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For a successful space program: Quality and Safety! (1)

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NOVEL APPROACH REQUIRED FOR THE RISK ANALYSIS OF SAFETY CRITICAL ELEMENTS
DESIGNED FOR FUTURE HUMAN MARS MISSION.**Abstract**

In the years prior to the launch of the International Space Station, the approach adopted to design and develop a space mission had to be revolutionized, in order to guarantee the survival, safety and wellbeing of astronauts in space for long-lasting periods. In an analogous way, human exploration of the Moon and Mars will introduce several new challenges with respect to what has been done up to now with the ISS. These environments will introduce new and diverse sources of hazard, which will affect the risk profile of the mission, highly jeopardizing the crew safety. For this reason, each single problem or failure will have to be thoroughly considered well in advance. In the framework of future human Mars exploration missions, several innovative technologies will have to be developed, and for some of them (e.g. surface habitable modules capable of guaranteeing to astronauts sheltering and protection for the external environment) the opportunity to be tested and verified on the lunar surface is foreseen. Taking into account this latter category of technologies, in this study the reform processes that will characterize all the product assurance procedures are investigated in detail, with a particular focus on how radiation effects, surface meteoroid impacts and other aspects will affect the risk analysis which will be carried out to characterize and guarantee the reliability of the safety critical elements of the mission. Namely, the effects that these new scenarios will introduce for what concerns the redundancy and hazard control of all the systems are investigated, with a specific interest on how either a single or double failure approach will influence the design and development phases of the mission. This study is carried out in the framework of II Level Master's programme SEEDS (Space Exploration and Development Systems), a project born from the collaboration between the Politecnico di Torino (PoliTo), the Institut Supérieur de l'Aéronautique et de l'Espace (ISAE) and the University of Leicester, with the participation of Agenzia Spaziale Italiana (ASI), Centre National D'Etudes Spatiales (CNES), European Space Agency (ESA), Thales Alenia Space and Altec.