

**EPFL**

# eSpace EPFL Space Center Activities 2023





# 2023 IN REVIEW

2023 was a fruitful year for eSpace. The highlight of the year was hosting the first European Aerospace Conference, a joint event between the Council of European Aerospace Societies (CEAS) and the European Conference for Aerospace Sciences (EUCASS) that brought over 700 participants from Europe and worldwide to EPFL, unifying the European aerospace community. We also celebrated the 20th year anniversary of the EPFL Space Center, which began in 2003.

**Education** — One of eSpace's main missions is to serve the student community at EPFL, which we do by managing the popular Minor in Space Technologies that still welcomes more than 90 students each year. We also hosted the concurrent engineering challenge for the second year, which attracted 14 students. And eSpace continues to support the space-related student teams that are part of the MAKE program: Asclepios, the EPFL Rocket Team, the EPFL Spacecraft Team, the Space Situational Awareness Team, and Xplore.

**Research** — eSpace launched the Sustainable Space Hub in January 2023, with the mission to measure, understand, and act toward a more sustainable space environment, making EPFL a leader in the field of space sustainability. eSpace staff and affiliated researchers presented papers at 10 space conferences such as the IAC, the ESA Clean Space Industry Days, and the Second International Orbital Debris Conference in Texas, and hosted eight space seminars on a range of topics for the EPFL community.

**Innovation** — In June 2023, the Space Sustainability Rating was spun off from eSpace and EPFL into an association with two full-time employees, and performed its first space mission ratings for clients such as Endurosat. We also launched innovation projects such as the assessment of the launch system project on the environment with funding from the European Space Agency along with working on projects to develop business plans, commercialisation technologies to define business applications of EPFL technologies in the space field.

2023 was also an important year as our Space Innovation colleagues joined us to officially become one center: the EPFL Space Center. To achieve this, we defined our new governance, setting up the steering committee and the advisory board. In September 2023, the Center kicked off its evaluation, which is an EPFL requirement. The process will be concluded in 2024. In a quickly moving environment and within the complicated current financial context, it is also an ideal time to reflect on the achievements of the last four years to ensure that we as eSpace and the EPFL Space Center are able to provide the EPFL community the best services at the forefront of space science and technology.



**Emmanuelle David,**  
Executive Director, eSpace



**Jean-Paul Kneib,**  
Academic Director, EPFL Space Center



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# 20 YEARS

EPFL SPACE CENTER

📅 Dec. 7th | ⌚ 18h30 | 📍 Rolex Center

# TWENTY YEARS OF THE EPFL SPACE CENTER

In 2023, the EPFL Space Center, which was created in 2003, celebrated its 20th anniversary! We commemorated this milestone with a party that included testimonies from EPFL Space Center directors and employees past and present, great presentations from our student space teams, and delicious food and drink.

01





## History of the EPFL Space Center

The EPFL Space Center was created to bring together space-related research and education across campus. In the last 20 years, the Center has grown, encompassing many research projects, student teams, startups, and a Minor in Space Technologies.

Until 2003, there was no central location for outer space at EPFL. There were some professors working on different research related to space, and students working on space-related projects, but there was no one place or program where they could meet, collaborate, and grow.

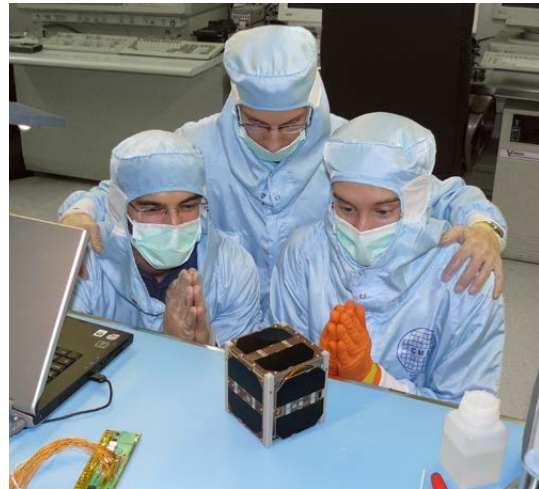
Then in 2003, EPFL and RUAG Aerospace decided to set up the Space Center at EPFL to develop R&D, technologies, and applications related to space at EPFL. In 2004, they were joined by the Swiss Space Office. Over the last twenty years, the EPFL Space Center has gone through many names and iterations, but the mission remains: foster, promote and federate space technology and science across education, science and industry at EPFL as well as across Switzerland and internationally.

One of EPFL's longest-running centers, the EPFL Space Center has helped send technology into space, created and ushered over 450 students through the Minor in Space Technologies, managed space-related student teams, and led the charge in the important emerging field of space sustainability with research projects and successful spinoffs



Early EPFL Space Center team with space professors and Claude Nicollier in 2003 © EPFL Space Center

The team building the SwissCube  
© Renato Krpoun



02



Local news coverage of the SwissCube launch in 2009 © Renato Krpoun



# eSPACE TODAY

Today, eSpace is the unit of the EPFL Space Center dedicated to the two core areas of education and research, bringing together students, professors, researchers, engineers, industries, and international space agencies. Its mission is to inspire the next generation of students in space-related projects and activities, develop novel space science and technology research topics in partnership with EPFL labs and beyond, and foster innovative space initiatives and projects.

In the area of education, eSpace supports EPFL's space-affiliated professors and students, coordinates the Minor in Space Technologies, and provides guidance and support to the EPFL Student Teams: Asclepios, the EPFL Rocket Team, the EPFL Spacecraft Team, the Space Situational Awareness Team, Xplore, and Space@ Your Service.

In the area of research, eSpace pushes space-related projects by supporting researchers in funding, information, and contact with the space community. eSpace boasts a team of experts and benefits from close collaborations with research laboratories and institutes at EPFL.

Within research and education, eSpace has identified three areas of focus that are structured as hubs:

- Space technology and innovation
- Space science and engineering
- Sustainable space and diplomacy

The mission of the hubs are to coordinate activities related to each theme: to answer to the three pillars of EPFL, research, education and innovation; and to push interdisciplinary research at EPFL, Switzerland, and globally.

## The 2023 eSpace team

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- **Jean-Paul Kneib**, academic director
- **Emmanuelle David**, executive director
- **Nicola Cardines**, engineer and student coordinator (until 01.2023)
- **Thomas Delacrétaz**, mediamaticien intern (until 08.2023)
- **Simon Hamel**, engineer and student coordinator (until 05.2023)
- **Stephan Hellmich**, postdoctoral researcher
- **Belén Yu Irureta-Goyena**, PhD student
- **Pierre-Alain Maüsli**, student projects supervisor
- **John Maxwell**, IT manager
- **Florian Micco**, project manager for the Space Sustainability Rating (until 06.2023)
- **Candice Norhadian**, administrative specialist and student coordinator
- **Stephanie Parker**, communication manager
- **Elisabeth Rachith**, PhD student
- **David Rodríguez**, research scientist (until 03.2023)
- **Anne-Marlene Rüede**, PhD student
- **Adrien Saada**, engineer for the Space Sustainability Rating and student coordinator (until 06.2023)
- **Tommaso Turchetto**, master's student
- **Mathieu Udriot**, engineer and student coordinator
- **Marnix Verkammen**, master's student and Research Engineer (from 12.2023)
- **Xiao-Shan Yap**, senior research scientist (from 03.2023)

In 2023, EPFL Space Center appointed a steering committee and an Advisory Board as per the EPFL regulation on centers, LEX 1.2.12.

## EPFL Space Center Advisory Board



The Advisory Board is composed of seven external experts who identify subjects of strategic importance to the Center and inform the Steering Committee of them; explore with the

Center the best way to conduct collaborative activities with partners; and provide advice on the development of the Center's program of activities.



**Camilla Colombo**  
Politecnico di Milano



**Etienne Deffarges**  
Entrepreneur



**Marie-Valentine Florin**  
International Risk  
Governance Council



**Peter Guggenbach**  
Swissto12



**Chiara Manfretti**  
Technical University  
of Munich



**Susmita Mohanty**  
Spaceport SARABHAI  
(S2)



**Thomas H. Zurbuchen**  
ETH Zurich

## EPFL Space Center Steering Committee



The Steering Committee is composed of three members of EPFL with connections to space,

whose role it is to guide the Center's strategic development.



**Andreas Burg**  
EPFL  
Telecommunications  
Circuits Lab



**Edoardo Charbon**  
EPFL  
Advanced Quantum  
Architecture Lab



**Mathieu Salzmann**  
EPFL  
Computer Vision  
Lab

# 2023 GOALS AND OBJECTIVES

In 2023, eSpace organized its activities around five objectives:

1. Academic excellence in space engineering
2. Promoting space technologies and innovation
3. Managing space science and engineering projects
4. Space sustainability and diplomacy
5. Education of future space leaders

For achieving academic excellence in space engineering, eSpace aimed to continue its work to consolidate EPFL strategy regarding space and support the application of young talents for grants, while also providing information to faculties and supporting professors with space-related information.

Secondly, regarding space technologies and innovation, eSpace identified future trends and projects with EPFL labs, supported making the Space Innovation Unit (SIU) a stronger entity, transferred knowledge to industry, and built up the EPFL academic community.

In the area of space science and engineering, eSpace planned project management and system engineering for space science projects, supported the development of key technologies, and collaborated with the Swiss Consortium for the Square Kilometre Array (SKACH).

In terms of space sustainability and diplomacy, eSpace aimed to support the development of key technologies and offer a space policy platform.

And finally in the area of space education of future leaders, eSpace continued to ensure financing of certain courses in the EPFL Minor in Space Technologies, offered innovative educational opportunities, and provided opportunities for EPFL students.

Throughout 2023, eSpace used these objectives to plan and structure its projects in research, education and innovation, in order to continue contributing to the development of a sustainable and prosperous space industry.



# 1.

## EDUCATION

### 1.1 Minor in Space Technologies

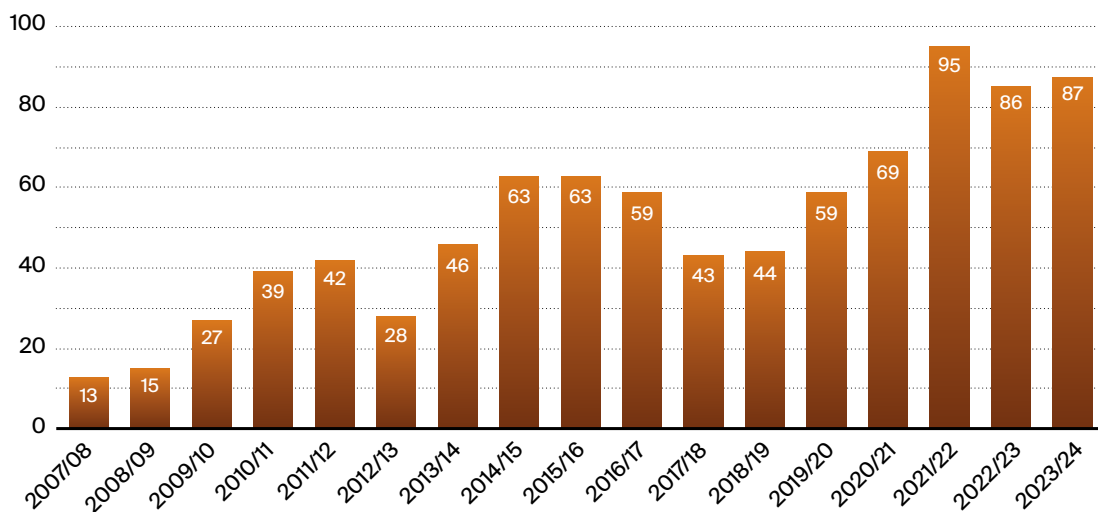
Since 2005, EPFL has offered the Minor in Space Technologies to foster and promote the awareness of space technologies and applications among students. The course is hosted by the Electrical Engineering and Electronics Section (SEL) but open to the entire EPFL student community.

The main goals of the Minor in Space Technologies are to help students increase their knowledge of space-related research; promote space applications, technology and science; and to foster a strong educational platform in the space sector, in parallel to the development of academic and research projects at EPFL.

In the 2022–2023 academic year, 86 students were enrolled in the minor, and for the first (autumn) semester of 2023, 87 students were enrolled. The minor offers over two dozen courses for students to choose from.

07

Total students in the minor



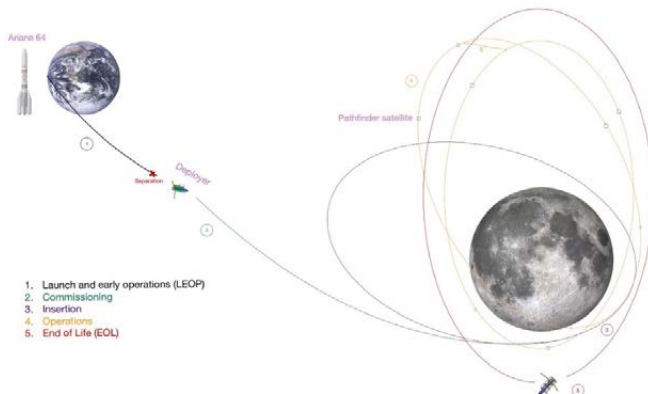
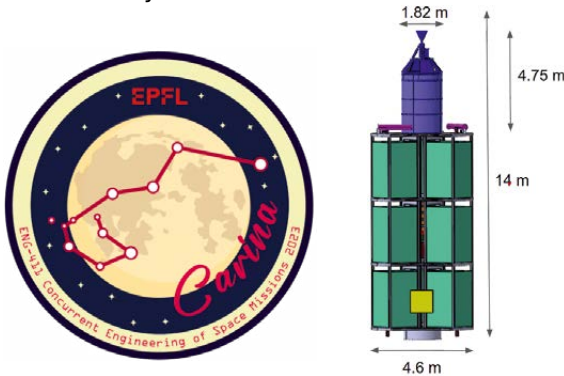


## 1.2 Concurrent engineering course

For the first time in 2023, the ENG-411 Concurrent Engineering course was held in the EPFL Space Center's own Concurrent Design Facility (CDF). Fourteen students attended a day of theoretical introduction, with the participation of a CDF engineer from ESA, about concurrent engineering, systems engineering, a tutorial session on the COMET tool used to share data during the sessions, and about teamwork and communication with the support of the EPFL LEARN Center.

For two weeks, the students, guided by a team of four facilitators, iteratively designed a space mission to deploy a constellation around the Moon. In the span of only a few sessions, they understood the power of co-engineering and went from a vague directive of deploying satellites around the Moon to a fully feasible and plausible mission design (see report [cdf.epfl.ch/ce\\_studies/2023\\_ENG-411](https://cdf.epfl.ch/ce_studies/2023_ENG-411)).

From trajectory, propulsion, electrical power system, to structure, all the main components and subsystems of a real spacecraft were defined. Students learned the complexity of space mission design, which requires collaboration between many fields of expertise. The course allowed them to apply theoretical knowledge to real-world operations and they are now better prepared for what awaits them in the industry.



## 1.3 Supervision of MAKE projects

In 2023, the space-related MAKE projects at EPFL saw a number of important accomplishments, including launching EPFL back into outer space. In addition, 2023 saw the introduction of sustainability into the MAKE projects, including using eSpace's expertise on space sustainability to advise students in implementing their own strategies, being ready for scrutiny, and preparing for industry.

### Asclepios



Two Asclepios analog astronauts during their mission on the San Gottardo Pass.

A new documentary on Radiotelevisione Svizzera (RSI) that aired February 19, 2023, spent a year with the EPFL Asclepios team, learning about their mission to build a lunar base simulation in a former Swiss military base.



The Asclepios III mission was successfully conducted during the summer 2023, simulating a human expedition to the lunar south pole. More than two dozen students took part in the adventure, either as analog astronauts or supporting the mission from the Mission Control Center (MCC). Students got a specialised role covering the real aspects of a space mission, from science, design, medical support, to communication and management. The six astronauts, isolated for two weeks in the Sasso San Gottardo fortress, conducted a space analog mission under extreme conditions.

With experience from its previous missions, Asclepios III successfully tackled research associated with space medicine, environmental sciences, and lunar manufacturing.

## EPFL Rocket Team



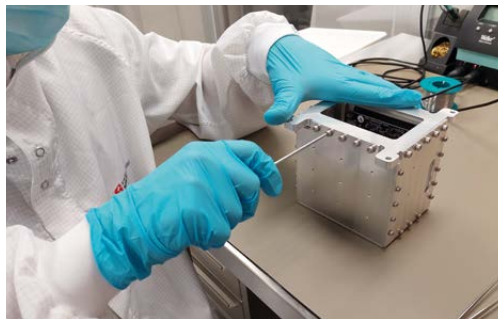
The EPFL Rocket Team competing at EuRoC 23 in Portugal.

For this year's European Rocketry Challenge (EuRoC 23) in Portugal, the team took on the challenge of creating a different kind of rocket, powered by a bi-liquid engine instead of conventional rocketry amateur propulsion methods, which was the first Swiss bi-liquid-propelled rocket to ever take flight. This technology is typically reserved for commercial-grade, full-size rockets due to its inherent complexity. Nevertheless, the team still undertook the challenge of designing, testing, manufacturing, and successfully incorporating this bi-liquid propulsion system into their rocket in under a year. Unfortunately, the engine shut down after two seconds of flight and 200 meters of altitude, and the rocket fell to the ground. In spite of the crash, the Rocket Team was still awarded second place for technical excellence.



eSpace has also been involved with the team to transfer some knowledge about eco-design of space systems, and is helping the team understand the environmental impacts of their work.

## EPFL Spacecraft Team



Members of the EPFL Spacecraft Team building and displaying the Bunny on-board computer.

2023 was an especially exciting year for the EPFL Spacecraft Team, which in January brought EPFL back into space for the first time since the launch of the SwissCube in 2009 with the launch of their onboard computer Bunny, built and designed by the team. Bunny travelled as a hosted payload on the D-Orbit spacecraft, which was on a rideshare Starlink launch along with multiple other Starlink satellites.



Bunny's mission concluded in July 2023 at the end of the planned operational phase, during which time the computer continued to respond to uplinked commands and most of the tests that the team ran. The success of Bunny led to the kick-off of the development for the team's next in-orbit demonstration/validation: the X-band transmitter and next-gen onboard computer, TwoCan. The goal is to fly these subsystems jointly by the end of 2024, to validate their performance in the low-Earth orbit environment, and to establish contact with the ground station on the roof of the ELB building at EPFL.

In 2023, the EPFL Spacecraft Team also won Space Universities CubeSat Challenge 2.0 (SUCC) out of 75+ applications with another Chinese Student Team from Beihang University. This gives them the possibility to launch their first satellite CHES Pathfinder 1 for free on a Chinese Launcher in 2026.



## Space Situational Awareness



Members of the SSA Team with their telescope, and a prototype design.

During autumn semester 2023, the SSA Team developed a design for an autonomous observing station with the help of students from Civil Engineering and Microtechnics. The cupola is currently being assembled and the team aims to set it up on the roof of the Cubotron building. Special attention was also paid to sustainability during the development of the cupola as the team selected environmentally friendly materials such as wood for the structure and plan to make the observatory completely self-sufficient by using solar panels. The cupola serves as a prototype for a larger version that is planned to be constructed at the AstroVal observatory in the Vallée de Joux. The team has further improved their observation data processing techniques and is now capable of accurately tracking satellites in low-Earth orbit and precise orbit determination.

## Xplore



Xplore team's Kerby rover at the European Rover Challenge 2023 in Poland.

In 2023, Xplore secured a third consecutive podium at the European Rover Challenge 2023, this time winning third place. During three days from September 15-17, the team competed with their latest rover, Kerby, and drone, Brokkoly, against other international rover teams at the world's largest Marsyard in Kielce, Poland. There were 35 of the world's best academic teams from nearly every continent at the finals.

For this year's edition, there was both an on-site and remote competition: 20 teams competed on-site, while 15 took part remotely. Organizers created obstacles for the teams to overcome, and in particular, the geological puzzle was so complex that only a few teams were able to solve it. Participants also underwent a certification process to prove their knowledge and skills for the first time in competition history. To secure their impressive spot on the podium, the Xplore team put a great effort into making the robotic arm of Kerby fully autonomous with an inverse kinematic system. This allowed the team to perform the maintenance task of the ERC without any manual intervention from the operator, which also earned them the excellence award for the best Maintenance Task overall.

## 1.4 Supervision of PhD and master's projects

**Anne-Marlène Rüede, 2024**

**[PhD] Connecting space logistics and architecture – A pattern language for robust mission design**

This PhD project by Anne-Marlène Rüede is hosted by eSpace and co-supervised by eSpace and Prof. Jeffrey Huang of the Media and Design Laboratory, EPFL Architecture and Computer Sciences. The four year project aims to improve decision-making methods for early-phase system architecture design in space missions with multiple material flows, such as robotic or crewed Lunar or Martian missions. Rüede completed a nine month research visit to MIT's Engineering Systems Laboratory, and a six month research visit at ESA ESTEC, during which the pattern language and program was developed, and verified using historic cases.

**Elisabeth Rachith, 2025**

**[PhD] Identification and characterisation of space debris from astronomical images**

Elisabeth Rachith's PhD work, supervised by the Laboratory of Astrophysics (LASTRO) in close collaboration with eSpace, focuses on the urgent and growing problem of space debris. She currently develops innovative machine learning techniques for the identification of space debris and satellites in large archives of astronomical data acquired by large-aperture optical telescopes. The techniques developed will be used to identify and characterise debris to improve our knowledge of the current population as well as to assist in the long-term understanding of its evolution and to support space debris removal missions.

Processing the first batch of data from the ESO VLT Survey Telescopes indicate the high potential of the archive for space debris research: with only one month's worth of data, several thousand streaks from space objects were detected, of which about 1000 could be identified with known orbital debris, rocket bodies, and satellites.

**Belén Yu, 2025**

**[PhD] Identifying moving objects in astronomical surveys using artificial intelligence**

For her PhD work, Belén Yu is developing advanced machine-learning techniques to detect asteroids in astronomical images. For this, she is using images from the VST and ZTF telescopes, and will soon be moving to images taken with the Euclid space telescope. A comprehensive accounting of all asteroids

will improve our ability to forecast the fall of near-Earth asteroids onto Earth, mitigating local and global damage. Additionally, her work will identify asteroids that can serve as tracers of the structure of the Solar System. Belén Yu is part of LASTRO, although she works closely with eSpace and the European Space Astronomy Centre. She is currently on a six-month research visit at Caltech's Infrared Processing and Analysis Center.

**Marnix Verkammen, 2023**

**[Master] Consensus-based single-score life cycle assessment for space missions**

Marnix Verkammen, an MSc Aerospace Engineer graduate from the Delft University of Technology, conducted his master's thesis at the EPFL Space Center, focusing on developing a single-score for space system life cycle assessments (LCA) to simplify outcomes and aid engineers with limited LCA experience. By means of a survey of international experts, Marnix reached consensus and applied and tested the resulting methodology to university-launched cubesat. Moreover, the thesis investigates ways in which the Space Sustainability Rating could implement LCA within its current rating. Ultimately, Marnix's study underscores the need for easy-to-understand LCA tools in space system design to promote environmental consideration from the earliest design stage.

**Tommaso Turchetto**

**[Master] Sustainable missions to the Moon – Sustainability guidelines for lunar activities: a state-of-the-art**

Tommaso Turchetto, a student from Politecnico di Torino, conducted a Master's thesis at the EPFL Space Center researching state-of-the-art sustainability policies in lunar orbit. He produced a first of its kind document with guidelines on behaviours to adopt from the design phase to the end-of-life of a mission to the Moon or the Lagrangian points of the Earth-Moon system. These recommendations stem from a literature and space law review in both lunar and Earth orbit, with insights gathered from experts and stakeholders in the field. The primary aim of the guidelines is to mitigate the proliferation of debris in the lunar environment. The document is reviewed by external experts of space sustainability and was presented at the Space Resources Week in March 2024 in Luxembourg.

## 1.5 Education plans for 2024



In 2024, eSpace plans to continue its work on growing the Minor in Space Technologies and also exploring ways to collaborate with the new ETH Zurich Master in Space Systems. In addition to formal education programs, eSpace will continue to:

- supervise and support of EPFL's space-related student teams;
- host master's and semester projects for students working on different topics in space sustainability and space engineering; and
- strengthen the offers of industry internships for students linked to research projects.

eSpace is also beginning to offer professional education, starting with a course on space sustainability. In March 2024, eSpace held a three-day space sustainability continuing education course entitled "How to design more sustainable missions". This course will help space professionals to lead missions and space businesses with an improved focus on sustainability. The program is organized by eSpace in collaboration with the International Space University, the IMS Space Consultancy and the Massachusetts Institute of Technology. Taught by experts in the field, this course tackles the history of space sustainability and geopolitical challenges. Different tools and methods are presented and then used in group work.

Further continuing education courses will be developed, such as systems engineering in collaboration with key space players.



## 2. RESEARCH

It is the role of eSpace within EPFL to coordinate space-related research projects and offer support to space professors across campus. In this role, eSpace manages a number of research projects with the participation of EPFL researchers. In addition, eSpace takes the initiative to connect EPFL's Space Profs with the wider Swiss and international space community by attending and organizing events, presenting at conferences, and finding and promoting funding opportunities.

Among its research projects, eSpace has a particular focus on the issue of space sustainability, a topic of increasing importance in nearly every area of research and industry, including outer space. Currently, more than one million objects larger than one centimeter are orbiting Earth. Among them, less than one percent are active satellites, leaving an overwhelming majority of inactive objects crowding the orbital environment.

The fast-developing space industry has led to the emergence of a growing number of actors and plans for large constellations, while in parallel it has been challenging to develop and enforce best practices, guidelines, and norms in a complex regulatory landscape. Without a change towards using space in a more responsible manner, it has been shown that space will become an unstable environment where collision rates will increase exponentially.

However, sustainability in space is not just limited to Earth orbit. The increasing number of launches and the constant flux of material from satellites re-entering the atmosphere have an impact on the environment here on Earth. The expected increase in activities to explore and exploit the moon or even more distant destinations such as Mars, which are mostly driven by private and commercial interests, must also be taken into account in the future.

As the launching pad of the Space Sustainability Rating (SSR) and the Sustainable Space Logistics initiative, eSpace is a leader in the space sustainability movement, and in 2023 began new projects in this important growing field. The sustainable use of space will continue to be a main focus of eSpace's activities in the coming years.

### 2.1 Research projects

#### Green Space Logistics

In 2023, the Green Space Logistics (GSL) project came to an end after a year, when eSpace, along with its partners the Paul Scherrer Institute (PSI) and Ateleris GmbH, delivered the first stable proof-of-concept for the Assessment and Comparison Tool (ACT). The tool is facilitating the assessment of environmental impacts of future space transportation systems, to be used in particular by engineers in early design phases.



Members of the consortium giving their final presentation in Paris (28 June) to close the GSL project.

The project was extended slightly to include new functionalities such as prospective data and negotiations led to the definition of a new project description tendered to ESA and kick-started at the end of 2023. The new REACT project is the continuation of GSL, will last for two years, with an extended consortium, and will see increased involvement of industrial actors. More information in “Research plans for 2024”.

#### Volare

The Volare project is done in collaboration with ArianeGroup, a major international player in the industry of launch vehicles, Thales Alenia Space Italy, and SpaceDreams. It is funded by ESA to imagine the main technical characteristics of the next family of European reusable launch vehicles. eSpace was chosen to bring its space sustainability expertise to advise the consortium regarding the environmental impacts of different design choices. It is one of the first times that a space project includes those questions so early in the development process which makes it interesting because sustainability considerations can really drive key decisions. The choice of propellant, recovery strategy, end-of-life management of the upper stages, etc. will all have an effect on the overall, lifecycle impacts of the future systems. This project is also useful for EPFL to test the tool developed during GSL.

#### Space sustainability: Policy options and interrelations with Earth system governance

This project, which began in March 2023, is coordinated by eSpace and was supported by the International Risk Governance Center (IRGC) until its closure in July 2023. It is led by Dr Xiao-Shan Yap, who pioneers the scientific research

topic of earth-space sustainability, with the aim of providing evidence-based insights to policy-making and linking with the Space Sustainability Rating. This project draws on qualitative and semi-quantitative analysis of primary and secondary data, as well as co-construction of problems and policy options with stakeholders. It broadens the framing of space sustainability by explicitly considering its interconnectedness with Earth-bound challenges and provide evidence-based insights for policymaking, engaging actively with the Space Sustainability Rating, OECD Space Forum and the International Telecommunication Union, among others. Funding for the project is provided by the Swiss State Secretariat for Education, Research, and Innovation (SERI).

## 2.2 EPFL space profs



The role of eSpace is to push space-related research by supporting interdisciplinary projects, often involving at least one of EPFL's labs involved in space research. To this end, eSpace maintains regular communication channels with EPFL's Space Profs, providing them with information about opportunities for funding and collaboration. See annex for a full list of space-related labs at EPFL.

In addition, eSpace organizes and participates in space-related events on campus. More information on events in [section 3.1](#).



## 2.3 Papers and articles



[Conference paper] S. Hellmich, E. Rachith, B. Y.I.-G. Chang & J.-P. Kneib, “Harvesting large astronomical data archives for space debris observations,” in *Proceedings of the 2nd NEO and Debris Detection Conference*, ESOC, Darmstadt.

[Conference paper] S. Hellmich, M. Udriot & E. David, “Sustainable Space Hub at EPFL: a review of ongoing research projects,” at the *Aerospace Europe Conference (10th EUCASS & 9th CEAS)*, 2023.

[Conference paper] A. Saada, “Promoting responsible space practices: A primer on the Space Sustainability Rating,” at the *Aerospace Europe Conference (10th EUCASS & 9th CEAS)*, 2023.

[Conference paper] M. Udriot, K. Treyer, E. David, O. Buehler, L. Etesi & V. Girardin, “Rapid life cycle assessment software for future space transportation vehicles’ design,” at the *Aerospace Europe Conference (10th EUCASS & 9th CEAS)*, 2023.

[Conference paper] M. Verkammen, “A consensus-based single-score for life cycle assessment of space missions: preliminary results,” at the *Aerospace Europe Conference (10th EUCASS & 9th CEAS)*, 2023.

[Conference paper] N. Billot, S. Hellmich, W. Benz, “Passive orbital debris detection from low Earth orbit: The CHEOPS viewpoint after three years of operations,” at the *2nd International Orbital Debris Conference*, 2023.

[Conference paper] E. Rachith, S. Hellmich, B. Y. Irureta-Goyena, “A novel machine learning based algorithm for efficient streak detection,” at the *2nd International Orbital Debris Conference*, 2023.

[Journal article] J. Markard, P. Wells, X.-S. Yap & H. van Lente, “Unsustainabilities: A study on SUVs and space tourism and a research agenda for transition studies,” in *Energy Research & Social Science*, vol. 106, December 2023.

[Journal article] M. Rathnasabapathy, E. David, “Space Sustainability Rating in Support of the Development and Adoption of Regulatory Guidelines Related to Long-Term Sustainability,” in *Air and Space Law* Volume 48, Special Issue, March 2023.

[Journal article] A.-M. Rüede, M.-A. Chavy-Macdonald, J.-P. Kneib & J. Huang, “Towards a pattern language for complex-mode mission concept generation,” in *Acta Astronautica*, vol. 203, February 2023.

[Master's thesis] M. Verkammen, “Consensus-based single-score life cycle assessment for space missions,” TU Delft.

## 2.4 Research plans for 2024



Looking forward to 2024, eSpace will continue its focus on space sustainability, where their work has already established EPFL as a leader in the field. The team will begin working on the REACT project (gREEn spACe logistics Tool), which is the continuation of the Green Space Logistics project (2022-2023). With a broader scope and based on the identified challenges in the previous project, this new activity will still be led by EPFL with a larger consortium now also including the University of Stuttgart and ISAE SUPAERO in Toulouse, in addition to the GSL partners Paul Scherrer Institute (PSI) and Ateleris GmbH.

Over the span of two years, the goal is to iterate on the development of the Assessment and Comparison Tool (ACT), improve its proof of concept to answer potential users' needs, and to enable its adoption in the design process of European space industries. This tool will enable the modelling and comparisons of space transportation systems, including in-space transportation vehicles, and shall be usable in the early design phase for actors to make decisions on (eco)design choices while still technically and financially possible. Indeed, the early design is lacking the precision in data which is necessary for robust life cycle assessment. The tool shall then enable the use of heritage data and simplify the LCA process with accurate results that enable the identification of environmental hotspots and the comparison of similar systems. Relative values as results of the analysis will support decision-making and allow the European space sector to reduce its environmental impact, in space and on Earth.

eSpace is also planning work on other research projects, some of which will involve collaboration with EPFL labs. While the proposals and planning for these are still in progress at the end of 2023, they will look at topics such as the atmospheric impact of launchers, application of space debris mitigation guidelines and requirements, and lunar sustainability.





A full-page background image featuring an astronaut in a white spacesuit floating in the dark void of space. The astronaut's helmet is visible in the lower-left corner, reflecting a bright orange-red planet, likely Mars. In the upper-left, a large, dark, cratered celestial body, possibly the Moon, is partially visible. The background is filled with distant stars and nebulae.

# 3. COMMUNICATION AND OUTREACH

In its communication and outreach capacity, eSpace is responsible for promoting space-related activities that take place at EPFL, which includes liaising with media, organizing and promoting events, participating in meetings and conferences, sharing news with the wider EPFL community, and managing social media accounts. In 2023, a new two-minute video about eSpace was made by the EPFL Associate Vice Presidency for Centers and Platforms.



## 3.1 Events



### 3.1.1 Events organised by eSpace

7 December 2023

#### EPFL Space Center – 20 years celebration

This event brought EPFL Space Center employees, students, and collaborators from the past two decades to celebrate twenty years of the EPFL Space Center. The party included speeches, food, drink, an interactive timeline of the Center, the Claude Nicollier archives from the EPFL Laboratory for Experimental Museology (eM+), and stands from the space-related student MAKE teams.

15–17 November 2023

#### Commons in Space 2023

This conference, organized by eSpace and the International Association for the Study of Commons (IASC), brought together scholars and practitioners on the commons in space. The increasing dependence of our societies on space infrastructures (GPS, remote sensing, internet access, etc.) and the potential mining of rare minerals for energy transitions are causing new sustainability challenges due to the lack of governance of human activities in outer space.

3 November 2023

#### Space Sustainability: Challenges and Outlook with Swiss Space Law Forum

Organized in collaboration with the Swiss Space Law Forum, this conference brought an array of specialists who provided their expertise on the various dimensions of this theme, as well as their legal implications.

14 July 2023

#### Aerospace Europe Conference 2023 x Space Generation Advisory Council (SGAC)

This event, organized in parallel to the Aerospace Europe Conference 2023, included presentations from young space professionals on topics such as establishing opportunities for women and closing the gap between science and society. This was followed by a In workshop exploring the significance of gender-disaggregated data and its impact on decision-making, policy formulation, and resource allocation, delving into the challenges faced in collecting gender-sensitive data, identifying existing gaps, and discussing strategies to bridge them effectively with a keen focus on empathy mapping.

11 July 2023

#### “Aiming high: The story of the James Webb space telescope and how it is changing our view of the universe”, by Thomas Zurbuchen

A sold-out conference on the JWST given by Thomas Zurbuchen, the longest continually running Head of Science at NASA from 2016 to 2022. Previously Professor for Space Science and Aerospace Engineering at the University of Michigan, and the founder of the largest entrepreneurship programme at an American university – the Michigan Center for Entrepreneurship – and a member of the international Academy of Astronautics.

9–13 July 2023

#### Aerospace Europe Conference, joint 10th EUCASS & 9th CEAS conferences

The Aerospace Europe Conference 2023, organised by eSpace at the Swiss Tech Convention Center was a joint event between the 10th European Conference for Aerospace Sciences (EUCASS) and the 9th conference of the Council of European Aerospace Societies (CEAS). The objectives of this event were to strengthen the link between space and aeronautics, facilitate cross-fertilisation, and lay the foundations for a major unified international congress of aerospace sciences in Europe. With rich scientific content for the future of space and aeronautics, the Aerospace Europe Conference 2023 presented cutting-edge ideas for the world of tomorrow. (See more on page 20).

29–30 April 2023

### **EPFL Open Days 2023 - Space Pavilion**

In 2023, EPFL's Portes Ouvertes returned after a three-year absence, with over 25,000 visitors. There were roughly 200 free activities on offer, including demonstrations, talks, performances, lab tours, booths and games. Visitors were welcomed by 1,500 researchers, other staff members, and students. EPFL uses events like this to showcase its activities in the areas of research, education and innovation. This year's Open Days covered five main topics – climate change, health, space, basic research and artificial intelligence.

As one of the main themes of the weekend was space, eSpace helped organise a number of space activities, including presentations by student groups, conferences featuring astronaut Claude Nicollier, Julie Böhning of the Gruyère Space Program, and ClearSpace's Luc Piguët, exhibits about radio astronomy, and solar viewing with different telescopes. Overall, it was a fun and interactive weekend, great for children and adults alike to learn about EPFL's exciting research, meet faculty and students, and explore our wonderful campus.



Prof. Thomas Zurbuchen giving his presentation "Aiming high: The story of the James Webb space telescope and how it is changing our view of the universe" at EPFL. © Alain Herzog

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The Space Pavilion at the EPFL Open Days.  
© Candice Norhadian





### 3.1.2 Aerospace Europe 2023

From 9–13 July, EPFL hosted the first edition of the Aerospace Europe Conference, a joint event between the Council of European Aerospace Societies (CEAS) and the European Conference for Aerospace Sciences (EUCASS). The goal of this joint conference was to unify the European aerospace community instead of having multiple meetings with fewer attendees.

The week-long event had more than 750 attendees from over 40 countries, including every continent except Antarctica. eSpace hosted the event on behalf of EPFL. It took place at the SwissTech Convention Center, one of the

world's most sustainable conference centers, and was organised with the support of Lausanne Tourism.

The conference included dozens of technical sessions on a range of topics including sustainability, aerodynamics and flight physics. In addition, the conference featured excellent plenary speakers, including from Thomas Zurbuchen, the former head of Science at NASA and new leader of the ETH Zurich Space Initiative; Renato Krpoun, the ESA Chair of Council at delegate level & head of Swiss Space Office; and eSpace executive director Emmanuelle David, who spoke about space at EPFL.



Members of eSpace, Space Innovation, and student groups, and Claude Nicollier at the Aerospace Europe 2023 conference. © Thomas Delacrétaz





Thomas Zurbuchen visits the EPFL Rocket Team.  
© Thomas Delacrétaz

Many members of the eSpace and Space Sustainability Rating teams, along with EPFL students, gave excellent presentations:

- Mathieu Udriot, "Rapid life cycle assessment software for future space transportation vehicles' design".
- Marnix Verkammen, "Feasibility study of a single-score life-cycle assessment for space missions: preliminary results".
- Adrien Saada, who offered a primer on the Space Sustainability Rating (SSR).
- Elisabeth Rachith, "Exploring large astronomical data archives for the characterization of space debris".
- Stephan Hellmich, who introduced attendees to EPFL's new Sustainable Space Hub.

EPFL space students also presented their papers:

- Guillaume Hueber, "Compliant high support stiffness rocket gimbal for thrust vector control on liquid engine".
- Michael Linder (EPFL Spacecraft Team), "Four months to orbit: Fast-tracking CubeSat development for reliability through in-orbit-demonstrations".
- Philippe Macheret, "Design and deployment methods for a Martian exploration airship".

- Angelina Frolova (EPFL Spacecraft Team), "Sustainability aspects of rapid prototyping and frequent IODs with CubeSats".
- Robin Bonny (EPFL Spacecraft Team), "Development of a modular half-duplex frequency-agile X-band transceiver for CubeSats and Robotic Spacecraft".

And a member of the Asclepios Mission, which is operated by EPFL, presented "Asclepios Mission III: third iteration of the student-lead analog mission simulating a human expedition to the lunar south pole".

The student groups Asclepios, the EPFL Spacecraft Team, the EPFL Rocket Team, and the Gruyere Space Program also had booths where they were able to present their projects to a large international audience. These booths included a model of the Spacecraft Team's CubeSat, the Rocket Team's prize-winning rocket, and the landing rocket from the Gruyere Space Program. The Asclepios team showed the documentary made about their mission by Swiss television network RSI.

### 3.1.3 Seminar series

- 13 March – Sustainable Space Hub: new technologies and services to secure the long-term usability of space, Stephan Hellmich and Mathieu Udriot [🔗](#)
- 22 May – ESA's ambition for space in Europe, Simona Richard
- 27 September – RF system design for robotic spacecraft requirements: design challenges and emerging technologies, Hannes Bartle
- 11 October – SWIR/NIR SPAD image sensors for LIDAR and quantum imaging applications, Prof. Edoardo Charbon [🔗](#)
- 13 November – What can we do about climate change? Charling Tao
- 28 November – The European aerospace sector: Perspectives from the industry, academia and the public sector, Isabel Pérez Grande, Miguel Belló Mora, and Pablo Gallego Sanmiguel

### 3.1.4 Events participated in by eSpace

- April – Spaceport Sarabhai, Space Law & Policy Dialogue #4: Orbital Debris Remediation
- April – Fundamentals of Space Law: Space sector careers for lawyers at University of Neuchatel
- April – Space Community Days Switzerland 2023
- June – 5th Summit for Space Sustainability
- July – PVSPACE23 - New Generation Photovoltaics for Space
- September – Commercial Space Days
- September – SXS Space Career Events 2023
- October – International Astronautical Congress 2023 in Baku
- October – ESA Clean Space Industry Days 2023
- October – European Parliament's Panel for the Future of Science and Technology (STOA) on "The Future of Space - the Sustainable Path"
- November – EPFL/UNIL CLIMACT Atmospheric Science Day 2023
- December – Second International Orbital Debris Conference (IOC II)

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Emmanuelle David speaking at the European Parliament's Panel for the Future of Science and Technology.  
© Emmanuelle David

Members of the eSpace team at ESA Clean Space Industry Days. © ESA





## 3.2 Publications



### 3.2.1 In the media

In order to reach people who are interested and invested in space both at EPFL and within the larger Switzerland, as well as abroad, eSpace prioritizes its contacts with media outlets and is proud to have its work covered by both Swiss and international media in 2023.

- 17.01 RTS [🔗 Avec son exposition «Cosmos Archaeology» l'EPFL vous emmène à la découverte de l'Univers](#)
- 31.01 Sat News [🔗 SpaceX launches D-Orbit's OTV ION in a first mid-inclination orbit](#)
- 31.01 Spaceflight Now [🔗 Starlink satellites, Italian space tug launched by SpaceX rocket](#)
- 01.02 Mirage News [🔗 EPFL Spacecraft Team is launching EPFL back into space](#)
- 01.02 20 Minutes [🔗 L'EPFL a fait son grand retour dans l'espace mardi](#)
- 01.02 Le Matin [🔗 L'EPFL a fait son grand retour dans l'espace mardi](#)
- 07.02 Space News [🔗 How fallen space junk could aid the fight against orbital debris](#)
- 09.03 20 Minutes [🔗 Depuis leur grange, ces étudiants EPFL planchent sur une fusée réutilisable](#)
- 19.02 RSI [🔗 Missione Asclepios](#)
- 11.03 24 Heures [🔗 Une bande de potes conçoit une fusée dans les vallons gruériens](#)
- 11.03 La Liberté [🔗 Colibri, la fusée qui peut aussi atterrir](#)
- 19.03 24 Heures [🔗 Des écoliers de 8 ans simulent une mission spatiale sous terre](#)

- 27.03 ESA Space for Earth [🔗 Making space more sustainable, one rating at a time](#)
- 10.04 NPR Short Wave [🔗 The importance of sustainable space exploration in the 21st century](#)
- 07.06 RTS [🔗 Les étudiants de l'EPFL rêvent de l'espace](#)
- 13.06 Le Temps [🔗 Thomas Zurbuchen, un ancien de la NASA pour mettre l'EPF Zurich sur orbite](#)

### 3.2.2 eSpace news articles

eSpace regularly publishes articles on the EPFL Actu channel and the eSpace website to share activities and news with the wider EPFL community.

- 1 February - The EPFL Spacecraft Team is launching EPFL back into space [🔗](#) (published on main EPFL site)
- 20 February - New documentary about EPFL Asclepios Mission on Swiss television [🔗](#)
- 21 April - New project continues EPFL's commitment to space sustainability [🔗](#)
- 31 May - Space Sustainability Rating wins 3rd place award from GCSP [🔗](#)
- 30 August - First joint Aerospace Europe Conference hosted by eSpace [🔗](#)
- 22 September - EPFL Xplore team wins third place at European Rover Challenge 2023 [🔗](#)
- 16 October - "If it's too easy, there's no point" [🔗](#) (published on main EPFL site)
- 24 October - eSpace attends the ESA Clean Space Industry Days [🔗](#)
- 30 October - eSpace Director addresses European Parliament on space sustainability [🔗](#)
- 2 November - "Choosing the right area of research is vital" [🔗](#) (published on main EPFL site)
- 6 November - EPFL Space Center appoints new Advisory Board and Steering Committee [🔗](#)
- 20 November - A reminder of the omnipresence of Murphy's Law in aerospace [🔗](#)
- 13 December - Twenty years of outer space at EPFL [🔗](#) (published on main EPFL site)

### 3.2.3 Newsletter

In 2022, eSpace began its quarterly newsletter Mission Log. This newsletter presents eSpace's activities and events, along with interesting news from the wider field of space, to an audience of EPFL researchers and students, along with other stakeholders in Switzerland and internationally. [Newsletter archive](#).

### 3.2.4 Social media

eSpace has a presence on multiple social media channels: LinkedIn, X, Instagram, Facebook and YouTube. These platforms are a key channel in eSpace's communication mix, especially for the promotion of larger events, for sharing eSpace online seminars on YouTube, and disseminating eSpace project work. 2023 saw an increase in followers for all social media channels.

**LinkedIn:** eSpace's LinkedIn channel is used to share eSpace news and events, as well as events of interest to our community and relevant posts from our partners. The eSpace LinkedIn account has high engagement, in particular with members from the space industry, government, and EPFL students. In 2023, the number of followers increased nearly 44%, from 2,152 to 3,098.

**X (formerly Twitter):** eSpace's X account is used to share eSpace news and events, as well as events that are of interest to our community. The eSpace X account has mediocre engagement, with most of that engagement coming from within EPFL along with some policymakers. In 2023, the number of followers increased over 22%, from 507 to 621.

**Instagram:** eSpace's Instagram account is used for promoting eSpace events as well as engaging with the student community by reposting videos and photos from student teams and offering encouragement during exams and welcoming students back from holidays. The Instagram account is by far the best of the eSpace social media accounts for engaging with the EPFL space student population. In 2023, the number of followers increased nearly 11%, from 1,268 to 1,403.

**Facebook:** eSpace has a Facebook page, which has less value with our target audience. eSpace decided to keep the account, but no longer invest much time nor energy in updating it.

**YouTube:** eSpace has a YouTube page to share videos from the Seminar Series as well as other informational videos from the unit.



# 4.

## LOOKING AHEAD

### 4.1 Evaluation of the EPFL Space Center

•  
In September 2023, an evaluation of the EPFL Space Center began as specified by the EPFL Lex. The timing is particularly relevant as in 2022, the Space Innovation Unit was transferred from the Vice-Presidency for Innovation under the Vice-Presidency for Academic Affairs to the Associate Vice Presidency for Centers and Platform as part of the EPFL Space Center.

The following methods were selected for gathering data and writing the evaluation report:

- Analyze data/desk research – annual activity reports
- Surveys of main stakeholders: EPFL professors with activities linked to the space sector, students, and Space Innovation members
- Interview of Grégoire Bourban, formerly of the Space Innovation unit, now director of the Swiss Space Exchange
- Definition of indicators by the authors of the report and validated with the eSpace Steering Committee and team.
- SWOT analysis and development plan with the team inputs/feedback.

#### 4.1.1 Key performance indicators (KPIs)

One important step was to define the KPIs for eSpace's work that can be tracked over the past few years.

##### Education

- Number of students in the minor and demographic (gender, type of studies, nationalities)
- Number of projects with ECTS supervised
- Success of the MAKE projects (funding and results in competitions)
- Employability of alumni and whether they are still in the space field
- Master's student grants and publications
- Number of exchange students in the frame of the Double diploma Supaero

##### Research

- Publications (including PhD and students)
- Grants (third party funding)
- Post docs/PhD/visiting researchers hosted at eSpace and what they do after they leave
- Academic and industrial partnerships
- Invited talks

##### Innovation

- Number of spin offs
- Transfer of technology
- Professional events/conferences

##### Public engagement / societal impact

- Exposure in the media (press articles, EPFL articles)
- Events organized and participated in by eSpace employees and students

#### **4.1.2 Surveys**

In order to better understand the impact of eSpace and the EPFL Space Center, three surveys were performed – one of the EPFL research community, one of the EPFL students and one of the Space Innovation members.

##### **Space professors survey**

The target audience was professors who work on space-related topics along with postdoctoral researchers, senior researchers, and Centers' directors. Out of forty labs, the survey gathered thirteen answers. Those who answered have had a long-term relationship with eSpace, ranging from a few years to over a decade. The expectations they have of eSpace are mostly to connect, to network, to inform, and to federate space activities at EPFL.

The strength of eSpace lies in its network in the space sector, the relationship around the master's students, dynamism, drive and visibility. When talking about weaknesses, the comments generally referred to the size of the team and the lack of resources. One reviewer mentioned eSpace might be too inward looking, which could be due to the third-party funding and resources. There are also difficulties to meet needs with the scale and speed of industry, for example given that EPFL's legal services are slow.

When looking at the types of interactions, the respondents mostly mentioned funding, co-supervision of students, and teaching. The interactions were "good" to "very good". This observation is in line with what the respondents value the most: information about funding, finding industrial partners as well as connections with other EPFL labs, and information about space-related topics. This is also in line with the answers about the topics the community would like to be informed on in the newsletter. Regarding education, the Minor is well-received and we were given some propositions of courses that could be added. The community agrees that any master should be in collaboration with the ETHZ. When asking about research, respondents supported eSpace's focus topics although they are still wide-ranging and one respondent challenged the possibility for eSpace to be an expert in all the topics.

In general, the survey shows a positive perception of eSpace and the EPFL Space Center. It also highlights the need of the space researcher's community: to be informed and connected in order to develop further space projects.

##### **EPFL students survey**

A survey of the students from the Space Technologies Minor and the MAKE teams (EPFL Rocket Team, EPFL Spacecraft Team, Xplore, Space Situational Awareness, Space@Your Service and Asclepios) was also conducted. In general, the students are satisfied with the support of the EPFL Space Center. The Center is available for the associations and provides enough support. The students find the most value in the administrative support, the resources provided (hardware and software), followed by the technical expertise and the management / strategic support. Some students mentioned the lack of support for the legal aspects, the lack of time for supervision, and also the wish to have the opportunity to connect with the other associations.

For their careers, most of the students are planning to stay in the space sector (63%) and are confident they will find a job. They want to stay in Switzerland (44%), or go abroad (Europe 44% and overseas). We see that half of the students are connected with EPFL alumni. Around 45% would be interested in pursuing a PhD.

Finally, they also expressed the interest to have more seminars in hybrid (Zoom / in-person) mode.

The two surveys also addressed the possible common master with ETH Zurich in Space Systems. It seems that researchers and students are favorable. Around 60% would have been interested to join such a master.

## 4.2 Strategic objectives 2024–2027



Based on the assessment we have identified three priority focuses around education, research and innovation that are being reviewed with the Advisory Board and will be validated in the evaluation process.

### Temporary strategic objectives

**Objective 1** – Push and promote space technologies and science education to train and challenge EPFL students and space professionals to address the challenges of tomorrow.

**Objective 2** – Maintain EPFL's leading role in space sustainability research, providing support to evidence-based policy making and enhancing dialogue with society.

**Objective 3** – Leverage EPFL's cutting-edge technologies to enable future discoveries in fundamental science and accelerate the transfer of EPFL technologies to the industry.

**Transversal objective** – Engage the public and society in the space technology push and increase awareness of the societal impact of space technologies.

We also understand that with the change of presidency in 2024 and the implementation of EPFL strategy 2025–2028, there might be some challenges along with opportunities to implement changes.

We will focus the first half of 2024 in translating these objectives into a solid working plan, while still ensuring our offer to our community.







# THANK YOU!

Thank you to everyone who helped us make 2023 such an exciting year! To our eSpace team and staff, Space Innovation teammates, all our motivated students, dedicated researchers, EPFL colleagues, participants at our seminars and events, and all our partners who have trusted us to develop new projects - we could not have done this without you. We look forward to continuing our great work together!



# Annex

AQUA	Advanced Quantum Architecture Laboratory	<a href="http://aqua.epfl.ch">aqua.epfl.ch</a>
LASPE	Advanced Semiconductors for Photonics and Electronics Lab	<a href="http://laspe.epfl.ch">laspe.epfl.ch</a>
LASTRO	Astrophysics Laboratory	<a href="http://lastro.epfl.ch">lastro.epfl.ch</a>
BIROB	Biorobotics Laboratory	<a href="http://biorob.epfl.ch">biorob.epfl.ch</a>
CCLAB	Composite Construction Laboratory	<a href="http://cclab.epfl.ch">cclab.epfl.ch</a>
MCSS	Computational Mathematics and Simulation Science	<a href="http://mcss.epfl.ch">mcss.epfl.ch</a>
LSMS	Computational Solid Mechanics Laboratory	<a href="http://lsms.epfl.ch">lsms.epfl.ch</a>
CVLAB	Computer Vision Lab	<a href="http://cvlab.epfl.ch">cvlab.epfl.ch</a>
CHILI	Computer-Human Interaction Lab for Learning and Instruction	<a href="http://chili.epfl.ch">chili.epfl.ch</a>
EPSL	Earth and Planetary Science Laboratory	<a href="http://epsl.epfl.ch">epsl.epfl.ch</a>
EMC	Electromagnetic Compatibility Laboratory	<a href="http://emc.epfl.ch">emc.epfl.ch</a>
ESL	Embedded Systems Laboratory	<a href="http://esl.epfl.ch">esl.epfl.ch</a>
ECEO	Environmental Computational Science and Earth Observation Lab	<a href="http://eceo.epfl.ch">eceo.epfl.ch</a>
EERL	Extreme Environments Research Laboratory	<a href="http://eerl.epfl.ch">eerl.epfl.ch</a>
FlexLab	Flexible Structures Laboratory	<a href="http://flexlab.epfl.ch">flexlab.epfl.ch</a>
TOPO	Geodetic Engineering Laboratory	<a href="http://topo.epfl.ch">topo.epfl.ch</a>
ICT4SMG	ICT for Sustainable Manufacturing Group	<a href="http://ict4sm.epfl.ch">ict4sm.epfl.ch</a>
IIG	Immersive Interaction Research Group	<a href="http://iig.epfl.ch">iig.epfl.ch</a>
LSI	Integrated Systems Lab	<a href="http://lsi.epfl.ch">lsi.epfl.ch</a>
LAMD	Laboratory for Applied Mechanical Design	<a href="http://lamd.epfl.ch">lamd.epfl.ch</a>
LARA	Laboratory for Automated Reasoning and Analysis	<a href="http://lara.epfl.ch">lara.epfl.ch</a>
GalSpec	Laboratory for Galaxy Evolution and Spectral Modelling	<a href="http://lara.epfl.ch">lara.epfl.ch</a>
LPAC	Laboratory for Processing of Advanced Composite	<a href="http://lpac.epfl.ch">lpac.epfl.ch</a>
LIS	Laboratory of Intelligent Systems	<a href="http://lis.epfl.ch">lis.epfl.ch</a>
LMM	Laboratory of Mechanical Metallurgy	<a href="http://lmm.epfl.ch">lmm.epfl.ch</a>
LPI	Laboratory of Photonics and Interfaces	<a href="http://lpi.epfl.ch">lpi.epfl.ch</a>
K-Lab	Laboratory of Photonics and Quantum Measurements	<a href="http://k-lab.epfl.ch">k-lab.epfl.ch</a>
LRESE	Laboratory of Renewable Energy Science and Engineering	<a href="http://lrese.epfl.ch">lrese.epfl.ch</a>
LMTM	Laboratory of Thermomechanical Metallurgy	<a href="http://lmtm.epfl.ch">lmtm.epfl.ch</a>
MAG	Microwaves and Antennas Group	<a href="http://mag.epfl.ch">mag.epfl.ch</a>
LCM	Mobile Communications Laboratory	<a href="http://lcm.epfl.ch">lcm.epfl.ch</a>
MMSPG	Multimedia Signal Processing Group	<a href="http://mmspg.epfl.ch">mmspg.epfl.ch</a>
NAM	Nanophotonics & Metrology Laboratory	<a href="http://nam.epfl.ch">nam.epfl.ch</a>
PHOSL	Photonic Systems Laboratory	<a href="http://phosl.epfl.ch">phosl.epfl.ch</a>
PVLAB	Photovoltaics and Thin Film Electronics Laboratory	<a href="http://pvlab.epfl.ch">pvlab.epfl.ch</a>
APHYS	Physics of Aquatic Systems Laboratory	<a href="http://aphys.epfl.ch">aphys.epfl.ch</a>
PowerLab	Power and Wide-Band Gap Electronics Research Lab	<a href="http://powerlab.epfl.ch">powerlab.epfl.ch</a>
PEL	Power Electronics Laboratory	<a href="http://pel.epfl.ch">pel.epfl.ch</a>
RFIC	Radio Frequency Integrated Circuits Laboratory	<a href="http://rfic.epfl.ch">rfic.epfl.ch</a>
RGL	Realistic Graphics Lab	<a href="http://rgl.epfl.ch">rgl.epfl.ch</a>
RRL	Reconfigurable Robotics Laboratory	<a href="http://rrl.epfl.ch">rrl.epfl.ch</a>
SPC	Swiss Plasma Center	<a href="http://spc.epfl.ch">spc.epfl.ch</a>
TCL	Telecommunications Laboratory	<a href="http://tcl.epfl.ch">tcl.epfl.ch</a>
TIC	Tribology and Interfacial Chemistry	<a href="http://tic.epfl.ch">tic.epfl.ch</a>
VITA	Visual Intelligence for Transportation	<a href="http://vita.epfl.ch">vita.epfl.ch</a>

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