INSTRUMENTS AND POWER SUPPLY FOR IGLUNA, VU SCIENCE EXPERIMENTS (VUSE)

A. Kruijver[1], A. Dingemans[2], B. Foing[3,4,5], B. de Winter[3], M. Heemskerk[3] and VU Amsterdam Igluna Team [1]VU Amsterdam (amandakruijver@gmail.com), [2]VU Amsterdam (arlenedingemans@hotmail.com). [3]VU Amsterdam, [4]ESA ESTEC, [5]ILEWG.

Introduction: New evidence suggesting the presence of quantitative volumes of ice on the south pole of the moon, sparked interest in another form of human habitation in space: namely that in lunar ice. The Moon Village platform [1 - 2] works on and envisions these different possibilities of space settlements. The community promotes global cooperation on space initiatives and mobilizes many disciplines, including astronomy, planetary science, robotic developments, resource utilization concepts, economy and life sciences, into international collaboration. To simulate a Moon Village, an ice habitat will be developed and implemented in a glacier in Zermatt, Switzerland. This project, called IGLUNA, is coordinated by the Swiss Space Center and is a demonstrator pilot programme to advance the ESA_LAB initiative [3]. Using ice for the habitat is very useful, as water is not only essential to life and able to function both as a source of fuel and oxygen, it can also act as an effective protection against radiation. The aim of VUSE at IGLUNA is to analyze ice cores on organic and chemical compounds to construct the formational history of the glacier. Besides this, experiments can be carried out with a teleoperated [4] station mounted on the glacier. Sensors on this ExoGeoLab [4] can measure parameters such as pressure and water temperature, and is therefore an excellent monitor of the dynamic environment.

Fig. 1: The ExoGeoLab and two analog astronauts preparing the Parrot drone

The VUSE team is mainly focused on the geologic aspect of this mission and also functions as remote mission support during this research. The instruments needed for the research will be provided by the VU and ILEWG [5]. As the technical support branch of the team, we are mainly concerned with powering the instruments and to perform and assist in remotely controlled operations. In addition, outreach plays an important role in our commitments to Igluna.

Power: To work as sustainable and efficient as is realistically possible, rechargeable batteries and solar power are mainly used. An ICIDU universal battery charger [9V, AA, AAA, Li-ion] will recharge the batteries and direct power supply is provided by a cigarette lighter plug and another ICIDU device [12V-1A]. Multi-sockets are used to allow for devices to be powered simultaneously (1m/3 slots and 15m/4 slots). A solar panel will produce 6V-12V and wires shall ensure a form of power supply [USB-Micro-USB] for the remaining instruments.

Electronics: Visual inspection and documentation will be done with the use of three advanced cameras: the Nikon D3000, Nikon D40X and the Nikon D90. Necessary for the cameras is a power supply of 0.9V-8.4V and camera links (USB long and short). The cameras operating from the glaciers will be made weatherproof. Drill cores and field samples from EVA's will be analyzed with Bresser Biolux AL microscopes. One of the microscopes is solar powered, the remaining two work on 3x AA batteries. The microscopes have built-in cameras and light provisions. The ExoGeoLab contains a VIS-NIR spectrometer and sensors for obtaining environmental parameters. The ExoGeoLab operates on site. It is connected to a laptop via WIFI, and is remotely controlled from ground control in Zermatt. It is able to transmit instructions to the remotely controlled instruments and will be self-sustainable, which is achieved by the generation of solar power. The ExoGeoLab will be placed visibly to visitors of the campaign.

Fig. 2: The Lenovo Y530 and two Bresser Biolux AL microscopes

The VIS-NIR spectrometer operates for ILEWG and is controlled by the analog astronauts. The computers that are used to control the ExoGeoLab, instruments and data are respectively a HP ProBook 4730S, Lenovo Y530 and Dell Latitude 7240. For observing the area and skies three telescopes are considered, the Celestron Nexstar SE and corresponding cam device, the Lunt Solar System and Vixen Astro telescope. Needed for the telescopes is a supply of 12V-2A. Important for the telescopes is that they can rotate 360 degrees and that they are remotely controllable. Two drones will observe the surrounding area and assist in navigation purposes. The Parrot Mambo will mainly encircle the ExoGeoLab to perform visual inspection of the instruments and proceedings of the experiments, while the DJI Spark is allocated the task to map the area. The drones can also assist in selecting favorable sample sections. Both of the drones are powered by Micro USB.

Fig. 3: The ExoGeoHab bench and the Celestron Nexstar SE telescope

Miscellaneous: Multimetre wire and distance measurements require 9V. For communication two sets of Walkie-Talkies are available, the first an Alecto and the second possessing a range of at least 400m. The Walkie-Talkies are powered by 9V batteries. Lastly, flashlights run on 1.5V batteries and a thermometer requires 2AAA batteries.

Remote Mission Support: An important aspect comprising our tasks as technical support will be to assist the analog astronauts in performing their duties. Both detailed descriptions of the instruments and protocols will be made available to the analog astronauts before the launch of the mission. In addition, briefing and testing will take place in the field where the feedback of mission control and the analog astronauts is processed in situ. Support during the mission is done through communication with a ground control center established in Zermatt. Two crew members of VUSE will be present at all times. The ground control center is in direct contact with the VU Igluna Team in Amsterdam. The team in Amsterdam assists in real time problem solving and with interpreting the generated data. The ground control center in Zermatt is able to access the on site computers and remotely controlled instruments by using TeamViewer software.

Outreach: An essential part to the project is outreach. By organizing events like the VU Space Day, or writing to local news outlets and university magazines, it is possible to motivate the public in either particcipating in or supporting Igluna. This is further encouraged by organizing interdisciplinary workshops held at ESTEC. By maintaining an active presence on social media one can appeal to communities that by other means are difficult to reach.

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Additional Information: To receive an extensive instrument list or if you have any other questions regarding this abstract please do not hesitate to contact us on the e-mail addresses provided.