

IAF MICROGRAVITY SCIENCES AND PROCESSES SYMPOSIUM (A2)
Facilities and Operations of Microgravity Experiments (5)

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ADVANCED MICROGRAVITY FRAMEWORK WITH THE COMBINED FACILITY IOSLAB –
SPACE RIDER – IOSHEX**Abstract**

Microgravity is a unique environment that enables a myriad of scientific and technological advancements and is currently at the forefront of space research. The state-of-the-art in microgravity research spans a diverse range of fields, from fluid science enabling long-duration cryogenic propulsion missions, to manufacturing in space, and studies on human survivability in space to allow for further space exploration. Aside from space related applications, also ground based industries across the globe recognize the potential of microgravity experiments, with applications spanning health, next-generation materials, manufacturing. However, with the impending retirement of the International Space Station (ISS) in the next 10 years, the future of microgravity research is poised for a significant transition. The advent of reusable space transportation systems, such as the European Space Agency's Space Rider (SR), offers a promising solution. SR, capable of operating in low orbit and returning to Earth with valuable payloads, is set to serve as a platform for in-orbit operation, experimentation, and demonstration for applications like microgravity experiments.

In this framework, SAB is developing a facility for microgravity experiments called In-Orbit Servicing LABORatory (IOSLAB). IOSLAB is a flexible universal space lab, optimized and compatible with SR interface characteristics and constraints. It can accommodate a variety of experiment typologies providing data lines for experiment control and results gathering as well as power and an optional active thermal control system. The lab features both pressurized and unpressurized slots for experiments and is equipped with a simple internal firmware to ensure smooth operations. The design of IOSLAB minimizes the number of changes needed between flights, requiring only the replacement of experiments in the slots and minor software updates, allowing for a "plug and play" capable of quickly adapt to customers' mission needs. To enhance the capabilities of SR + IOSLAB and meet the demands of customers, the In-Orbit Servicing orbital module IOSHEX (In-Orbit Servicing HEXagonal module) allows for extended orbital durations for experiments while ensuring precise pointing for IoD activities. This is achieved through seamless cooperation with SR, leveraging its highly dexterous robotic system for cargo handover. Additionally, IOSHEX is equipped with ways to interface with IOSLAB to provide power and data connections.

These evolutions in the field of microgravity research is expected to open new avenues for scientific discovery and industrial innovation, ensuring the continuity and expansion of this vital area of study.