

X-ARM: A NOVEL ARM EXOSKELETON COMBINED WITH EXTENDED REALITIES TO TRAIN FUTURE ASTRONAUTS

Andres Martin-Barrio¹, Guillaume Fau, Mathieu Deremetz, Tigo van Roy, Raphael Boitte, Ernest Porqueras-Codina, Antoine Bayou, Guilhem Le Carrou, Pierre Letier, Jeremi Gancet*

¹ amb@spaceapplications.com

*Space Applications Services NV/SA., Leuvensesteenweg 325 1932 Sint-Stevens-Woluwe (Brussels Area). Belgium

Technical themes:

- Effective mixed reality through haptics and sound
- Interfaces between AR/VR and other systems, how to integrate
- Common platforms and frameworks dedicated to space applications
- Enhanced immersion and presence through avatars

Abstract:

Over the next few decades, a remarkable rise in the number of space travellers is expected. However, current tools for astronauts are not well adapted to the requirements of training a large number of individuals for microgravity environments. The X-aRm project offers a novel immersion experience aimed at preparing future space visitors. Combining an arm exoskeleton with eXtended Reality technologies, the project provides multi-modal stimuli to enhance the feeling of presence during the training process. The primary purpose of the exoskeleton is to offer force-feedback to the user. Through a thorough redesigning process, it prioritizes robustness, comfort, and responsiveness, resulting in significant improvements over previous iterations. Functioning as a technology demonstrator, this device is driven by three custom-designed Brushless DC motors and integrates two passive degrees-of-freedom. The bilateral communication between the exoskeleton and the virtual world allows users to experience the forces involved in different activities of typical Extravehicular Activities, such as pushing and pulling from handrails in microgravity. This innovative strategy replicates the movements of trainees and the constraints of wearing a spacesuit in real time, assisted by gravity compensation technologies. As a result, the system is expected to require less supervision and occupy a smaller footprint, while also providing higher flexibility, scalability, customization, safety, and unprecedented levels of immersion

