



## Space Challenges

Preparing the next generation of explorers

Space Challenges is one of the biggest educational programs in the field of space science and high technologies in Europe - <http://spaceedu.net>

The main aim is to inspire more young people to pursue science, technical and engineering careers. The program fosters entrepreneurship in the high-tech field facilitating the development of new tech start-up projects that bring innovation to the region.

The initiative involves a range of leading experts from ESA, NASA, Caltech, MIT, Stanford University, Harvard University, University of Oxford, and many World-class organizations.

Space Challenges establishes a strong connection between education and local high-tech industry. Our efforts are aimed at helping young people to acquire knowledge and skills and to apply those at creating innovative companies and organizations.

Since 2010, hundreds of students participated the course and had the opportunity to interact with leading professionals from the high-tech sector.

## The Program

The sole objective of Space Challenges Program is to attract the interest of students and young people to space exploration, science and technology. The program is designed to inspire and motivate the next generation of scientists and technologists, as well as to catalyze the development of an entrepreneurial culture among researchers in the high-technology space sector.

Space Challenges revolves around 2 major pillars:

- Spaceport Platform (MOOC platform): <http://spaceport.academy>
- Hands-on Educational Program: <https://www.spaceedu.net/#filter=.curriculum>

By organizing hands-on experience and positive, active attitude towards space science and development in students and young people, we aim to improve the development of a competitive space industry.

Space Challenges enables the participants coming from diverse background and experience, to learn together, form research collaborations, and launch space-related enterprises based on common interests and expertise, gained during the program.

The informal educational program is designed to give a broad knowledgebase of what the space scientific and industrial fabric includes. Since 2010, the annual Space Challenges program has offered its participants (Space Cadets) an exposure to the latest advances in space-related science and technology, as well as first-hand interaction with leading experts worldwide. The program has revolved around three components: Science, Technology and Entrepreneurship.

The biggest achievement of the program is that it is completely practice oriented and the participants are engaged into active participation, workshops and exercises in more than 70% of the whole duration of the program. At the end of the program's activities, the

participants have designed, developed and built technological solutions and are ready to start new companies and continue their education in the science and technology fields.

**The program fee is 400 EUR (800 BGN) for all selected participants, however partial or full scholarships will be provided to up to 10 of the participants by EnduroSat – Space Challenges’ prime partner**

Space Challenges consists of FOUR thematic weeks, which will cover the basics of most Space-related areas including the business side. The typical workflow is shown in the following table:

Week(s)	Theme
1	<b>Aerospace Engineering and Mechanics</b>
2	<b>Astrobiology, Biotech and Space Medicine</b>
2	<b>Electronics, Robotics and A.I.</b>
3	<b>Space Science and Exploration</b>
4	<b>Space Applications</b>
4	<b>Entrepreneurship and Team Projects Finals</b>

Detailed description of the curriculum:

## **Weeks 1 - Aerospace Engineering and Mechanics**

- Intro to Mechanics
- Introduction to Engineering
- What is a spacecraft: System level engineering and space architecture
- How does it function: Subsystems, integration and testing
- Mission Design: Concurrent Mission Design, Concurrent Mission Engineering
- Spacecraft technology: State-of-the-art projects – extremely small VS extremely large projects/CubeSat technology, swarm satellites
- Rocket science: Rocket engines and Space propulsion systems and the next-generation launch systems
- Space stations: Current technology (International Space Station)

- Space Systems Architecture

## **Week 2 - Astrobiology, Biotech and Space Medicine; Electronics, Robotics and A.I.**

- Intro to Space Biomedicine
- Intro to Astrobiology and latest developments
- Neuroscience - biological/computer interaction
- Life in Space: Human physiology in Space
- Introduction to Robotics
- Robotic engineering: Subsystems and functionalities
- Computer Vision, Virtual Reality, Augmented Reality
- Human – Robot interaction, Uncanny Valley, Bionics
- Introduction to A.I., Adaptive Algorithms and Machine learning
- Robotics for Earth-based applications: Exoskeleton structures

## **Week 3 - Space Science and Exploration**

- Introduction to Astrophysics
  - Spaceflight and Orbital Mechanics
  - Interplanetary flight
  - Introduction to STK
  - Cosmology
- Introduction to Space Physics
  - Solar and Magnetospheric Physics
  - Space Weather
  - Space Radiation
- Relevant topics to Space Exploration
  - Human Spaceflight

- Robotic Space Missions: Lunar exploration, Deep space exploration, Mars exploration, Comet and asteroid exploration
- Robotics in space exploration and extreme environments: Flyers, Divers, Landers and Orbital Probes
- Space stations - future designs and experiments

## Week 4 - Space Applications; Entrepreneurship and Team Projects Finals

- Connecting the planet: Communication technologies and applications
- Remote Sensing – Observing Earth from above
- Space-based Positioning, Navigation and Timing (PNT)
- Data Visualization: Extracting information from the data
- Space Mining: Asteroids and in-situ resource utilization
- Space Tourism
- Why do we explore space? – workshop activities
- Creating a space organization: Intro and Lessons
- Next steps in Space: Permanent settlement
- New Space Initiatives
- Economy vs Technology
- Team Projects Finals
- Space Challenges Expo: Space Cadets Prototypes Demonstrations

### Core Lectures

The Space Challenges program includes lectures and talks by World-leading scientists, technologists, and entrepreneurs who share their success stories and their perception about the near future. Space Challenges is a multidisciplinary program and explores the links between science and technology topics.



It is open to young people with diverse background. It includes core-curriculum lectures, separated in thematic modules: *Aerospace engineering, Space systems technologies and applications, Astrophysics, Robotics and AI, as well as entrepreneurship studies on how specific technologies create common wealth and disrupt whole industries.*

List of lecturers: <http://www.spaceedu.net/lecturers-at-space-challenges/>

## **Team Challenges**

Space Challenges is a multidisciplinary educational program and it is completely practice oriented. The Space Cadets are working in teams of 4 - 6 participants throughout the entire duration of the program. Their goal is to design, build and test tech prototypes, solving concrete challenges.

## **Satellite Challenge**

Do you want to become a mission director and send commands to a real satellite in orbit?

EnduroSat One mission was launched in space on May 21st 2018 (<http://one.endurosat.com/>). It is the first Bulgarian CubeSat and you will get the exclusive opportunity to work directly along with EnduroSat engineering team - sending commands and receiving telemetry from uniquely designed Ground Station, built entirely by you and your team during the program.

Create a vision for the next generation of satellite systems and prove that you are worthy for a career in space!

Prerequisites - one or more of the following is required:

Electronics, Mechanical Engineering, Programming, Finance

## **Challenge AeroSpace**

Design and engineer a payload to be integrated with the next generation of heavy duty (4.5m wingspan) Unmanned Aerial Vehicles (UAVs). Collaborate with one of the most interesting engineering teams in Bulgaria, supported by mentors of Space Challenges Program. Use satellites by one of the leading satcom companies on the planet to control the transport aircraft and help it achieve its next stage of autonomous flight capabilities.

Work in a team with young space enthusiasts and prove you are worthy of a space career!

Prerequisites - one or more of the following is required:

Electronics, Mechanical Engineering, Programming

## Workshops

Workshops and hands-on activities are designed to develop teamwork and leadership skills. All practices are embedded within the core curriculum. Every week of the program, workshops and presentations extend further the knowledge of the participants and help them develop successfully their tech prototypes.

Workshop include

- Orbital Simulations (Kerbal Space Program and STK introduction)
- Electronics and Mechanics workshop
- Numerical Simulations workshop
- Observational Astronomy workshops (TBC)
- Presentation workshop: Selling your ideas

## Resources

**Spaceport:** <http://spaceport.academy>

The Space Challenges team has developed a massive online educational platform with over 100 hours of original educational video content. It is freely available, complementing the physical program course. Our Space Cadets are expected to use the Spaceport during the entire physical program.

**Spaceport:** <http://spaceport.academy>

## Partnerships

Space Challenges Program has established close cooperation with Sofia University “St. Kliment Ohridski” and Technical University – Sofia – two of the leading universities in the Balkans.



**Through close collaborations Space Challenges brings industry, education and science and technology closer to each other and acts as a bridge between those segments of the economy.**

Each year Space Challenges participants get access to cutting-edge online resources, well designed office and lab space for project development and lecture auditoriums for the core presentations. The program provides all required technical resources for the development of the tech projects, as well as hands-on mentorship and custom-built workshop assignments.

Upon successful completion of all the aspects of the program, the Space Cadets will receive certificates of completion for the program, introduction to leading high-tech companies and seed and venture capitals funds.