



EMC13

13th Mars Society European Conference

IPSA Paris – Ivry sur Seine

25-27th of October 2013

Program and abstracts

Friday 25th

2 pm Introduction

Welcome speeches - Alain Souchier (APM) and Hervé Renaudeau (IPSA director)

Program presentation – practical information - Alain Souchier

2.30 pm Session « Agencies Mars activities situation »

2.30 pm – Mars and the CNES programs – Michel Viso (CNES)

3.00 pm - ESA Mars program – Olivier Witasse (ESA)

3.30 pm - NASA Mars Program – (NASA)

4.00 pm Break

4.30 pm Life on Mars – Pierre Brisson (Mars Society Switzerland/APM)

We now know that Mars was once habitable but we don't know whether this was enough for the appearance of Life. We once had running water on the surface but it's now dry and we have perchlorate and hard radiations as well as a very low atmospheric pressure and a low temperature. Life could have developed or taken shelter underground. It could also have developed on the surface, taken shelter underground and come back onto the surface. But we found almost no free oxygen and production of methane is doubtful. It may be that Martian Life is extinct, almost extinct or sheltered in isolated caves or porous rocks or that it did not evolved beyond prebiotic matter. To get an answer we must analyze the most hydrated and therefore oldest surface terrains (Phyllosian clays) or dig

down to underground levels sheltered from radiations, where temperature should be milder, water still liquid and pressure acceptable for transferring elements. In case we find “something”, we’ll have to check the relationship, if any, between terrestrial and Martian life (Steven Benner’s theory).

Saturday 26th

9am Session « Manned flight to Mars »

9.00 am - MELISSA: The European project of closed life support system –
Christophe Lasseur (ESA)

Among all the challenges of a manned missions to Mars, the mass of metabolic consumables (oxygen, water and food) as well as crew safety (chemical and microbial contaminants) represent the key challenges of the Life support system. For these reasons the MELISSA project (Micro-Ecological Life Support System Alternative) has been initiated. This presentation reports on the key challenges, the engineering approach as well as the current state of art.

9.30 am - Propulsion options for manned flight to Mars – Elisa Cliquet (CNES)

Different trajectories are possible for a Mars mission. The case of missions with low thrust propulsion is also examined. Two types of high thrust propulsion are possible: cryogenic propulsion and nuclear thermal propulsion. Different solutions are possible for electric engines but the main question is the power source and its efficiency in terms of mass per kW.

10.00 am - Important findings on manned Mars missions – Jean-Marc Salotti
(ENSC Bordeaux, IMS lab/UMR 5218, APM)

The impact of the size of the crew has been examined. Considering the NASA reference mission, reducing the number of astronauts from 6 to 3 allows important mass savings in several domains: consumables, life support systems, structure, entry, descent and landing systems, surface vehicles, Mars ascent vehicle, propellant, etc. The key finding is that it also has a huge impact on the risks and architecture of the mission, allowing for instance aerocapture for all interplanetary vehicles and avoiding the development of nuclear thermal propulsion and the complex assembly in LEO. Finally, the roadmap leading to the first human mission becomes simple. It is shown that an upgraded version of Mars sample return could be the key preparatory mission and that no intermediate destination such as the Moon or the asteroids has to be included in the roadmap.

10.30 am - Break

11.00 am - Mars Inspiration, the Dennis Tito proposal – Robert Zubrin (Mars Society president)

Inspiration Mars is a project committed to sending a two-person American crew – a man and a woman – on an historic journey to fly within 100 miles around the Red Planet and return to Earth

safely. The mission's target launch date is Jan. 5, 2018. This exceptionally quick, free-return orbit opportunity occurs twice every 15 years. This mission is strongly supported by the Mars Society.

12 am Break for lunch

1.30 pm Session « Robotic Exploration »

1.30 pm - Electric Propulsion to facilitate MSR – Olivier Duchemin (Safran/Snecma) and Dominique Valentian (consultant)

Most Mars Sample Return scenarii involve two launches, one with an orbiter, one with a lander, providing a rocket with a sample storage container. The rocket performs a rendezvous with the orbiter, then the orbiter returns toward Earth. This type of mission is both costly (two launches) and risky (Mars orbit rendezvous), hence the interest of single launcher. Electric propulsion is a key enabler for single launch missions. Two options are presented: a short term mission with a rendezvous in Mars orbit, and a more advanced mission with EP, Cryogenic propulsion, ZBO and a heavy lander with direct return toward Earth

2.00 pm – Inside Curiosity: ChemCam at Gale crater- Nicolas Mangold (Nantes University)

Curiosity landed at Gale crater more than one year ago showing us a fantastic landscape paved by sedimentary rocks formed in a watery past. The Chemcam instrument is a fully new technique at the surface of other planets, with a laser able to derive rocks composition at distance. Nicolas Mangold is co-investigator on the ChemCam instrument of the Curiosity rover and will review some of the recent results from the rover and especially the ChemCam instrument.

2.30 pm – Curiosity SAM results - Michel Cabane (IPSL -LATMOS)

The Sample Analysis at Mars (SAM) experiment is the biggest carried by the Curiosity rover. Under the NASA Goddard Space Flight Center responsibility, this experiment is a cluster of a quadrupole mass spectrometer (NASA GSFC), a tunable laser absorption spectrometer (NASA JPL) and a gas chromatograph (LATMOS and LISA under CNES responsibility). SAM provides the chemical composition of atmospheric and soil samples. The instrument has been successfully operated on board the Curiosity rover.

3.00 pm - Scientific enigmas and Mars robotic exploration– François Forget (IPSL - Dynamic Meteorology Laboratory)

Some discoveries about Mars remain to be explained. The future robotic missions (Maven, Insight, Exomars 2016 orbiter and lander and 2018 rover, the new 2020 US Curiosity size rover, and the future Mars Sample Return mission) will help to understand these recent discoveries.

3.30 pm – Break

4.00 pm - INSIGHT 2016: the first geophysical Martian observatory – Philippe Lognonné (IPGP - Paris Diderot University)

The INSIGHT mission was selected by NASA in 2012 for a launch in March 2016. The main science instrument, the Seismic Experiment for Interior Structure (SEIS) is developed under CNES and Paris Institut of Earth Physics (IPGP, Paris Diderot University, CNRS) responsibility with US, English, German and Swiss partners. The DLR Planetology Institute provides an instrument to measure the thermal flux coming from Mars inner zones. Other instruments will contribute to the INSIGHT geophysical mission. The SEIS objective is to monitor Mars seismic activity and the seismic signals coming from impacts, atmospheric activity, Phobos tides, and to determine the planet internal characteristics in order to understand its geodynamic evolution since 4 billion years.

4.30 pm - Mars Flyby CubeSat, an educational project to study the radiations – Boris Segret (APM – ESEP – LESIA - Paris Observatory)

The Mars Flyby Cubesat is a project aiming at measuring the radiations level during a trip to Mars and back in preparation of future human missions. As a secondary objective the Mars Flyby Cubesat will contribute to the hunt for Near Earth Object Asteroids during its trip to and from Mars. The launch is expected as a passenger payload to a heavier probe.

7 pm Reception at Aéroclub de France

Sunday 27th

9 am Session « Exploration and simulations »

9 am - The Mars society 365 days 2014/2015 simulation in Arctic - Robert Zubrin (Mars Society president)

The Mars Arctic 365 project aims at conducting a long-duration simulated expedition to Mars in the polar desert of the Canadian High Arctic, in the Mars Society FMARS habitat located on Devon Island. A preparation phase 1 mission to upgrade the facility and prepare the one year mission has been successfully conducted during the 2013 summer. The MA365 mission crew will conduct a program of field exploration in one of the most Mars-like environments on Earth, while operating under many of the same operational constraints as an actual Mars mission. In the course of doing this, crew members will learn a great deal about which methods, technologies and tactics will work best on the Red Planet. Furthermore, they will do this while dealing with the stresses that come not only from isolation, as the Mars500 crew experienced, but also cold, danger, hard work and the need to achieve real scientific results, and thus truly begin to explore the critical human factor issues facing Mars exploration. Nothing like this has ever been done before.

9.45 am - MARS2013: a 23-nation Mars Analog Simulation in the Northern Sahara – Gernot Groemer (OEWf/Austrian Space Forum)

Between 01 - 28. February 2013, the Austrian Space Forum – in partnership with the Ibn Battuta Center in Marrakesh and research partners from 23 nations - conducted an integrated Mars analog field simulation in the northern Sahara near Erfoud, Morocco in the framework of the PolAres research programme. Directed by a Mission Support Center in Austria, a small field crew conducted experiments preparing for future human Mars missions mainly in the fields of engineering, planetary surface operations, astrobiology, geophysics/geology, life sciences and other.

Supported by exceptional imagery by the renowned photographer Katja Zanella-Kux, an account of the largest Mars Analog simulation in 2013 is given and the highlights of the scientific activities are presented.

10.30 am – Break

11.00 am - Isolated bases, Earth Mars analogies – Alain Souchier (APM)

Many isolated scientific bases are in operation to day in remote areas on Earth. The operations on these bases, the constraints, the scientific activities, the crew psychology and morale bear similarities to what will be Mars bases conditions. Lessons may be learned from these situations to be applied to Mars bases. The particular example dealt by the presentation is the Crozet islands Alfred Faure base.

11.30 am - Mars 105/500 simulation – Cyrille Fournier (Mars 105 crew)

Mars 500 was a simulation of a trip to Mars and back conducted in 2010-2011 at the Russian Academy of Sciences Institute of Biomedical Problems (IBMP) in Moscow. The main objective was to study psychosocial isolation. The crew was international with participation of two Europeans sent by the European Space Agency ESA. The final simulation lasted 520 days from June 2010 to November 2011. A 105 days preparation mission was conducted previously, including also two European crewmembers and ended in July 2009.

12 am Break for lunch

1 pm Mars Society chapters internal meeting

2 pm Session « Outreach and Mars Societies actions»

2.00 pm - The URC rover competition – Mateusz Jozefowicz (Mars Society Polska and ABM SE)

The Mars Society Polska has initiated since many years a program of Analog Mars rovers with participation in many analog simulations in the world (Utah, Dachstein ice cave in Austria, Mars2013 operations in Morocco). The polish rovers have regularly participated to the University Rover Challenge (URC), the world's premier robotics competition for college students. URC challenges students to design and build the next generation of Mars rovers which will one day work alongside astronauts on the Red Planet. They compete at the Mars Desert Research Station (MDRS) in the remote, barren desert of southern Utah. The 2013 competition featured the largest international field to date, and was won by the polish rover Hyperion from Bialystok University of Technology.

2.30 pm - The Archimedes Mars balloon project – The MIRIAM test flights – Jürgen Herholz and Kai Gehreth (Mars Society Germany)

The Mars Balloon Mission ARCHIMEDES is a joint undertaking of the German Mars Society (MSD) and the University of the Armed Forces of Germany. The major scientific goals of the mission are to evaluate the composition of the Mars atmosphere and the residual magnetic field of Mars with a scientific payload attached to a 10 m balloon. The balloon will be inflated already outside the Mars atmosphere, then being steered into an atmospheric entry orbit for decelerating the balloon, until it reaches a near-floating condition in the thin Mars atmosphere and descends to the surface.

The entry of a balloon into a thin atmosphere has never been attempted before and constitutes therefore a major challenge for the ARCHIMEDES project. Research and tests performed at the University of the Armed Forces since 2003, including a doctorate thesis, have confirmed that a 10 m balloon can be designed with technologies and techniques in reach, that can survive the deceleration and heat loads during entry in the Mars atmosphere.

The sounding rocket flight test program MIRIAM 2 shall validate the research and test results for the critical atmospheric entry phase. For this purpose a 4-m balloon carrying a payload with a large number of sensors will be inflated in 200 km altitude, approach the earth in a parabolic flight trajectory and finally enter the earth atmosphere. Previous tests performed in preparation of the ARCHIMEDES Mars Balloon mission include: balloon development and drop tests between 2003 and 2006, parabolic flight testing of the balloon deployment mechanisms in the Zeor G Airbus in 2005, a sounding rocket flight test of the balloon storage and deployment system in 2006 ("REGINA" mission), and the full simulation test "MIRIAM 1" on a sounding rocket in October 2008, where MIRIAM 1 was carried to 175 km altitude.

3.15 pm - Artificial gravity demonstration on parabolic flight – François Noyez, Denis Le Goff, Victor Vaudaux (Centrale Lille/APM)

To avoid the consequences of long weightlessness periods on the Mars mission crews, a long time proposed solution is to create an artificial gravity by linking the transfer habitat to the spent launcher upper stage by a cable and rotating the assembly. After two years of preparation by a team of students from Ecole Centrale Lille, a mock up was demonstrated in the Novespace Zero G Airbus the 9th of October. The operation was sponsored by CNES and by the Planète Mars association (APM).

3.45 pm – Break

4.15 pm - The MDRS 127 simulation - ULC team (Mars Society Belgium)

In March and April 2013 a team of six students from Université Catholique de Louvain (ULC) spent two weeks in the Mars Society MDRS station in Utah simulating a Mars exploration campaign. The team had a scientific experiment program and was composed of one geologist, two physicists and three engineers.

4.45 pm – Colonize Mars – Olivier Walter and Pierre Brulhet (APM)

After more than 12 years of discussions and studies on projects of Martian bases, pressurized rovers (models, 3D movies, photographs, drawings) in partnership with the Association Planète Mars, schools of architecture (Paris Val-de-Marne) and design (Strate College Designer), then a mission in the MDRS in Utah desert in 2006, it became clear that the next step was to work on a Martian colony concept. With our experience on habitat in extreme environment conditions, we have presented at the EMC11 Neuchâtel of 2011 a project (model, plans and illustrations) of a Martian colony for 70 people. Today we want to develop and to test new ideas, to provide solutions for a better and more comfortable life on Mars. The future will be to extend this concept to a bigger colony on the scale of a small town of about 2000 people.

5.15 pm – The ARTSEM association – Stéphane Grès (ARTSEM/UTC-TSH-COSTECH)

Presentation of the ARTSEM association devoted to research, development and application of new tools and methodologies in the design and development of robotic and manned space exploration missions.