CZECH ROCKET SOCIETY

Czech Rocket Challenge 2027



The CRC Organising Team

17 November 2026

CZECH ROCKET SOCIETY

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1 Introduction

The Czech Rocket Challenge (CRC) is a rocket competition that gives students the opportunity to turn theoretical knowledge into real flight hardware. It brings together space enthusiasts and industry experts, creating an environment where future rocket engineers are nurtured.

1.1 Objective

The aim of the competition is to design, build and launch a functional rocket that fulfils a specified mission. Participants learn to work in a team, adhere to safety standards and defend their technical solutions before a panel of experts. In this way, the CRC builds key competencies for future careers in technical fields in an informal manner.

1.2 Competition overview

The competition is divided into three main categories:

- High School – beginners
- High School – advanced
- University – advanced

Teams that have not won in their main category compete for one of three secondary awards. Each team may win a maximum of one of these.

- Best Report
- Special Jury Prize
- Best predicted height

The categories differ in terms of rules, scoring and challenges, which are described in more detail in the following sections.

All university teams automatically compete in the Advanced category. New high school teams start in the Beginners category. Returning teams from previous editions that submitted their final reports will be placed in the Advanced category. If a team is mixed and includes at least one university student, the team is automatically placed in the University category. If a mixed high school team includes 2 or more students who submitted a final report in at least one previous edition, the team is automatically placed in the Advanced category. Misrepresenting the category on the application form may result in disqualification.

The engine will be provided by the competition organisers. Its thrust characteristics, impulse and other necessary data are set out in **Appendix A**. Each rocket must carry a calibrated, standardised altimeter, which will be provided by the organisers, and have a designated space for it. Further details can be found in **Appendix C**. Teams will be provided with design specifications for building the rocket; however, a high degree of independent work is expected. Individual members will thus have the opportunity to gain an independent understanding of various aspects of rocket design.

Throughout the project, teams will receive support from members of the Czech Rocket Society (CRS), whom they may contact in the event of difficulties. A series of workshops will also be organised for the teams, running from mid-January to mid-February.

The rockets built by each team will be assessed on both their design and flight performance. The rockets' flight performance will be evaluated on the final launch day, when the final scores and the overall winners in each category will be announced.

2 Project timetable

2.1 Registration

Team registration is open until 17 January 2027 on the website czeroc.cz.

This also includes payment of a registration fee of 500 CZK. Payment details and an invoice will be sent to the team leader's email address. The due date for all registered teams is January 18, 2027.

2.2 Design

Between January and June, teams will have time to design, build and test a functional rocket. To ensure a smoother start, **several workshops** are planned **for January and February, along with a number of workshops dedicated to answering your questions**. The workshops are likely to last 1–2 hours on one of the dates listed below and will be held online for greater accessibility. Details will be finalised later, but you can already make allowance for these dates. The workshops should enable participants to better understand the main components of the rocket, how to begin designing them, and how to allocate roles within the team. The workshops will be recorded.

At **the first workshop (16–17 January)**, we'll introduce the competition, explain the rules, go through the handbook, discuss last year's experiences and outline the competition schedule. At **the second workshop (23–24 January),** you'll have a go at the OpenRocket rocket simulator and we'll teach you how to use it. At **the third workshop (30–31 January)**, we'll explain how to design avionics and a recovery system correctly and safely. **The fourth workshop (6–7 February)** will focus on standardized tests, which must be passed in order to be invited to launch day. During **the fifth workshop (13–14 February),** competitors from previous years will share their experiences, successes and challenges with you.

The first two months should be devoted to the conceptual design of the rockets. This conceptual phase will conclude for all categories **on 7 March** with the submission of the **mandatory** conceptual report. The maximum length of the conceptual report is **5 pages**, **excluding the cover page and table of contents**; it must be submitted in **PDF** format and will not be included in the final assessment. Any attached files, such as photos, presentations, simulations or calculations, must form part of the report.

From March onwards, teams should focus on building and testing individual components and systems. In April and **May**, they should then build and, where applicable, test the entire rocket.

For greater safety and better assessment in the individual categories (see **Chapter 4**), *a final report* (hereinafter referred to as *'the report'*) is required. *The report* should clearly demonstrate that the team has carried out specific calculations and simulations of individual components, the entire rocket and its flight. Standardised tests, which each team must provide evidence of and which are described in more detail in **Chapter 5**, should also assist with this. *The report* should also demonstrate that the rocket is airworthy, aerodynamically stable and has a functional recovery system. Competitors will learn more practical details about *the report* from the *report* handbook and during the workshops. *The report* should serve as a critical evaluation of the competitors' own project, whilst also highlighting any shortcomings or limitations of the rocket. Writing *the report* is a challenging task and, for many, may be their first experience of this sort; therefore, ***a draft of the final report*** is required **by 2 May for university teams and 9 May for high school teams,** followed by an individual design review call taking place from mid-May to mid-June. During the review, we will discuss the details of your design, ask for any missing information and go through our comments. Both the report and participation in the review are compulsory. However, *the draft* will not yet count towards the final assessment.

The deadline for submitting *the final report* is 27 June 2027 for university teams and 11 July 2027 for high school teams. If *the report* is in order and the rocket is deemed airworthy, the team may be invited to the launch day based on a preliminary assessment of the final reports.

For the safety of competitors, organisers and spectators on the final day, *the concept report, draft final report, design review* and *final report* are **mandatory**. If teams fail to provide evidence of their work to date, the organiser may disqualify them from the competition. Furthermore, on the day of the competition, the organiser may deem a rocket unfit for flight and refuse to allow the team onto the launch pad.

2.3 Launch Days

Launch days are scheduled for Thursday and Friday, 29–30 July 2027, for **approximately 20 teams**, which will be invited on the basis of *their final report*. All registered competitors will be informed of the details of the launch day once registration has closed (17 January 2027). The date of the launch day is subject to change depending on the weather.

Table 2.1: Schedule for the Czech Rocket Challenge 2027

Competition Schedule	
Registration	by 17 January
Workshop 1	16–17 January
Workshop 2	23–24 January
Workshop 3	30–31 January
Workshop 4	6–7 February
Workshop 5	13–14 February
Concept report for university teams	by 7 March
Concept report for high school teams	by 7 March
Draft of the final report for university teams	by 2 May
Draft of the final report for high school teams	by 9 May
Design review calls	mid-May to mid-June
Final report for university teams	by 27 June
Final report for high school teams	by 11 July
Launch days	29–30 July

3 Competition rules and requirements

This section sets out the competition rules, which apply to all rocket designs submitted by all teams. These rules have been drawn up to ensure that the competition meets safety standards and that all teams have an equal chance of winning.

Maximum altitude

The maximum altitude is limited to 800 m above launchpad. If this altitude is exceeded, the team automatically receives 0 points for the flight section. If this altitude is exceeded in the simulations, the team will not be permitted to launch.

Engine

The engine will be the same for all teams and will be supplied by the competition organiser in return for a deposit of 1,000 Kč upon registration on the day of the final. The engine must be returned to the organiser. The deposit is refundable upon return of the engine in good condition on the day of the launch. Competitors must ensure that the engine does not move in either the axial or radial direction relative to the rocket and that it does not become loose or fall out during ignition and flight. The engine must be installed without the use of excessive force. Specifications can be found in **Appendix A**.

Fuselage

The fuselage may be made from almost any material, with the exception of paper and cardboard. These may only be used in the form of special tubes designed for rocket construction, purchased from specialist online shops. The material must ensure sufficient rigidity and safety to prevent the rocket from breaking. When constructing the rocket, bear in mind that although the rocket motor burns for only a short time, it radiates heat and the outer surface of the combustion chamber can reach temperatures of up to 120 °C. Sufficient insulation (and motor mounting, etc.) must therefore be provided to ensure that the immediate vicinity of the motor is not damaged. The choice of size, wall thickness, diameter, weight and other parameters is at the discretion of the competitors, in accordance with the competition rules.

Rocket size

In the *beginners'* category, the rocket must have a minimum external diameter of 60 mm along its entire length, with the exception of the rear section of the rocket where the stabilisers (the so-called 'boat tail') and the nose cone are attached; otherwise, a penalty of up to 200 points may be imposed (see the **'Penalties'** section). This rule does not apply to the *advanced* category, where the diameter is unrestricted. However, bear in mind that sudden changes in diameter can cause aerodynamic problems.

Nose cone

For safety reasons, the nose cone must not be made of metallic materials. The nose cone can be used as usable space. To achieve optimal flight performance, it is essential to select an aerodynamic profile with a favorable drag coefficient. The nose cone must not fall in free fall.

Materials

The rocket must not use toxic or reactive materials, nor homemade cardboard or paper tubes and components (see the **'Fuselage'** section). It is always advisable to consult the competition organiser.

Avionics

Electronic systems, such as any data-logging devices, printed circuit boards, Arduino modules, parachute deployment systems or launch systems, must be securely fastened within the fuselage to prevent them from becoming loose and damaging other parts of the rocket during flight. Every rocket is also required to carry an audible buzzer or other locating beacon to aid recovery after landing, as wind drift during descent can carry the rocket far from the launch pad or into hard-to-reach terrain. **The use of LiPol batteries in the rocket is prohibited.**

Ground Station

Remote communication with the rocket via a ground station is permitted and encouraged. However, teams must adhere to the following conditions. Failure to comply may result in the ground station being banned on the final day. Transmission on the 2.4 GHz and 136–174 MHz frequencies is prohibited due to interference with the organisers' equipment. On the final day, only teams taking off are permitted to transmit during the launch window, in order to minimise the risk of interference. The signal from the ground station may not be used as either the primary or secondary trigger for the recovery system or for launch detection.

Stability and stabilisers

The rocket's stability must be ensured passively and must not depend on active control systems. The use of paper or cardboard is prohibited in the construction of stabilisers. The strength of the stabilisers is verified by a standardised **'Stabiliser Strength Test**'. The centre of pressure C_p must lie behind the rocket's centre of gravity C_g. The minimum aerodynamic stability must be greater than 1 cal at the moment of leaving the launch pad (note: C_p should be at least the diameter of the rocket behind C_g). Stability is calculated using the OpenRocket programme. Stability upon leaving the launch pad is determined by the following parameters: **Launch pad inclination angle = 1°; launch pad length = 240 cm; wind speed 5 m/s.** Active control of the stabilisers or any of their parts is prohibited.

Recovery system

For the *beginners'* category, only one parachute is permitted as a recovery system. The *advanced* category has no restrictions, but other alternative methods will be carefully reviewed. The parachute must be red or orange in colour to facilitate tracking of the rocket. The recovery system must ensure a controlled, non-ballistic descent of the rocket and all of its components after launch, excluding components intentionally jettisoned prior to or upon leaving the launch rail (such as separable launch guides). If an ejection charge is used for deployment, teams must comply with **Annex E**.

Activation of the recovery system

For safety reasons, all teams, regardless of category, must also have a secondary system for triggering the recovery system. For example, triggering based on barometric measurements as the primary method and a simple timer as the secondary method. The recovery system, in particular the parachute or ribbon, must be deployed at a speed of less than 15 m/s. For alternative methods, the descent speed may be adjusted subject to authorisation from the organisers. A signal from the ground station cannot be counted as one of the mandatory activation methods.

Launch detection

Launch detection is one of the key components for a successful flight. Therefore, for safety reasons, every rocket must also incorporate a secondary launch detection system, e.g. a breakaway wire, which mechanically disengages the flight computer at launch. A signal from the ground station cannot be counted as one of the mandatory detection methods.

Descent speed

Rockets must descend at a speed of 5–9 m/s. A satellite (payload) released from the rocket must descend at a speed of between 10 and 15 m/s if the satellite's mass is 150 g or less. For satellites heavier than 150 g, the descent speed must be between 6 and 9 m/s.

External propulsion

The rocket must not use any additional propulsion system to help it reach a higher apogee.

Flight altitude recording

The rocket must contain an altimeter provided by the competition organisers to record the flight altitude. Please ensure that the altimeter is easily accessible whilst preparing for launch on the launch pad. See **Appendix C** for further details. The altimeter will be provided to competitors against a deposit of 1,000 Kč upon registration on the final day. The deposit is refundable upon return of the altimeter in good condition. Additional measuring instruments and sensors are welcome.

Payload

The payload for competitors is specified within the challenge. The mandatory payload is the altimeter, as described above and in **Appendix C**. However, the rocket may carry additional payload, instruments or technology, for which points may be awarded as part of the rocket's design. The rocket's payload must not contain living creatures, flammable substances or explosives.

Modularity and ease of assembly

When designing the rocket, emphasis should be placed on ensuring it can be assembled quickly and easily. During final preparations on the launch pad, it is necessary to switch on all avionics, activate the altimeter and install the engine within ten minutes. It is therefore advisable to design the rocket in a modular fashion, minimise the amount of fasteners required and provide access hatches for key components.

Launch procedures

Each team must draw up its own procedures for the correct launch of its rocket. The procedures must include all the information necessary for assembling the rocket, from screwing the components together and joining the individual parts, through switching on the system, to fitting the engine and placing the rocket on the launch pad. The final report must include a procedure comprising at least 30 steps. The procedures are a mandatory part of the final report.

System Endurance

Each team must provide evidence that its flight system can remain powered on for at least 120 minutes and then perform the required actions . This evidence forms part of **the Recovery System Deployment Functionality Test.** This requirement is due to the possibility that a prepared/powered-up rocket may remain on the launch pad for a longer period than it takes for the surrounding area to be ready for launch, whether due to other teams preparing to launch, repairs to the launch equipment, or waiting for launch clearance from the airport control tower.

Launch pad and guide rail

All rockets will launch from the standardized launch pad provided by the competition organizers (technical specifications are given in **Appendix B**). To ensure the rocket tracks accurately along the launch rail, launch guides (rail buttons/lugs) must be mounted to the airframe. The guides must be sufficiently strong not to shear off during liftoff and deflect the rocket off course, yet slide freely within the rail slot without binding. Due to the aluminum alloy material of the launch rail, **manufacturing launch guides from aluminum alloys is prohibited**. The rocket must be equipped with at least two launch guides spaced along the length of the airframe.

Please note:

- The actual performance of rocket engines never exactly matches the values stated in the engine specifications.
- The drag coefficient used in calculations also varies depending on ambient conditions. The drag coefficient is influenced not only by every component of the rocket (nose cone, stabilisers, etc.), but also by the current ambient conditions.
- Wind speed is often far more important than a drag coefficient that is one hundredth better or a one-metre higher altitude in the OpenRocket simulation.
- If the rocket does not fly straight up vertically, its altitude decreases.

Note: Failure to comply with any of the rules mentioned above may result in the immediate disqualification of the offending team from the competition.

The organiser reserves the right to amend the rules.

4 Scoring

All categories have their own scoring system. In order to determine the winner of the competition, teams will be assessed according to several different criteria, with the three main areas being **the Theoretical Section**, **the Flight Section** and **the Challenge**. The maximum achievable score is 1,000 points. *The report* relates in particular to the sub-categories Design & Innovation; Analysis, Simulation & Report. **Table 4.1** provides an overview of the assessment methodology.

Scoring will be carried out by a panel of judges from CRS, academia and industry, who will assess each category for each team impartially and independently of one another, after which their results will be averaged. Details will be published in advance of the submission of the final report.

Table 4.1: Evaluation methodology

Criterion	High School Beginners	High School Advanced	University Advanced
Theoretical section			
Design & Innovation	300	300	200
Analysis, simulation & report	150	150	150
PR Challenge	50	50	50
Flight section			
Predicted altitude accuracy	200	100	100
Maximum altitude reached	100	100	100
Challenge			
Satellite presentation	0	50	50
Design & cost	200	100	200
Satellite launch	0	150	150
Total	**1,000**	**1,000**	**1,000**

Theoretical section

As noted in **Chapter 2**, teams are required to submit a technical report detailing their rocket, which forms the basis for this evaluation area. The report must describe the operation and engineering design of individual subsystems (airframe structure, parachute, fins, etc.), present flight and structural simulations and calculations, and document the completion of all standardized tests. Teams can earn up to 400 points in the University – Advanced category and up to 500 points in the High School – Beginners and High School – Advanced categories. This section is divided into three subcategories:

Design & Innovation

Innovation is the factor that sets certain engineering firms apart from the rest. For example, SpaceX and NASA are constantly pushing the boundaries of science and the capabilities of rockets. Teams are therefore encouraged to come up with innovative solutions to the problems set and to stand out from the rest. Innovation can take any form – from an interesting design that solves a complex problem to the application of new technology. Any part of a rocket can be innovated. *Design & Innovation* is the highest-scoring category, with a maximum of 300 / 200 points in the *Beginners* and *High School Advanced* / *University Advanced* categories respectively, which is roughly one-third / one-fifth of the total score.

Analysis, Simulation & Report

Analysis, simulation and written reports are three key components of modern engineering. The use of technologies such as the finite element method or computer simulation enables engineers to model the forces at work or the overall behaviour of individual components. Teams must demonstrate the rocket's strength and safety by passing standardised tests (see **Chapter 5**). They may also use strength analyses, their own calculations or software (MATLAB, Python, etc.) to assist them. The report should be clear and concise, yet contain all the necessary information and effectively 'sell' your work. Competitors will be provided with sample reports and a list of items that must be included in the report. A maximum of 150 points is awarded for this section, distributed equally between the analysis, simulation and report.

PR Challenge

Communicating science and innovation is an integral part of modern development. If we want to secure funding for a project, we must present it. This is even more true for space missions, as they are often funded by public money, so it is vital that people understand where their money is going. That is why the CRC PR Challenge is part of the competition and will take place throughout the event. Teams are tasked with sharing stories on Instagram throughout the competition and tagging @czechrocketchallenge, as well as using the hashtags #CRC27, #czechrocketchallenge and #CzechRocketSociety. The organisers will then repost and evaluate these stories and posts. For scoring purposes, we ask teams to summarise the stories they share in *a* dedicated Instagram Highlight. The PR Challenge will be awarded up to 50 points.

Flight section

The second area on which teams are assessed is their performance on the day of the launch. A maximum of 300 / 200 points can be awarded for this section, which is divided into two smaller sub-sections.

Accuracy of predicted altitude

In this competition, the prediction of apogee is a more important factor in rocket design than the maximum altitude achieved. An accurate prediction is a good indication of high-quality modelling, simulations and calculations. A useful analogy is the concept of carrying out a space mission involving delivery to a specific orbit – the launch service provider must be able to achieve the objective specified by the customer. Teams are therefore required to predict their rocket's apogee before launch on the day of the competition. Software (OpenRocket) or manual calculations may be used for this prediction. A maximum of 200 / 100 points can be awarded for this category. Points will be allocated according to the following equation:

$$Points = \frac{P_{pred,max}}{1 + 0{,}0002 \times (Reality - Prediction)^2}$$

$P_{pred,max}$ is the maximum number of points for prediction accuracy (200 or 100 points),
Reality is the actual altitude (apogee) reached in metres,
Prediction is the predicted altitude in metres reported by the team.

Highest apogee

Reaching the highest apogee is one of the most enticing goals for all budding rocket engineers. Yet rockets do not always fly with the sole aim of reaching the highest possible altitude. Our aim is to encourage competitors to focus more on safety, airworthiness and the rocket's mission than simply mindlessly breaking the X-metre barrier with a small, narrow, fast rocket. At the same time, however, we want to reward the altitude achieved fairly. All teams that reach 500 metres or more above the launch site will therefore receive the full number of points. The team with the highest apogee achieved below 500 metres will receive 80 points. The remaining teams will share the points proportionally between 0 and 80, which will be determined on the day of the launch based on the current number of teams.
Points for apogee prediction and highest apogee are only awarded if the rocket returns safely to the ground and has risen to at least 50 metres above the ground. After landing, competitors must show the altimeter reading to the judges.

Table 4.2: Scoring methodology for highest apogee

Points awarded	Highest apogee
100	Apogee 500 m +
80	First highest apogee reached below 500 m
–	The remaining teams will share the points proportionally from 0 to 80 points
0	Lowest apogee reached

Beginners Challenge

The aim is to lift a standard chicken egg and bring it back down to the ground without breaking it. Size M eggs will be provided by the organisers at the competition venue. If the egg remains intact, the team receives the full number of points. If the egg breaks (the contents leak out of the shell), the team receives 0 points. If the egg cracks, the number of points will be determined by the panel of judges on site.

Advanced Challenge

Carrying a payload is the primary function of most civilian rockets. In many cases, this payload consists of one or more satellites. In the small satellite category (which even student teams are now able to design and launch), the best-known is the CubeSat. However, it also has an even smaller relative – the PocketQube. Over 100 PocketQubes have already been launched into orbit. The smallest size within this standard – 1P – measures just 50×50×50 mm.

In this year's challenge, your primary task will be to design a satellite of this type in the 1P size and successfully launch it from a rocket at apogee. The official PocketQube standard, as published in its first edition on 7 June 2018, serves as the basis for the satellite's design. However, as your satellites will not be travelling into space, the requirements placed on them are considerably lower. Within the CRC, your satellite must therefore meet the following requirements:

PQ-Gen-01: The PocketQube shall ensure no deliberate detachment of any components throughout the lifetime of the entire mission: launch, ejection and in orbit operation.

CRC clarification – in our case, the mission consists of launch, deployment and return by parachute. This rule does not apply to the separation of the PocketQub from the rocket.

PQ-Gen-02: Pyrotechnics shall not be allowed on board.

CRC clarification – it is permissible to use an ejection charge to eject the satellite, but pyrotechnics must not form part of the satellite itself.

PQ-Mech-01: The PocketQube configuration and dimensions shall be in accordance with Figure 4.1.

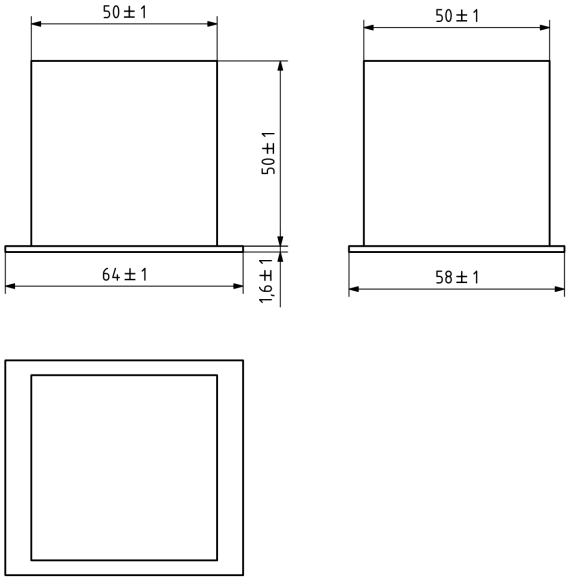


Figure 4.1 – Dimensions of a 1P PocketQube satellite

PQ-Mech-02: A 1P PocketQube shall be 51.6±0.1 mm wide (Y dimensions as seen in Figure 2). This comprises 50.0 mm + 1.6 mm the thickness of the sliding plate.

CRC clarification – the total permitted tolerance for this dimension within the CRC is ±2 mm. The launch plate must form part of the satellite – it must not detach during launch.

PQ-Mech-03: A 1P PocketQube shall be 50.0±0.1 mm wide (X dimensions as seen in Figure 2) with a sliding plate of 58.0±0.1 mm in the same direction.

CRC clarification – the permitted tolerance for this dimension within the CRC is ±1 mm.

PQ-Mech-04: A 1P PocketQube shall be 50.0±0.1 mm long (Z dimensions as seen in Figure 2) with sliding plate dimensions of 64.0 ±0.1 mm in the same direction.

CRC clarification – the permitted tolerance for this dimension within the CRC is ±1 mm.

PQ-Mass-01: Each PocketQube unit (1P) shall not exceed 250 g mass.

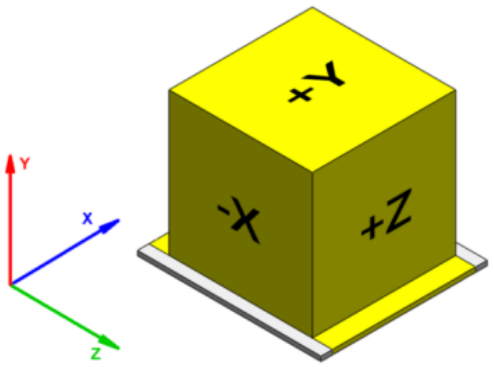


Figure 4.2 – PocketQube coordinate system

Additional CRC rules:

PQ-CRC-01: A PocketQube must have its own recovery system. The permitted descent rate is 10–15 m/s if the satellite's mass is 150 g or less. For satellites heavier than 150 g, the descent rate must be within the range of 6–9 m/s.

PQ-CRC-02: The PocketQube shall be released from the rocket at apogee .

PQ-CRC-03: The PocketQube must have its own flight computer, independent of the rocket's flight computer.

PQ-CRC-04: The PocketQube must incorporate its own locating system/beacon to facilitate recovery after landing.

PQ-CRC-05: After ejection, the PocketQube must measure at least the altitude profile of the descent using a barometer. The sampling rate must be at least 2 Hz.

PQ-CRC-06: Battery life must be at least 120 minutes.

Challenge Evaluation

The evaluation consists of three parts:

1. **Satellite presentation**
   - Teams will be assessed on how well they present and defend their satellite design to the expert panel.
2. **Satellite design**
   - The satellite is checked to ensure it complies with the requirements and rules.
   - The expert panel assesses the design of the entire satellite, including the launch method.
3. **Launch, Functionality and Locating the Satellite**
   - The launch and flight sequence will be assessed by a flight judge.
   - The satellite must separate from the rocket at apogee.
   - For university teams, in-flight performance is assessed on the basis of a post-flight presentation to the expert panel.
   - If the satellite is not recovered after landing, the team is not assessed in this category.

Recovery system technology

In spaceflight, the recovery system is often just as important as the propulsion system. In the Czech Rocket Challenge, however, the recovery system is the most important. We therefore pay close attention to its high-quality construction and strive to minimise the risk of failure during flight. If a rocket's recovery system is not functioning, it poses a serious safety risk to others and could potentially cause the destruction of the entire rocket. If an accelerometer is used to detect launch, the detection threshold must be set to no more than 2G ($19.61 m/s^2$).

The recovery system must function. If it does, you will then be awarded points for the flight section. If not, the flight is deemed unsuccessful and the team will be penalised with a DNR designation.

Penalties

In the event of a recovery system failure, the team is designated as DNR (did not recover). If a team receives a DNR penalty, no points are awarded for the flight segment.

In the event of an unstable flight, the team is awarded a penalty of up to 200 points at the discretion of the judges.

If a team turns up on launch day with a rocket other than the one specified in the final report, the team is automatically disqualified.

If any part of the rocket's fuselage in the beginners' category has a diameter of less than 60 mm (with the exception of the rear section of the fuselage where the stabilisers are attached, and the nose cone), the team is penalised by the deduction of 200 points or, in the case of an extensive section with a smaller diameter, disqualified.

In the event of late arrival at the technical committee, a penalty of up to 200 points may be imposed, depending on the length of the delay. Details regarding the organisation of the launch day can be found in **Chapter 6**.

If a team is unable to attend the pre-flight check when summoned, it will be penalised proportionally by up to 200 points, depending on the length of the delay.

In the event of an excessively long delay whilst preparing for the launch in the vicinity of the launch pad (more than 10 minutes), the team will have up to 100 points deducted, at the discretion of the launch pad operators and judges. Further details on the format of the final day can be found in **Chapter 6.**

In the event of a late submission of *the final report,* points may be deducted or the team may be disqualified from the competition.

If false parameters are reported in the final report, the team will be penalised 50–100 points for each parameter breached. If all the parameters reported are false or the results of standardised tests have been falsified, the team will be disqualified (DSQ).

If the height limit is exceeded, the team will be penalised by having their points for the flight phase disregarded.

Unsporting behaviour during the design or construction of the rocket, or on the day of the competition, will result in the team's disqualification (DSQ) from the competition.

If a report is submitted in a format other than PDF or is incorrectly named, the team will be penalised by up to 50 points for each report submitted in this manner.

Even at this level, rocket science is a dangerous activity. It involves the use of flammable substances and pyrotechnics, and a flying rocket can very easily cause damage to property or injure people. It should therefore be taken seriously. Any unacceptable behaviour at any point during the project which is deemed dangerous and/or poses a potential threat to others will result in the team's disqualification from the competition.

Abbreviation	Description of abbreviation	Consequences
DNR	Did Not Recover (Unsuccessful flight)	Points from the flying section are not counted and the competitor is eliminated from the main category.
DNL	Did Not Launch (Team withdrew from launch)	Points from the flying section are not counted and the competitor is eliminated from the main category.
DSQ	Team disqualification	Not permitted to start and disqualification from all categories.

5 Standardised tests

As part of *the final report*, teams will also be required to submit reports on standardised tests. These are designed to ensure a basic level of safety for the rocket, and thus for the entire competition. During the workshops, teams will be given specific and precise requirements regarding the content, parameters and format of the reports. The materials provided will also include a template for compiling the test report. Teams must adhere to this template. The test reports must be submitted as a separate PDF file together with the final report. Below is a general overview of the required tests; a separate Standardized Testing Handbook containing detailed procedures will be distributed to accepted teams.

5.1 Stabiliser Strength Test

The aim of this test is to verify that the stabilisers are strong enough not to break off in flight as a result of aerodynamic forces.

5.2 Rail Guide Structural Integrity Test

During rocket launch, in extreme cases, the rocket may become jammed in the launch track. The aim of the test is to verify that the guide members do not break off and cause the rocket to veer off course, which could endanger spectators, competitors and surrounding property.

5.3 Recovery system deployment functionality test

In this test, the team's objective is to demonstrate that their chosen system is capable of successfully and fully deploying the recovery device. For systems using an ejection charge, the test will be extended to include a functional test of the RBF pin.

5.4 Recovery device drop test

As part of this test, the team must demonstrate that their chosen solution achieves the required descent speed. In the case of non-conventional systems, the aim is also to demonstrate the basic functionality of this principle.

5.5 Test of the strength of the engine and recovery device mountings

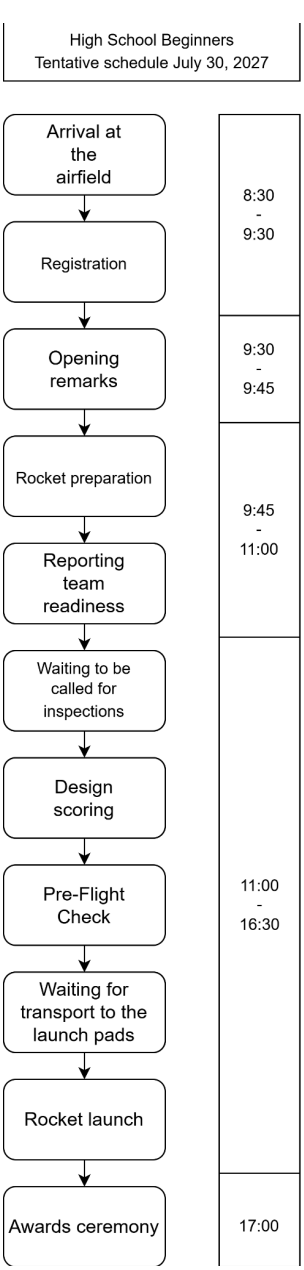
The main objective of this test is to apply a load to the engine and recovery device mountings and to demonstrate that no deformations occur which would jeopardise flight safety.

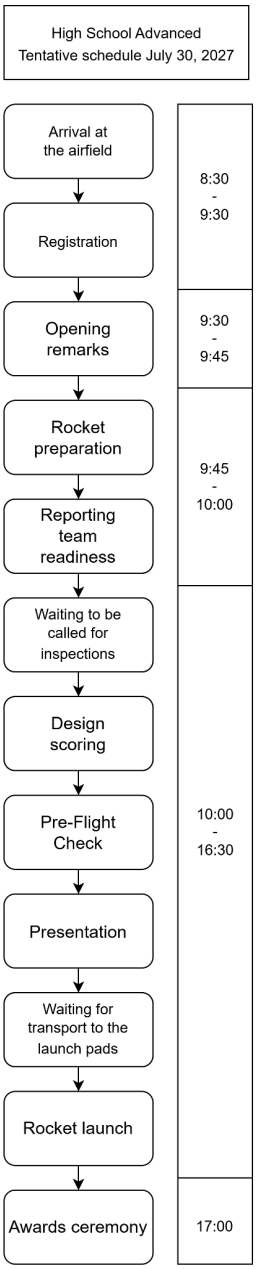
5.6 Parachute strength test

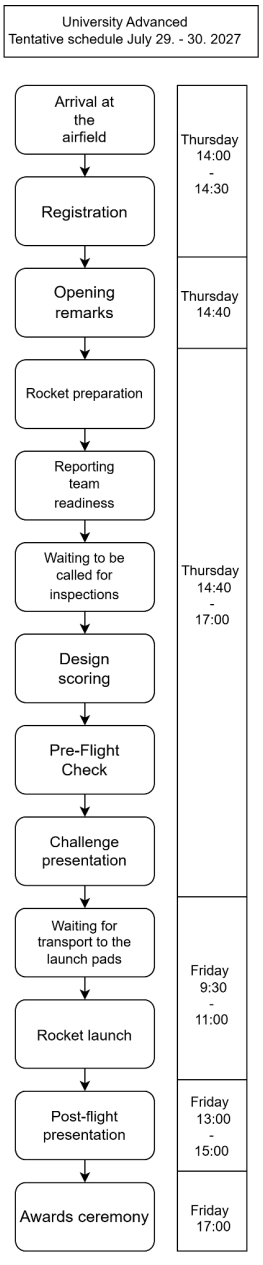
When the recovery system is deployed, considerable forces are generated which act not only on its mounting but also on the braking device itself (parachute, ribbon, etc.). It is therefore essential to verify the strength of all components exposed to this load, such as cables, parachute fabric and harnesses.

6 The team's programme on the final day

Further details regarding the final day will be communicated to participants well in advance; in any case, the philosophy behind the final day is as follows:







1. Invited university teams will arrive in Moravská Třebová on the afternoon of the first day of the competition (**29 July 2027**). They will be registered there. They will then undergo all three types of checks/committees. First, the team will visit the evaluation committee, which requires a presentation of the challenge, the rocket and the team as a whole. This panel awards the final marks for the Design and Innovation category. The team will then proceed to the pre-flight technical inspection. This will verify the rocket's technical airworthiness and grant launch clearance (the organiser reserves the right to impound the rocket until the team's launch window). Finally, the team will visit the challenge panel, comprising experts and scientists, who will evaluate the PocketQub design. Here, the team will give a presentation lasting approximately 15 minutes.
2. The other teams will gather at the airport on the day of launch (**30 July 2027**). They will have all the necessary tools and their rocket, fully assembled, with them.
3. Upon arrival, the team will register. They will pay a deposit for the engine and altimeter. In exchange for the deposit, they will receive the altimeter. They will only receive the fuelled engine at the launch pad, but mock-up engines will be available during the pre-flight check and in the preparation tents for balancing the centre of gravity, testing the thread or carrying out a test assembly of the rocket.
4. The pre-flight technical inspection will open at 9.45.
5. All advanced high school teams must report their readiness to the team coordinator by 10:00, and all beginner high school teams by 11:00. Failure to do so will result in a penalty for the team. They will then be summoned by a coordinator from the organising team to appear before the judging panel. Teams therefore do not need to wait outside the judging panel's tent.
6. Here, the team will have to defend their rocket before a panel comprising experts and members of the CRS. The final report will be reviewed with the team, and questions will be asked regarding the challenge, the rocket's systems and its functionality. Following this assessment, the team will be awarded their final score in the *Design and Innovation* category.
   After the judging panel, the team moves on to the pre-flight check, which takes place in the adjacent stand.
7. The team will then be summoned for the technical pre-flight inspection, which consists of three parts. If the team is unable to attend the inspection when summoned, they will be penalised. In the first part, the technical condition of the rocket will be assessed, and its centre of gravity, mass and basic dimensions will be measured. Next, the flight simulation in OpenRocket will be reviewed in accordance with current weather and wind conditions. The third part involves an assessment of the rocket by a safety officer. In case of doubt, the judges may request a re-run of the test or a demonstration of the rocket's individual systems on the spot. If a fault or a non-functional or dangerous system is found, the judge has the right to automatically disqualify the team on the spot. If everything is in order, the team will receive confirmation that the rocket is airworthy.
8. Following the pre-flight technical inspection, the team must not make any structural changes or other unauthorised modifications to the rocket. Only the actions specified in the approved launch procedure are permitted, in particular the preparation of the electronics, the installation of the altimeter and the placement of the engine on the launch pad. Any further changes must be approved by the judge and may require the pre-flight inspection to be repeated.

9. Between 9.45 am and 12.30 pm, advanced high school teams will also be called up for the third discipline, which consists of a 15-minute presentation of the challenge and experiment to the audience and the scientific committee. Teams may be called up for this discipline at any time during this period, provided the team is not currently undergoing one of the two checks.
10. Launches by university teams will take place between 9.30 and 11.00.
11. Once a rocket has been inspected, assessed and declared airworthy, the team may wait for its launch wave. For advanced high school teams, this time slot is from 12.30 to 14.00; for beginner high school teams, it is from 14.00 to 16.00.
12. Once a team has been called to the launch site, the whole team gathers at the departure point for transport to the launch site. Upon the arrival of the transport, the team boards and is taken to the launch pads.
13. The team, with their rocket prepared and switched off, waits for instructions from the launch pad.
14. As soon as the team receives instructions from the team coordinator, it moves to the launch pad.
15. At the launch pad, the team will be given a fuelled engine and will prepare the rocket for the launch pad (switching on the electronics, altimeter, etc.). The team has 10 minutes for preparation. If the team exceeds this time limit, they will be penalised. Ideally, the team should handle the rocket as little as possible, as it will already be prepared from the previous check.
16. The team moves to a safe distance and waits for the remaining teams from the same launch batch. However, these teams may be delayed, so the rocket, whilst switched on, should remain operational for at least 120 minutes.[1]
17. All rockets from a single launch batch will be launched one after the other. ONLY THEN will the teams be asked to locate and collect their rocket. They will show the altimeter, displaying the measured altitude, to the flight judge present. Both the altimeter and the motor must be returned to the organisers.
18. Teams that have already launched may pass the time in the fun zone or by watching their opponents and their presentations.
19. From 13:00 to 15:00, post-flight presentations by university teams will take place. University teams will be called up for their presentations by the team coordinator or the presenter.
20. The results will be announced once all eligible rockets have been launched.

[1] If a team fails to meet the 10-minute time limit or the additional time allowed, the organiser may exclude it from its launch wave and move it to another.

7 Further information

7.1 What will be provided

Several workshops will be held during the rocket design phase. These should help teams to allocate roles within the team, begin designing individual components and understand various aspects of the rocket, such as aerodynamics, flight simulation and structural analysis. In addition, 'office hours' will be provided, during which competitors will be able to discuss any queries or issues relating to their specific rocket. Competitors will also be able to contact the organisers via the CRC server on the Discord platform.

On launch day, a covered workspace (a table measuring approximately 200 x 50 cm) with a power supply, a motor, an altimeter and a launch pad will be provided on site.

7.2 Contact details

All necessary public information is available on the website: **www.czeroc.cz**

The person in charge is Eva Hrnčířová: **crc@czechrockets.com**

A Gragas engine

Engine specifications

Main parameters of the Gragas engine. (. denotes a decimal place)

Table A.1: Geometric parameters of the Gragas engine

Gragas engine parameters	
Outer diameter of the motor	43.4 mm
Motor length (excluding nozzle)	155.6 mm
Motor length (with nozzle)	167.7 mm
External motor temperature	120 °C

The motor consists of three machined parts: the nozzle, the plug and the chamber. For illustration purposes, **Figure A.1** below shows an assembly drawing of the motor and a drawing of the plug.

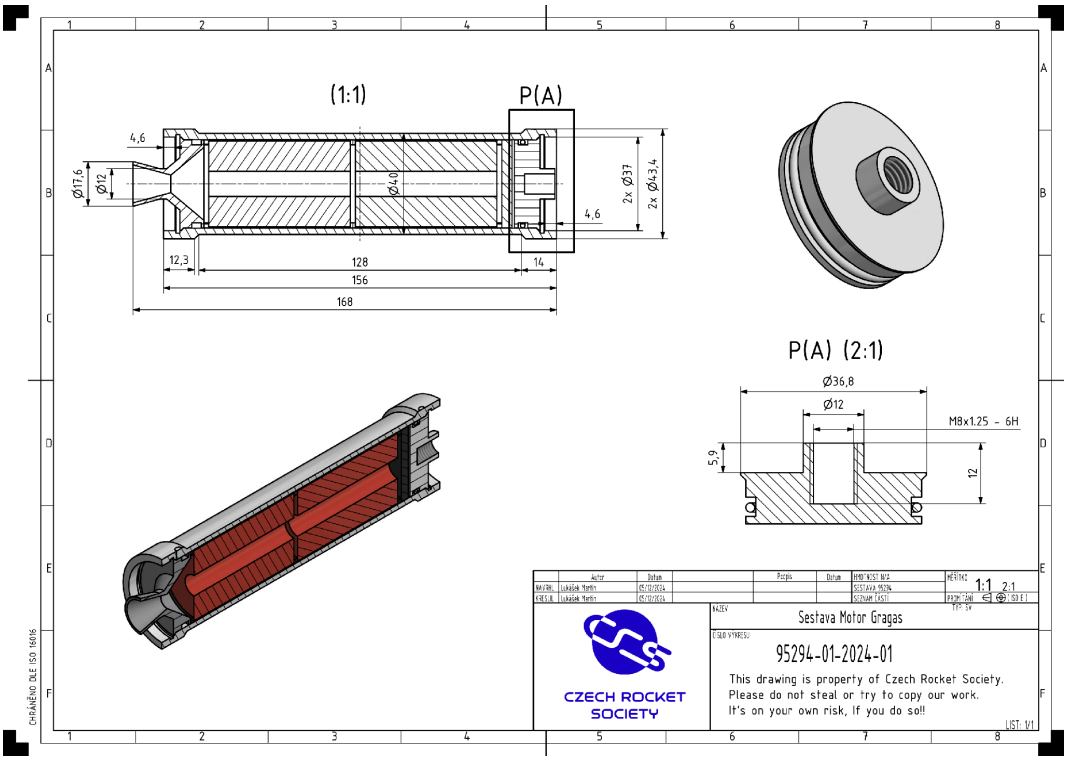


Figure A.1: Drawing of the Gragas engine

The technical drawings of the engine are the property of the Czech Rocket Society and may not be distributed without the Czech Rocket Society's permission.

Engine characteristics

Table A.2: Performance parameters of the Gragas engine

Gragas engine performance parameters	Value
Total impulse	166 [N·s]
Burn time	1.59 [s]
Maximum thrust	138 [N]
Fuel mass	158 [g]
Empty engine weight	209 [g]

The organiser reserves the right to change the engine specifications.

Engine mounting in the rocket

The figure below shows the recommended method for mounting the engine in the rocket. If a team opts for a different method, it must describe it in detail in the final report and ensure that the engine can be fitted quickly.

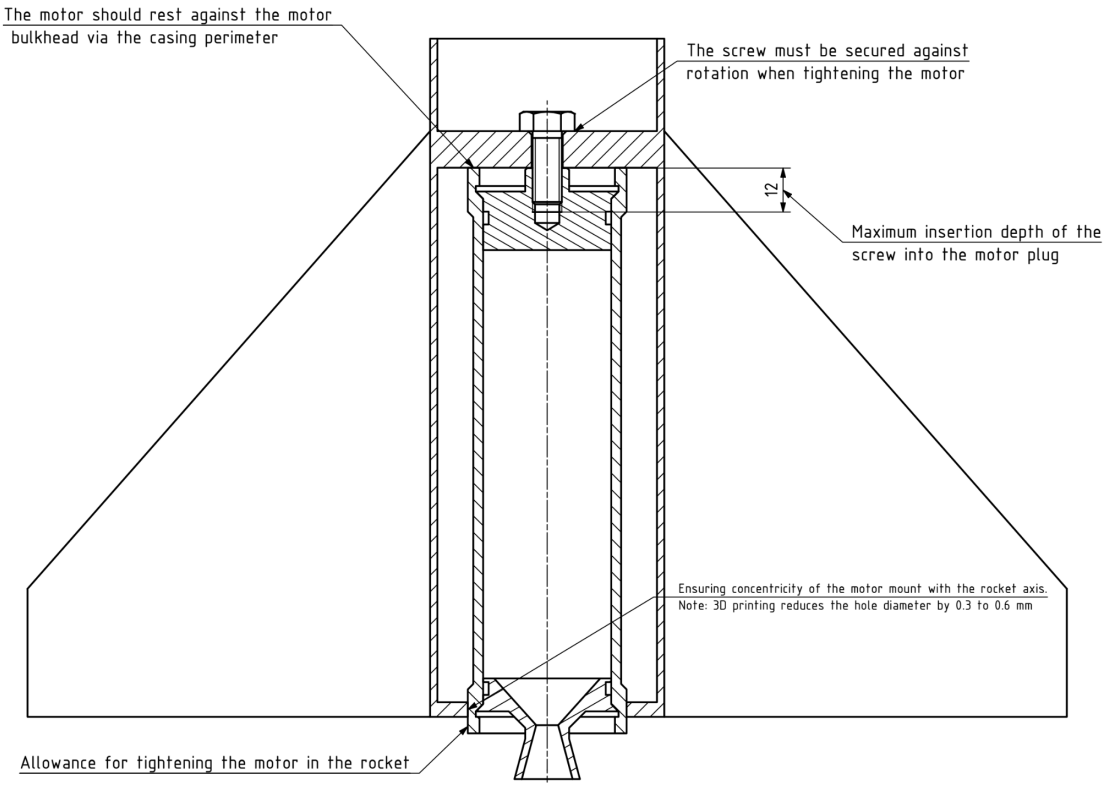
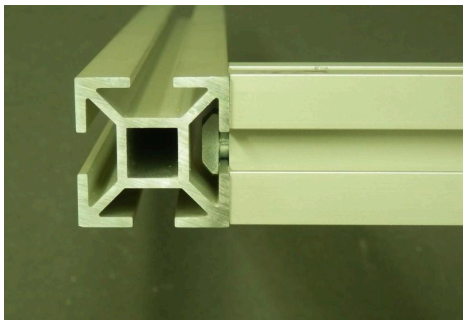


Figure A.2: Engine mounting in the rocket

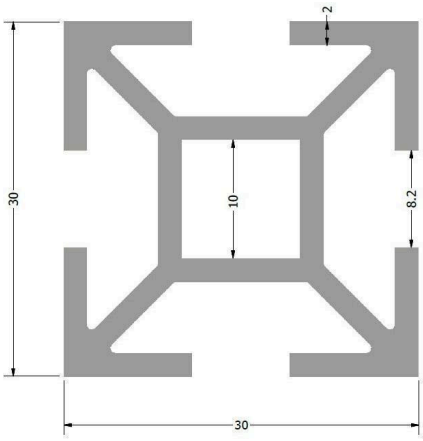
B Launch pad

The length of the launch ramp rail is 2.4 metres.

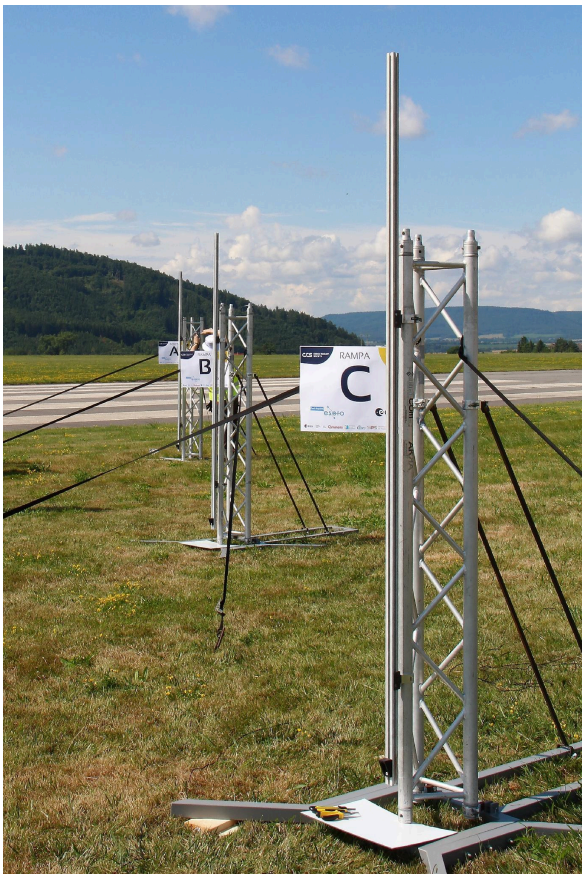
The launch ramp profile is 'Alutec', specifically *the Kombi system 30x30*, as shown in **Figure (b)** below. A photograph of the profile can be seen in **Figure (a)** below. At the end of the profile is a 3D-printed stop that holds the rocket in place within the profile. The mounting of the profiles is designed to prevent any contact with the rocket. A photograph of the launch pad can be seen in **figure (c)**.



(a) Photograph of the 'Alutec' profile



(b) Launch ramp profile



(c) Photograph of the launch pad

Figure B.1: Overview of the ramp and its profiles

The images are taken from the website of the manufacturer, Alupa s.r.o., **here** and **here**.

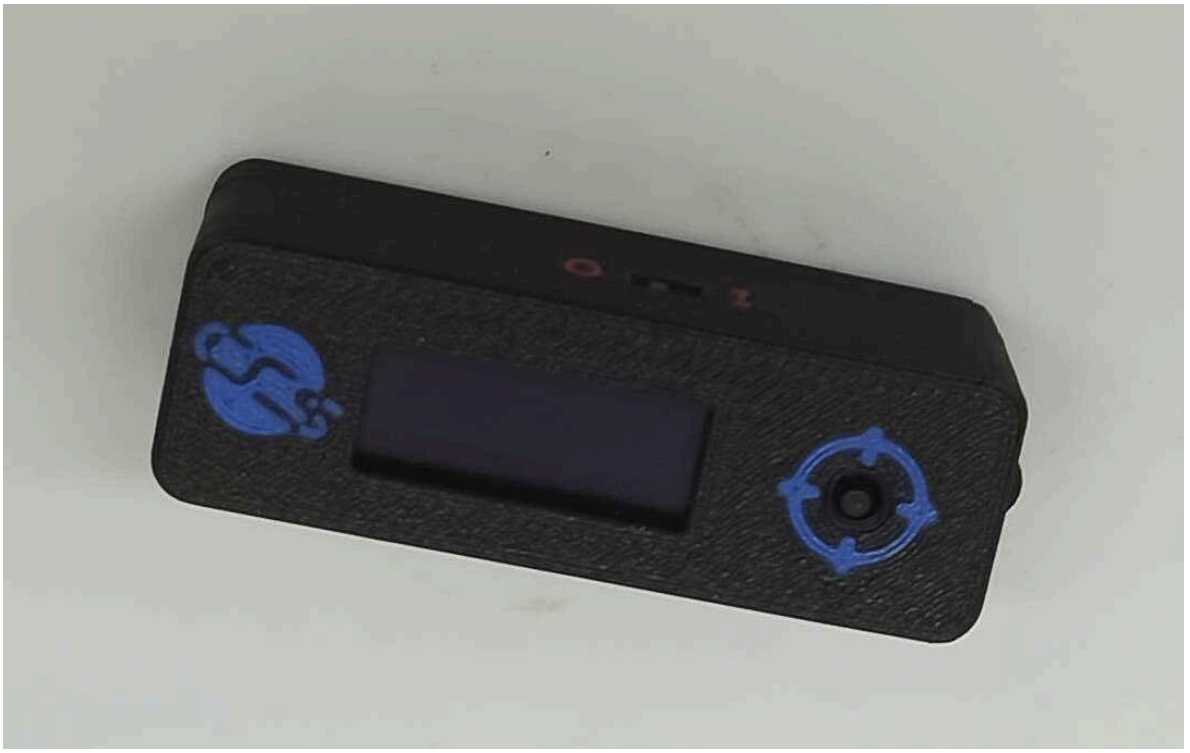
The rocket must be guided through the groove. It is not recommended to produce a shape that exactly matches the profile's groove; otherwise, there is a risk of the segments getting stuck in the profile during launch, or the segments may not fit into the groove at all.

The organiser reserves the right to change the parameters of the launch ramp.

C Altimeter

The altimeter has maximum dimensions of (58+2)×21×15.5 mm (L+eyelet × W × H). It is fitted with an eyelet on one side. It features a two-position switch which turns the altimeter on and activates altitude measurement. The altimeter operates by sensing barometric pressure; therefore, it requires air to be able to flow freely around it. The altimeter will remain operational for at least 3 hours when switched on. It is also advisable for the altimeter to be easily accessible after the rocket has landed, without the rocket having to be dismantled (the altimeter is switched on at the launch pad). We recommend securing the altimeter to a fixed part of the rocket so that it is not lost should the rocket break on impact. A refundable deposit of 1,000 Kč is collected upon registration for the loan of the altimeter.
The altimeter weighs 18 g.

The organiser reserves the right to change the altimeter whilst remaining within the specified parameters.



D Active rotation control

Definition

Active spin control systems are defined as systems whose primary purpose is to control the angular velocity about the rocket's longitudinal axis. It is prohibited to control spin about any other axis. Due to range safety perimeter constraints, roll control must not be achieved using movable aerodynamic fins or control surfaces attached to the fins.

Requirements

This chapter lists all requirements relating to active control:

1. Active rotation control systems are permitted only in the *'Advanced'* category.
2. Stabilisers that ensure the rocket's stability must not be controllable.
3. A rocket with the system switched off in a neutral position must still meet the stability criteria.
4. Active components may only be activated after leaving the launch pad. In the case of direct detection (for example, a breakaway wire of the correct length), activation is permitted immediately upon leaving the launch pad. For indirect detection (a timer starting from launch detection), a delay of 0.5 s is mandatory.
5. Active components must be mechanically lockable in the neutral position in the event that the team does not receive authorization for an active flight. A possible alternative is to remove the system.
6. Active control systems must be described in detail in the final report, including the control principle, planned control effectiveness and flight trajectory. The organisers reserve the right to request further information and to impose additional restrictions.

E Ejection charge

Definition

An ejection charge is a small charge of gunpowder used to eject a recovery device.

Requirements

This chapter lists all requirements relating to the ejection charge:

1. The total charge must not exceed **0.5 g** of gunpowder.
2. The recommended method for determining the quantity of gunpowder is set out at https://rocketrycalculator.com/rocketry-calculator/bp-estimator/. It is possible to use your own calculation method. However, this must be thoroughly documented in *the final report*.
3. The ejection charge must be transported with the circuit short-circuited.
4. When working with the ejection charge, everyone present must wear safety goggles or face shields. Ensure your personal safety.
5. The use of home-made gunpowder is prohibited.
6. An RBFP (remove before flight pin) must be incorporated into the igniter circuit. When inserted, this physically isolates the igniter from the battery. This ensures that premature ignition does not occur in the event of a faulty signal from the avionics.
7. The RBFP must remain inserted at all times whilst the igniter is connected, until the moment of departure from the launch pad.
8. When the RBFP is removed, a unique audible signal lasting at least 2 seconds must sound. The *'Armed'* status should then be continuously indicated by a visual signal. The RBFP signalling system must be described in detail in the final report.
9. Parachutes and other vulnerable systems must be protected against hot exhaust gases from the activation of the ejection charge.
10. The ejection charge must be described in detail in the final report. The quantity of powder, the design of the entire ejection charge, the method of connection to the RBFP and the protection of the recovery device against exhaust gases must be documented.

Standardised tests

Rockets utilising an ejection charge will undergo an additional step in the standardised 'Recovery System Ejection Functionality Test'. Details can be found in the Standardised Tests Manual.