

## WEARABLE AUGMENTED REALITY WEAR++

### PROJECT OVERVIEW

WEAR++ is an ESA/ESTEC project that aims at developing a powerful, lightweight, modular and easily wearable Augmented Reality (AR) system that allows hands free operation using speech recognition and synthesis, image-based location and orientation tracking, and barcode reading. This technology is applicable to domains as diverse as architecture and construction engineering or crew-operations support onboard the International Space Station (ISS).

As computer systems become lighter and more powerful, it is expected that wearable devices will become commonplace. These devices bring software tools closer to the user and integrate seamlessly in the workflow of manual activities. Wearable systems can assist and increase the efficiency of the user in complex, human-intensive tasks.

The WEAR++ project has produced a space-qualified demonstrator of such system to support payload and maintenance procedures onboard the ISS. The prototype has passed all the acceptance tests and it is ready to be flown to the ISS in Space Shuttle mission STS-128.

Onboard the station, WEAR++ will be used to assist an astronaut during a representative maintenance procedure in the Columbus laboratory. This exercise will provide valuable knowledge on the usability and the usefulness of different technologies:

- Wearable devices for procedure execution support
- Augmented reality to assist crew operations in space
- Combination of vision-based and inertial techniques for indoors localization and orientation tracking
- Speech recognition and synthesis in the ISS environment
- Interfacing with the ISS inventory database from a mobile device



WEAR++ headset

The WEAR++ demonstrator has been qualified for usage onboard the ISS. Safety and reliability tests included:

- Electro-Magnetic Compatibility (EMC) testing
- Offgassing testing

- Thermal and flammability assessment
- Vibration testing
- Safety assessment by medical board

The WEAR++ project also involved crew training activities at the European Astronaut Centre (EAC), Cologne.



Astronauts Frank De Winne and André Kuipers train with WEAR++ at EAC

### OUR ROLE

Space Applications Services is the prime contractor for this project with full responsibility for the demonstrator hardware and software design, development and validation.

The VISICS (VISion for Industry, Communications and Services) group from the Katholieke Universiteit Leuven (VISICS-KUL) has also taken part in the project as subcontractor in charge of vision-based localization software.

### PROJECT DETAILS

ESA/ESTEC Project

Date: 2008-2009

Technical capabilities:

- 3D augmented reality on head-up display
- Position tracking with visual and inertial sensors
- Speech recognition and synthesis
- Barcode reading and SQL database access
- ODF procedure execution support

The system runs in an ISS multipurpose laptop IBM Thinkpad A31p. All the hardware has been qualified for usage in manned spaceflight environment.

### GROUP RESPONSIBLE

Systems & Ground Segment (S&GS) Engineering Group.