EPSC Abstracts
Vol. 12, EPSC2018-816, 2018
European Planetary Science Congress 2018

AMADEE-18 Junior Explorers Program

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Abstract

During the AMADEE-18 Mars analog field campaign, a human-robotic Mars mission was simulated in the Dhofar region in Oman, where a field crew was supported by a Mission Support Center (MSC) in near-real time. Instrument workflows, pilot data analysis was emulated in a workflow as it is to be expected for future a human-robotic Mars mission. We report on an innovative education project including student teams to mimick the full life-cycle of a Mars analog mission from experiment design to publication. Lessons learned and pitfalls are identified, as well as the long term effects of this inclusion projected.

1. Introduction

AMADEE-18 was an international Mars analog simulation mission of the Austrian Space Forum (OeWF), in partnership with the Oman Astronomical Society. The mission took place in the Dhofar region in Oman in February 2018, including 19 experiments looking into engineering, geoscience and human factors research for future human-robotic Mars missions (Fig.1).

A highly trained field crew, including 7 analog astronauts with high-fidelity spacesuit simulators were directed in real-time by a control center on "Mars" during Extravehicular Activity (EVA) and through time-delayed communications by the Mission Support Center on "Earth" in Austria.

1.1 Student experiments

Building upon previous experiences from Mars analog field campaigns [1], students from Europe and Oman are invited to submit experiment proposals for this extraordinary expedition.

In a dedicated effort, four student teams, three from Austria, one from Oman, were included in the experiment list, complementing 16 peer-reviewed experiments from established research teams.

The idea was to have the student teams, consisting of 2-4 students aged between 16-19 years, join the project and work through the full life cycle of a scientific experiment.

The following experiments were choosen:

EOS	HTL Eisenstadt, Austria	Radio Navigation System for EVA's on GPS-less planets
Tumble Weed	Sir Karl Popper School, Vienna	A wind propelled compact rover to be used for efficient Mars exploration.
Water Explorer	Umm Al Khair Primary School, Oman	Water detection via a set of geophones, which measures the reflection of sound waves in the subsurface
A3DPT-2-Mars	TU Graz, Austria	3D printing operational workflow experiments for crewed Mars expeditions

The students were tasked to:

- Define research questions and implement the experiment
- Train the feld crew and interact with the Mission Support Center of the Austrian Space Forum
- Observe *(and tele-operate if necessary)* the experiment during its implementation

- Analyze and interpret the data and publish them in a final experiment report and present the findings at the AMADEE-18 science workshop.

Figure 1: Kepler-Station for the AMADEE-18 Mars simulation in Oman.

Figure 2: The ADAPT2Mars 3d-printing experiment deployed during the AMADEE-18 mission (red plastic and golden silica-coated steel printed soil sampling scoop)

2. Lessons learned

Lessons learned include the realization, that highly motived student teams can contribute to a field campaign like AMADEE-18 like a senior research team when it comes to mission planning compliance and dedication. However, senior team members were required to manage both the expectations and ambitions of the young researchers. These were challenged by the balancing between what they wanted to accomplish and what was realistically possible within budget and within schedule.

The latter seems to be a skillset, that is underdeveloped in this age group.

References

[1] Groemer, G., Losiak, A., Soucek, A., et al.: The AMADEE-15 Mars simulation. Acta Astronautica Vol. 129, pp. 277-290, 2016.