communication between teams and the motor suppliers so for this year's competition we are switching to all teams ordering through UKSEDS so the NRC organising team are the only one communicating with the motor suppliers about motor orders. This also allows us to ensure all of the motors are handled correctly by qualified persons with the correct licences.

Teams are limited to 2-grain 29mm Cesaroni reloads of G impulse and 29mm Aerotech G class motors with an impulse under 130Ns. These are classified as mid-power motors and so do not require UKRA certification to purchase or fly.

For individuals wishing to obtain a UKRA level 1 certification, it is suggested that you look into UKSEDS' Project Odyssey. Please note that this is for individuals rather than teams due to the UKRA Level 1 certification process.

VV Method: D

Parent: N/A

NRC MRD-MIS-005 | Rev: A

The rocket motor shall be supplied by Cesaroni Technology Incorporated or AeroTech.

Due to safety and competition restrictions, only approved motors can be used in the NRC. UKSEDS will not allow self-made motors or motors from unlicensed manufacturers. Motors from Cesaroni Technology Incorporated or AeroTech are UKSEDS verified and approved, and as such are the chosen suppliers for motors.

VV Method: D

Parent: NRC MRD-MIS-004

NRC MRD-MIS-006 | Rev: A

The rocket motor shall be obtained through UKSEDS' NRC organising team.

In previous competitions we have had significant issues with communication between teams and the motor suppliers so for this year's competition we are switching to all teams ordering through UKSEDS so the NRC organising team are the only one communicating with the motor suppliers about motor orders. This also allows us to ensure all of the motors are handled correctly by qualified persons with the correct licences.

VV Method: D

Parent: NRC MRD-MIS-004

NRC MRD-MIS-007 | Rev: A

The launch vehicle shall carry a rideshare payload of a minimum of 100g.

The rideshare payload is to be provided by the teams. It is up to the team to determine what this shall be.

HINT: some of the other requirements might hint to some features that your payload should incorporate but you may add more!

VV Method: D

Parent: N/A

4   "The Customer's" Payload [CPD]

Note: "The Customer's" payload will be provided on the day by UKSEDS. You are **<u>not</u>** expected to design or provide this.

"The Customer's" payload has a power of 7.5W and a mass of 75g (not including the mass of the launch vehicle adapter).

NRC MRD-CPD-001 | Rev: A

The launch vehicle shall provide a DC bus voltage of 3.3-5V to "The Customer's" payload.

VV Method: D,T

Parent: N/A

NRC MRD-CPD-002 | Rev: A

The launch vehicle shall provide power to "The Customer's" payload for a minimum of 45 minutes.

This includes time on the pad, flight, and recovery. It assumes that the rocket is on the pad for 15 minutes.

VV Method: D

Parent: NRC TSN-ESS-001

NRC MRD-CPD-003 | Rev: A

The launch vehicle shall provide sufficient current to power the "The Customer's" payload.
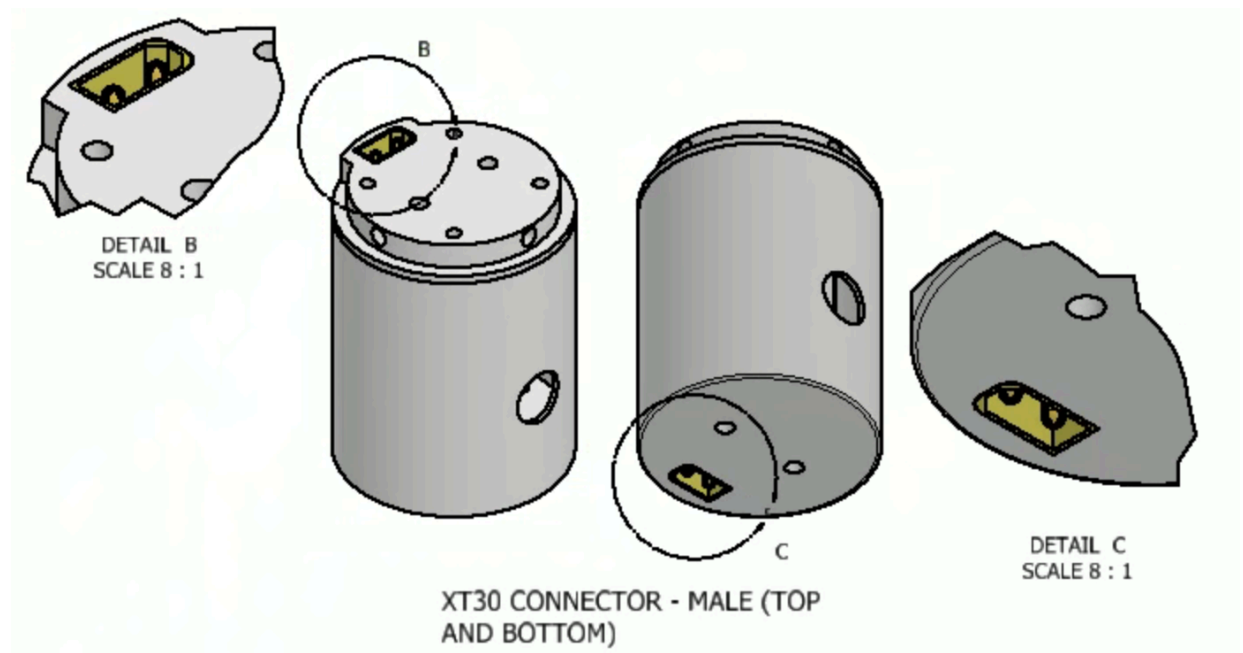

VV Method: D,T

Parent: N/A

NRC MRD-CPD-004 | Rev: A

The launch vehicle shall provide power via a female XT30 connector at the top and bottom of the "The Customer's" payload.

Please note: the payload only needs to be powered via the top or bottom port, two options have been provided to give participants more flexibility in their designs.

"The Customer's" payload showing XT30 connector locations top and bottom

Male XT30 connector (left) to be provided by UKSEDS. Female XT30 connector (right) to be provided by participants.

VV Method: D

Parent: N/A

NRC MRD-CPD-005 | Rev: A

The launch services provider shall provide a microSD with a minimum of 16GB storage for the "The Customer's" payload.
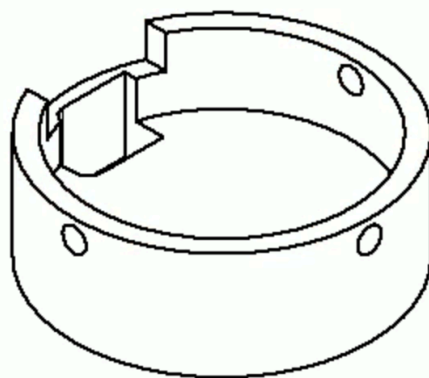

VV Method: D

Parent: N/A

NRC MRD-CPD-006 | Rev: A

The launch vehicle shall mechanically interface with "The Customer's" payload via the launch vehicle adapter.

The launch vehicle adapter file has been shared with teams through the documentation page on the website. **You** are expected to print out and provide the launch vehicle adapter. This has been done so that you design for and include the correct adapter in your design. It should also reduce interface issues on the competition day. You are welcome to modify the launch vehicle adapter to interface with your design but the face that interfaces with the payload should remain untouched.
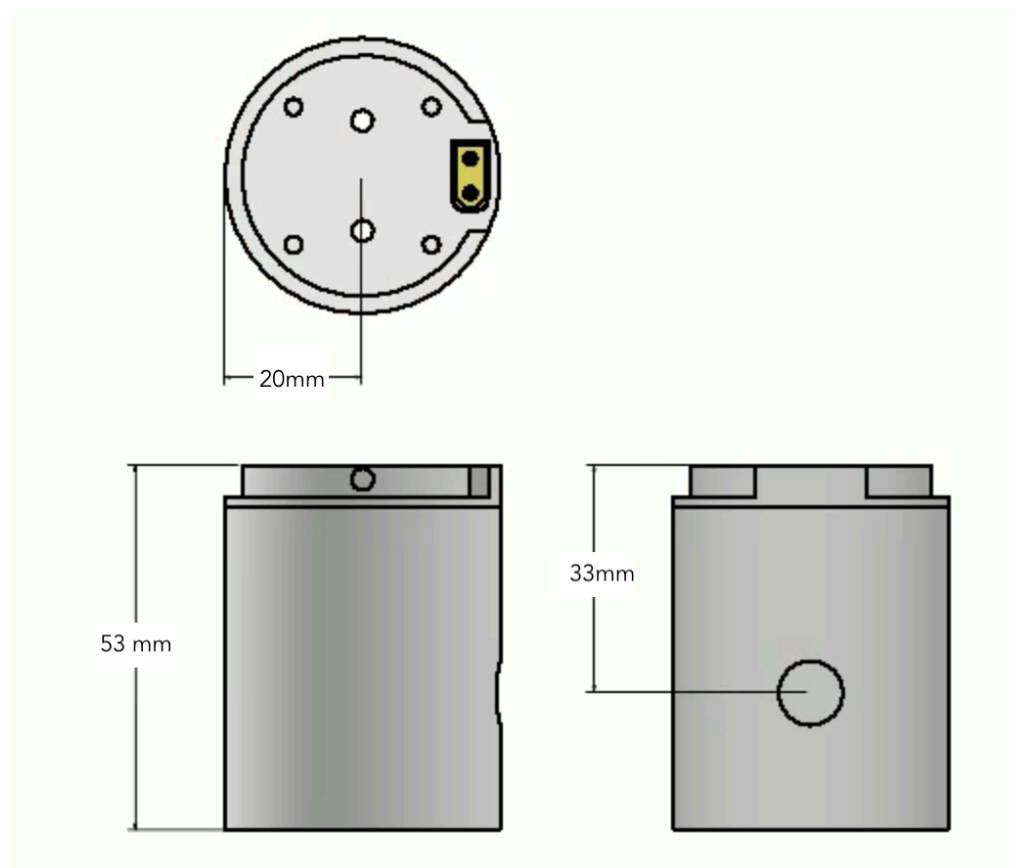

Launch vehicle adapter

VV Method: D, T

Parent: N/A

NRC MRD-CPD-007 | Rev: A

The launch vehicle shall provide a minimum payload bay of 40mm diameter and 53mm length for "The Customer's" payload (not including the launch vehicle adapter).

VV Method: D

Parent: N/A

NRC MRD-CPD-008 | Rev: A

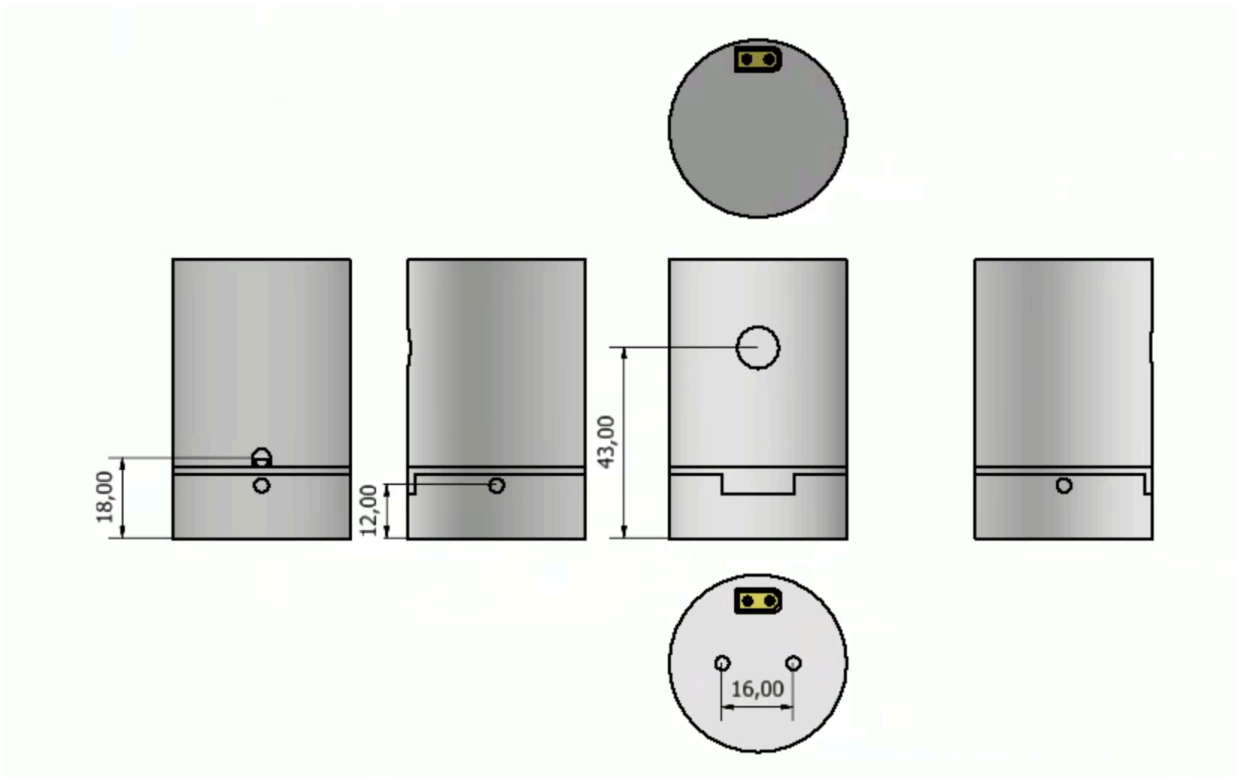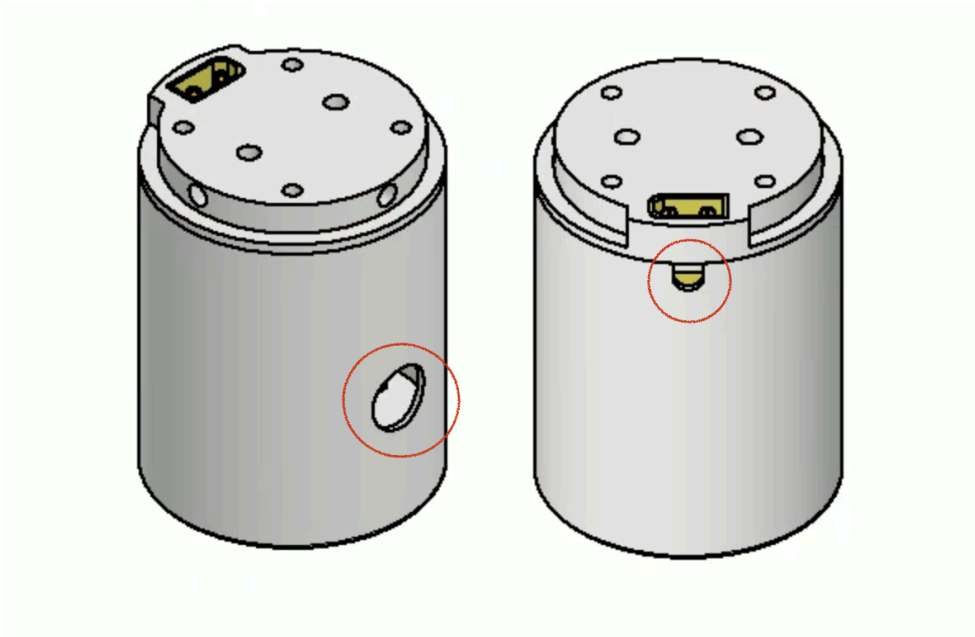The thrust vector shall go through the centre of "The Customer's" payload.

VV Method: D

Parent: N/A

NRC MRD-CPD-009 | Rev: A

The launch vehicle shall provide permanent external access to the following points for "The Customer's" payload (circled red).

VV Method: D

Parent: N/A

NRC MRD-CPD-010 | Rev: A

The launch vehicle payload bay shall be unpressurised.

This is so that "The Customer's" payload can read the altitude of your rocket.

VV Method: D

Parent: N/A

5   Rideshare Payload [RPD]

NRC MRD-RPD-001 | Rev: A

The rideshare payload shall contain a printed circuit board designed from scratch.

This PCB should be designed fresh for this year's competition. We will be releasing a training course to help teams get started with this.

VV Method: *D*

Parent: *N/A*

NRC MRD-RPD-002 | Rev: A

The rideshare payload shall detect the launch vehicle's altitude.

IMU's have a tendency to quickly drift over time giving inaccurate results so barometers should be used for this.

VV Method: *D*

Parent: NRC MRD-RPD-001

NRC MRD-RPD-003 | Rev: A

The rideshare payload shall be able to produce an altitude vs time plot in feet and seconds within 10 minutes of recovery.

Note: the payload does not *have* to have a screen to show the graph. You may use an external screen such as a laptop if you wish.

VV Method: *D*

Parent: NRC MRD-RPD-001

NRC MRD-RPD-004 | Rev: A

The rideshare payload shall be able to provide an apogee value in feet within 10 minutes of recovery without the use of external equipment.

Note: tools are allowed to gain access to the rideshare payload. Equipment such as laptops to retrieve the data from the rideshare payload are, however, banned.

VV Method: *D*

Parent: NRC MRD-RPD-001

NRC MRD-RPD-005 | Rev: A

The rideshare payload shall have a silkscreen on the printed circuit board containing the team logo.

VV Method: *D*

Parent: NRC MRD-RPD-001

NRC MRD-RPD-006 | Rev: A

The rideshare payload should record at least one extra type of data and present this within 10 minutes of recovery.

Note: you may use external equipment to display this data. This data must not be collected with the sensor used for NRC MRD-RPD-002.

VV Method: *D*

Parent: NRC MRD-RPD-001