PREPARATIONS EXOGEOLAB LANDER FOR LUNAR ANALOGUE FIELD CAMPAIGN, EIFEL, GERMANY. O. M. Kamps[1,3], M. S. Offringa[2,3], B. H. Foing[3,2], [1] Faculty of Geosciences, Universiteit Utrecht, Utrecht, The Netherlands (o.m.kamps@students.uu.nl), [2] Faculty of Earth and Life Sciences, Vrije Universiteit, Amsterdam, The Netherlands, [3] ESA/ESTEC, Noordwijk, The Netherlands (marloes.offringa@esa.int) (bernard.foing@esa.int),.

Introduction: The closest and most suitable location to conduct lunar analogue missions for ESA/ESTEC is the volcanic region of the Eifel, Germany. A mock-up lander, which is an element of the ExoGeoLab depicted in figure 1, was prepared for a geological orientated campaign in the area. In November 2015 a test-run was conducted as preparation to gain insight into what aspects should be improved. In February the improvements will be implemented during a campaign in the same region.

Figure 1. The ExoGeoLab in combination with telescope.

ExoGeoLab: ExoGeoLab is a project initiated by ESA and ILEWG [1,2]. In the last years the system has undergone updates with respect to remote control and usability for geological campaigns. Several spectrometers and sensors are the basis for the scientific payload of the mock-up lander, together with a telescope [3].

During the next Eifel campaign (February 2016) the lander will be used as an in-situ laboratory. The landercampaign could be a useful addition for sample return missions, since it is possible to conduct preliminary analyses in the field to estimate the scientific value of samples.

The lander is divided into three sections, namely the platform, upper compartment, and lower compartment. The lower compartment is used for scientific payload, while the upper platform supports the computer and cable systems. The telescope has additional value since it can support astronauts during their "EVA". The telescope can be used to observe the environment and define regions of interest, perform safety analysis, and provide a distant view on sampling sites.

The scientific payload consists of a UV-VIS spectrometer, NIR spectrometer, Raman spectrometer, telescope as well as temperature and CO_2 sensors.

Via an ad-hoc network together with share screen software, TightVNC, the equipment can be remotely controlled. This combination makes it possible to control all systems with the lander-computer from a few meters distance. This enables us to remotely control the telescope, including its focus, take pictures, control the panels that provide access to the lower compartment and control the equipment to perform the measurements.

Eifel field campaign November 2015: During the Eifel field campaign in November 2015, the ExoGeoLab lander was not installed in its complete form as depicted in figure 1. Only the necessary components to test the functionality in the field were used during this stage of the ExoGeoLab field campaigns.

The lander set-up that was used to perform measurements consisted of the top plate of the lander that provided room for the equipement as well as a computer. The telescope was deployed separately. The top plate of the lander was equipped with a UV-VIS reflectance as well as laser Raman spectrometer. The telescope functioned to firstly analyze the area where the experiments would be conducted. With a camera mounted to the telescope a mosaic image of a volcanically layered quarry was obtained, in order to further select regions of interest.

After making geological descriptions of the volcanic layers, samples from the different layers were collected using a sample collecting arm that could be used by an astronaut working in combination with the lander. The samples were analyzed in the field using the portable UV-VIS reflectance spectrometer and the Raman laser spectrometer. Furthermore samples were collected and returned to be analyzed under laboratory conditions and function as a reference. The set-up of the spectrometers on the top plate of the lander is depecited in figure 2.

Figure 2. ExoGeoLab field test in the Eifel with portable UV-VIS reflectance spectrometer.

Future adaptations: Based on our experience with the lander during the November 2015 campaign we summarized some aspects that could be improved or included in the next campaign. The next campaign in Februiary 2016 will be conducted with a complete lander set-up which requires a more complex measurement strategy compared to the previous campaign where only the top lander plate and equipment was utilized.

Since the set-up during the next field campaign will be that of a complete lander, the distribution of the equipment over the separate compartments of the lander has to be arranged and tested thoroughly.

During the last campaign it became clear that it is important to have an overview of the power supply required for all systems. Since the lander has to perform as autonomous as possible it is necessary to clearly state which systems need additional power from an external battery and to what extent portable equipment functions on an internal power source.

As preparation for the next campaign a protocol will be arrayed, so that an analogue astronaut could assemble the lander with equipment and solve possible problems as well as conduct experiments autonomously.

Future field activities: Several ideas and goals are proposed to be tested in the field:

(1) The equipment and its set-up will be tested in the next campaign (February 2016). The set-up is already tested under laboratory conditions but its functionality never in the field. Obtained data can be combined to see if the quality of laboratory measurements can be approached during field measurements.

(2) The usability of the lander in combination with a rover or astronaut. Several panels on the side provide access to the lower compartment where samples can be analysed. During the next campaign it will be tested whether or not the panels and the size of the compartment will be functional during experiments.

(3) The applicability of the updates to the lander with respect to remote control. It should be possible to perform remotely controlled measurements on sample and control the telescope as well as the side panels remotely.

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References: [1] Foing B. H. (2010) *EGU 2010*, 13779. [2] Foing et al. (2010), *LPSC 2010*, 1701. [3] Foing et al. (2009), *EGU 2009*, 13122.