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FUNCTIONAL PROTOTYPING OF CREW COLLABORATIVE ROBOTIC SYSTEMS: GAINING
CONFIDENCE AND KNOWLEDGE IN VIEW OF PLANETARY APPLICATION**Abstract**

Robotics has been involved in space applications since a long time in the International Space Station in support of human Extra-Vehicular Activities. In the frame of the International Space Exploration Plans, robots have been identified as essential actors in support of manned expeditions and human permanent settlement on Moon and Mars, in view of further destinations. In fact, in early human exploration missions, teams of robots shall work under the supervision of few astronauts as robotic assistants in extra-vehicular conditions; they will have mobility and manipulation functions, “naturalistic” communication, capability to react to changing environment and safe behaviour during close cooperation tasks. Human-size, humanoid robots, are indeed the best candidate and in fact their development has started since several years and is strongly pursued by all the major space agencies including NASA and the European Space Agency. Thales Alenia Space Italia (TASI) is deeply involved in development of collaborative robotic systems as prime contractor for the ESA program Eurobot, a robotic assistant which can be configured for both orbital and planetary application. TASI also pursue robotic research activities and collaborate with academics and industrial groups focusing on selected robotic issues and projects, a hand exoskeleton to be embedded in the astronaut glove, systems for visual human recognition, sensing lightweight coating, advanced HMI in immersive VR environment are among the selected projects. To support the development of innovative related technologies, to share with the end-users the identification of the driving requirements for robotic systems, the experience with ground prototypes is considered mandatory as first step, in view of the development of flight robotic demonstrators and of the initiation of the relevant space programs. The role of functional demonstrators is considered particularly important in the development of systems involving human cooperation. In fact, the building and testing of prototypes, allows the engineers to identify and solve some of the arising criticalities at an early stage and most of all gives the possibility to the users (astronauts, robot controllers) to participate to the design process and contribute to an early concept evaluation. This paper provides an overview of the performed and on going activities within the Eurobot project, focusing in particular on the lesson learned from the functional testing of the Eurobot ground prototype for surface application. The paper also describes the guidelines followed for other ongoing TASI robotic activities and the early development of breadboard and prototyping in support to research activities.