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CREW COLLABORATIVE ROBOTICS FROM ISS OPERATIONS TO PLANETARY HUMAN EXPLORATION: THE EUROBOT PROJECT

Abstract

The role of robotics in support of space human operations has been long recognized and, in the International Space Station (ISS) experience, large use is made of the available robotic arms and dexterous manipulators in support of most of the space station external activities.

To fulfill the need of optimizing the EVA sortie time, the concept of a mobile robot helping the ISS astronauts to perform their EVA tasks was envisaged by the international partners and ESA initiated in 2002 the Eurobot program, a crew assistant robot with a slight anthropomorphic resemblance and human-like size able to operate in ISS EVA environment. The program was developed under the prime contractor ship of Thales Alenia Space up to phase B completion. At the end of 2004 it was decided to build a first fully functional prototype of the future space robot assistant, called Eurobot Wet Model (EWM). The EWM, derived from the flight model design, is a mobile, underwater, three-arm robot, with stereo vision head; it is able to handle and transport equipment and to "walk" semi-autonomously on the exterior of a space station mock-up using the ISS existing EVA handrails. The project covered several technological challenges, but one the main objectives was to evaluate the effectiveness of task sharing between an astronaut during EVA and an intelligent robot assistant. At the end of 2007 extensive tests were performed at the NBF of the European Astronaut Center in Cologne, Germany and at the NBTF of ALTEC Turin, Italy. The results have been encouraging: skilled users and astronaut validated the concept and provided feedbacks for the flight design.

Recently, following the international exploration roadmaps toward planetary exploration, possible applications of robotic assistants in the surface scenarios are considered in preparation and in support of the human presence on Moon and Mars: from preparation of landing sites to construction and maintenance of manned infrastructures.

In 2008 ESA started a new Eurobot phase to expand the project purposes beyond the ISS use in preparation of human arrival and during human presence for exploration missions. Thales Alenia Space is leading an industrial team which has currently completed the design and subsystem manufacturing phase, and is starting the system integration and test activities.

This paper provides an overview of the performed and on going activities within the Eurobot project, focusing on the role of functional demonstrators in the development of systems involving human cooperation.