EPFL Space Center

EPFL Space Center
Activities 2024

2024 IN REVIEW

We would like to share key highlights of our Center's activities and achievements.

This year marked significant growth in our team structure and capabilities. We strengthened our research capacity through strategic recruitment, welcoming two new staff members while promoting one team member to research engineer and hosting an international exchange scholar. These additions have enhanced our ability to deliver on our core missions. Our team's cohesion and effectiveness were further reinforced through targeted professional development activities. Notably, we successfully completed our Center's review, which validated our strategic direction and operational approach.

Our **academic and research excellence** was demonstrated through an impressive portfolio of over twenty scientific contributions, spanning peer-reviewed papers, technical reports, and conference presentations. The Center developed and supported eight major research proposals, maintaining our position at the forefront of space research. We reinforced our presence in the international space community through active participation in key industry events, including the International Astronautical Congress, Cleanspace Days, Life Cycle Assessment workshops, and ESA Space Industry Days.

Space Innovation demonstrated remarkable performance metrics this year. We established twenty-one new industry connections, delivered eleven technical information services, and completed two commercial transactions. Our test facilities were utilized for three significant projects, and we conducted numerous outreach activities and facility visits. The implementation of enhanced reporting mechanisms has improved our ability to track and optimize our impact.

Our **Sustainable Space Hub** achieved several strategic objectives. We secured integration into CPS IAU working groups and formalized our commitment to responsible space practices through the signing of key statements. The Hub led the development of the Zero Debris Technical Booklet and contributed significantly to Product Footprint environmental category rules. Regular knowledge-sharing sessions maintained strong stakeholder engagement throughout the year.

The Center's digital presence saw substantial growth, with significant increases in our professional network engagement across our institutional LinkedIn platforms, enhancing our visibility and influence in the space community.

Emmanuelle David,
Executive Director, eSpace

Jean-Paul Kneib,
Academic Director, EPFL Space Center

Acknowledgement and congratulations

We would like to express our deep gratitude to Anna Fontcuberta i Morral for her dedication as associate vice president for centers and platforms (AVP-CP). During her tenure, her leadership and vision have greatly contributed to the success of our initiatives. We are delighted to congratulate her on her well-deserved appointment as EPFL's new president, and wish her every success in this new chapter.

At the same time, we are delighted to welcome David Atienza as our new AVP-CP. We look forward to his leadership and the future direction of our Center under his leadership. We also welcome Fatine Ezbakhe, who will be his deputy. Together, we are convinced that innovation and excellence will continue to be stimulated within our community.

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INTERVIEW WITH CLAUDE NICOLLIER

by Lucie Ryser

Claude Nicollier — who needs no introduction — was Switzerland's first ESA astronaut and had an exceptional career spanning more than twenty years at NASA, contributing to missions such as repairs to the Hubble Space Telescope, including an extravehicular activity. At EPFL, he became a highly respected teacher for the Minor in Space Technologies and a professor emeritus. His last lecture was given in 2024, marking a high point in his long relationship with the institution (ed. note: see p. 12).

I sat down with him on 11 February 2025 to discuss his journey, his time spent at EPFL, and his insights into the future of space exploration.

It's Tuesday morning, 10 o'clock, and Claude Nicollier has invited me to his office at the EPFL Space Center for this interview. He warmly welcomes me into his workspace, which reflects his exceptional career as an astronaut: models of rockets and satellites are arranged on the shelves, framed photos immortalize moments with prominent figures, and signed portraits and mementos tell the story of his professional journey. The office could feel intimidating, but Claude puts me at ease right away. He invites me to sit, offering me a cup of coffee. "That's something I always do," he says with a smile. "Before anything else, I offer coffee. And cookies! There are always cookies here — please, take one." It's a simple gesture, but one that speaks volumes: an extraordinary man with an exceptional career, yet his kindness and humility are what stand out the most.

The interview begins — smiling, sipping coffee, and nibbling cookies.

Lucie Ryser: What has been your relationship with the EPFL Space Center over the years, and how did you first get involved?

Claude Nicollier: Well, It's a long story! My association with EPFL began in 1993, when I was honored to receive the title of Doctor Honoris Causa from the School following my first space mission a year earlier. At that time, I was also offered a position as adjunct professor, but I wasn't yet teaching, as I was still involved in the space program in Houston.

In 2007, after leaving ESA, I became a full professor until 2014, teaching the course Space Mission Design and Operations. I became professor emeritus in 2015, and continued teaching until 2024. And I'm still partly involved in my successor Thibault Kuntzer's course for the human spaceflight and extravehicular activities sections. I am also giving some courses at the ETH Zurich in the frame of their new Master's in Space Systems program.

I have a passion for space. And I've learned so much in my 25 years at NASA in Houston and 43 days in space. My idea, when I agreed to take part in EPFL activities, was to transmit to EPFL students at least some aspects of this extraordinary experience.

Do you feel it's like a duty you have to fulfill?

Yes, it's a responsibility, and I felt it as a duty. I'm reminded of these words by André Gide, in his preface to Saint-Exupéry's "Vol de Nuit": *« Le bonheur de l'homme n'est pas dans la liberté, mais dans l'acceptation d'un devoir »* ("Man's happiness lies not in freedom, but in the acceptance of a duty"). For me, it would have been irresponsible to return to Switzerland and not take the opportunity to pass on the very unique experience I had been privileged to acquire as an active professional astronaut.

EPFL is often described as offering a unique learning environment. What do you believe makes this environment special for students, particularly to those interested in space-related fields?

It's common knowledge that EPFL is an excellent institution on a European and global scale. It is highly rated as a school where, on the one hand, you have a wide range of disciplines taught and researched, and on the other hand, you have a clear goal of excellence. I think excellence is in EPFL's DNA. These qualities make it an attractive and stimulating place to study space, among other disciplines.

What makes EPFL different from ETH Zurich, for example?

Space landed at EPFL much earlier than at ETH Zurich. We've had the Minor in Space Technologies for many years and we now have strong roots in the space disciplines, plus a number of excellent startups in the space sector, with roots at EPFL.

At ETH Zurich, with the arrival of Thomas Zurbuchen who, in a brilliant manner, brought space into the School, there is now a Master's program in Space Systems. This was set up rapidly and at a fairly advanced level, but it takes time to reach maturity in such an ambitious project. I gave a few lectures in Zurich in autumn 2024 in the frame of this new Master, and realized that there's a lot of enthusiasm, motivation and talent for this project, but still work to be done — on my side as well!

Having experienced both the academic world and professional space operations, what do you think EPFL offers that prepares students to tackle real-world challenges in space exploration?

I noticed that EPFL, more than any other academic institution in Switzerland, has a lot of student associations related to space. (ed. note: see p. 14). This is an indication that many students have a passion for space and want to work in this field. They study, and at the same time, they prepare themselves to work professionally in this discipline by participating in these associations which are really a bridge between the academic world and the research, industrial, and operational worlds. These associations cover quite a broad spectrum of space activities: not only rockets that go up, but also rockets that come back down for a soft landing, rovers, spacecraft systems, space situational awareness projects, and analog astronaut missions. For me, this is a huge plus at EPFL. We have the high level teaching, we have the Minor in Space Technologies, and we have the student associations where amazing things are done.

Many students know you as an astronaut and an international figure in the space community. How do you feel about being recognized globally for your achievements? Has your status ever created challenges or unexpected opportunities in your teaching?

Well, astronaut is an unusual profession that is highly sought after by many students. But I always tell my students that the space sector is run by people in all kinds of jobs: technicians, engineers, scientists, instructors, medical doctors, flight directors and flight controllers in the flight control room, managers, lawyers, etc. An astronaut happens to be a very visible contributor in a space mission, but this mission is carefully prepared, and run by thousands of people! Personally, I try not to put myself too much in the spotlight, because astronauts are a part of a large team working hard to achieve mission success.

Still, the students look up to you...

Yes, perhaps. But I don't look down on them. It is a real privilege to be an astronaut. It requires work and persistence, but also luck. In the mission team I was talking about before, we are the only ones experiencing the extraordinary space environment, but also exposed to the physical risks of the mission and the periodic strong adrenaline rushes!

Over the years, you've worked closely with many students. What specific, remarkable qualities have you observed in the students you've taught? Are there any moments or interactions with students that have stood out to you as particularly inspiring?

I was always really impressed by the students' creativity and inventiveness, especially in the context of their semester or master's projects. Over the years, I had the chance to interact with small groups of motivated students who, at the end of the course, always came to ask me additional questions. I was very touched by their interest and their willingness to learn more from someone who had been exposed to space as I had. The idea of having succeeded in motivating at least some of them, bringing them into the world of space exploration and potentially making them future contributors in this discipline was very gratifying. Then I felt like I was not completely useless *(laughter)*. A little, but not completely! *(more laughter)*.

In space, you've been tasked with one of the most technically demanding repairs ever — the servicing of the Hubble Space Telescope. How do you see parallels between that mission and the challenges students face when working on projects, like a semester project at EPFL?

In both cases, you have a project, a goal, and you try to do what it takes to achieve it. The mental, physical and organizational processes are in fact quite similar. The difference is essentially in the magnitude of the task, and the level of responsibility. Every space mission has a well defined goal, or set of goals. If you are not after a clearly defined objective, you can never succeed. The next step is the determination of the technical and organizational steps to achieve it. The whole team trains along these lines, and off we go!

It is good to have this process exercised already at the academic level, because if you are a student prepared for this flow of activities, then when you get involved later in satellite, rover or telescope in space projects, you already know what steps are needed to reach success.

Looking ahead, how do you envision the future of space exploration? What do you think will be the next big milestones for humanity in space?

(Laughter) Okay, that's a big question! Well, historically, we started in the low Earth orbit (LEO), and then we went to the Moon with the Apollo program. This was a key undertaking that significantly raised the level of motivation for human space exploration. It was an exemplary program, superbly run by the people at NASA and in the aerospace industrial teams in the US.

We then went back to the LEO with the Space Shuttle program (first flight in April 1981). We stayed in LEO for decades because there were important things to do in this region of space. Hubble is one example, the International Space Station ISS is another. Both were challenging projects, but eventually very successful. Hubble is still alive and productive, but cannot be serviced any longer because the Shuttle was needed for that, and that program was terminated in 2011. ISS should be de-orbited at the end of this decade, and replaced by a set of future private space stations.

The other "playground" for current and future robotic and human space exploration is and will be the Solar System, starting with the Moon, and then to Mars, and beyond. All planets of the Solar System, and many moons of these planets, plus some asteroids and comets, have been visited by spacecraft in flyby or orbital mode. We also have had several landers and rovers on the surface of Mars, and even one ESA spacecraft, Huygens, which landed on the surface of Titan, the largest satellite of Saturn, in 2005, and another one, named Philae and also from ESA, that landed on the nucleus of a comet in 2014.

Artemis is the new Moon human exploration program, initiated in the US in 2019, with participation of several other agencies and countries, including ESA, CSA (Canada), JAXA (Japan), and the Emirates. The program is ongoing, with the Artemis I mission executed in November 2022, without a crew, and the Artemis II mission, around the Moon with a crew, now planned for end 2026, and Artemis III, which should touch down in 2027 maybe, near the south pole of the Moon, and provide the opportunity for the next human steps on the surface of our satellite. These dates will certainly shift quite a bit to the right, mainly because of the delayed readiness status of the Human Landing System (HLS) based on the SpaceX Starship that has not yet reached orbit in its flight test program!

Artemis is an exciting program with the involvement of several private companies, building and operating spacecraft that land on the surface of the Moon for scientific work and logistic support of the future Artemis Moon base. Long-duration human missions on the Moon surface will be challenging, with the absolute need for radiation protection and the development of our ability to live from the resources of the Moon itself to the maximum extent possible. It is my sincere hope that my successor Swiss ESA astronaut Marco Sieber will have the opportunity to experience once the surface of the Moon and to work there, some day !

A clear highlight in future human spaceflight programs is of course the SpaceX Starship rocket, with its impressive payload capabilities, and potential reusability of both stages. We just have to wait for the system to reach maturity, but, at some point,

it is very likely to make a huge difference in Moon exploration, and in our capability to perform human missions to Mars, and possibly beyond Mars in the future.

As far as the low Earth orbit is concerned, does the fact that there are so many satellites in it frighten you?

You are right, the very large, and rapidly increasing, number of satellites, plus space debris, in LEO is a definite concern. We must find solutions very quickly, because if we don't, we might get to a situation known as the Kessler syndrome, where collisions produce enough debris which collide with other satellites and debris, and produce more debris, resulting, at the end, in a catastrophic self-feeding dense cloud of debris in low Earth orbit. Not a good situation!

Spacetalk, a company based in Lausanne, is trying to get all space actors worldwide to communicate the details about their satellite systems, so that we can put all this data together and design proper space traffic management. There is also Clearspace, of course, a spin-off company from the EPFL Space Center, which has been given the mandate by ESA to remove the no-longer functioning PROBA-1 satellite from orbit. Large debris have a higher probability to enter collision with other space objects and have to be removed at a high priority. Clearspace will work in the future on servicing satellites on orbit, which is an effort towards reaching sustainability in the space environment.

Finally, for students who are considering the Minor in Space Technology, what advice would you offer to someone who's still uncertain about whether to take the plunge?

I did my homework and looked at the list of all the courses that currently are in the Minor in Space Technologies. I already knew it more or less but I needed an update. I definitely think that the Minor provides a good and solid foundation of knowledge that will make a positive difference in any application for a job as an engineer in the space sector. There are many possibilities in Switzerland: there are many companies that hire engineers who come out of EPFL, whether they studied electrical engineering, mechanical engineering, computer engineering, or microtechnology. If they have the Minor in Space Technologies in addition, it is a huge advantage, there is no doubt about it.

You told us about passion, but what other skills or qualities do you think are essential for those pursuing a career in space science and technology?

I would also say perseverance. You always have to have a clear goal as a student, and you must keep moving towards it. After all, it's not just about getting the degree, it's also about getting a good result you can be proud of, because that's what people look at when they want to hire. Work hard! Passion is one thing, but you also have to have the drive to achieve your goal.

I feel really very close to EPFL and the students, the research teams, the associations, and the school Presidency and management. I was always very happy here, and, to tell you the truth, I am not ready to leave. I still feel on a stable orbit around EPFL, and it looks like I will never get close to escape velocity.

06

EPFL SPACE CENTER

The Center in a nutshell

The EPFL Space Center is made up of two groups: eSpace and Space Innovation.

The mission of **eSpace** is to promote space-related research, support EPFL's space-affiliated professors, coordinate the Minor in Space Technologies, and manage the EPFL student teams.

The mission of **Space Innovation** is to support space industries, academies and research and technologies organisations in Switzerland by coordinating and maintaining the network and offering access to cutting edge technologies, test facilities, continuing education and outreach activities.

The Center review

In September 2023, an evaluation of the EPFL Space Center began, as specified in EPFL Lex 1.2.12, dated 15 July 2022. The timing was particularly relevant because in 2022, the Space Innovation group was transferred from the Vice Presidency for Innovation (VPI) to the Vice Presidency for Academic Affairs (VPA) under the Associate Vice Presidency for Centers and Platforms (AVP-CP) as an integral part of the EPFL Space Center.

On 25 January 2024, the EPFL Space Center held its first Advisory Board meeting and shared some of the findings of the self-evaluation report.

On 7 May 2024, two experts, Prof. Massimiliano Vassile of the University of Strathclyde and Prof. Franco Bernelli of the Politecnico di Milano, visited EPFL for a day to assess the Center and provide recommendations to the AVP-CP.

In June 2024, the Center sent a response on their recommendations to the AVP-CP. The report concluded a year of significant investigation, questioning and information gathering, and set objectives for the period September 2024 to September 2028.

In January 2025, EPFL management renewed the Center's mandate and budget for 2025—2028.

This nine-month process and feedback from AVP-CP with the Advisory Board and external partners allowed the Center to genuinely reflect on strengths and areas of interest. EPFL Space Center is key for EPFL as it ensures a dynamic community of students and professors that work on space topics, and creates an ecosys-

tem where industry players can thrive. Internal and external feedback was positive.

The unique selling proposition of EPFL and its Space Center are: the Minor in Space Technologies, the MAKE students' projects, numerous spin-offs from EPFL, the heritage of Space Innovation members community, and cutting-edge research in the area of space sustainability.

The main takeaway is that EPFL Space Center should focus on this unique selling proposition and growth to ensure excellence while exploring cutting-edge technologies. Communicating the results and the success is also key to show the role of the Center.

This evaluation is part of the continuous process of improving our operations and efficiency and the plan shall be updated each year by the Center's Direction with the staff. As the world is evolving fast it is important to be agile. Therefore, one mid-term review will be performed internally at the end of 2025 (or early 2026) with the main stakeholders of EPFL to present the main achievements, the updated roadmap and to gather feedback.

EPFL Space Center team

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- **Emmanuelle David**, executive director
- **Jean-Paul Kneib**, academic director
- **Lucie Ryser**, communication specialist
- **John Maxwell**, IT manager

eSpace

- **Candice Norhadian**, administrative specialist & student coordinator
- **Mathieu Udriot**, engineer & student coordinator
- **Marnix Verkammen**, research engineer
- **Pierre-Alain Maüsli**, student projects supervisor

- **Andrew Price**, postdoctoral researcher
- **Stephan Hellmich**, postdoctoral researcher
- **Thai-Nam Hoang**, software developer
- **Cui Kaiqi**, visiting PhD student
- **Xiao-Shan Yap**, senior research scientist
- **Francesco Renis**, master's student

Space Innovation

- **Martine Harmel**, operations coordinator & secretary to Claude Nicollier
- **Gilles Feusier**, head of science and technology
- **Christian Cardinaux**, industry partnership manager
- **Volker Gass**, strategic initiative support
- **Yannick Delessert**, technology specialist

Part of the EPFL Space Center team (almost) managing sheep during the annual team building day

EPFL Space Center Advisory Board

In 2024, the EPFL Space Center appointed an Advisory Board and a Steering Committee as per the EPFL regulation on centers, Lex 1.2.12. It is composed of seven external experts who identify subjects of strategic importance to the Center and inform the Steering Committee of them; to explore with the Center the best way to conduct collaborative activities with partners; and to 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 Manfletti
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

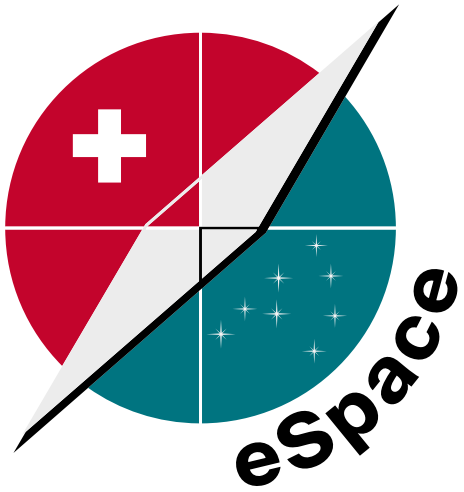
Mathieu Salzmann
EPFL
Computer Vision Lab

"My personal experience at the EPFL Space Center has been very inspiring. Working in the Steering Committee has given me the opportunity to see the challenges that space imposes on electronics and computing and also how critical it is to make sure that space will be a sustainable resource for future generations."

Edoardo Charbon

"The EPFL Space Center has been a source of inspiration for my research for the past seven years. Being part of the Steering Committee has allowed me to further witness the diversity and quality of their activities, as well as given me the opportunity to return the favor and, in turn, contribute to this endeavor. I look forward to continuing this collaboration."

Mathieu Salzmann



eSpace is the group 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 (SSA) team, and Xplore.

Unfortunately, the Asclepios and SSA teams lost their MAKE status in 2024; eSpace therefore no longer supervises them directly, but remains at their disposal for advice, and of course continues to follow their activities with great interest.

In the area of **research**, eSpace pushes space-related projects by supporting researchers with 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, in Switzerland and globally.

Claude Nicollier at his last lecture, enjoying a surprise visit from colleagues, friends and family. © Alain Herzog / EPFL

1. EDUCATION

1.1 Minor in Space Technologies

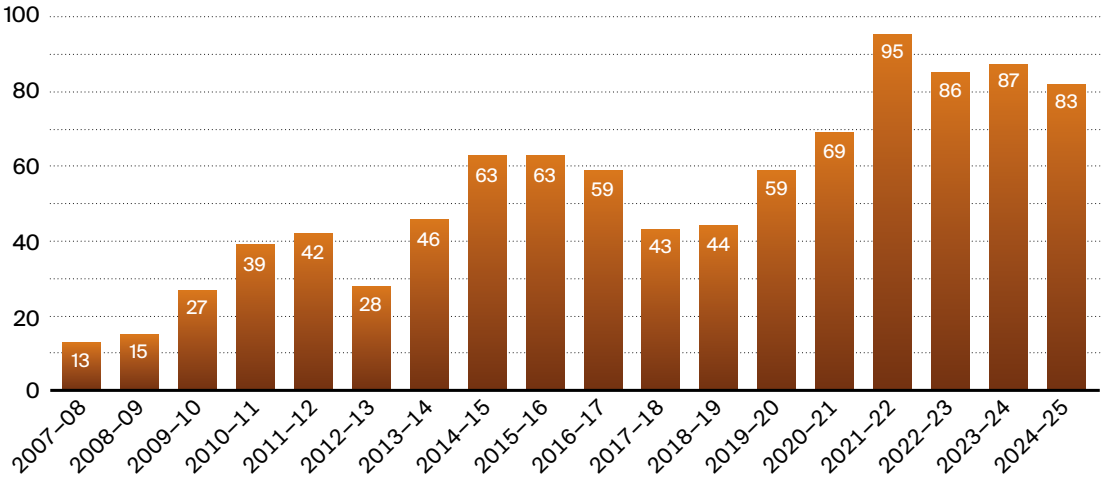
For the last twenty years, EPFL has offered the Minor in Space Technologies to foster and promote the awareness of space technologies and applications among students. The Center coordinates the minor to maintain a coherent and state-of-the-art coursebook, and its staff are directly teaching some of the core classes.

Since the beginning, the minor has benefited from the support of astronaut Prof. Claude Nicollier, and thanks to him and the high quality teaching in various topics, has received an increasing number of students over the years, culminating in 2024 with 83 students.

One of the big changes in 2024 was Claude Nicollier's official retirement, and his last official lecture given at EPFL. His course "Space mission design and operations" was moved to the fall semester with the recommendation that students take it in their first semester. It is now taught by Thibault Kuntzer, a former EPFL PhD and teaching assistant of Nicollier. The course provides basic knowledge about orbital mechanics, space mission concepts, and the space environment, and is useful for all subsequent courses of the minor. And Nicollier came back for a special lecture about his spaceflight experience in Kuntzer's course.

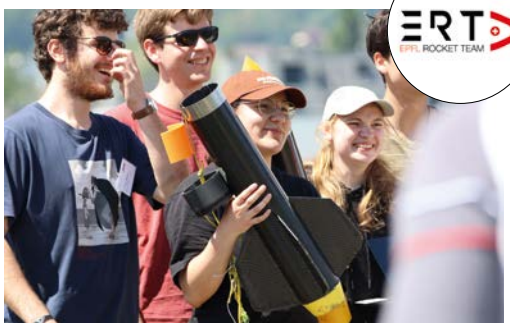
The more advanced EE-584 Spacecraft Design and Systems Engineering course, recommended for the third semester, was taught this fall with a new team and refreshed structure. For the first time, an optional practical session was offered for students to visit the cleanroom at the Space Center and discover the thermal vacuum chambers and test facilities. The project was done in teams of two or three students, who could choose the type of mission to design between an active debris removal of SwissCube, the deployment of a constellation around the Moon, or a mission for space weather forecasting. Several external experts were invited to share their experience and teach in their specialised topics (e.g. AIT, avionics, spacecraft configuration, etc.).

Total students in the minor



1.2
Supervision of MAKE projects

EPFL Rocket Team



ERT space race 2024 / ERT test facility site

The EPFL Rocket Team continues to expand the student rocketry field, constantly reaching for new orbits and elevating the name of the EPFL community. The current team has 235 members. The academic year of the team began with the symposium event on 24 September, where stakeholders, sponsors, alumni, team members, and their families gathered to share key project updates and future goals.

Firehorn, the team's first cryogenic bi-liquid rocket, has reached significant milestones in preparation for its 9 km maiden flight in 2025. The recovery bay successfully tested its line cutter for controlled parachute deployment, while the tanks and pressurant bay are ready for integration.

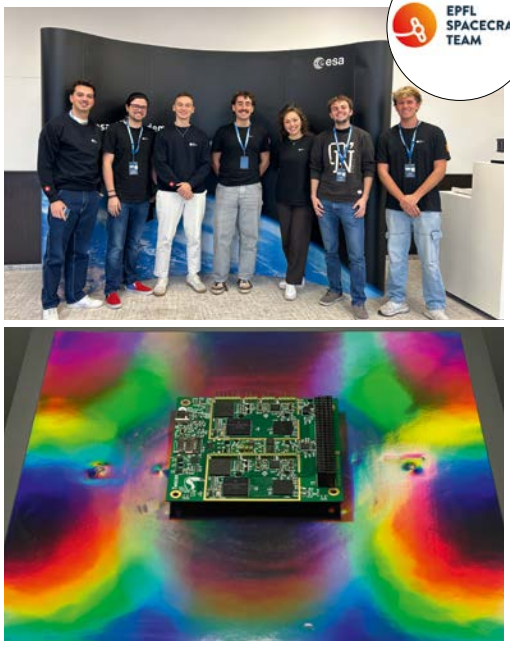
The DEMO-B1 cryogenic engine, Wyvern, demonstrated excellent material properties and completed cold flow tests. The DEMO-A3 engine showcased 1 kN thrust, becoming a crucial part of the hopper system. The team also completed its custom-built test bench for engines up to 15 kN of thrust.

Hyperion P continued its pioneering work in satellite propulsion with plasma technologies. The Avionics subsystem finalized PCB designs, with half assembled, ready for testing GNC algorithms. The gimbal system proved reliable under extreme conditions. And as always, this year's edition of the Space Race was launched, bringing together teams of students to design and build their first-level rockets.

"Being part of the EPFL Rocket Team, especially as Vice President, has helped me develop skills beyond the ones of my courses, like managing a team and learning how to handle challenges. One of the accomplishments I'm proud of this year is the testing facility for our bi-liquid engines, which wouldn't have been possible without eSpace's support. They were with us every step, from connecting us with experts to providing advice. What stands out to me is their involvement through our monthly meetings, where they not only check on our progress but also ask how they can help. It's clear they care about what we're doing and want to see us succeed. I know we can always knock on their door when we need help."

Rayane Maalouf, vice president

EPFL Spacecraft Team



EPFL Spacecraft Team at ESA / TwoCan projec.

This year, the EPFL Spacecraft Team has made significant progress with the main mission CHESS, as well as its sub-projects and smaller missions.

The most notable milestone of the year was the team's second In-Orbit Demonstration (IOD). Twocan, an upgraded version of the onboard computer featuring redundancy capabilities, was launched in January 2025 aboard SpaceX's Falcon 9. A significant part of 2024 was dedicated to integrating the board into Space-locker's platform, a payload for a D-Orbit ION Spacecraft.

On the Ground Segment side, the manufacturing of the X-band antenna began at PLTE, while the UHF antenna is now operational, streaming live video of its activity on YouTube. The ground segment division has accomplished remarkable achievements this year.

Despite the discontinuation of the educational program CANSAT, last year's winning team had the opportunity to launch their can satellite in Portugal last October, aboard a rocket from TU Darmstadt's rocket team. Around the same time, the EPFL Spacecraft Team participated in IAC Milan, where several members presented research papers. The event also provided an opportunity to exchange ideas with other space-related associations, companies, and institutions, such as the Space Universities CubeSat Challenge.

A major highlight of the semester was the selection of the EPFL Spacecraft Team for a special program directed by ESA. The ESA Fly Your Satellite! The Design Booster program aims to support and advise the team throughout the next year and a half during the development of their satellite. This achievement is expected to drive further progress for the team.

"I joined the team to apply my knowledge to a concrete project, and discovered a passion for space along the way. The stimulating environment has enabled me to develop not only my technical skills, but also my management and organizational abilities. Among our achievements, I'm proud of the launch of Twocan, our on-board computer, on a D-Orbit satellite, and our membership of the ESA Design Booster. These milestones give me great confidence for the future of the association."

Álvaro Martínez Vizmanos, president

Xplore

The Xplore team gathered around their latest rover

In 2024, EPFL Xplore gained yet another dimension by launching two new projects, the Xplore Rover Challenge and the Xplore Research Pole. The Xplore Rover Challenge is an educational initiative for students who are eager to learn, but do not feel ready to be involved in large-scale robotics projects. The results were immediate as Xplore was able to retain eight engineers for 2025.

In parallel, the Xplore Research Pole ensures the sustainability and versatility of the association as the senior members along with experienced additions tackle on the challenge of participating in long-term projects: the legged-robot (Chienpanzé), the plastic recycling machine (Wall-e), and the development of AI features.

Finally, the heart of the association remains the European Rover Challenge in which EPFL Xplore sent its latest rover Onyx with its drone Dragonfly to compete against some of the best university teams in the world, bringing home the Presentation Task Excellency prize, which was awarded by the judges for the long-term vision and growing outreach of the association.

"As a member of EPFL Xplore for the past five years, this student association has taught me, amongst other things, how to manage a team, how to balance school work and extracurricular activities, and how to collaborate with colleagues along with laboratories, administrators, companies, etc. Among these collaborators is eSpace, with Candice Norhadian and Maxime Rombach guiding us through administrative procedures and managerial decisions, and presenting us with incredible events and opportunities to meet ESA members, astronauts, Nobel prize winners and more! Overall, EPFL Xplore has taught me the real meaning of passion, commitment and of taking on responsibilities. And also that work can be a lot of fun!"

Emma Poggiolini, vice president & head of sponsoring

1.3 Supervision of other EPFL space associations

Workshop organized by eSpace for the students MAKE teams

- 21 November – Sustainability Workshop
- 8 May – Stakeholders Management Workshop

Around twenty students from all teams met during these workshops to interact with staff and external speakers.

Michka Mélo, sustainability coach at MAKE, presented his role and efforts ongoing in other EPFL student associations. Staff from the EPFL Space Center gave an overview of ongoing research efforts in the domain, which might be relevant to support the teams. Then, the EPFL Rocket and Spacecraft Teams introduced their efforts in sustainability, explaining how they are organised, what they are doing and what is their objectives.

Gruyère Space Program

GSP's Colibri, a bi-propellant vertical take-off and landing (VTVL) rocket

The Gruyère Space Program (GSP) had an incredible 2024, marked by groundbreaking achievements and a major transition. The small team's bi-propellant VTVL rocket, Colibri, completed 53 successful flights over the course of five months. On its final flight, the 2.5 meter tall hopper reached an altitude of 105 meters and returned safely to its launch pad, becoming not only Europe's first free-flying rocket and the world's first student-built rocket, but also fulfilling the promise made by the core team when they initiated the Colibri project four years ago.

GSP, founded by Swiss engineering students at EPFL, has now evolved into PAVE Space, a startup focused on advancing space mobility and robotics. As the team graduates and moves on, PAVE aims to pioneer advances in space logistics with autonomous "space handyman" spacecraft and unlock new opportunities that space has to offer on Earth. It's a fitting farewell to GSP's student-led legacy and an exciting new chapter for the team.

Asclepios

The Asclepios team, along with Claude Nicollier, in the Sasso San Gottardo fortress. © EPFL Space Center - Lucie Ryser

The Asclepios IV mission was successfully conducted during summer 2024, simulating a human expedition to the lunar south pole. Two dozen students participated in this space simulation mission, either as analog astronauts or as part of the Mission Control Center (MCC). Students had the opportunity to experience various elements of human spaceflight operations from science, design, medical support, to communication and management. During the mission, the astronauts spent two weeks in isolation in the Sasso San Gottardo fortress in Airolo conducting science experiments from industrial and academic partners, performing extravehicular activities while wearing spacesuits, and testing new technologies and procedures. Building on the previous three Asclepios missions, Asclepios IV took another big leap forward in the field of human space exploration.

Callista

Satellite tracking X-band antenna

Callista's activities focus on amateur astronomy, including observations both on campus and in remote locations, alongside astrophotography. The association's radio astronomy group also runs practical sessions for physics students using a radio telescope built on the ELB building roof.

In March 2024, Callista hosted the first "Semaine de l'astronomie" in collaboration with other EPFL student teams. The event featured renowned speakers, workshops, and nightly observations. Building on its success, a second edition is planned for 2025.

Also in 2024, the Panoptes project was launched in partnership with Stem Inspire Hawaii and the Astropléiade association. This initiative aims to develop a device that automatically detects exoplanets and other events through photometry. An enhanced prototype will be installed at the Astropléiade site in autumn 2025, with plans to expand to remote regions, following Bhutan's successful pilot with the first prototype.

Space Situational Awareness (SSA)

EPFL Spacecraft Team's antenna for satellite communication

In 2024, the SSA project officially became an independent commission within EPFL's astronomy association, Callista. Over the past year, the team has more than tripled in size, leading to a complete reorganization and optimization of task distribution.

A prototype dome for one of our telescopes was built and installed on the roof of an EPFL building and is currently undergoing testing. The team actively participated in multiple events, including the Space Science and Technology Conference at EPFL, and two members even had the opportunity to attend the International Astronautical Congress in Milan.

New members were trained in telescope operations, allowing the team to observe, track, and identify multiple satellites despite challenging weather conditions. With growing expertise and enthusiasm, the team is more motivated than ever for 2025.

Space@yourService

The Space@yourService team next to the Lunar Base

In 2024, Space@yourService connected space enthusiasts through creative, fun, and accessible events. The association hosted its immersive escape game, "Switzerland, We've Had a Problem!" twice in Hall SG, splitting players between Mission Control and Lunar Base tents. Teams raced to restore communication, repair damaged systems, and conserve oxygen—all while solving space-themed puzzles.

During the March 2024 Semaine de l'Astronomie, Space@yourService held its 11th "Astronomy on Tap" event, blending lively cosmic talks with a cozy bar atmosphere, where drinks and discussions flowed freely. It was a great opportunity to exchange between experts and students. The team's year concluded with the launch of PolySpace, a collaborative event to gather campus space associations and showcase their work to the student community. Looking ahead, the student association is excited to create even more innovative and fun events, sharing its love for space sciences with everyone.

1.4 Supervision of master's and semester projects

1.4.1 Master's projects

Angelina Frolova
[Master] A long time from now, in a galaxy far, far away: Remoteness of effects as a factor of sustainable space technologies' market acceptance
(supervisor assistant: Andrew Price)
This master's project was co-supervised at eSpace with Davide Bavato from the EPFL College of Management of Technology. In order to promote sustainable space activities, it is necessary to promote the adoption of sustainable technologies. This work explored the barriers to technology adoption in the space sector through the use of the Technology Acceptance Model (TAM). A new factor, "remoteness of effects", was proposed for TAM. The factor was assessed in the context of space situational awareness and active debris removal technologies through a survey of semi-structured interviews including: non-space industry experts, space experts and space academics. A case study was performed with the eSpace Open Debris Lightcurve Inventory (ODLI) exploring commercialization avenues. The study concludes with recommendations for policymakers to emphasize immediate localized benefits of sustainable technologies to promote their adoption by industry.

Hannah Besser
[Master] Sustainable space logistics — Design of an on-orbit refuelling infrastructure
(supervisor assistant: Mathieu Udriot)
Hannah was a visiting student from RWTH Aachen University who approached the EPFL Space Center for her master thesis. She was interested in the concepts of in-orbit servicing and found our previous work done on sustainable space logistics and the development of the TCAT tool. Her project used orbital mechanics, object-oriented programming, logistics optimization with a genetic algorithm, and visualisation techniques. With a set of constraints and user inputs, she was able to identify a Δv optimal refueling infrastructure design for a European GEO mission, derived general design recommendations, with a mission simulation integrating trajectory selection and logistics optimization that provides a holistic framework for system-of-systems design.
She also presented her work with a poster at the CleanSpace Days at ESA ESTEC.

Oliver Pineda Suárez
[Master] Digitization of space components: Implementing dynamic automated generation of standardized digital twin data models for interoperability and traceability in space projects
(supervisor: Gilles Feusier)
This master project is done in collaboration with Maxon motors (Sachseln, Switzerland). It consists of developing a digital twin that will allow the company to deliver robust data, models, and simulation tools to clients, enabling them to test and analyze products in a digital environment to validate their potential use in space. The automated generation of said models makes use of the rich data available within the company's digital infrastructure. The generated models are integrated along with the documentation package into an IDTA (International Digital Twin Association) Digital Twin Asset Administration Shell of a product, to make them accessible for the user through a web service. Space motors have been used in the frame of the project in order to test the developed tools in a specific domain, Maxon's strategy being to implement in the future such digital twins into their other markets.

1.4.2 Semester projects

- **Martin Lemaire & Ryan Svoboda**, "Technology roadmapping for a suborbital rocket with multidisciplinary design optimisation" (Volker Gass, Mathieu Udriot)
- **Julie Böhning**, "Optimizing project management — Developing tools and automation strategies for space company" (Jean-Paul Kneib, Gilles Feusier)
- **Julie Böhning**, "Space market dynamics: an extensive analysis and trends for emerging ventures" (Jean-Paul Kneib, Sonia Ben Hamida)
- **Adrien Dupont**, "Conception and testing of an acquisition pipeline for a UHF antenna" (Jean-Paul Kneib, Hannes Bartle)
- **Florent Gaspoz**, "Design and prototyping of a robotic quick release mechanism for a rocket propellant filling system" (Jean-Paul Kneib, Hendrik Jäger)
- **Marco Karam**, "Design, manufacture and testing of bench test to characterize pulsed plasma thrusters in the Rocket Team" (Jean-Paul Kneib, Pierre-Alain Mäusli, Pierre Sintre, Constant Panisset)
- **Matthieu Tonneau**, "Arcjet thruster design" (Jean-Paul Kneib, Pierre-Alain Mäusli)
- **Sebastian Belanger**, "Perception of space sustainability by space investors" (Emmanuelle David)
- **Gunnar Dofri Vidarsson**, "Machine learning based orbit estimation from Seeing effect"

(Mathieu Salzmann, Andrew Price, Stephan Hellmich)
- **Julia Adonia Tillia Renard**, “Spectral rendering of space objects” (Mathieu Salzmann, Andrew Price, Stephan Hellmich)
- **Sarah Mathilde Marciniak**, “Orbit fitting of satellites that cross the entire field of view” (Jean-Paul Kneib, Stephan Hellmich)
- **Mathilde Simoni**, “Digital twin at the EPFL Spacecraft Team” (Jean-Paul Kneib, Andrew Price, Mathieu Udriot)
- **Asma Belhaj Jrad**, “Design of next generation EPS for the EST” (Emmanuelle David)
- **Jérôme Mayolet**, “Sustainable ISRU and human development on the Moon” (Jean-Paul Kneib, Mathieu Udriot)
- **Clément Loyer**, “Hold-down and release mechanism, CHESS CubeSat Solar Array, EPFL Spacecraft Team” (Gilles Feusier)
- **Mathurin Froment**, “Implementation of an orbital simulation framework for satellite operations” (Gilles Feusier)
- **Thomas Scherrer**, “Testing and verification of an antenna pointing mechanism for X band data acquisition” (Gilles Feusier)
- **Jolan Fath**, “Xplore core drilling design” (Gilles Feusier)
- **Héloïse Fabbretti**, “Solar panels hold-down and release mechanism (HDRM)” (Gilles Feusier)

1.4.3 Other student support

Wei Jonathan Xiaocheng
[Master] Simulating space policy implications on collision avoidance decisions using the environment-vulnerability-decision-technology FrameworkSchool / businessMITStart
(supervisor assistant: Danielle Wood, MIT)

Mathieu Udriot supervised a student team, OrbitOut, at the Student Aerospace Challenge.

Martine Harmel served as expert for the E2MC Venture course pitch day. It was an opportunity to connect with students and discover their creativity in terms of business opportunities: a lunar station for O_2 and H_2O extraction, biofuels and refuelling stations for mars and the moon, high-end luxury goods from space, debris hubs and space ports. These might become lucrative businesses some day.

1.5 Continuing education: Space Sustainability course

In March 2024, EPFL hosted its first professional course on space sustainability — “Space sustainability: How to design more sustainable missions”. Experts tackled the history of space sustainability and geopolitical challenges. Different tools and methods were presented and then used in group work. On the last day, the concepts of environmental social governance (ESG) and corporate social responsibility (CSR) were presented.

After completing the course, the participants had a better understanding of the challenges of space sustainability, a concrete set of tools, and methods on how to better measure, analyse and act towards more sustainable space missions. The three day course also allowed in-depth exchanges with experts.

The target audience is composed of professionals — engineers, managers, or policy-makers — with interdisciplinary backgrounds and a few years of working experience. The group work included a learning-by-peers dimension to the students and identified the challenges from other disciplines.

Building on its success and fruitful collaboration with the UNIL-EPFL Continuing Education organization, the course is being repeated in 2025, with an additional day of training, taking place from 24 to 27 March. The EPFL Space Center would like to warmly thank the Extension School for their grant and support in business development

1.6
Education plans for 2025

1.6.1 EPFL's Minor in Space Technologies

Following a transformative 2024, the EPFL Space Center is setting focused objectives for 2025 that build upon our established foundation and heritage in space education while introducing key new developments.

Design and deliver an educational curriculum that motivates EPFL students and professionals to use novel technologies for space applications and science.

We will continue to enhance our core minor program through targeted improvements and additions. A significant milestone will be the first edition of our space sustainability course, introducing students to this critical aspect of modern space operations.

The intensive course on concurrent engineering of space missions will be taught following a new format: with two theory lectures and five design sessions spread over the first half of the semester. The course had to be cancelled in 2024 because too few students registered (minimum eight are required to create an interdisciplinary team). In 2025, we are confident that we will attract enough students with a relevant and advanced mission concept: provide space situational awareness (SSA) in cis-lunar space and a strong teaching team.

A course on systems engineering will also be reintroduced after a couple of years' absence. Systems engineering is critical for understanding and working on complex systems such as spacecraft or launch vehicles.

Train students to become future leaders by providing hands-on experience and exposure with industry to be ready to address tomorrow's challenges and create a better future.

We are continuing our grant program to support student participation in academic conferences, with a particular focus on the European Conference on Aerospace Sciences in 2025. This initiative will specifically support students who have papers accepted for presentation, fostering research excellence and international visibility. We will also provide support for the main challenges of our three make teams:

- **EPFL Rocket Team** - participation to the Euroc 2025 competition and completion of the new testing facility.
- **Xplore** - participation to the European Rover Competition 2025.
- **EPFL Spacecraft Team** - secure the financing and enter the next satellite development phase.

1.6.2 Appointment of Daniel Neuenschwander in STI

Finally, We are proud to welcome Daniel Neuenschwander as professor of practice in the School of Engineering (STI).

As the current director of Human and Robotic Exploration at the European Space Agency (ESA) in Cologne, Germany, Prof. Neuenschwander brings exceptional international expertise in the aerospace sector. His extensive experience includes previous roles as ESA's director of launchers and leadership of the Swiss Space Office and Swiss delegation to ESA. His appointment significantly strengthens our academic program, offering students unique insights from his vast experience in space technologies and management.

1.6.3 Strategic KPIs

To ensure program effectiveness and maintain high educational standards, we will track several key performance indicators.

Student demographics and engagement

- Comprehensive analysis of minor program enrollment, including gender distribution, academic background, and nationality diversity.
- Monitoring of ECTS-credited project supervision and completion rates.
- Tracking student participation and paper presentations at international conferences.
- Evaluation of student engagement in the new Space Sustainability course.

Academic development

- Assessment of student grant utilization for conference attendance.
- Tracking of research publications and conference presentations.
- Evaluation of the impact of the professor of practice position on student learning and industry connections.

Through these focused initiatives and careful monitoring of our performance metrics, we aim to strengthen our position in space technology education while preparing our students for successful careers in the rapidly evolving space sector.

2. RESEARCH

Space Sustainability was the top research subject at eSpace in 2024, and will still be in 2025.

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 1 million objects larger than 1 cm are orbiting Earth. Among them, less than 1% 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. The sustainable use of space will continue to be a main focus of eSpace's activities in the coming years.

2.1 Research projects

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The Sustainable Space Hub

espace.epfl.ch/research/sustainable-space-hub/

The Sustainable Space Hub was created in 2023 as a way to organise several projects at EPFL that were connected with space sustainability, without prior strong interactions. This has been a success so far, getting more interested master's students, PhD candidates, and ongoing research projects to connect with and through the Hub.

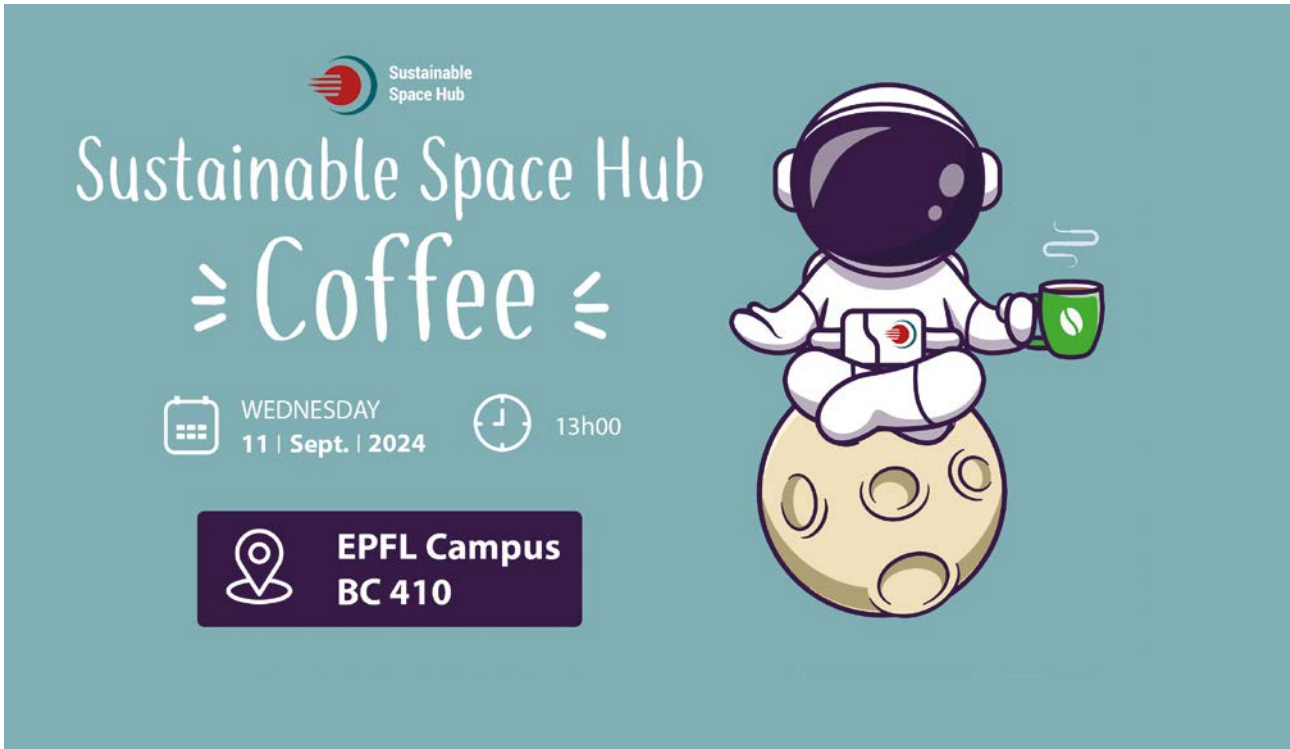
The Hub is connecting individual projects in a workflow that rests on three intertwined pillars: measure, understand, and act for space sustainability. From a first phase of mapping and consolidating existing projects, the Hub is now moving on to creating and pushing for new projects to tackle some of the identified knowledge gaps in space sustainability, and establish Switzerland as a leader in Europe, especially on questions of life cycle assessment of future space systems, ecodesign, atmospheric emissions in high altitude, and sustainability in

the cis-lunar space. Indeed, several research groups in Switzerland have projects and complementary competences that are linked to the wider topic of space sustainability.

This will be even more true with the Swiss Space Sustainability Research Days (SSSRD) taking place in Les Diablerets, Switzerland, in January 2025, at the instigation of the EPFL Space Center. This event extends the vision of the Hub, with a nation-wide scope to federate the activities around the topic, and to contribute to the long-term sustainability guidelines (LTS) of UNOOSA.

The **SSH coffee events** are a good example of how the Hub is a catalyst to bring researchers and students together: they all have different specialised domains but some connections and a better understanding of the global picture are found when meeting other people.

- **6 March** — The first edition focused on atmospheric impacts and sustainable lunar missions.
- **1 May** — Summary of the PhD that Alexandre Looten recently obtained at LPAC, on the atmospheric re-entry of composite materials and design for demise of spacecrafts.
- **11 September** — A short presentation from Niki Sajjad, a visiting PhD student who has spent one year at EPFL and whose research focused on the feasibility of using computer vision to estimate the 6D pose of very small satellites, such as PocketQubes, during conjunctions at distances greater than 1 km, rather than during proximity operations.
- **6 November** — EPFL Space Center staff have compiled the lessons learned from the events and conferences they attended in 2024, and produced a summary of international research to share with the EPFL community.



Ecodesign of space system (REACT, Volare and support to PEFCR)

Regarding the work done around life cycle assessment (LCA), the main project REACT, started in November 2023, saw great progress in 2024, meeting all its deadlines thanks to a well-functioning consortium. The EPFL Space Center is leading this large scale and ambitious project, with contributions from the Paul Scherrer Institute (PSI), Ateleris GmbH, University of Stuttgart, ISAE SUPAERO, and WaysEheads. This project has been the spark of many follow-up initiatives and has been key to catalyse the work done at European level on the topic of LCA of space systems. The expertise of the Space Center is recognized and requested for providing support to the European Commission Directorate-General for Defence Industry and Space (DG DEFIS) in the elaboration of the PEFCR4space (product environmental footprint category rule), participating in the Stuttgart Workshop on LCA of Space Transportation Systems, and joining the ESA ecodesign task force. EPFL was also involved in a feasibility study called Volare led by ArianeGroup for ESA. Study on a future European family of reusable launch systems encompassing human space transportation capability, based on common building block and reusability. The project was delivered on time and EPFL's contribution was appreciated by the other members of the consortium. The results of the joint work done at EPFL with the ecodesign team of ArianeGroup were presented during the CleanSpace Days 2024.

EPFL Handbook for Sustainable Space Mission Design

To further promote EPFL Space Center's leading position in the field of space sustainability, a handbook was developed, targeting managers and system engineers of space missions. The EPFL Handbook for Sustainable Space Mission Design provides an overview of the best practices to take all aspects of sustainability into account. Built on current guidelines, recommendations and EPFL expertise, this document includes topics such as life cycle assessment, ecodesign, space debris mitigation, and dark & quiet skies. First introduced at the ESA Clean Space Days 2024 at ESA ESTEC in the Netherlands, the Handbook has seen great interest by industry players and was discussed by the Swiss community during the Swiss Space Sustainability Days in January 2025. The handbook will be published with open access in 2025 after internal and external reviews. Further extensions of the handbook in the space and ground segment are considered and initial work is planned through student semester projects in 2025 and beyond.

Link to the handbook: indico.esa.int/event/516/contributions/10037/

BRIDGE (accurate ground-based and in-orbit tracking for space debris capture)

This project is a collaboration between CVLab, LASTRO, and the EPFL Space Center. In January 2024, a postdoc was hired to support the implementation of the project during its final phase. Throughout the year, contacts were established with several Swiss companies to transfer the expertise developed by the project to the Swiss space economy. CVLab will work together with software company Klypsedra on optimization and deployment of the computer vision techniques for 6D pose estimation that were developed in the BRIDGE project on space-grade hardware. The Space Center further initiated a collaboration between Uni Bern, CVLab, and the Swiss space situational awareness (SSA) company s2a-Systems and submitted a MARVIS proposal to continue developing cutting edge technologies in SSA. In addition, a repository for the satellite and space debris observations that are extracted from the VST astronomical data archive has been developed. The repository will contain the detections, information about whether a detection could be identified as a known space object, as well as a lightcurve (time series of brightness measurements) for all identified detections. The lightcurves represent the starting point of a more detailed physical characterization of the observed objects. Follow up projects to continue the data analysis and incorporate more astronomical data archives are in preparation.

Dark and Quiet Skies

As part of SKACH, the Swiss contribution to the Square Kilometer Array Observatory (SKAO), the Space Center supports efforts to protect astronomy from satellite interference. In 2024, the Center engaged in this initiative by joining the IAU Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference (CPS). Further, Prof. Kneib joined the UN COPUOS Group of Friends of the Dark and Quiet Sky for Science and Society (GoF) as a radio astronomy expert, and the Center started bringing together Swiss expertise in this field in order to prepare proposals at the national and European level. To raise awareness and further establish the network in the scientific community and economy, the Center participated in several conferences, such as the IAU General Assembly 2024 in Cape Town, the Swiss SKA Days in Geneva, and the Space Sustainability Conference in Hong Kong. At the Swiss Space Sustainability Research Days in Diablerets, the Center organized a panel discussion with the IAU CPS, the Swiss radio astronomy community, SSA data providers, and satellite constellation operators dedicated to the interference of large satellite constellations with radio astronomy.

The Space Sustainability Rating (SSR)

The SSR achieved significant milestones in 2024, marked by Eutelsat Group's OneWeb securing the prestigious platinum rating by exceeding the 80% threshold. This accomplishment demonstrates the Group's commitment to sustainable constellation design and operations. The first half of 2024 saw the technical and policy working group complete their initial findings and establish key technical priorities for SSR development. Focus shifted to business model optimization and core activities in the latter half of the year. Looking ahead to 2025, efforts will concentrate on developing the RATE-SPACE platform to streamline the rating process and enable direct company data input. Throughout 2024, the SSR maintained strong industry presence through key events, including The Economics and Law of Space-Based Commerce in Bern (January), BD- Bundesverband der Deutschen Industrie online presentation (February), Space Traffic Management of the International Academy of Astronautics Conference in Austin TX (February), Military Space Situational Awareness in London (April), and the Space Debris and Sustainability Conference in Hong Kong (December). These engagements strengthened SSR's position as a leading authority in space sustainability assessment. The successful implementation of these initiatives and growing industry participation underscore the SSR's vital role in promoting responsible space operations. The RATE-SPACE platform development represents a strategic step toward increasing accessibility and efficiency in space sustainability assessment, positioning the SSR for continued growth and impact in the space industry.

2.2 EPFL space profs

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The Space Center significantly expanded its engagement with Space Professors throughout 2024, organizing several high-impact information sessions. A key event in June 2024, coordinated with the Research Office, focused on ESA funding opportunities. ESA has committed 634M CHF to Switzerland from 2023-2025, representing a significant growth opportunity, as EPFL received over 1.6M CHF in ESA funding during 2020-2023. Additional sessions covered emerging areas including the ESDI Quantum Technology for Space research program and the Swiss Armed Forces' space capabilities development. To strengthen collaboration, the Center initiated regular lab visits and lunch meetings with Space Innovation in fall 2024. Notable achievements include securing Prof. Edoardo Charbon's (AQUA) participation in the Space Weather NCCR proposal. The Center maintained active communication through over twenty targeted emails sharing funding opportunities and industry developments. The successful review meeting featured valuable presentations from participating professors, highlighting the Center's role in fostering space research collaboration at EPFL.

2.3 Papers, articles and presentations

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Publications from eSpace can be found on espace.epfl.ch and infoscience.epfl.ch.

[Position Paper] M. Udriot, M. Verkammen, K. Treyer & J.-S. Fischer (approved by J.-P. Kneib & E. David), "REACT announcement of opportunity."

[Semester project] L. Flückiger, "STReAKS: synthetic streak rendering for satellite kinematics and surveillance."

[PhD thesis] A.-M. Rüede, "Connecting space logistics and architecture - a pattern language for robust mission design."

[Semester project] G. Mellinand, "ESG and CSR in Space."

[Master's thesis] A. Frolova, "A long time from now, in a galaxy far, far away: Remoteness of effects as a factor of sustainable space technologies' market acceptance."

[Semester project] M. Lemaire, R. Svoboda, "Technology roadmapping for a suborbital rocket with multidisciplinary design optimisation."

[Semester project] O. Pineda, "Space logistics optimization — Python software development — Interplanetary scenario infrastructure."

[Master's thesis] H. Besser, "Sustainable space logistics — Design of an on-orbit refuelling infrastructure."

[Guidelines] T. Turchetto, P. Guardabasso, M. Udriot & A. Saada, "Space Debris Mitigation Guidelines for Lunar Orbits."

[Master's thesis] T. Turchetto, "Sustainable missions to the Moon — Sustainability guidelines for lunar activities, a state-of-the-art."

[Position Paper] J.-S. Fischer, M. Udriot, K. Treyer, L. Schulz, G. J. Dominguez Calabuig, "Recommendations for the development of space systems life cycle assessment methodology for space transportation systems," Results of the *2nd Workshop on Life Cycle Assessment of Space Transportation Systems*.

[Conference paper] M. Verkammen, A. Frolova, A. Zecchin & L. Kuhlmann, "Streamlining life cycle assessment framework for space missions at early design stages: Insights from the CHESS Cubesat mission," *75th International Astronautical Congress (IAC)*, Milano, Italy.

[Conference paper] M. Verkammen, A. Wilson, E. Tormena, T. Turchetto & A. Saada, "Meta-study of current proposed life cycle assessment single-score methodologies for space missions' eco-design," *75th International Astronautical Congress (IAC)*, Milano, Italy.

[Conference paper] M. Udriot, K. Treyer, J.-S. Fischer, M. Verkammen, V. Girardin, E. Wolf, A. de Oliveira, A. Urbano & E. David, "Sustainability of end-to-end space transportation missions: Modelling technical and environmental aspects for early phases ecodesign decision support," *75th International Astronautical Congress (IAC)*, Milano, Italy.

[Conference paper] M. Udriot & E. David, "The assessment and comparison tool — Status and next steps for the simplified, space-specific, prospective LCA tool," *Cleanspace Industry Days 2024*.

[Conference paper] H. Besser, "Optimization of GEO satellites on-orbit refuelling for sustainable space logistics," *Cleanspace Industry Days 2024*.

[Conference paper] M. Verkammen & E. David, "EPFL's Handbook on sustainable practices for spacecraft mission design," *Cleanspace Industry Days 2024.*

[Conference paper] M. Udriot & B. Quelennec, "Screening life cycle assessment of families of future reusable launchers for early-stage ecodesign considerations in the Volare project," *Cleanspace Industry Days 2024*.

[Journal article] R. Tonasso, D. Tataru, H. Rauch, V. Pozsgay, T. Pfeiffer, E. Uythoven & D. Rodríguez-Martínez, "A lunar reconnaissance drone for cooperative exploration and high-resolution mapping of extreme locations," *Acta Astronautica, 218*, May 2024, pp. 1–17.

2.4 Research plans for 2025

For the year 2025, eSpace will continue to raise awareness in space sustainability by proposing to "Advance Swiss Space Sustainability Leadership Through International Forums", supporting the follow-up of the Swiss Space Sustainability Research Days competency mapping. In particular it will finish the project REACT. REACT runs until November 2025, with several key milestones —such as development of the tool, with tests done in parallel, demonstrations, and validation with ESA— are planned before that time. Two contract change notices to extend the perimeter of the project and enable more tests with industrial players are in discussion. The plans to continue on the development, but most importantly to start using and disseminating the Assessment and Comparison Tool, are being prepared and the team will work on a smooth transition so the path is clear before the end of the ESA funding.

Swiss Exploration, Education and Science Endeavor

The EPFL Space Center has established strategic collaborations with forward-looking organizations across various domains. The Center's partnership with Space Cities Network aims to develop sustainable urban technologies with space-derived innovations, while its work with CHEESE (Swiss [CH] Exploration, Education and Science Endeavor) focuses on advancing scientific exploration and educational initiatives through collaborative research programs. Following productive discussions with ESDI Quantum Space, EPFL is exploring quantum computing applications for complex scientific challenges, complemented by strengthening financial technology relations during the Unlimitrust visit.

Marnix Verkammen providing cookies, information and inspiration to young visitors

Panel discussion at Space, Science & Technology Day, 14 November 2024

3. COMMUNICATION AND OUTREACH

In its communication and outreach capacity, eSpace is responsible for promoting space-related activities that take place at EPFL. This includes organizing and promoting events, participating in meetings and conferences, creating and sharing news with the wider EPFL community, sharing opportunities with our space profs and student community, managing social media accounts, and liaising with the media.

3.1 Events

3.1.1 Events organised by eSpace

14 September 2024
CHASM 2024
EPFL has hosted the CHASM biennial conferences, which connects cutting edge analog researchers with the general public. Analogue space missions aims to replicate space missions at reduced costs and risks. They take place on Earth, underwater or even in zero-gravity flights. Their duration, equipment, protocols and crews vary considerably. CHASM exists to provide knowledge to the community as well as to the larger public as to what these missions are and what opportunities and research arise from them.

14 November 2024
Journée "Osez tous les métiers" (JOM)
On the occasion of JOM, the EPFL Space Center welcomed four 10 to 12 year-olds to its premises. They were able to meet Claude Nicollier and watch space physics demonstrations by engineer Marnix Verkammen.

14 November 2024
Space Science & Technology
We were honored to support the event held at the EPFL Rolex Learning Center Forum, in collaboration with Space Innovation and Mediacom. The event opened with an introduction by Martin Vetterli, president of EPFL, who reflected on the past twenty years of remarkable projects and research in the field of space at EPFL. The closing remarks by Pierre Dillenbourg, associate vice president for education, paid tribute to the many students present in the audience.

The panel discussions, expertly moderated by Chloé Carrière, were insightful and featured prominent figures in Swiss space exploration, research and industry, including Emmanuelle David, Claude Nicollier, Michel Mayor, Aude Pugin, Daniel Neuenschwander, and Thomas H. Zurbuchen.

A special thanks to the student space teams who showcased their impressive work during the event!

3.1.2 Seminar series

- 24 January – **USSF-MIT researchers present their work: AI technologies and simulation tools for SSA – Space sustainability and policy**
- 22 February – **Solar flare X-ray observations with a Cubesat**
- 19 March – **Integrating life cycle engineering of space systems into the concurrent design process**
- 25 April – **Setting the bar for the replacement of the probability of collision metric in conjunction assessment**
- 28 May – **Space-based solar power, the Moon and Switzerland – A case study**
- 5 June – **Product safety management in high-tech industry projects**
- 8 Oct. – **MOXIE: Mars oxygen ISRU experiment**

3.1.3 Events participated in by eSpace

- April – **The future of near-Earth space. Space debris and space sustainability**
- May – **New space forum exploring new space business opportunities and their environmental impact**
- May – **Symposium Research & Sustainability**
- May – **SG 2024, France**
- June – **Presentation with research office about ESA fundings for EPFL community**
- July – **Switzerland in Space: Navigating Security Threats and Opportunities**
- September – **Life Cycle Assessment of Space Transportation Systems Workshop**
- September – **ESA Business Incubation Centre Switzerland**
- October – **European Parliament's Panel for the Future of Science and Technology (STOA) on "The Future of Space – The Sustainable Path"**
- October – **Clean Space Days 2024**
- October – **IAC Milano**
- November – **Swiss Space Law Forum**
- November – **Swiss Logistics Innovation Day 2024**
- December – **Space Debris and Sustainability Conference in Hong Kong**

Clean Space Days 2024

The eSpace team engaged in crucial discussions on space sustainability at the largest Clean Space Days yet, with over 30 countries and 300 attendees.

Mathieu Udriot presented updates on the Assessment and Comparison Tool (ACT), sparking insightful discussions. He also presented and discussed the use of ACT for ecodesign in future European launchers, underlining its significance in early design stages.

Hannah Besser and Marnix Verkammen engaged attendees with their research during the poster sessions: Hannah presented her master thesis thesis on optimizing GEO satellite on-orbit refuelling for sustainabile space logistics, while Marnix presented the EPFL Handbook on sustainable practices for space missions design.

EPFL contributed to the Zero Debris Technical Booklet, translating sustainability goals into actionable developments.

International Astronautical Congress (IAC)

A delegation from EPFL Space Center participate in the 75th International Astronautical Congress (IAC) about “Responsible Space for Sustainability”. The event was marked by major announcements, lively panel discussions and incisive presentations. An inspirational gathering.

The IAC offers everyone the latest space information and developments in academia and industry, networking opportunities, contacts, and potential partnerships. As representatives of an institution at the cutting edge of innovation, and as a Center with a pedagogical vocation committed to federating space-related entities in Switzerland and Europe, it is essential for us to take part in this major space event. It enables us to exchange ideas, make progress and collaborate on projects and subjects of vital importance, and sheds new light on our domain.

Many Swiss students and young professionals were attending the congress, some for the first time. Special mention to Space Exchange Switzerland (SXS), the organisers of the Swiss Pavilion, who, with the support of the Swiss SGAC points of contact, provided grants to fifteen young people across Switzerland! The EPFL Space Center also supported eight students by providing them access to the event, as it is important to include them in these conferences and give them exposure.

Emmanuelle David signing ESA’s Joint Statement for a Responsible Space Sector at IAC 2024

3.2
Communication channels

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 2024.

Link to all media articles:
espace.epfl.ch/news-and-events/in-the-media/

05.04 La Liberté *Jeunes Gruériens parés au décollage*

09.04 RTS la 1ère | La Matinale *La plus grande carte en trois dimensions de l'univers jamais créée*

09.04 20 Minutes *L'EPFL explore les débuts de l'univers*

08.05 RTS 2 | Forum *Le grand débat – Exploration spatiale: les vols habités sont-ils vraiment utiles?*

23.12 LFM podcast | Ici c'est vous… [saison 1, épisode 4] *Découverte de la Rocket Team de l'EPFL*

27.07 Le Temps *Sur la «Lune», mais au coeur du Gothard*

22.08 Radio Chablais | Le Journal 12.00 *Claude Nicollier, la passion pour l'espace*

28.08 20 Minutes (web) *Satellite Starlink en feu « On n'a aucune garantie que tout brûle avant d'arriver au sol »*

02.09 La Regione *Claude Nicollier, 80 anni nello spazio*

24.09 RTS | Couleurs Locales *Entretien avec Julie Böhning, cofondatrice Gruyère Space Program*

27.09 24 Heures *Première mondiale à Payerne: Le Gruyère Space Program aussi fort que SpaceX*

27.09 Swissinfo.ch *Swiss students drive rocket research forward*

17.10 24 Heures *Claude Nicollier « Je crois avoir fait une différence »*

18.10 RTS | L'info *Le « Gruyère Space Program » a réussi une première européenne à Payerne*

04.12 HQ Magazine *Space Cities Network: Emmanuelle David on Driving Sustainability in Space*

06.12 RTS la1ère *La science souffre de la prolifération des satellites*

20.12 RTS 1 | Le Journal 19h30 *Claude Nicollier et Marco Sieber réunis à Lausanne*

13.12 Blick *«Wir werden eine industrielle Revolution im All erleben» Weltraumforscher Oliver Ullrich sieht exorbitantes Wirtschaftspotenzial*

16.12 HBradio *Er fliegt und fliegt… SwissCube seit 15 Jahren im All*

16.12 Lausanne Cités *Quand Lausanne forme les futurs leaders du spatial*

3.2.2 News articles

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

- 9 December – **IAC 2024: the largest space-related event of the year**
- 9 December – **ESDI event brings together quantum and space at EPFL**
- 9 December – **Twinkle, Twinkle Little Satellite**
- 13 November – **Clean Space Days 2024: The place to discuss space sustainability**
- 23 September – **Swiss Space Science Cubed**
- 23 April – **Release of a white paper to give feedback to ESA**

3.2.3 Newsletter

The 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. It is sent out on average every two months. Newletter archive.

3.2.4 Social media

eSpace has a presence on multiple social media channels: LinkedIn, Instagram, YouTube and Facebook. 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. The year 2024 saw an increase in followers for all social media channels, except X.

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 2024, the number of followers increased 20%, from 3,098 to 3,729.

Instagram: eSpace's Instagram account is used for promoting eSpace events and activities 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 2024, the number of followers increased 11.5%, from 1,403 to 1,565.

X: eSpace's X account was used to share eSpace news and events, as well as events that are of interest to our community. The eSpace X account having mediocre engagement, it was decided to close it in 2024.

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

“The Swiss network for space innovators”

The year 2024 was marked by the consolidation of Space Innovation within the EPFL Space Center and the review of the terms of reference, with the collaboration of the Steering Committee.

The team was very active to help its members individually on specific proposals and connecting people, be it businesses or students with members, underlining the usefulness of the Space Innovation network.

Objectives

Space Innovation enhances and connects a network of entities active in the space domain, with the goal of fostering Swiss space innovation, research and technology, education and outreach.

Its mission is to:
- strengthen the members’ space-related activities,
- offer opportunities to involve new players and new technologies.

Its core capabilities are:
- an established network in Switzerland,
- a strong link between industries, research and technology organizations and academia,
- sustainable national and international connections,
- access to heritage and cutting-edge technologies and expertise.

Its objectives are:
- to harness a strong network and ecosystem,
- to be heedful of its members’ needs,
- to foster and support innovative projects with the members and external partners,
- to represent its members nationally and internationally.

Terms of reference

A review of the terms of reference became necessary as the latest version (Issue 8/0) dated back to March 2020 at a time when Space Innovation was called Swiss Space Center and was no longer aligned with the reality of the Space Innovation unit.

The process also depended upon the transfer of Space Innovation to EPFL Space Center in 2022 and the evaluation and renewal of the Center's mandate in 2024.

The new terms were set up in collaboration with the Steering Committee, the EPFL Vice Presidency for Center and Platforms, and the EPFL Legal Office and shall be ratified in 2025.

Steering Committee

In 2024, the Steering Committee was made up of the following people:

- **Emmanuelle David**, EPFL representative and chair
- **Marcel Egli**, Hochschule Luzern, academic representative
- **Gerrit Kuhlmann**, EMPA, RTO representative
- **Fabrice Rothmeier** (Almatech), **Erik Uythoven** (APCO) & **Bruno Zemp** (Schurter), industry representatives

The EPFL core staff was invited to partake in every meeting.

Space Innovation thanks the Steering Committee for their guidance and dedication. New elections will be held in 2025.


VENTURI LAB
THE COUNTDOWN COMPANY
Swissto12
TSS Innovations Projekte GmbH
Viasat
SpacePNT+
spacetalk
ThalesAlenia Space
WISeSat
Hes·so
HSLU Hochschule Luzern
unine
SOLENIX
GENERAL ATOMICS SYNOPTA
n|w University of Applied Sciences Northwestern Switzerland School of Engineering
SAPHYRION communication technologies
SCHURTER ELECTRONIC COMPONENTS
EPFL
csem
SAAB
SAFRAN
OST Ostschweizer Fachhochschule
CERN
Empa Materials Science and Technology
mps MICROSYSTEMS
pmod wrc
Menhir Photonics
micos Optical Systems for Space and Industry
Schweizerische Eidgenossenschaft Confédération suisse Confederazione Svizzera Confederaziun svizra
Swiss Armed Forces
Lumartix SA
MEGGiTT smart engineering for extreme environments
KISTLER measure. analyze. innovate.
9T LABS
aerospacelab
almatech
INVOLI
KLEPSYDRA
APCO TECHNOLOGIES
astrocast
Freeze
ExoLabs
CLEMESSY
DPHI SPACE
COMPPAIR
CYSEC
clearspace today
beyond gravity

4.
SPACE INNOVATION NETWORK

4.1
Space Innovation members

As of December 2024, the Space Innovation industrial network has 44 members, consisting of six academic institutions, four research and technology organisations (RTOs), and 34 industrial companies. The network remains predominantly focused on upstream activities. Nevertheless, there is a growing momentum in the Swiss ecosystem toward downstream applications, driven by the emergence of new companies aiming to address industry-specific needs through space-enabled services.

The space sector continues to evolve rapidly, with increasing financial pressure requiring companies to focus on commercially viable projects. In this context, ESA is actively promoting its role as a facilitator, aiming to better connect technology providers with end-users rather than acting as the sole customer.

To follow this market evolution, Space Innovation has revised its Terms of Reference to allow all actors of the global space value chain, from upstream enablers to downstream users, to join the network. This update is intended to enhance industry matchmaking and foster cross-sectoral collaboration within the Swiss space ecosystem.

In 2024, the Space Innovation network welcomed the following new members:

- **DPhi Space** — Designs, builds, and launches ridesharing platforms enabling fast and affordable deployment of hardware and software in orbit — unlocking access to space for previously unfeasible missions.
- **Lumartix** — A leader in plasma lighting systems that fully replicate the solar spectrum, used in agronomy to boost plant biomass and nutritional value, and in material testing for solar and UV durability applications.
- **The Countdown Company** — Provides end-to-end engineering and manufacturing services for industrial and aerospace sectors, covering feasibility studies, mechanical design, and the development of test benches and special tooling.

4.2
Services to members

In 2024, the Space Innovation team actively supported its members through a broad and personalized range of services. The Space Innovation staff performed over thirty visits. These included direct opportunity sharing, targeted conference reporting, access to test facilities, communication of members' profiles to strategic partners, and consistent outreach to the network. The intensity and variety of these engagements made 2024 a particularly active year, underlining the team's ongoing commitment to deliver operational value and tailored support to each member.

Space Innovation helped students across Switzerland facilitate:
- funding to go to IAC;
- projects in relation to businesses;
- internships and placements within Swiss businesses.

For ESA projects, Space Innovation supported members with:
- ESA proposals;
- ESA-Star administration;
- ESA-P invoicing;
- Connections with ESA collaborators;
- Coordination and administrative set-up of five call-off-orders for the ESA Frame Contract.

Amongst international collaborations and partners, Space Innovation:
- provided support to Swissnex India to promote partnerships between Swiss and Indian companies;
- helped UK embassy to promote free-trade between Switzerland and the UK;
- in general, maintained tight collaboration with other global entities such as Space Exchange Switzerland, the Swiss Space Industry Group of Swissmem, the SERI/ Swiss Space Office, Swissnex and various embassies to help promote space for Switzerland;
- is organising the European Space Mechanisms and Tribology Symposium in collaboration with CSEM, Almatech and the European Space Agency which will be held from 24 to 26 September 2025.

In the frame of Swiss funding schemes, Space Innovation helped consortiums:
- NCCR proposals;
- Marvis proposals.

Space Innovation operated the thermal vacuum chamber to test devices and for bake-outs, in total:
- 330 hours since January 2024;
- 5 projects.

Space Innovation hosted members in the cleanroom to enable them to assemble for space missions.

Space Innovation updated the test facilities database across Switzerland and beyond in 2024, under the lead of Gilles Feusier through an extended survey, and spotted the facilities that are most needed. The list contains:
- 50 test equipment
- More than 400 potential test equipment identified (classified by types)
- More than 300 laboratories (worldwide, 130 in Switzerland, 133 in EU)

The document is not public. Members are invited to address requests directly to Gilles Feusier.

5. PROJECTS

ESMATS 2025

Gilles Feusier has the lead in collaboration with CSEM and Almatech. We are also honoured to have APCO and Beyond Gravity as sponsors.

NCCR Space Weather

The proposal was led by Prof. Lucia Kleint of University of Bern, and included a substantial consortium, amongst which were ETH Zürich, PMOD-WRC, and FHNW. Martine Harmel was asked to collaborate on the Space Weather Hub for national and international collaborations. She set up interviews with stakeholders such as NOAA, MeteoSwiss, the Danger Prevention Office of the Confederation and requested support letters. EPFL finally accepted to be co-PI through Prof. Edouardo Charbon, Head of the Advanced Quantum Architecture Lab.

Eagle Nebula Results

In 2022, Space Innovation initiated a call for ideas to identify and demonstrate disruptive space innovations based on ideas and concepts. This call was open to consortia of members (at least two members per proposed idea) of the Space Innovation network. The best idea, compliant with the rules of the call, was awarded a funding of 50kCHF. Space Innovation received 20 proposals that were evaluated. Many highly relevant proposals were received, however, due to the limited available funding, the evaluation board selected the proposal made by the consortium composed of Saphyrion Sàgl and Thales Alenia Space Switzerland Ltd, entitled “Photonic Assemblies in TX/RX Integration for Challenges in Inter Satellite Access (PATRICIA)” for funding. The activity was started in 2023 and completed in 2024.

MOOC

Since its launch in February 2016, the EPFL Space Center’s MOOC “Space Mission Design and Operations” – A Journey of Knowledge”, taught by astronaut Claude Nicollier, has been followed by over 38,000 students from all over the world. More than 2,000 of them have completed the exams and earned their certification.

The latest updated edition, released in 2021, is now available without moderation (no responses to questions) and with no fixed end date, offering flexibility for anyone who wants to take the course at their own pace. Registration is free of charge.

This is a remarkable achievement, and we are proud to have been part of this project. A huge congratulations to all the students who have participated so far and to those who will join in the future.

6. COMMUNICATION AND OUTREACH

Space Innovation remained active in the following communication and outreach activities.

Martine Harmel collaborated with HSLU in view of preparing a roadmap for the deployment of a possible ESERO call for Switzerland. The Confederation seems to have postponed the call for the moment.

Space Innovation tried to find a host for a future national Cansat competition. This led to discussions amongst several academic members.

6.1 Events

6.1.1 Events involvement

26 February – 3 March 2024
MINT Vaud

Yannick Delessert and Martine Harmel participated extensively, along with the Swiss Space Exchange (SXS), ETH Zürich and the University of Zürich. The stand consisted of several activities around space: a virtual visit of the ISS, an Earth observation puzzle and pictures, and a topographic sandbox. From Monday to Friday, the stand received visitors from many different schools and classes representing over 1,100 children aged 10 to 12. Saturday and Sunday were also very busy with children and their families. Some children were so enthusiastic that they returned to show their parents.

Shared stand of the Space Exchange Switzerland and EPFL Space Center

3 March 2024
TecDay

The TecDay in Payerne was the last of a long series of TecDays, and Yannick Delessert's final TecDay with Space Innovation. We would like to take this opportunity to thank Yannick for setting up the module in 2014, and organizing and participating in a total of 56 TecDays since. His dedication was key to bringing space notions to over 4,050 students across Switzerland: Zofingen, Locarno, Porrentruy, Bellinzona, Aarau, Sion, Geneva, and more.

There were two different topics to the modules: "Space debris" and "Back to the Moon and beyond", each time using drones to simulate either grabbing debris in orbit around the earth or returning to the moon. Drones and space have always been a very attractive topic for journalists, thus ensuring regular media coverage, and a great media coverage.

On average, the organization of a TecDay requires three days. This takes into account coordination with SATW, checking the drones and their batteries, driving up to the location and back down. For Space Innovation, a TecDay represents an expense of about 3,000 CHF if we consider staff, material and transportation and is only possible if membership contributions are sufficient.

Yannick's contribution went far beyond the above as he would come back each and every time with cramps in his hamstrings for several days following a TecDay!

10 May 2024
Rotary Club Lausanne

The Rotary Club of Lausanne came to visit the EPFL Space Center and learn more about how space technologies are present in their daily lives with a presentation by Martine Harmel. The group consisted of about thirty people from all local industrial realms: banks, transportation, architecture, health energy. Mathieu Udriot made a presentation on space sustainability. They then visited the EPFL Rocket Team.

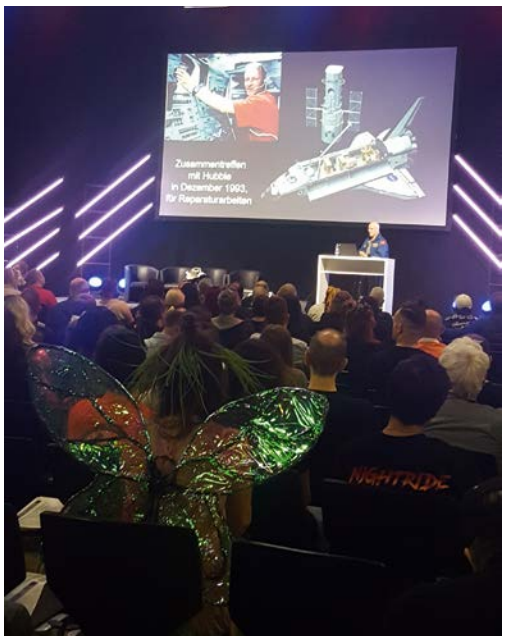
Martine Harmel and Rayane Maalouf, from EPFL's Rocket Team, present the lab to members of the Rotary Club

Yannick Delessert at TecDay in Payerne

9–11 May 2024

Fantasy Basel, the Space to be!

In 2024, 88,000 people visited Fantasy Basel – the Swiss Comic Con –, which is an ideal outreach opportunity for REAL space to promote activities. Organized by the Swiss Space Museum, the space exhibition area with more than 1,000 m² featured experiments, artifacts, fantastic large-scale models, technology demonstrations and much more. Here the visitors met experts from science and technology and experienced exciting talks and panels on the Space Stage. Claude Nicollier, once again gave an exciting presentation attended by an audience of galactic warriors and fairies.



Fantasy Basel 2024, © Guido Schwarz, Swiss Space Museum

12 June 2024

Reaching out to Kenya

Through Logitech and EPFL, Martine Harmel was given the opportunity to present outreach activities to Nelly Cheboi, winner of the 2022 CNN Hero award and founder of TechLit Africa, an organization that teaches digital skills in rural primary schools. She was visiting Logitech on the EPFL Innovation Park to launch the video “Women Who Master”.

Martine gave Nelly and Leddy the opportunity to visit Claude Nicollier in his office at EPFL. Leddy wants to become an astronaut!

Claude Nicollier, Leddy Bianca and Nelly Cheboi in the EPFL Space Center lab, surrounded by EPFL Rocket Team rockets

13 November 2024

ESMATS roundtable

Space Innovation’s Interest Group for High Precision Space Mechanisms and Instruments hosted its much-anticipated roundtable event, bringing together top experts in the space sector for an insightful day of knowledge-sharing and networking. The event took place at the Lucerne University of Applied Sciences and Arts (HSLU), where attendees were treated to an informative tour of the campus, followed by engaging sessions and keynote presentations.

16 November 2024
Elargis tes Horizons

Space Innovation had the chance to take part in “Elargis tes Horizons” at UniMail in Geneva, which is dedicated to offering experiences in mathematics, computer science, natural sciences and technology (MINT) to young girls. The stand offered a tour of the International Space Station, using a virtual reality headset. Using a computer, the girls explored the satellite’s facilities and learned more about space.

We were well accompanied! There were some really interesting stands and workshops on offer from a host of institutions, associations and companies.

The sciences will be in good hands in the years to come: the new generation of women has shown itself to be enthusiastic, brilliant, a team player and eager to learn.

Martine Harmel helps young girls navigate the ISS with an interactive and immersive tour, during the “Elargis tes Horizons” event

6.1.2 Seminars and conferences attendance

Conferences and seminars are key to creating new collaborations for the members and staying at the cutting-edge of funding possibilities and technology. In 2024, Space Innovation attended six conferences:

- March — **EPFL Engineering Industry Day “Roundtable on Quantum for Space”** was an opportunity for ESDI to promote their future calls.
- May — Gilles Feusier attends the **Aerospace Mechanism Symposium (USA)** and promotes the future European Space Mechanism and Tribology Symposium that will be in 2025
- May — Martine Harmel attends the **Sounding Rocket and Balloon Symposium** in Lucerne organized by HSLU. Apart from Kistler that had a nice stand with interesting items, and the Swiss academic rocket teams, Switzerland could have been more present, and we have the impression that Swiss companies missed the opportunity to connect with foreign entities.
- June — Visit of the **China National Space Administration** with the presence of interested members in search of business opportunities
- June — Space Innovation helped **Swissnex** to promote a webinar on possible collaborations with businesses in India. A few members went to India in June.
- October — Martine Harmel and Christian Cardinaux went to the **ESA Industry Days** held at ESTEC. The two days were filled with fruitful exchanges with international partners, companies and conferences held by the different ESA Directorates.

6.1.3 Annual meeting at EMPA

The visit of EMPA during the last annual meeting on 6 February 2024 was an opportunity for members meeting in a different environment, and for EMPA to promote its space activities. We warmly thank EMPA for having hosted the event.

Space Innovation is willing to organize similar events in the premises of its members and remains open to suggestions.

6.2
Communications channels

6.2.1 News articles

Space Innovation publishes articles on its website to share activities and news with the wider EPFL community.

- 20 November – Roundtable on Space Mechanisms and Instruments
- 18 November – ClearSpace will use Minority Report technology from EPFL
- 25 September – SwissCube completes fifteen years of mission!
- 11 June – Beyond Gravity is hiring

Keep up to date with our news here: space-innovation.ch/about-us/news/

6.2.2 Newsletter

The newsletter presents Space Innovation's activities and events, along with interesting news from the wider field of space, to an audience of stakeholders in Switzerland and internationally, along with EPFL researchers and students. It is sent out on average every two months.

In addition to the newsletters aimed at a wide audience, Space Innovation regularly sends emails to its members to inform them about specific opportunities and events.

6.2.3 Social media

Space Innovation has a presence on multiple social media channels: LinkedIn, Instagram, YouTube and Facebook. These platforms are a key channel in Space Innovation's communication, particularly for promoting larger events, sharing Space Innovation's efforts and involvement in several projects, and sharing important information about its members. The year 2024 saw an increase in followers for all social media channels, except X.

LinkedIn: Space Innovation's LinkedIn channel is used to share news, as well as events of interest to our community and relevant posts from our members. The Space Innovation LinkedIn account has high engagement, in particular with members from the space industry, government, and the EPFL community. In 2024, the number of followers increased 8.6% from 6,714 to 7,291.

Instagram: Space Innovation's Instagram account is used for promoting events as well as engaging with the community by posting videos and photos from our activities and team, promoting our members. In 2024, the number of followers increased 5.5%, from 1,482 to 1,564.

X: Space Innovation's X account was used to share news and events that are of interest to our community. This account having mediocre engagement, it was decided to close it in 2024.

Facebook: Space Innovation also has a Facebook page, which has less value with our target audience.

YouTube: Space Innovation also has a YouTube page to share videos from projects as well as other informational videos from the unit.

EPFL SPACE CENTER LOOKING AHEAD

The EPFL Space Center looks toward 2025 with strong confidence and clear vision. The completion of the Center's strategic review will enable us to unify eSpace and Space Innovation under consolidated leadership, creating a more cohesive and impactful organization.

Our strategic priorities for 2025 are sharply focused:

- Maintaining EPFL's Minor in Space Technologies as the premier educational program in its field
- Supporting student initiatives to launch rockets and satellites with cutting-edge standards and technologies
- Establishing an innovative space innovation program that bridges academic research with industry applications
- Securing crucial funding for pioneering research in lunar sustainability and understanding the environmental impact of space activities

The upcoming ESA Ministerial Conference and the launch of the new ETH Board strategy cycle create significant opportunities to apply EPFL's research capabilities and increase our global impact. We are strategically positioned to leverage these opportunities and contribute to Switzerland's leadership in space innovation.

The Center remains deeply committed to societal impact through our diverse outreach initiatives. These efforts will continue to inspire the next generation of space scientists and engineers while effectively transferring valuable knowledge to Swiss citizens, reinforcing our role as a cornerstone of Switzerland's space ecosystem.

Through these coordinated efforts, we are not merely preparing for the future—we are actively shaping it.

Strategic objectives 2025–2028

Objective 1

Offer cutting edge space education

→ Promote EPFL Space Education minor and Make projects.
→ Develop one course for continuing education of space system engineering.
→ Develop with ETH Zurich the space tech masters, especially leveraging experience and existing courses from the minor.

Objective 2

Enable future discoveries & tech transfer

→ Develop a Space Innovation program with funding.
→ Maintain and increase the network of members.
→ Strengthen continuous research and further develop the long-term research strategy by supporting at least one large proposal.
→ Enhance access to ESA fundings.

Objective 3

Maintain and develop space sustainability leadership

→ Strengthen the Sustainable Space Hub by continuing current eSpace project on the topic and also including future and emerging aspects such as satellite mega constellations and increasing lunar and interplanetary space activities. Some in collaboration with EPFL labs, especially on the topics of sustainable lunar activities, and atmospheric impacts of the space sector.
→ Develop student competence groups with coordinated semester and master projects.
→ (Co-)organise an event with the other sustainibility hubs at EPFL.
→ Inform and collaborate with international institutions based in Switzerland and to Swiss policy-makers, especially regarding the upcoming Swiss Space Law.
→ Strengthen the Sustainable Space Hub by continuing current eSpace project on the topic and also including future and emerging aspects such as satellite mega constellations and increasing lunar and interplanetary space activities. Some in collaboration with EPFL labs, especially on the topics of sustainable lunar activities, and atmospheric impacts of the space sector.

Objective 4

Engage with the public, media and policy makers

→ Organise two major space conferences and one minor workshop per year.
→ Increase media presence.
→ Engage with the public- participate to two MINT activities per year
→ Represent EPFL in international forums (IAF, SCN).
→ Develop project with general public (one event per year and content creation).

THANK YOU!

Thank you to everyone who helped us make 2024 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	aqua.epfl.ch
LASPE	Advanced Semiconductors for Photonics and Electronics Lab	laspe.epfl.ch
LASTRO	Astrophysics Laboratory	lastro.epfl.ch
BIOROB	Biorobotics Laboratory	biorob.epfl.ch
CCLAB	Composite Construction Laboratory	cclab.epfl.ch
MCSS	Computational Mathematics and Simulation Science	mcss.epfl.ch
LSMS	Computational Solid Mechanics Laboratory	lsms.epfl.ch
CVLAB	Computer Vision Lab	cvlab.epfl.ch
CHILI	Computer-Human Interation Lab for Learning and Instruction	chili.epfl.ch
EPSL	Earth and Planetary Science Laboratory	epsl.epfl.ch
EMC	Electromagnetic Compatibility Laboratory	emc.epfl.ch
ESL	Embedded Systems Laboratory	esl.epfl.ch
ECEO	Environmental Computational Science and Earth Observation Lab	eceo.epfl.ch
EERL	Extreme Environments Research Laboratory	eerl.epfl.ch
FlexLab	Flexible Structures Laboratory	flexlab.epfl.ch
TOPO	Geodetic Engineering Laboratory	topo.epfl.ch
ICT4SMG	ICT for Sustainable Manufacturing Group	ict4sm.epfl.ch
IIG	Immersive Interaction Research Group	iig.epfl.ch
LSI	Integrated Systems Lab	lsi.epfl.ch
LAMD	Laboratory for Applied Mechanical Design	lamd.epfl.ch
LARA	Laboratory for Automated Reasoning and Analysis	lara.epfl.ch
GalSpec	Laboratory for Galaxy Evolution and Spectral Modelling	lara.epfl.ch
LPAC	Laboratory for Processing of Advanced Composite	lpac.epfl.ch
LIS	Laboratory of Intelligent Systems	lis.epfl.ch
LMM	Laboratory of Mechanical Metallurgy	lmm.epfl.ch
LPI	Laboratory of Photonics and Interfaces	lpi.epfl.ch
K-Lab	Laboratory of Photonics and Quantum Measurements	k-lab.epfl.ch
LRESE	Laboratory of Renewable Energy Science and Engineering	lrese.epfl.ch
LMTM	Laboratory of Thermomechanical Metallurgy	lmtm.epfl.ch
MAG	Microwaves and Antennas Group	mag.epfl.ch
LCM	Mobile Communications Laboratory	lcm.epfl.ch
MMSPG	Multimedia Signal Processing Group	mmspg.epfl.ch
NAM	Nanophotonoics & Metrology Laboratory	nam.epfl.ch
PHOSL	Photonic Systems Laboratory	phosl.epfl.ch
PVLAB	Photovoltaics and Thin Film Electronics Laboratory	pvlab.epfl.ch
APHYS	Physics of Aquatic Systems Laboratory	aphys.epfl.ch
PowerLab	Power and Wide-Band Gap Electronics Research Lab	powerlab.epfl.ch
PEL	Power Electronics Laboratory	pel.epfl.ch
RFIC	Radio Frequency Integrated Circuits Laboratory	rfic.epfl.ch
RGL	Realistic Graphics Lab	rgl.epfl.ch
RRL	Reconfigurable Robotics Laboratory	rrl.epfl.ch
SPC	Swiss Plasma Center	spc.epfl.ch
TCL	Telecommunications Laboratory	tcl.epfl.ch
TIC	Tribology and Interfacial Chemistry	tic.epfl.ch
VITA	Visual Intelligence for Transportation	vita.epfl.ch

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