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SEAMLESS RADIO ACCESS NETWORK FOR INTERNET OF SPACE (SERANIS): NEW SPACE
MISSION FOR RESEARCH, DEVELOPMENT, AND IN-ORBIT DEMONSTRATION OF
CUTTING-EDGE TECHNOLOGIES

Abstract

The significance of space-based services has increased remarkably in recent years. One of the factors behind this is the increasing success in deploying innovative technologies in space. Yet, due to their novelty, it is essential to demonstrate the functionality and robustness of these technologies and innovative approaches directly in space under real operational conditions. However, this still poses a difficulty today, as the opportunities of such in-orbit demonstrations are not readily available to researchers and developers without significant lead time and costs.

In its SPACE Research Centre, the University of the Bundeswehr Munich has been ever since performing innovative development and research work on a variety of relevant topics for spaceflight and space-based services. While predominantly lab-based in the past, as a next step towards a responsive and more agile RD process, an in-orbit demonstration and testing programme has been implemented. In the core of this programme, SPACE will conduct its own mission for technology demonstration called SeRANIS, which is scheduled to launch in 2025.

SeRANIS aims to provide a rapidly deployed multifunctional space mission with a large number of innovative experiments (>10) on a small satellite in LEO. The mission offers a high-level scientific framework for researchers to investigate, assess, develop, and demonstrate novel methods and technologies in space. Among the scientific areas to be addressed are advancements in the field of space communications including broadband communications and Internet-of-Things, radio science, high-level AI-based autonomy, GNSS technologies, optical IR Earth Observation as well as object detection algorithms, payload operation concepts, modern structures, innovative system-health-monitoring techniques, and electrical-propulsion will be demonstrated in space.

This paper provides an introduction into the SeRANIS project, its mission objectives, mission system design, a description of each experimental setup, and the hybrid mission architecture and development process combining traditional and New Space approaches to ensure access to space with short lead times.

Keywords: New Space, Small Satellite Missions, In-Orbit Demonstration, Satellite Communication, Satellite Technology, Artificial Intelligence, Autonomous Operations.