Humans on "Mars"

Results of the Austrian Multinational Mars Landing Simulation in the Northern Sahara

Gernot Groemer Austrian Space Forum



MARS today

- -70 °C, 6-11 mBar
- 10 µm of precipitable water
- Chemically reactive surface

MARS 3,5 Gyrs ago

- probably warmer, >1 Bar
- oceans and lakes
- effective radiation shielding

PolAres research programme



- Passepartout stratospheric ballon
- Phileas rover
- Aouda spacesuit simulator
- Goal: preparing exploration strategies for a human-robotic Mars expedition with a focus on planetary protection.
- PolAres reference mission architecture



Aouda.X spacesuit simulator prototype

- Based upon NASA DRM 5.0 & Aurora
- NASA Human-System Standard STD-3000 & MIL-STD-882c
- <45 kg, unpressurized, Hard-Upper Torso, custom-built OBDH and advanced humanmachine-interface
- Outer layer optimized for planetary protection, 4-6 hours field operations
- Broadband telemetry

Groemer et al., 2012, The Aouda.X space suit simulator and its applications Astrobiology. February 2012, 12(2): 125-134.

Previous system integration field tests

- Field-Test 1 **Comissioning July 2009**, Kramsach, Austria
- Field-Test 2 Pasterze-Glacier, August 2009, Austria
- Field-Test 3 Cryo-Test, September 2009, Seefeld, Austria
- Field-Test 4 **Eifel-region, September 2009**, Germany
- Field-Test 5 Koppenbrueller-Cave, January 2010, Austria
- Field-Test 6 Innsbruck, May 2010, Austria
- Field-Test 7 Kaunertal Glacier, July 2010, Austria
- Field-Test 8 Rio Tinto Integrated Sim, April 2011, Spain
- Field-Test 9 Dachstein Ice Caves, May 2012, Austria



Precursor Field Tests

International Mars Simulation In Rio Tinto/Spain 2011

Focus:

- Human robotic interaction
- Geoscience & Remote Science Support



Dachstein Ice Caves

Subsurface field tests in Austria, 2012

Remote Science Support Terrain Trafficability tests & Robotics Contamination vector analysis Ground validation of EXOMARS instrument



Precursor site assessements

- Geological analysis, precursor sampling
- Safety/Security/Logistics analysis
- Erfoud/Morocco region exhibits topographical and geological similarities to Martian surface features



Basic Maps:

Prepared before the mission, regularly updated during the mission



Geological Map



Terrain Risc Map



Wifi Coverage Map

Legend Basement Units Layered Unit Cones Units Cones Unit Surficial Units Aeolian Sand Unit Dunes Unit

Alluvial/Colluvial Unit

Colluvial Unit

White-tonned Unit



Suitability Map (example: SREC-Experiment)

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Training of a new group of analog astronauts

More than 100 volunteers from 23 Nations

The Flight Planning allowed for a flexible remote science support



Field operations ("OPS") Remote Sci. Teams/Public Satellite link 1-1-1 Mission Support Center

Field crew & experiments





Mission Experiment Highlights

MAGMA / L.I.F.E.-Laser

Robotic vehicle of ABM Space/Poland Instrument: Bioflourescence laser (Univ. of Innsbruck/Austria)

Controlled from Torun/Poland

Cliff Recon Vehicle

(Association Planete Mars, France)

Human-operated vehicle for steep terrain High-resolution imagery

PULI Rover (GLXP Hungary)

Autonomous (lunar) rover Terrain & teleoperation tests

SET COM XPRIZE



Wellington / New Zealand





Deployable Shelter (TU Vienna / OeWF)

Inflatable/pressurizable shelter Proof-of-concept study

Hunveyor Station

(Eötvös Loránd University, Hungary)

An automated environmental station

microEVA (NASA/JPL-OeWF)

Quantifying contamination vectors for planetary protection

Epiflourescence pattern with contaminated surface under excitation.

Selected results

Despite limitations of high-fidelity analog-research and without prior knowledge of site, previous water activity was identified.

"potential biological activity" 300 Myrs ago.

Measurement of work speed suited vs unsuited: 1.3-fold

Thermal inertia measurments as a field method for detecting cave entrances

Three robotic vehicles, two suits & deployable shelter successfully tested

Risc assessement of actual injuires: MSC vs field crew: w.r.t. traumatic injuries 1:4

MultiMission Data Archive



Mission data from all major OeWF Analog Missions are public under

mission.oewf.org/archive

SUMMARY

MARS2013 was a complex Mars analog simulation in 2013, results will be published in a special edition of ASTROBIOLOGY.

It is considered as a precursor for an arctic expedition in 2016+ in the Canadian Arctic.

We would like to acknowledge the support of UN/OOSA for facilitating the contacts with our Moroccan partners.

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