

MExRover – a tool for research and education in planetary geodesy, cartography, and photogrammetry at MIIGAiK

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Abstract

The MIIGAiK Extraterrestrial Laboratory (MExLab) is currently developing an automatic mobile platform MExRover, designed for simulating rover activities on the surface of earth-type planets and satellites. In the project, we develop a hardware and software platform for full rover operation and telemetry processing from onboard instrument, as a means of training undergraduate and postgraduate students and young scientists working in the field of planetary exploration.

1. Introduction

The project is designated for multipurpose applications. One important focus is on research in photogrammetry, in particular, digital surface model creation for macro- and microrelief surveying in real-time for autonomous navigation. Other special attention is given to development of research programs with participation of students and young scientists of the University, for public awareness and education purposes. Mex Rover would be a bridge from the old soviet Lunokhod experience [1] to the new research base for the future rover technology development support.

2. Rover Design

The design of the rover (Fig. 1) and its instrument suite allows acquiring images and navigation data satisfying the requirements for photogrammetric processing. The data will allow us to create high-quality color panoramas as well as DTM (Digital Terrain Models) in the rover vicinity. IMU and GNSS data are used not only for post-mission reconstruction, but also for real-time tracking of the rover traverse. A local operator may control the rover remotely from a distance up to 2 km. The telemetry system allows the operator to continuously monitor

all the systems in real-time. A remote command center connects to the operator via satellite data link and controls the mission. The rover has onboard an automatic control system (ACS), which controls all the processes. The system includes a 10 GB storage system and standard interfaces for communicating with devices constituting the payload.

The MExRover has a modular design, which provides maximum flexibility for accomplishing different tasks with different sets of additional equipment weighing up to 15 kg. The framework can be easily disassembled and fit into 3 transport boxes. The weight of the boxes allows transporting them on foot, by car, train or plane.

The imaging system included in the standard design comprises two camera sets: low resolution telecameras and a high resolution stereo camera. More instruments are planned to be installed later as auxiliary equipment, such as: IR camera, spectrometer, video camera, odometer, solar radiation sensor, temperature sensor, wind sensor, magnetometer, radiation detector, and microphones. The first version of the MExRover is expected to be operational by the end of 2012 and will be subjected to thorough testing.



Figure 1: Current MExRover design.

3. Specification

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|------------------|-----------------|
| Dimensions W×L×H | 600×1000×250 mm |
| Maximum weight | 60 kg |
| Payload weight | 20 kg |
| Cruising range | 3 km |
| Mean velocity | 1 km/h |

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References

[1] Basrukov ed.: Travelling laboratory on the moon. Lunokhod 1, Nauka, Moscow, Vol. 2, 1971.