UPT Space Engineering Challenge

A New International STEM Competition for High School and University Students

Edition 2025

Overview

The UPT Space Engineering Challenge is an international educational competition organized by the Politehnica University Timișoara (UPT), in collaboration with a network of institutional and industrial partners. Structured into two main sections — High School and University — the competition aims to stimulate curiosity, creativity, engineering skills, and scientific inquiry through practical challenges inspired by contemporary space exploration missions.

As space agencies increasingly rely on autonomous robotic systems to explore and operate in extraterrestrial environments, the UPT Space Engineering Challenge introduces young minds to the multidisciplinary reality of designing and deploying such systems. Whether simulating orbital drones, surface rovers, or aquatic submersibles, each edition of the challenge immerses participants in hands-on learning experiences grounded in real-world space engineering problems.

All communications, submissions, and presentations in the UPT Space Engineering Challenge will be conducted in English, to promote international standards and cross-institutional accessibility.

Objectives of the Competition:

- To foster interest in STEM (Science, Technology, Engineering, and Mathematics) disciplines among pre-university and university students
- To develop competencies in robotics, embedded systems, and scientific methodology
- To encourage critical thinking, teamwork, and innovation through project-based learning
- To promote cross-disciplinary collaboration between future engineers, scientists, and educators
- To provide a platform for young talent to engage with academic mentors and industry professionals

Educational Benefits:

Participants in the UPT Space Engineering Challenge gain valuable experience in areas such as:

- Autonomous systems design
- Sensor integration and data collection
- Software development and real-time control
- Scientific experimentation and report writing
- Project planning and teamwork in a competitive setting

Through this initiative, UPT and its partners reaffirm their commitment to shaping the next generation of engineers, researchers, and space technology pioneers.

1. Structure of the Competition

The **UPT Space Engineering Challenge** is structured to simulate the development and execution of a space robotics mission, with a focus on space rovers in the 2025 edition. The competition is divided into two main sections:

- **Section A – High School Teams**
  Targeted at students enrolled in authorised high schools in grades IX to XII at 21.11.2025
- **Section B – University Student Teams**
  Dedicated to undergraduate (bachelor level) students from Romanian or foreign universities.

Each section follows a similar timeline and evaluation framework, adapted to the educational level and experience of the participants.

1.1. Team Composition

- Each team must consist of **between 2 and 3 students**.
- Teams must be coordinated by **one adult mentor** (teacher, academic, or external professional).
  One mentor may guide a single team and must not be directly involved in the technical development/implementation of the solution. No hands-on approach!
- Each institution may enroll **more than one team**, subject to selection capacity.

1.2. Format

The competition consists of several key phases:

a) Application Phase

Teams must submit a template-based **Letter of Intent** containing:

- Team name and composition: team name shall consist of a single, non-offensive, easelly pronouncable and distingushable word; Selection committee may require applicant to choose a different name. Name can be followed by an optional number.
- Short description of project objectives (following Template Annex 1);
- Initial concept and technical approach (following Template Annex 1)

A selection committee will choose between **3 and 10 teams** to participate in the challenge, based on clarity, feasibility, and educational value of their proposal.

b) Development Phase

Teams will use the **technical specification brief** (Annex 2 to this document) and must:

- Design and build a (semi)autonomous robot suitable for land exploration simulation;
- Develop a mission plan tailored to the tasks described;
- Prepare a **video report** (3–5 minutes) detailing concept, progress, and key design decisions;
- Submit documentation as required by the organizing committee.

Hardware cost limitation:

- The maximum hardware value deployed in the field must not exceed **€1,000**
- The sum refers to all the equipment on the robotic system and does not include the IT equipment (laptop(s), WiFi devices, power supply, video camera(s)) used by the team as part of the ground/remote control system.

c) Competition Phase (3 Days – On-site)

- **Day 1 – Check-in and Technical Inspection & Go/No-Go Checks**
  - **Check-in**
    - Paperwork/ID
    - Safety documents
  - **Technical inspection**
    - Communication systems
    - Compliance with size, weight, and safety limits
    - Steering/control (autonomous or remote-controlled, per section)
    - Budget verification
    - Engineering design decissions
- **Day 2 – Field Operations**

    - Safety briefing, on-site (with local partners, depending on site specificities)
    - Execution of mission tasks such as, but not limited to:
        - Navigation
        - Sampling or object detection
        - Data collection and transfer
- **Day 3 – Final Reporting & Awards**
    - Teams present their results, technical and scientific interpretation, and receive jury feedback;
    - Awards and certificates are granted based on evaluation criteria;
    - Technical meeting with mentors and teamleaders (optional)

1.4. Tools and Environment

- All programming platforms, microcontrollers, and mechanical configurations are allowed, provided safety and budget compliance are respected.
- Use of simulation tools and digital twins is encouraged during development.
- A standard testing field (and backup) will be described in the technical brief.

2. Evaluation Criteria

All participating teams will be evaluated by a multidisciplinary jury composed of representatives from UPT, industry partners, and relevant space or education institutions. The evaluation will consider both **technical merit** and **project execution**, tailored to the section (High School or University Students) to ensure fairness and comparability.

The final score will be composed of the following categories (evaluation criteria are not exhaustive and will be detailed in the grading sheet (Annex 4):

2.1. Engineering Design (30%)

This component evaluates the overall quality, originality, and functionality of the robotic platform:

- Mechanical structure and build quality
- Embedded systems integration
- Sensor selection and data processing pipeline
- Robustness and fault tolerance
- Use of available materials and cost-efficiency

2.2. Software & Autonomy (20%)

Focuses on the logic and autonomy of the system:

- Autonomous navigation and task execution
- Communication protocols
- Real-time control and fail-safes
- Software clarity and modularity

2.3. Scientific and Technical Understanding (20%)

Evaluates how well the team understands and applies core STEM principles:

- Clear articulation of design rationale
- Understanding of physics/aerodynamics (if applicable)
- Use of scientific methodology in design/testing
- Documentation and proper referencing

2.4. Mission Performance (20%)

Assesses performance during the operational phase of the challenge:

- Successful completion of the assigned/proposed mission tasks
- Accuracy and efficiency in data collection, navigation, or detection
- Adaptability to real-time conditions
- Validity and clarity of collected mission data

2.5. Soft Skills & Project Management (10%)

Recognizes the importance of collaboration, communication, and planning:

- Team coordination and time management
- Communication quality during the pitch or final report
- Clarity of the video report (MVP)
- Team roles and transparency of effort

2.6. Bonus Considerations (Non-Scored)

In addition to the scored criteria, the jury may offer **honorable mentions** for outstanding contributions in areas such as, but limited to:

- Creative use of limited resources
- Innovative engineering solutions
- Environmental sustainability
- Outreach or educational impact

Scoring Approach

Each jury member will provide a score per category on a 1–10 scale (weighted accordingly).
The final ranking will be determined by the weighted average across all categories.

In case of a tie, priority will be given in the following order:

1. Mission Performance
2. Engineering Design
3. Scientific Understanding

---

3. Awards & Prizes

The **UPT Space Engineering Challenge** seeks not only to reward excellence but also to recognize effort, creativity, and deep understanding. A set of awards will be granted at the end of the competition, based on jury evaluation and final mission outcomes.

To ensure the prestige and educational value of the awards, the total number of prizes will not exceed **50% of the total number of teams (rounded-up to integer)** in each section.

3.1. Main Awards

These distinctions are awarded based on overall jury scoring:

- 🏆 **Grand Prize – Best Overall Project**
  Awarded to the team with the highest total score, demonstrating exceptional performance across all dimensions of the challenge. Highest

- 🛠️ **Best Engineering Design**
  For the most robust, well-integrated, and innovative hardware and software

system.

- 🔬 **Best Scientific Understanding**
  For the team that demonstrates exceptional command of the scientific principles and methods underlying their project.

- 📊 **Best Project Management**
  For the team that excels in organization, planning, and documentation.

3.2. Special Mentions

The jury **may** award **Special Mentions** for outstanding achievement in specific areas, such as, but not limited to:

- Most Creative Technical Solution
- Best Use of Sensors
- Most Effective Low-Cost Design
- Most Resilient Team (overcoming setbacks)
- Best Communication or Outreach Effort

Special Mentions are at the discretion of the jury and may vary from year to year.

3.3. Certificates & Recognition

All finalist teams will receive:

- **Certificate of Participation** (individualized for team members and mentors)
- **Invitation to participate in future UPT STEM events or workshops**

Winners will also receive:

- **Nominal Diplomas and Trophies or plaques** (custom-designed per edition)
- **Material prizes**, sponsorship-based (e.g., kits, vouchers, tech items) — subject to availability
- **Recognition on official platforms** (UPT website, partners, media)

3.4. Awarding Ceremony

The awards will be announced and presented on the final day of the competition.

If the event is held online, a virtual awards ceremony will be streamed, with prize delivery organized by mail or through institutional channels.

---

4. Eligibility & Participation Conditions

Participation in the **UPT Space Engineering Challenge** is open to both high school and university students, under the terms outlined below. All teams must adhere to the structure and ethical standards of the competition.

4.1. Participant Categories

Section A – High School Students

- Participants must be enrolled in a **secondary education institution** at the time of application.
  Students must be **in grades IX to XII at 21.11.2025**
- Each team must be supported by an **adult mentor** (e.g., teacher, club coordinator, engineer, or academic).
- Teams may represent (have the official affiliation) a school, an informal group, or a private educational center.
- All high school teams (Section A) must be **accompanied by a responsible adult (mentor or teacher)** throughout the duration of the competition, including any on-site activities. This adult:
  - Must be officially listed in the application form;
  - Is responsible for student conduct, and safety outside the contest area;
  - Must be present at all briefings, technical inspections, and field sessions;
  - Teams without an assigned adult supervisor **will not be allowed to participate in on-site activities**.

Section B – University Students

- Participants must be **enrolled in a university** (bachelor-level programs) at the time of application.
- Teams may be multidisciplinary and represent a faculty, department, or student association.
- Each team must have at least **one responsible mentor or supervisor**, either academic or external.

4.2. Team Composition

- Teams must consist of **2 to 3 student members**.
- Each team must designate:
  - **Team leader:** student member**,** acting also as primary contact person (for communication purposes)
  - **Mentor**
- A single mentor may supervise a single team.

4.3. Rules of Conduct

- All participants must respect fair play and academic integrity.
- Plagiarism or unauthorized assistance may result in disqualification.
- Mentors must act as guides, not as project builders or coders.
- Collaboration and mutual support among teams is encouraged, but submissions must be original.

4.4. Technical and Budget Constraints

- The total cost of components used in the robot system must not exceed **€1,000**.
- Any platform or programming language is allowed, provided it complies with safety and interoperability guidelines.
- Organizers may request proof of purchase or a detailed **bill of materials**.

---

5. Timeline & Key Dates

The **UPT Space Engineering Challenge** is organized over several phases, spanning from announcement to final evaluation and awards. The calendar below outlines the major milestones for the **2025 edition**.

> 🗓️ **Note:** Specific dates may be subject to adjustment. Final scheduling and instructions will be confirmed through official communication channels and can change on a short notice, similar to actual space operations.

🔹 Phase 1 – Launch & Registration

- **01 June 2025**
  🛰️ Official Launch of the Competition
  - Regulation document and technical theme published
  - Application period opens
- **15 September 2025**
  📩 Final Deadline for Submission of Letter of Intent & Project Proposal
- **17 September 2025**
  🔎 Shortlisting and Notification of Selected Teams

🔹 Phase 2 – Development & Interim Submission

- **01 November 2025**
  🎥 Project Milestone Submission
  - 3–5 minute video report presenting the concept, design progress, and any testing
  - Intermediate documentation (optional but recommended)

🔹 Phase 3 – Competition Days

Format: On-site, Timisoara, Timis County, Romania. Travel during the competition days and to/from mission site provided by organisers. Teams are responsible for arriving in Timisoara, Romania on 21.11.2025

- **Day 1 – Technical Review & Go/No-Go Check**
  - Verification of communication, safety, mechanical specs, and budget compliance
  - Platform walkthrough and Q&A with jury
- **Day 2 – Field Day**
  - Execution of mission tasks
  - Data collection, transfer, and logging
  - Added value knowledge
- **Day 3 – Final Presentations & Award Ceremony**
  - Submission of final report or post-mission presentation
  - Jury deliberation
  - Awards ceremony and feedback session

Tentative Window for Phase 3: 21–23 November 2025

6. Jury Composition & Responsibilities

The **UPT Space Engineering Challenge** will be evaluated by an independent and multidisciplinary **jury panel** composed of academic experts, industry professionals, and representatives from partner institutions. The jury plays a critical role in maintaining the fairness, educational value, and technical standards of the competition.

6.1. Composition of the Jury

The jury will typically include:

- **2 representatives from Politehnica University of Timișoara (UPT)**
  - Relevant experience in robotics, embedded systems, aerospace, or pedagogy
- **1–2 representatives from industry partners**
  - Professionals in R&D, systems engineering, or innovation management
- **1 representative from the Romanian Space Agency (ROSA)** *(to be confirmed)*
  - With experience in aerospace projects and STEM outreach
- **Optional: 1 representative from educational authorities or STEM education NGOs** *(e.g. ISJ or ESERO)*

6.2. Jury Responsibilities

The jury is responsible for:

- Reviewing applications and selecting participating teams
- Providing technical and scientific feedback at each stage
- Evaluating video reports, documentation, and mission performance
- Scoring each team based on the official evaluation criteria
- Awarding distinctions, special mentions, and resolving any disputes
- Offering public feedback and mentorship during the final stage of the competition

6.3. Evaluation Protocol

- Each jury member will independently score teams based on the evaluation rubric
- Scores will be weighted according to the criteria outlined in Section 2
- Final rankings will be determined by averaging jury scores per team
- In case of tie or conflict, a deliberation round will be held with the full jury

6.4. Transparency and Integrity

- The jury's decisions are **final and non-contestable**
- Conflict of interest declarations are required from all jury members
- Jury members may not mentor or support participating teams
- Feedback will be provided constructively and educationally

7. Final Provisions

7.1. Communication and Official Information

All official information regarding the UPT Space Engineering Challenge — including updates, changes, results, and clarifications — will be published on:

- The official UPT website or designated subpage: https://ac.upt.ro/sec
- Partner websites (as applicable)
- Direct communication via email with registered team leaders and mentors

By registering, participants agree they are responsible for staying informed of updates and adhering to all official deadlines and requirements.

7.2. Data Protection and Image Rights

By registering in the competition, all participants and mentors agree to:

- The use of their name, image, and project materials for non-commercial educational or promotional purposes by the organizers and partners.
- The storage and processing of personal data strictly for the purpose of contest organization, in accordance with GDPR regulations and Romanian law.

Consent forms may be required, especially for participants under the age of 18.

7.3. Safety and Compliance

All participants must comply with safety regulations regarding the design, transportation, and operation of robotic systems. The field environment for the 2025 edition may include **enclosed or partially enclosed spaces**, such as **a natural or artificial cave-like setting**, with limited overhead clearance, visibility, and maneuverability.

Key safety requirements include:

- All robots must be structurally stable and pose **no mechanical or electrical hazard** to participants, organizers, or equipment.
- Aerial drones are not allowed.
- Autonomous movement must include **collision avoidance** or fail-safe behavior, especially in enclosed environments.
- Sharp, hot, or rotating components must be safely enclosed and/or clearly marked.
- Wireless communication must respect allocated bandwidths and frequencies to avoid interference;
- Maximum weight, size, and operating power limits will be specified in the Technical Brief.

During on-site activities, **high school participants must be supervised at all times** by a registered adult mentor or teacher. This is a condition of participation and a matter of legal and institutional liability.

Safety Briefing and Local Protocols:

- Before Field Day, all teams are required to attend a **mandatory safety briefing** led by **local organizers and the field authority** (e.g. site manager, host institution, or safety officer).
- Teams must demonstrate a basic understanding of the site constraints and show compliance with all operational limits.
- Personal Protective Equipment, if required by the site, will be provided;
- Organizers reserve the right to **ground or disqualify** any system that is deemed unsafe or non-compliant.

Failure to comply with safety protocols may result in **penalties**, including **disqualification** or **exclusion from live operation** during Field Day.

7.4. Amendments to the Regulation

The organizers reserve the right to amend this regulation in response to unforeseen circumstances (e.g. technical constraints, partner withdrawal, external events). Any changes are final and will be promptly communicated to all selected teams.

7.5. Official Language

The official language of the UPT Space Engineering Challenge is **English**.

All official communications, technical documentation, reports, video submissions, and presentations must be written or delivered in English. This ensures fair evaluation, consistency across jurors, and alignment with international STEM and aerospace standards.

Mentors are expected to support students in meeting this requirement. Language quality is not directly scored but will affect the clarity and impact of submissions.

7.6. Contact

For questions, clarifications, or technical support, teams may contact the organizing committee at:

📧 **alexandru.iovanovici@upt.ro (Start the subject with “[SEC2025]” without quotes)**

P.S. 13 pages is not intentional 🙂