

SPACE OPERATIONS SYMPOSIUM (B6)  
New Operations Concepts (2)

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GROUND SEGMENT AND OPERATIONAL CONCEPT FOR LUNAR AND PLANETARY ROBOTIC  
MISSION

**Abstract**

ALTEC facility is becoming an international centre of excellence and candidate Mission Control Center for planetary robotic missions and it will host the ESA ExoMars Rover Control Centre. The paper intends to give a general overview of the new studies ALTEC is performing to collect knowledge and models necessary to support and lead future robotic planetary missions, in particular focusing on Moon missions. ALTEC is actually in the process of setting the requirements for the ground segment infrastructure and Mission Control Centre for Moon robotic missions, needed to support in real time rover operations. Objective of this paper will be to describe chosen strategies by ALTEC in designing and realizing the Ground Segment and Operational Concept of lunar missions both privately and publically founded. The focus will be on the Team interaction aspects and on the detail of the Ground Segment and Operations design. The Ground Station System represents the direct interface with the space segment and it must be designed considering the different requirements and constrains of each mission's phases. During LEOP and cruise the stations must provide moderate data rate transmission with precise orbit determination capabilities. Meanwhile during surface operations the necessary data rates grow and a more important factor becomes the time coverage in order to reduce the rover uncontrolled periods: antennas must substantially be totally dedicated to the mission during each visibility period. The study verifies the available stations, both national and international, trying to define a versatile network usable for many mission profiles, describing possible constraints. The Moon Robotic Operational concept is based on the tele-operation of the rovers' activities and movements from Ground. This generally permits the streamlining of the on-board control systems, a simplification of the architecture and a containment of the costs. This operational concept could bring the ground operator to be in charge of many activities related to robotic planning, like the image processing and obstacles avoidance, in case they cannot be evaluated on board. Operational concepts are here analyzed considering team composition and interactions. Ground operations are then listed and analyzed, providing possible Mission Control Center architectures, verifying possible optimization processes and parallelization of activities necessary to reduce operative time and make operations faster and safer.