



Strategic Plan – Xplore Research

(EPFL Xplore)

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September 23, 2025

Abstract

EPFL Xplore introduced Xplore Research (XRE) in September 2023 to enhance the research capabilities of its students, by providing a structured platform for more advanced projects not necessarily related to the European Rover Challenge (ERC) and the Rover EPFL Xplore is building each year.

This document first synthesizes XRE's achievements and highlights the challenges it faced. In a second time, it outlines strategic objectives for the next two years by presenting a strategic plan for XRE, centered around "Call for Proposal", a concept where students will propose their own space robotics related projects that could be built at EPFL.

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1 Introduction

EPFL Xplore started in 2020 with the objective to compete in the European Rover Challenge (ERC), a competition held in Poland each year where Martian-like Rovers compete in different tasks. With five qualifications, EPFL Xplore has gained a huge hands-on experience for building Rovers, capable of navigating, manipulating objects using its robotic arm, and drilling in the sand - and the overall autonomously.

Even if the competition tries to bring updates each year, increasing the complexity of the Rover is not necessarily needed, and more advanced solutions on the Rover become less crucial. To keep students in the association, EPFL Xplore introduced a Research pole, called Xplore Research (XRE), with more advanced projects, leaving students - most often enrolled in master's programs - explore cutting-edge topics and develop proof-of-concept prototypes. In just two years, XRE presented three incredible projects. The first one called **Wall-E** came from the idea that we could reuse obsolete 3D-printed parts to create new filament. We built a full recycling mechanism and we have been able to print again from this recycled filament. The second ambitious project was to design a complete custom **Legged Robot**, from hardware to software. In addition to that, XRE created an AI division to help the ERC pole to create efficient AI solutions for the different autonomous tasks of the competition.

These successes demonstrated XRE's potential impact, but also revealed challenges: project continuity across cohorts, strategic alignment, and governance. The previous projects were introduced by students with no real long-term vision for the research pole. Finding people who want to continue the work of previous ones is not an easy task, especially in an engineering school where every student has its own idea. XRE must adopt a long-term research vision to provide a more stable platform for the development of new projects. Concerning AI division, many projects were developed under semester projects at EPFL, and lacked integration inside the Rover. The main reason we found was that AI division in the XRE pole was developing projects for the ERC pole, leading to timeline issues.

Starting from September 2025, EPFL Xplore will restructure the XRE pole in the following ways:

1. The AI division of XRE will move to the ERC pole.
2. XRE will give students the opportunity to start their own projects in the association with a closer look at space robotics.

2 Strategic Objectives

The strategic objectives for XRE will be expressed in two terms: **Space Robotics** and **Call for Proposal (CFP)**. XRE will focus on developing technologies related to space robotics. Keeping a steady, long-term vision will help XRE stay focused on meaningful goals rather than chase every new idea that comes along. This approach also gives students the freedom to prototype, test, and refine their solutions properly, strengthening both the technical results and the transferable skills. Sponsors and faculty will respond better to well-planned initiatives than to ad hoc efforts, so a

consistent strategy helps secure steady support. In the end, projects that grow gradually under a shared vision lead to deeper learning, higher quality results, and a stronger foundation for future work.

In addition, space robotics is a perfect vision for the following reasons:

1. **Resurgence of a New Space Race:** countries and private companies are racing back to the Moon and Mars, making space robotics more important than ever.
2. **High Interdisciplinary Scope:** space robotics contains robotics, AI, computer vision, power systems and communications, giving students a chance to collaborate across specialties and build a well-rounded skill set.
3. **Real-World, Impactful Applications:** whether it's planetary exploration, debris removal, or orbital habitat maintenance, space robotic systems address high-stakes and socially-relevant problems.

The idea behind the CFPs is to leave students the choice of starting projects related to space robotics. XRE does not want to impose projects but rather leave students in a process of thinking and developing their own ideas. Students will be allowed to make these projects work as potential semester projects, but this will not be a requirement. We expect some group of students just interested creating something new. Projects could last more than a year, leaving students mix semesters with and without semester projects, but still working on the overall projects.

In addition to this CFP aspect, EPFL Xplore and XRE will each semester publish a list of semester projects directly on our Website for XRE. These projects will not be related to the ERC pole and its Rover. They will follow the vision of the research pole.

3 Call for Proposal

The CFP will be separated into three different phases. The first important step is the **Initial Proposal**, where any group of students can fill and submit a form provided by XRE to propose a project. The form initiates the process of on boarding in the association by proposing a research project related to space robotics. The first phase is followed by an **Examination** phase, where XRE will analyse and dig into the project proposals. At the end of this process, XRE will start the **Presentation** phase, asking groups of students to pitch their project. After all presentations, and depending on the number of projects proposed with the budget allocated to XRE, the final decision of which projects will be financed and welcomed to XRE will be revealed.

3.1 Requirements

XRE will impose students to propose their projects by filling a specific document available on our Website. The projects will have to (i) be **open-source**, (ii) address **real-world engineering challenges**, and (iii) demonstrate **awareness of current developments** in industry and relevant organizations.

Even if XRE is not strictly reserved for master students, the level of complexity and knowledge

we require tend to target these students.

3.1.1 Initial Proposal

During the Initial Proposals phase, any group of students can submit a project via the standardized XRE proposal form. Each submission will include: (i) a concise abstract of the project and a full presentation of team members, (ii) technical objectives and expected deliverables, (iii) a preliminary work plan and timeline, and (iv) an estimated resource and budget breakdown. Proposers are encouraged to demonstrate how their idea advances space robotics research and leverages interdisciplinary methods. Submissions will open in September and close after a four-week window, ensuring ample time for ideation while keeping the timeline on track.

3.1.2 Examination

Once the submission period ends, XRE will conduct a thorough technical review of each proposal. Reviewers assess feasibility, scientific merit, alignment with space robotics themes, and resource requirements. Then each team is invited to a meeting to clarify technical details and refine the goals. Based on these evaluations, proposals are reevaluated.

3.1.3 Presentation

Teams will prepare a 10-minute pitch followed by a Q&A. Presentations should include detailed diagrams of the system architecture, risk mitigation strategies, and outreach plans to demonstrate results. XRE will invite faculty advisors and industry sponsors that could provide real-time feedback. XRE wants to prepare students to pitch their projects, really important when launching a start-up.

3.2 CFP Submission Requirements

The CFP is designed to collect comprehensive, high-quality proposals. Each team must complete and submit a form with the following elements.

3.2.1 Project Abstract & Team Members

- **Title:** A concise, descriptive name (max. 15 words).
- **Abstract:** 1000-2000 words summarizing the problem statement, innovation, and expected impact in space robotics.
- **Presentation:** The different members of the team have to provide a CV with their previous experiences (EPFL and outside).

3.2.2 Technical Objectives & Expected Deliverables

XRE wants to tackle real engineering problems where the solution is not directly under the nose of the students. Teams need to incorporate major details about the project (related projects, for example). In the end, we require the following:

- **Objectives:** List 3–5 clear technical goals.

- **Deliverables:** For each objective, specify the concrete outcome (e.g., prototype hardware module, software simulation, etc). They have to be enough detailed to have an idea of feasibility.

XRE wants students to think beyond their projects: is it maintainable, what improvements could be made afterward, where it could lead (in a bigger project), etc. These questions would highlight the ability of students to scale and understand the limitations of their projects.

3.2.3 Preliminary Work Plan & Timeline

An important objective is to let students develop their own and precise timeline. It is mandatory to fix objectives and milestones during the project to (i) not lose the direction of the project, and also to (ii) acquire a management experience, very important in industry and research.

- **Chart:** Semester-by-semester breakdown with at least four milestones (e.g., Preliminary Design Review, Prototype Fabrication, Integration Test, Final Demonstration).
- **Milestone Descriptions:** For each, a detailed description is required.

3.2.4 Estimated Resource & Budget Breakdown

Each academic year, EPFL Xplore allocates a budget to its various poles based on several factors, including sponsorships. XRE uses this budget to support approved projects. To be eligible for funding, each project must submit a detailed budget description that outlines all required materials and associated costs.

While XRE will cover the expenses of selected projects, we also ask students to include a list of companies that might be interested in collaborating with us or supporting the initiative.

- **Itemized Budget:** Line-by-line costs (materials, components, tooling, subcontracting) with unit prices and quantities.
- **Resource Needs:** Lab space, equipment, software licenses, and any required training or external services.
- **External Partnerships:** List up to three potential industry or academic collaborators, with current contact status.

4 AI Division

The AI division developed multiple projects during these past two years. Path Planning for a Rover and Human Recognition are two examples of projects developed at XRE in the AI division, very useful for the ERC pole. Still, none of them have been integrated into the Rover as explained earlier in the document.

By moving the division into the ERC pole we expect a better phase of integration. As for the other Subsystem teams for the Rover, semester projects will be available each semester for the AI division.

5 Conclusion

Over the past two years, EPFL Xplore and its research pole has demonstrated its ability to tackle cutting-edge projects, in recycling 3D-printed filament with Wall-E and in conceiving parts of a custom legged robot. It also revealed key challenges in project continuity, where these advanced projects need a more long-term vision to be push forward in time. By adopting a structured “Call for Proposals” process centered on rigorous evaluation of feasibility, budget, timelines, and long-term vision, Xplore Research will now provide a clear, repeatable framework for launching new space-robotics research initiatives.

Looking ahead, our strategic objectives are twofold: first, to cement Xplore Research’s identity as a hub for advanced space robotics projects at EPFL by nurturing them that address real engineering problems with scientific rigor; and second, to ensure sustainable project evolution through robust governance, documentation, and cross-cohort knowledge transfer. Over the next two years, we will monitor key performance indicators, such as proposal quality, project completion rate and prototypes delivered, and adjust our resource allocation and risk-mitigation strategies accordingly.

By empowering motivated students (particularly at the master’s level) to propose, manage, and scale their own research projects under the umbrella of a cohesive, long-term vision, Xplore Research will not only enhance EPFL Xplore’s competitive profile at events like the European Rover Challenge but also contribute meaningful innovations to the broader space-robotics community. We invite all interested students and faculty to engage with Xplore Research, submit their proposals, and help us build a legacy of sustained, high-impact research—and together, push the frontier of what student-led space exploration can achieve.