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ExoGeoLab Test Bench for Landers, Rovers and Instruments

B.H. Foing[1*], J. Page[1,4], P. Poulakis[4], G. Visentin[4], P. Mahapatra[1*], L. Boche-Sauvan[1*], F. Nijman[1], A. Noroozi[3], J.P. Lebreton[1], A. Barton[11], T. Zegers[1], P. Ehrenfreund[10], C. Stoker[2*], J. Zhavaleta[2*], P. Sarrazin[2*], D. Blake[2], L. Wendt[8*], C. Gross[8*], C. Thiel[9]*, S. Peters[1,6*], A. Borst[1,6*], V. Pletser[5*], E. Monaghan[1*], D. Wills[1*], C. McKay[2] , G. Davies[6], W. van Westrenen[6], P. Batenburg[1,3*], G. Drijkoningen[3], E. Slob[3], E. Gill[3], M. Guglielmi[4], M. Freire[4], R. Walker[7], ExoGeoLab team[1,4] & EuroGeoMars team[1,4,5]

[1]ESTEC/SRE-S Postbus 299, 2200 AG Noordwijk, NL, [2]NASA Ames [3]Delft TU Aerospace/ Geology and Civil Engineering , [4]ESTEC TEC Technology Dir., [5]ESTEC HSF Human Spaceflight, [6]VU Amsterdam, [7]ESTEC Education Office, [8]FU Berlin, [9]Max Planck Goettingen, [10]Leiden/GWU, [11]AOES/WLS, [*] EuroGeoMars crew
(Bernard.Foing@esa.int/ Fax: +31 71 565 4697)

Abstract

In the frame of ESTEC technology and research pilot project, we have started a small pilot facility with a ExoGeoLab and a Mobile Lab Habitat, supported by two design and control offices in the European Space Incubator (ESI), as well as infrastructure support and manpower. We have in addition to contribution on external instruments and manpower from partner institutes. From this test bench and kit of ExoGeoLab instruments, we plan to operate comprehensive instruments packages that could help in the technical research and science preparation of lander/rover missions studied in the frame of Cosmic Vision or the Exploration programme.

Fig. 1: Preparation of ExoGeoLab instruments tests of cooperative robotics

ExoGeoLab

The ExoGeoLab research incubator project includes a sequence of activities:

- Data analysis and interpretation of remote sensing and in-situ data, and merging of multi-scale data sets

- Procurement and integration of geophysical, geochemical and astrobiological breadboard instruments in an surface station and rover (ExoGeoLab)

- Research operations and exploitation of ExoGeoLab test bench for various conceptual configuration, and support for definition and design of science surface packages (Moon, Mars, NEO, outer moons)

Goals and methods of ESTEC ExoGeoLab:

We integrated instruments integrated in an ExoGeoLab, crossing various techniques. The methodic steps for this hands-on research are:

1) We have procured and adapted instruments to equip a mid-size ExoGeoRover (made available in collaboration with ESTEC robotics section), and a small surface station.

2) This terrestrial payload (instruments, sensors, data handling) has been deployed, operated and used as collaborative research pilot facility

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(ExoGeoLab), first tested and operated at ESTEC, and later transportable

3) We performed functional tests of these instruments, and operated them in terrestrial conditions to correlate measurements using various techniques.

4) We have implemented the possibility of remote control of instruments from an adjacent mobile laboratory, and a remote science desk.

5) The suite of measurements includes a comprehensive set with telescopic imaging reconnaissance and monitoring, geophysical studies, general geology and morphology context,geochemistry (minerals, volatiles, organics), subsurface probe, sample extraction and retrieval, sample analysis.

6) We have reproduced some simulation of diverse soil and rocks conditions (mixture of minerals, organics, ice, penetrations of water, oxydant, organics) and diagnostics

7) We used these instrument packages to characterise geological context, soil and rock properties

8) Science investigations include geology, geochemistry, mineral, oxydant, organics, and volatiles diagnostics.

9) After first validations we started to exploit the facility for collaboration with partners that will provide some additional guest instruments, and perform specific investigations,

10) We have organised field campaigns in specific locations of scientific and exploration interest, making use of the mobile lab habitat for logistics support and local operations.

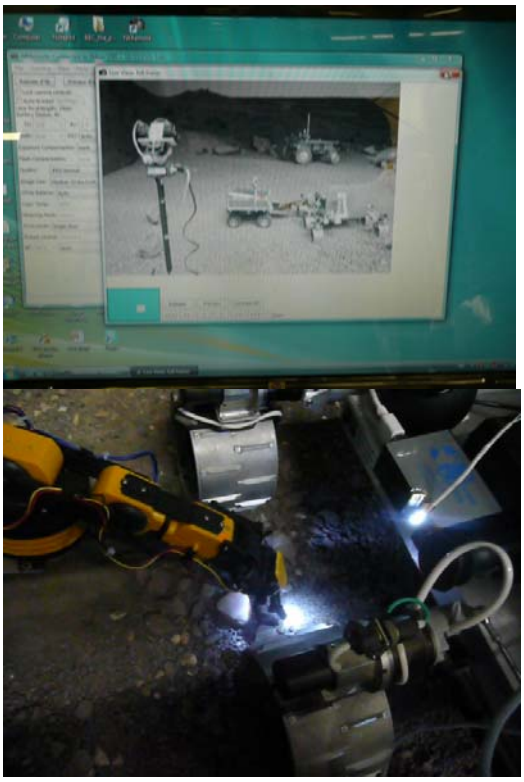

Fig. 2: ExoGeoLab tests of Remote control, rover RdV

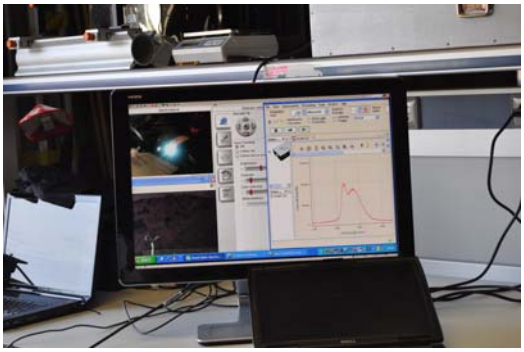

Fig. 3: ExoGeoLab tests of Remote sample Raman and reflectance measurement

References

[1] Foing, B.H. et al . (2009) LPI, 40, 2567.