

SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)Systems and Infrastructures to Implement Future Building Blocks in Space Exploration and Development
(2)

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ENABLING TECHNOLOGIES FOR SPACE EXPLORATION SYSTEMS: THE STEPS PROJECT
RESULTS AND PERSPECTIVES**Abstract**

The project **STEPS** (**S**istemi e **T**ecnologie per l'**Es**plorazione **S**paziale) is a joint development of technologies and systems for Space Exploration supported by Regione Piemonte, the European Regional Development Fund (E.R.D.F.) 2007-2013, Thales Alenia Space Italia, SMEs, Universities and public Research Centres belonging to the network "Comitato Distretto Aerospaziale del Piemonte" the Piedmont Aerospace District in Italy.

The first part of the project will end in the next months with a final demonstration event that will highlight the technological results of the research activities carried-out during the last three years.

The project has been focus to develop virtual and hardware demonstrators for a range of technologies for the descent, soft landing and surface mobility of robotic and manned equipment for Moon and Mars exploration.

The two key hardware demonstrators – a Mars Lander and a Lunar Rover - fit in a context of international cooperation for the exploration of Moon and Mars, as envisaged by Space Agencies worldwide.

The STEPS project includes also the development and utilisation of a system of laboratories equipped for technology validation, teleoperations, concurrent design environments, and virtual reality simulation of the Exploration Systems in typical Moon and Mars environments.

This paper will present the reached results in several technology domains like:

- A vision-based GNC for the last portion of Mars Entry, Descent Landing sequence, Hazard avoidance and complete spacecraft autonomy;
- Autonomous Rover Navigation, based on the determination of the terrain morphology by a stereo camera;
- Mobility Mechanisms providing an Integrated Ground Mobility System, Rendezvous Docking equipment, and protection from Environment effects;
- Innovative Structures such as Inflatable, Smart Multifunction Structures, an Active Shock Absorber for safe landing, balance restoring and walking;
- Composite materials Modelling and Monitoring;
- Human-machine interface features of a predictive Command and Control System;

- Energy Management systems based on Regenerative Fuel Cells;
- Aerothermodynamic solutions for Atmospheric Re-entry of Commercial Transportation Systems;
- Novel Design Development Tools, such as a Rover S/W simulator and prototypes of the DEM viewer and of a S/W Rock Creator/visualizator.

The paper will also provide perspectives on the proposed STEPS 2 project that will likely continue the development of a subset of the above technologies in view of their possible in-flight validation within the next five years.