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Telecontrol of ExoGeoLab lander

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1. Introduction

ESA-ESTEC and the International Lunar Exploration Working Group (ILEWG) developed the ExoGeoLab Lander. This pilot prototype intends to prove the utility of common use of instruments by astronauts and remotely. Its aluminum structure can be equipped with payloads, such as telescopes, spectrometers, controllable cameras, drills, etc. Anyone of them can be remotely controlled, in short range by a dedicated computer, which can in turn be remotely controlled for long-range manipulations.

1.1 Goals

A set of computerized instruments, such as telescopes or spectrometers could be used in the frame of Moon/Mars habitats to obtain scientific results, such as astrophysics or soil analysis, but also for cooperation with astronauts, such as the monitoring of distant Extra-Vehicular Activities (EVAs). The remote operation of such scientific instruments has already been demonstrated with this lander [1-5], so we are now working on the improvement of the reliability of the technologies and the capabilities of our instruments, and especially the telescope.

1.2 Known advantages

The Lunar surface has obvious advantages for astrophysical studies, because of the low-seismic activity, the absence of an atmosphere or even the low and very predictable orbital rotation [6].

2. Modifications and architecture improvements

To improve the robustness of our control system, which is made of off-the-shelf components, we worked on the developments of dedicated drivers. The mainly problematic system remains the telescope, because of communications issues between the mount and the controller. To avoid troubles due to motions out of the safe range, we developed a monitoring systems made of controllable cameras broadcasting real-time images of the lander and its telescope, while looking into the communication issue itself. This system and the drivers mentioned above are the main improvement made since last year.

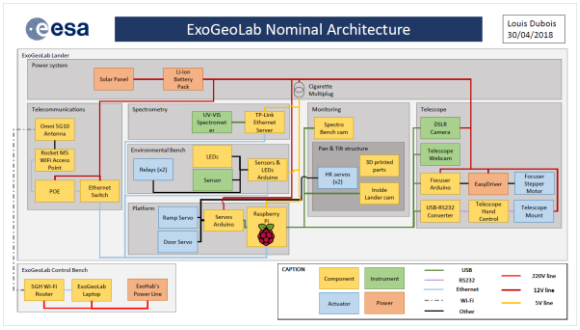

Figure 1 Architecture of the ExoGeoLab lander

3. Preliminary results

The EuroMoonMars team organized on the 19th and 20th of April a two-day workshop. We ran two analogue simulations with experienced and beginner participants, and let them use the lander. This field test gave us feedback on the user-friendliness of our systems, its robustness, etc.

Figure 2 Analogue astronauts practicing remote control and target acquisition before simulation

So far, because of the communication issue between the embedded computer and the telescope, we cannot perform any kind of alignment. However, manual motion control remains doable, and thanks to a webcam mounted on the telescope's tube, we already managed to perform fully remote astrophysical observations.

Figure 3 Image of the Moon taken with ExoGeoLab's telescope from ESTEC

4. Expected Improvements:

We are now working on the solving of the communication issue described above, which precludes alignment. Once this problem solved, we will be able to align the telescope, to automatically target at stars from databases and even program automated observations. Then we would be able to acquire usable data remotely from a distant facility, as astronauts could do from their habitat. We are also working on the ability to orientate and target automatically at non-astronomical marks. Such a capacity would allow, as explained earlier, to follow distant EVAs from the habitat, but also to target some interesting areas in order to send manned or unmanned exploring systems, like rovers or drones.

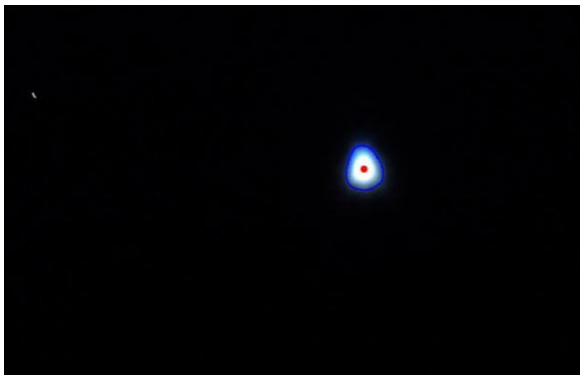

Figure 4 Contour and centre detection on a picture of the Moon

5. Acknowledgements

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