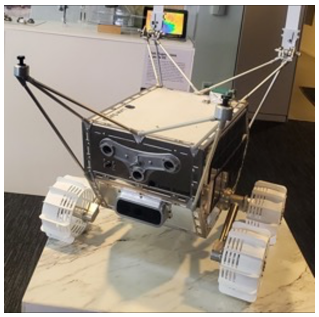
Space Exploration Initiative

The MIT Space Exploration Initiative (SEI) provides a collaboration space, resources, mentorship, and inspiration for teams across the Media Lab to explore use cases of cutting-edge technology in space and extreme environments. Through a full slate of flight opportunities—from field expeditions and zero-g flights, to ISS orbital missions and an upcoming lunar surface deployment—students are guided in exploring space from the lab bench to the Moon. Just as many emerging technologies have application in space, space endeavours can also be re-imagined for a more sustainable future here on Earth. SEI's mission to democratize access to space exploration and prototype our sci-fi space future comes full circle by applying the transformative technologies developed for other worlds, and future worlds, to Spaceship Earth.



Expanding our exploration: SEI fieldwork expeditions

In 2022, SEI launched its field expedition program. The program provides students with access to remote environments with unique features: extreme conditions, limited accessibility, and minimal human presence in which to test their space research. The inaugural mission was in Svalbard, Norway, providing 5 student researchers with a Moon- or Mars-like environment to conduct fieldwork. Svalbard, an Arctic Archipelago midway between Norway and the North Pole, is a fragile environment, extremely sensitive to human presence. The desert landscapes boast otherworldly views, frigid temperatures, and a space-like remote operational environment, and yet the sensitive flora, permafrost, and glacial geology are key indicators for climate change studies for Earth. While the experiments going into the expedition were firmly based on space exploration, all the researchers found Earth-connections during their 10-day expedition. For example, a remote-access virtual reality platform being developed for Lunar surface exploration was reimagined for a scientific exploration tool for fragile Earth environments to minimize human impact. These connections in the field are critical for binding space exploration to the protection of our planet. SEI ran a second expedition to Svalbard in June, 2023, and plans to expand the field expedition program in 2024 to multiple locations with aims to address climate-based and space-based field work needs and encourage the development of on- and off-planet solutions.





SEI's Cody Paige and Jessica Todd test a rover-mounted camera in low-light conditions above the Arctic Circle. This fieldwork directly supports the depth-field camera payload that MIT is sending to the moon in a historic return to the lunar surface this year (2023).

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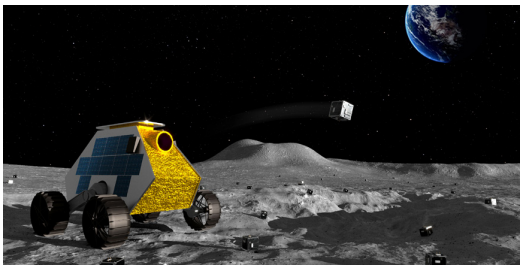
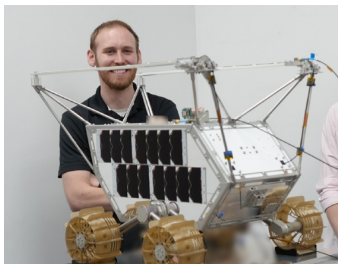
Working in Microgravtiy: from Zero-G to the International Space Station

SEI is now in its sixth year of teaching the Prototyping our Sci-Fi Space Future: Designing & Deploying Projects for Zero Gravity Flights course, a course teaching project development, prototyping, and deployment readiness for parabolic flights, culminating in an annually chartered research flight with Zero-G. Altered gravity projects from students across MIT and Harvard range from medical devices and propulsion systems to self-assembling architectures, free-floating fashion and musical instruments designed for space. These flights prepare student experiments for longer-duration microgravity testing on the International Space Station. Working with Axiom and one of their private astronauts in 2023, SEI enabled the testing of a gravity-loading suit for a 1-week mission on the ISS. Missions like these provide a unique opportunity to gather invaluable data propelling projects from ideation to realization following the SEI launch pipeline.


SEI's 2022 Zero-G flight included Larissa Zhou's H0TP0T, a liquid mediated cooking device designed for microgravity (left) and Rachel Bellisles' Gravity Loading Countermeasure Skinsuit (right), testing in preparation for the Axiom-2 mission in 2023.

SEI Lunar Mission: returning to the moon to stay

Space start-ups, industry partners, and the Commercial Lunar Payload Services (CLPS) are all contributing to making space more accessible. Using student-led research projects, SEI has partnered with these services to further this accessibility, opening the scientific exploration of data collected in space to a broader range of researchers. In collaboration with NASA Ames and the Solar System Exploration Research Virtual Institute, SEI is sending a commercial off-the-shelf (COTS) LiDAR and RGB camera for lunar surface exploration in virtual reality, and a miniaturized robot, the AstroAnt to the Lunar south pole on a CLPS mission in 2023. The data collected during this mission, as well as the lessons learned from the development, will push the boundary of exploration for students at MIT, create accessible Lunar science, and will provide training for the next generation of space explorers. The results from both payloads will also support the Artemis III crewed mission, empowering the return of humans to the moon and the first woman to ever walk the surface.


SEI will be flying on the Lunar Outpost "MAPP" Rover on the IM2 CLPS mission, with two payloads: a depth field camera and swarm robot.

Earth Mission Control: data across scales

SEI supports a range of projects in virtual and augmented reality, and can use our expertise to connect remote-sensing research across the Media Lab and MIT. We are developing a new Lab-wide proposal to unite in-situ ocean sensor readings, satellite observation data of the Earth's surface, climate change monitoring for emissions in the atmosphere, and space situational awareness of low Earth orbit debris, all into one holistic Earth Mission Control (EMC), is an immersive, multi-user VR/AR data visualization platform, aimed at enabling climate scientists to more effectively communicate their data stories to policy makers to drive more informed policy decisions. This work builds on an existing partnership with NASA, through the RESOURCE program, and will extend that program's focus to actionable data insights across scales. We hope that ESS can act as a catalyst for Future Worlds collaboration.