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DEVELOPMENT OF A VIRTUAL REALITY SPACE DOCKING SIMULATOR FOR RESEARCH AND TRAINING - A CASE APPLICATION IN THE SPACE ANALOG SIRIUS-21

Abstract

Over the last decade, the Institute of Space Systems (IRS) in Stuttgart, Germany, has developed and deployed a series of space docking simulators, mainly based on the Soyuz and PTK-Orel spacecraft, which have been used for research of piloting performance during experiments in Antarctica and Moscow, Russia. Now, a new concept of a spacecraft docking simulator has been developed using emergent technologies such as virtual reality (VR), eye-tracking and hand-tracking.

This paper describes the latest development of this VR simulator concept and its first field deployment for the SIRIUS-21 analog mission at the facilities of the IMBP in Moscow. The simulator allows for the acquisition of flight telemetry, pilot behavior, and biometric parameters during flight scenarios involving the ISS and the Lunar Gateway. Its deployment in analog missions and isolated environments provides tools to enhance the understanding of human performance and the assessment of potential risks in long duration space missions. The use of eye-tracking and hand-tracking, for instance, enables the study of the pilot's interaction with spacecraft instrumentation and provides an insight into mental focus and compliance with flight safety procedures.

Finally, a critical analysis of the simulator and its development perspectives for potential use in real astronaut training are given.