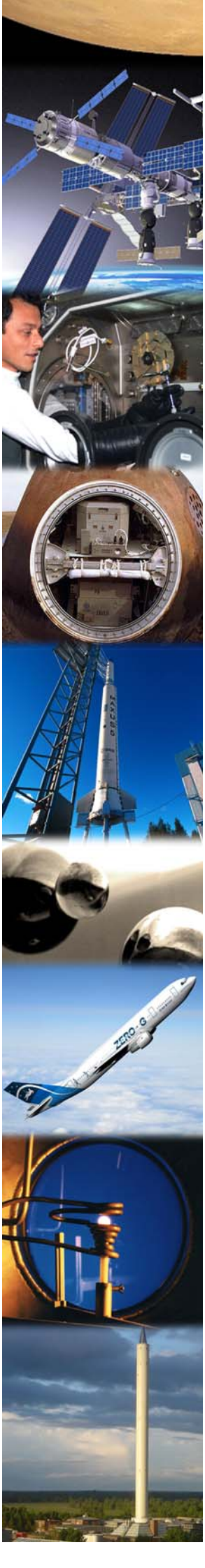
Human Spaceflight, Microgravity and Exploration

NEWS

April 2007



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Physical Sciences

IMPRESS PRIZE FOR YOUNG RESEARCHERS WINNER ANNOUNCED
March/April 2007

IMPRESS PAPER "ADVANCED INTERMETALLIC MATERIALS AND PROCESSES"
given at TMS 2007 Annual Meeting, Orlando, March 27

Life Sciences

WORKSHOP ON PSYCHOLOGICAL SUPPORT
Technology and Techniques, March 26, 2007

Life and Physical Sciences

ISS IN APRIL 2007 - ESA SCIENCE PERFORMANCE ONBOARD

FOTON-M3 MISSION SEQUENCE TEST
at ESTEC, April 10-20, 2007

Exploration

MARS-500 RESEARCH ANNOUNCEMENT
release on April 02, 2007

CONCORDIA RESEARCH ANNOUNCEMENT
release on April 02, 2007

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IMPRESS Prize Winner Announced

THE WINNER OF THE IMPRESS PRIZE FOR YOUNG RESEARCHERS FOR 2006 WAS ANNOUNCED THIS MONTH, NAMELY DR. FRANÇOIS DEVRED OF THE LEIDEN INSTITUTE OF CHEMISTRY, LEIDEN UNIVERSITY. THE PRIZE WAS AWARDED FOR HIS WORK ON PREPARING AND ANALYSING THE PERFORMANCE OF RANEY NICKEL CATALYSTS.

The IMPRESS prize, which is awarded annually, is open to PhD students and post doctoral researchers who are working on the IMPRESS (Intermetallic Materials Processing in Relation to Earth and Space Solidification) project. The scientific objective of the project is to gain a better understanding of the links between materials processing and final properties of intermetallic alloys. Microgravity platforms such as parabolic flights and sounding rockets are used to perform benchmark experiments on these alloys. The two main applications identified are in gas turbine blades and Raney-type catalytic powder. IMPRESS combines the expertise of 42 research groups from academia and industry. The IMPRESS Integrated Project is co-funded by the European Commission in the 6th Framework Programme, the European Space Agency, the Swiss Government and the individual partner organisations.

Dr. Devred's work involved studying the catalytic activity of various Ni – Al alloys after exposure to strong alkali solutions. It is anticipated that Dr. Devred's research will help in the development of improved catalysts for industrial hydrogenation processes as well as cheaper and more effective hydrogen fuel cells. His prize includes 1,000 € together with the IMPRESS Prize Trophy which is modelled on the Ariane 5 launcher. Both will be presented at the IMPRESS plenary meeting in Krakow on 2nd July.

In further news from IMPRESS on 27th March 2007, an IMPRESS paper was given at the TMS 2007 Annual Meeting, which is a unique conference in the fields of minerals, metals and materials, involving over 3000 delegates. Dr. David Jarvis presented the status of the titanium aluminide research at the Symposium on Shape Casting. The presentation entitled "Advanced Intermetallic Materials and Processes" covered a wide range of activities including improved casting technology, fundamental studies of solidification both terrestrially and in space, the creation of reliable thermodynamic and kinetic databases, thermophysical property measurements, multiscale computer modelling, structure characterisation, mechanical property testing and industrial product development. The paper was well received by an audience of established industrial and academic researchers in the area of alloy casting.

The full paper can be obtained from the following reference:
D. J. Jarvis, D. Voss and N. P. Lavery, Shape Casting: The 2nd International Symposium, Edited by Paul N. Crepeau, Murat Tiryakioðlu and John Campbell, TMS (The Minerals, Metals & Materials Society), 2007, p. 69-76.

For further information on this story and on the IMPRESS project in general visit
http://www.spaceflight.esa.int/impress/

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'Tools for Psychological Support during Exploration Missions to Mars & Moon' Workshop, ESTEC March 26

On March 26, 2007, a workshop on "Tools for Psychological Support during Exploration Missions to Mars & Moon" took place at ESTEC in the Netherlands.

Long-duration exploration missions like e.g. to Mars will pose completely new challenges to space crews, compared to Low Earth Orbit flights. One of the potentially critical issues is psychology. Factors like the very long duration, the extreme isolation in a hostile environment (vacuum, radiation etc.), the small crew size with limited privacy, limited communication possibilities with friends and family, no emergency return possibility etc. will act as stressors on the exploration crews.

Today, most psychological support measures are employed in-flight. There are regular private conferences with psychologists, regular conferences with family, re-supplies, uplink of news, visiting crews etc. However due to communication delays, probable bandwidth restrictions and mission characteristics (that e.g. don't allow for re-supply or visiting crews) most of these measures will either be impossible, or possible only in a limited measure on a mission to Mars.

As an effect, even more emphasis will have to be placed on selection and training of crews. Support measures to be used in-flight must also be considered in order to reduce the risk of mission critical psychological problems. However these must take into account the above mentioned specific constraints of exploration missions.

In order to study possible concepts for psychological support in exploration class mission, ESA has awarded a contract to the British company Systems Engineering & Assessment Ltd (SEA). In the frame of this contract, the abovementioned workshop was organised.

Sixty-five participants contributed to a very successful and productive workshop. Topics of presentations and posters ranged from a review of current psychological support measures, lessons from recent space psychological research, lessons from other environments, ideas for new support tools up to considerations for good habitats, e.g. through the use of colours.

Mars situation – artist impression, courtesy Ducros/ESA

Together with the presentations and posters lively discussions took place and the considerable collective experience and expertise reflected in this, will certainly have been a very valuable contribution to the success of the study and thus help to better prepare for future human exploration.

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Onboard ISS in April 2007 - ESA Science Performance

THE EXPEDITION 15 CREW AND SPACE FLIGHT PARTICIPANT, CHARLES SIMONYI ARRIVED ON 9 APRIL, 2007 WHEN THE SOYUZ TMA-10/14S SPACECRAFT DOCKED WITH THE INTERNATIONAL SPACE STATION. THE EXPEDITION 15 CREW INCLUDES COSMONAUTS FYODOR YURCHIKHIN, COMMANDER, AND OLEG KOTOV, FLIGHT ENGINEER, AND ASTRONAUT SUNI WILLIAMS, FLIGHT ENGINEER.

Commander Michael Lopez-Alegria, Flight Engineer Mikhail Tyurin and Space Flight Participant Charles Simonyi returned to Earth on 21 April in the Soyuz TMA-9/13S spacecraft, with a safe landing in Kazakhstan.

'Cardiocog-2' done by T. Reiter, the Astrolab Mission in 2006

ESA Science Activities in April:

The 14S mission was planned to perform the experiments Chromosome-2, Low Back Pain, Neocytolysis, SAMPLE
The experiments were performed as follows:

- Choromosome-2 is investigating the effect of in particular radiation on the genetic material, and the experiment is done before and after the flight in the form of two blood samples. These are compared regarding effect on the chromosomes as an expression of the effect space radiation has. Similar experiments have been performed over the years, on a considerable number of astronauts. The material allows evaluating the risks related to exposure to space radiation for shorter or longer periods.

- Low Back Pain follows a similar model, examinations being performed only before and after the space flight, but with a questionnaire to be filled in at regular intervals during the flight. The experiment builds on the valuable

foundation, which was created in the simulation study Berlin Bed Rest I. Among other things that study was concerned with the problem of the back being unloaded for longer periods. A large number of astronauts experience back pain during and after space flights. In addition, this experiment has a strong clinical application in examining reasons for developing low back pain. Space Flight Participant Simonyi provided several entries into the log/questionnaire for this ESA study.

- Neocytolysis looks in particular at the possible effect of radiation on blood cell production. The experiment is related to spaceflight anaemia which probably is due to microgravity effects rather than radiation. Blood samples are drawn before and after flight.

- SAMPLE is an experiment that will take samples from diverse surfaces, on the station itself as well as from the skin of the astronauts. Samples are taken for screening of the development of micro organisms in the ISS environment, in order to create a better understanding of microbiological risks related to living and working onboard a spacecraft. Kotov collected microbial samples for this ESA experiment. Samples were collected from Kotov himself as well as from areas of the ISS (switches, keyboards, personal hygiene equipment, etc) at several points during the flight.

Increment 15 has started with the crew arriving on 9 April. In addition to the activities undertaken during the short Soyuz exchange mission between 13S and 14S, further and generally longer term investigations have been started. Increment 15 experiments, of which some are continuations, are:

ALTCRISS, CARDIOCOG-2, EDOS, IMMUNO, MATROSHKA-2B, NOA-2, whilst the experiment SAMPLE performed in the context of the 14S mission, will be continued. As the Increment is around one month old now, a number of the indicated experiments have not been performed yet. The experiment formats and status are described in the following:

- ALTCRISS (using the Italian ALTEINO equipment) is dedicated to perform a long term measurement of the radiation environment at different points inside the International Space Station (ISS). This includes continuous measurement of the cosmic radiation flow also in relation to long and short term solar activity. The experiment is functioning nominally.

- CARDIOCOG-2 studies the impacts of microgravity on the cardiovascular system and the respiratory system. This investigation will examine the stress as well as the cognitive and physiological reactions of crewmembers during long-duration space missions. The first planned CARDIOCOG-2 session could not be performed since a power cable could not be found.

- EDOS is an experiment that is examining the effect of spaceflight on the skeleton, implementing scanning of bones before and after the flight. Use of the pQCT method allows identifying changes in the trabeculae in the bone. In addition analysis of blood samples for identification of diverse biochemical so-called bone markers is done. The experiment is performed on the ground pre- and post-flight for both Russian Expedition crew members.

- IMMUNO is an experiment that will be continued on Increment 15, the first occasion around June-July 2007 and the second towards the end of the increment. One person will provide samples. Blood and urine samples are given for analysis of the status of the immune system under space conditions.

The experiment is planned to start in June.

- MATROSHKA-2B is a continuation of the earlier radiation monitoring activities that this dosimeter complement facility has been used for the last year, under the name MATROSHKA-2A. After around one year of monitoring, Thomas Reiter removed the sensors late in 2006 onboard the ISS from the 2A version . Form February 2004 until August 2005 MATROSHKA-1 was collecting date outside the ISS. The phase -2A has been collecting data inside the ISS using the same facility. Whilst MATROSHKA-2A has been applying passive detectors only, the MATROSHKA-2B phase (to start not earlier than August-September 2007, due to the fact that the new detector-set needs to be built into the presently passive MATROSHKA facility) will represent both passive and active detectors. Experiment to start late in this increment.

- NOA-2 is an alternative application of the NO device, compared to the NOA-1 experiment performed on earlier increments for indication of disturbance of the lining tissue in the airways. This disturbance can be substantiated by measuring the production and exhalation of Nitric Oxide (NO) from the lungs. As a basis for the NOA-2 experiment, ground-based experiments have substantiated that potential decompression sickness can be estimated using this method. For this reason measurements will be done around times for EVA activities, as they entail so-called pre-breathing and different air pressure regimes. The regimes mentioned have the potential of developing decompression symptoms. NOA-2 had a technical check point in April for exchange of a vital limited-life part. The device has however not been located in the expected storage location.

For more in depth description of the experiment and their background, please visit this location

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FOTON-M3 Mission Sequence Test at ESTEC, April 10-20

View over the Biobox hardware in focus (ESTEC)

THE FOTON-M3 MISSION IS SCHEDULED FOR LAUNCH ON FRIDAY 14 SEPTEMBER 2007. THE EARLIER FOTON-M2 WAS FLOWN JUNE 2005.

During the period April 10-20, 2007 a so-called Mission Sequence Test has been performed at ESTEC, in order to check out all equipment related operations issues.

Functioning of equipment and communication between equipment and the 'ground station' has been tested, simulating the first three and the last three days of the nominal 12 day mission. See the payload composition here.

For monitoring the science, FOTON missions are relying on telemetry via ground stations. Over the years an ever increasing demand for scientific real-time data has been experienced. As a result, an additional science monitoring ground station has been established in northern Sweden, at the ESRANGE location, where the Telemetry Science Unit (TSU) is now located. ESRANGE is mainly used for launching, monitoring and controlling sounding rockets and their payloads, but is now also serving as the ground station, where scientist can follow their FOTON payload, and to a certain extent control it. Control of the spacecraft itself is done from Tsup-Korolev Control Centre in Moscow.

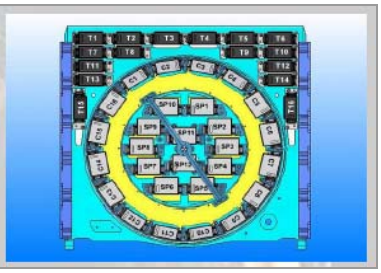
Whilst the on-going MST is purely operational, thus without scientific samples, the FOTON-M3 mission in September will be supporting:

- 36 highly rated scientific experiments,
- 4 technology prototype demonstrators,
- 2 technology application projects (MAPs), and
- 2 educational students' projects.

The mission is presently scheduled for launch on 14 September, at 1400 hours GMT. The duration will be 284 hours orbital flight. Each day the Kiruna ground station at ESRANGE will have telemetry contact with FOTON during 4-6 consecutive orbits only out of a total of 16, with telemetry also possible via two Canadian ground stations at Saskatoon, and at St. Hubert. In addition scientists will be able to monitor a part of the data in their home institutes.

- 5 Experiments:

CONNECT	University of Liège (B)
OBADIS	LBTO, St Etienne (F)
OSTEOGENE	University of Leuven (B)
RADCELLS	University of Ghent (B)
OCLAST	University of Bari (I)



Top schematic view of placement of experiment containers in one of the two Biobox incubators onboard FOTON M3

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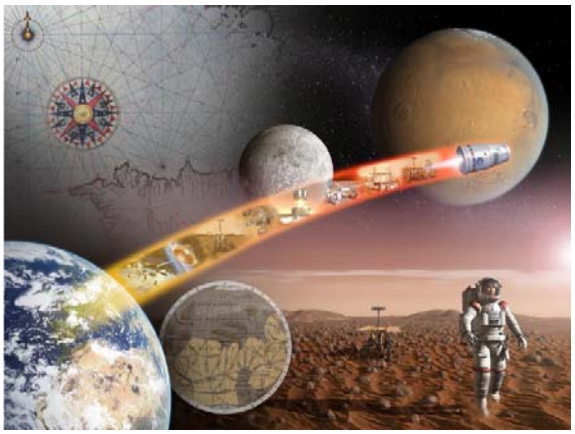
Mars-500 Research Announcement, April 02, 2007

In order to prepare for crewed exploratory missions to Moon and Mars, studying aspects in a simulated ground-based environment is regarded as an important step. Therefore ESA is engaging in a 500-day isolation study cooperation with the Russian Life Science Space Authority, the Institute for Biomedical Problems, or IBMP, which will simulate all aspects of a manned mission to Mars, e.g. autonomy of the crew, limited supplies, confinement etc. A crew of 6 persons will participate; four will be Russian, and 2 will be from ESA member states. The long study will be preceded by 1-2 shorter 100-day pilot studies. A programme designed to simulate travel to Mars, a 30 day surface exploration phase and travel back will be performed.

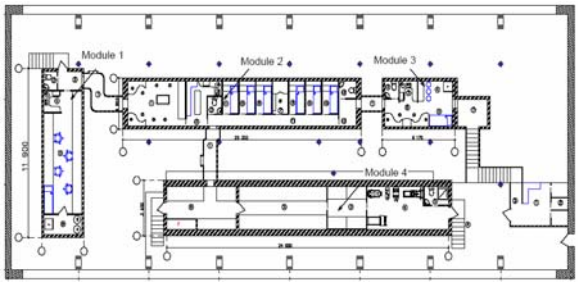


Characteristics of the studies will as an example be a signal passage delay of up to 20 minutes during communication of the crew and the ground-based control centre, that will be built in with the aim of simulating a real interplanetary mission (radio transmission time between Mars and Earth).

The Ground-based Experimental Facility (NEK) in which the experiment will be carried out is located in a special building on the IBMP site in Moscow. This building comprises the isolation facility itself, as well as the operations room, technical facilities and offices. The current lay-out of the isolation facility comprises 4 hermetically sealed interconnected habitat modules, in addition to one external module, which will be used to imitate a stay on the "Martian surface". The total volume of the habitat modules is 550 m3. The technical drawing of the architecture of the facility shows: 1) Technical-Medical Module, 2) Living Quarters, 3) Mars Landing Module, and 4) Storage Module

An Announcement of Opportunity (AO) was released on 02 April 2007, soliciting proposals for psychological, medical and technical research and will start looking for volunteers starting in June 2007.

The study defined still awaits formal agreement between ESA and IBMP.



See further details on: http://spaceflight.esa.int/users/downloads/ao2007/AO-07-Mars500.pdf .
Contact Mars500@esa.int

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Concordia Antarctic Station Announcement of Research Opportunity, April 02, 2007 for Medical, Physiological and Psychological Research

ON 2 APRIL THE CONCORDIA ANNOUNCEMENT OF OPPORTUNITY HAS BEEN RELEASED BY ESA. THE CONCORDIA STATION IS CONSIDERED AN ANALOGUE TO LONG TERM SPACE MISSIONS, ESPECIALLY IN TERMS OF DEGREE OF ISOLATION AND THE REQUIREMENT OF CREW AUTONOMY. CONSEQUENTLY, THE KEY FOCUS OF THE AO IS THE INVESTIGATION OF THE ADAPTATION OF HUMAN BEINGS TO EXTREME CONDITIONS, SUCH AS ISOLATION, CONFINEMENT, CLIMATE AND ALTITUDE.

Each Concordia crew is composed of up to 16 persons that stay 10-14 months at the Concordia station of which 8-9 months will be in isolation due to the harsh environmental conditions. This implies that all problems (incl. medical ones) during the local winter period have to be solved on/site by the crew with existing resources. Other characteristics of this setting include the multicultural composition of the crew, limited mobility, altered day/night rhythms, periods of under-stimulation and boredom etc.

Dates to note:

- 02 May 2007: Letter of Intent Deadline
- 10 May 2007: Proposal Workshop @ ESA/ESTEC, Noordwijk, The Netherlands
- 02 July 2007: Full proposals due.

The implementation of selected experiments is planned to start in the 2008-9 time frame.

The full research announcement can be found at : http://spaceflight.esa.int/ao2007
Information on the Concordia Antarctic Station http://www.concordiastation.org

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