Human Spaceflight, Microgravity and Exploration

MAY 2008

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The Research and Operations Department of the Directorate of Human Spaceflight, Microgravity and Exploration releases a Newsletter on highlights of the month

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EUTEF – ON-ORBIT COMMISSIONING AND INITIAL SCIENCE OPERATION

Columbus Module attached: SOLAR (mid-left) and EuTEF (under SOLAR) mounted on their structures (courtesy NASA)

THE EUROPEAN TECHNOLOGY EXPOSURE FACILITY – EUTEF – AND THE SUN MONITORING OBSERVATORY – SOLAR – HAVE BEEN LAUNCHED ON THE STS-122 (1E) SHUTTLE FLIGHT ON 7 FEBRUARY THIS YEAR AND DEPLOYED ON THE COLUMBUS EXTERNAL PAYLOAD FACILITY ON FLIGHT DAY 10. ALL 9 INSTRUMENTS, APART FROM ONE ARE IN FULL FUNCTION, AND ARE SENDING DATA FOR ANALYSIS BY THE SCIENTISTS. FIRST RESEARCH RESULTS HAVE BEEN OPTAINED.

DESPITE THOROUGH TESTING ON GROUND, SOME INSTRUMENTS HAVE SHOWN ANOMALIES DURING THEIR FIRST STAGE ON-ORBIT, WHICH, IN MOST CASES, HAVE BEEN CORRECTED, NAMELY VIA SOFTWARE UPDATES. A DETAILED DESCRIPTION OF THE INDIVIDUAL INSTRUMENTS AND THEIR 'TASKS' WAS PROVIDED IN NEWSLETTER N°. 2, 2008, - A GOOD BACKGROUND FACTS PAPER, WHEN GOING THROUGH THE STATUS REPORT HERE.

The operations team of the ERASMUS User Support Operations Centre (USOC) in Noordwijk, The Netherlands, is responsible for operation and control of the EuTEF payload and instruments. The scientists have full access to the data generated by their EuTEF instruments and they have commanding capabilities that allow them to control the execution of their experiments on ISS from their User Home Bases (UHBs). The command stacks they prepare are sent via the ERASMUS USOC, who checks for acceptability of the operations and coordinates the activities with the Columbus Control Centre (Col-CC), before the commands are up-linked to ISS and routed to the instruments. Scientists can also command their instruments by means of Instrument Operations Programmes (IOPs). These are command sequences that, once uploaded into EuTEF, are executed by EuTEF automatically as EuTEF Operation Plans (EOPs). This direct involvement of the scientists at their UHBs has already proven to be highly successful.

The start of the activation of a facility such as EuTEF on orbit, is marked by the commissioning period, during which the instruments are set up for nominal function, calibration, check of data and power links, etc. Some corrections, e.g. fine-tuning of on-board settings, are also performed during this time.

The instruments have been sending data almost continuously with the exception of some power down periods.

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The EuTEF platform is powered down during EVAs with crew activities in the vicinity of EuTEF, to protect the crew from risk of electrical shock and locally high surface temperatures on the PLEGPAY instrument.

The EuTEF instruments are designed to withstand periods without receiving electrical power from Columbus, for a period of a duration of up to three hours. They are designed to withstand unscheduled power losses and other off-nominal situations such as software errors. As ISS does not have continuous ground coverage with Loss-of-signal (LOS) periods of up to 90 minutes, EuTEF monitors all relevant parameters automatically and autonomously initiates, if needed, the necessary actions to guarantee safety at all times, even without ground coverage.

On Sunday 20 April the EuTEF facility went into off-nominal mode, due to a EuTEF internal software error, which had struck twice before. The problem was corrected by a graceful shutdown and power cycle of EuTEF. None of the instruments were affected, and they were up running again when powered up. On 25 April the entire platform was shut down accidentally by Col-CC during a power-switching for the SOLAR payload, but powered up again immediately without a lasting impact on the instruments, which could be recovered by ERASMUS.

While most detected anomalies have been corrected in the meantime and the instruments are operating normally, no pictures could be received on ground from the Earth Viewing Camera and a technical investigation into the problem is on-going.

MEDET, MATERIAL EXPOSURE AND DEGRADATION EXPERIMENT

MEDET in preparation for thermal testing at ESTEC

The MEDET instrument has been running since 6 March soon after the first activation of EuTEF. MEDET has been commanded via EuTEF Operations Programme[1] (EOPs), command sequences directly from its UHB as well as the ERASMUS USOC.

MEDET, like all other EuTEF instruments, was switched off prior to EVA-3 during the 1J/A assembly flight and was powered on without problems afterwards. On 24 March, automatic monitoring of MEDET by EuTEF on-board software was enabled and science data collection was started without problems. On 4 April a parameter change was commanded successfully to overwrite some default values.

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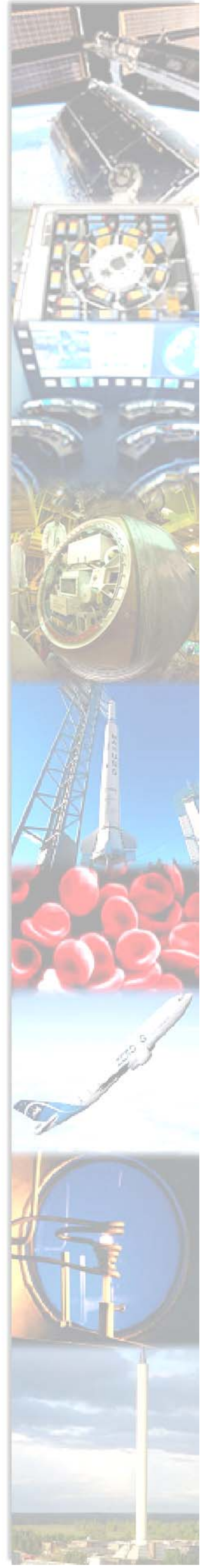
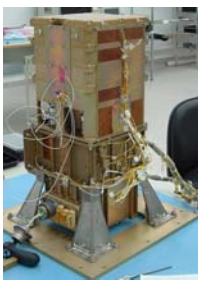
[1] EOPs and IOPs: IOPs are command sequences prepared by the scientists to perform an experiment with their instrument. IOPs are sent to the ERASMUS USOC where a compilation and verification of received IOPs is done, forming a so-called EuTEF Operations Programme (EOP) which is uploaded and executed by the EuTEF DHPU.



The spectrometer sample wheel got stuck in the zero position at one time, but the problem could be solved via ground commanding. MEDET was power-cycled and the reboot EOP was performed to overcome the problem. MEDET has been running without problems since then, delivering science data checked by the scientists on the MEDET UHB.

DOSTEL, DOSIMETRY TELESCOPES RADIATION MEASUREMENTS – DLR – SMALL RADIATION TELESCOPE FOR MEASURING RADIATION ENVIRONMENT

It may be recalled that the DOSTEL facility has been flown several times earlier, in different configurations, which offers an experience basis regarding functionality under space conditions. It was therefore no surprise that it did not cause any problems since EuTEF was first switched on. On 24 March automatic monitoring of DOSTEL parameters by EuTEF was enabled and DOSTEL has been recording the radiation environment data since then.



TRIBOLAB, TRIBOLOGY PROPERTIES OF MATERIALS:

Tribolab is measuring lubrication effects under micro-g conditions. On 5 March, the instrument was running nominally in stand-by mode. In preparation of the EVA-3 during the 1J/A assembly flight, it was commanded into Thermal Stabilization Mode (TSM) on 16 March. On 18 April it was then deactivated and reactivated after the EVA without any incidents. Tribolab cannot run experiments during ISS manoeuvring or docking activities. Hence it was the intention to start data collection early April after the Automated Transfer Vehicle (ATV) would have docked with the Station.

After ATV docking on 3 April the first Tribolab experiment could start as planned, the first experiment being the ‘Pin-on-Disk’ (POD) experiment. In preparation for the start, diverse tests were run to make sure that the full functionality would be available. In this context, also the ball-bearing experiment planned for a later start was tested briefly with a command stack put together at the User Home Base (UHB). The scientists follow and communicate with their instrument from their UHB.

The POD experiment was planned to run for about 7 days, but on the fourth day the experiment unexpectedly stopped during a period of so-called Loss of Signal, or LOS, i.e. a period during which no telemetry or other communication with the experiment has been available, due to the not 100% communication coverage around the globe. It was found that the POD experiment had experienced a sudden increase in friction, which was unexpected. The experiment was restarted on 21 April after evaluation of the data gathered during the first run, and it stopped early again, for the same reason as before. The scientists are still analysing their data, but first results show that the behaviour of the lubricants under micro-g and vacuum conditions is indeed different than on Earth, which may well explain the initially unexpected measurements.

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No Tribolab experiments were performed until 25 April where the ISS got an orbit boost (by ATV), as the instrument HW is sensitive to movements of that magnitude. On 25 April the POD#2 experiment was initiated, but the accidental loss of power for EuTEF interrupted this experiment. After verifying that no damage to the instrument had occurred, the POD#2 experiment was restarted a day later and it successfully finished, as planned, on 8 May.

EXPOSE, Photo- and Exobiology EXPOSE has been in the R3D nominal mode from the beginning, indicating activation of data transfer from the so-called Radiation Risks Radiometer Dosimeter (R3D), which measures solar radiation in 4 channels and cosmic ionizing radiation. This important data will be used for the interpretation of the evolution of the various organic samples during their space exposure. EXPOSE will remain in this mode and continue to gather further environmental data. The EXPOSE facility Responsible Centre (FRC) – MUSC, Cologne, Germany - runs the same experiments as reference on ground under laboratory conditions parallel to the experiments on orbit. This will allow the scientist(s) to compare the samples that will be returned from orbit with EuTEF.

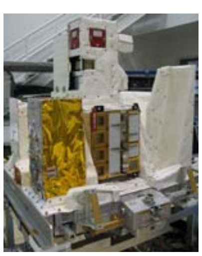
Five single experiments are being served, namely: LIFE, ADAPT, PROCESS, PROTECT, and SEEDS, all described in detail in the previous Newsletter.

DEBIE-2, DEBRIS IN ORBIT EVALUATOR-2,

MICROMETEORITE AND ORBITAL DEBRIS DETECTOR.

This instrument is still not yet fully operational as it has encountered a variety of functional problems. Initially a sensor unit reported a degraded state and DEBIE-2 was switched off by ERASMUS USOC while the telemetry was analysed to find the cause of the problem. On 19 March the instrument was started up again but the sensor unit went again into degraded mode. Comparison with previous versions of DEBIE-2 has shown that the sensors are not actually degraded or faulty. It seems that these readings are triggered by an interaction of the sensors with plasma in the environment of the space station and are thus not anomalies.

Another problem, however, has occurred, which so far has prevented science operation of DEBIE-2: It looses the connection with the EuTEF main computer (DHPU) from time to time. This happens in particular when DEBIE-2 generates a large amount of data. The troubleshooting activities now concentrate on this problem and a (software) solution is expected soon.



FIPEX, (Flux (Phi)-Probe-Experiment) Atomic Oxygen Detector

The instrument initially ran without any problem but on 12

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March a problem on the interface with the EuTEF DHPU occurred, and that same link error occurred during the following days. After EVA#3, during which EuTEF was off, the instrument was switched on again and troubleshooting started. ERASMUS USOC was testing the effect of a gradually increased load on the serial link with the EuTEF DHPU. As a result a way was found for how to operate FIPEX without overloading this link. On 3 April the first data set – data from three sensors for a period of 7 hours - was downlinked and provided to the UHB, and on the following day, the work-around solution to the interface link problems was tested and demonstrated to work without problems. FIPEX operates nominally and has been successfully commanded directly from its UHB on numerous occasions. FIPEX IOPs have also been loaded several times and are now run routinely.

On 10 April, however, the sensors suddenly went into off-mode. On 16 April a new set of instructions were sent to the instrument from ground, but the sensors were kept in off-mode, with a six-day monitoring period scheduled to start 23 April. This re-start took place as expected without further problems.
On 25 April the EuTEF platform was shut down accidentally interrupting the IOP running at the time, but ERASMUS could download the data collected until that point and make it available to the scientists for evaluation. On 30 April a new six-days science run was started based on the data saved after the power loss. The research is related to the important mapping of drag factors in the upper thermosphere, relevant for orbiting space craft, not the least

Science status:
First results show interesting time resolved behaviour of atomic oxygen into flight (RAM) as well into ZENITH direction. The results indicate some minor and a significant deviation of the transient behaviour of maximum and minimum values compared to the prediction of atomic oxygen using the models of the higher atmosphere, e.g. NRLMSISE, MET and DTM[2]. The results prove a prompt increase of the atomic oxygen soon after local sunrise when ISS is travelling along the orbit from south to the equator followed by a decrease when continuing the orbit to higher latitudes. Some minutes before the ISS exits the local eclipse phase (night phase), the atomic oxygen level reaches its minimum. Exact results will be published soon after careful investigation of the processed data to be collected during the next IOPs. See Newsletter N°. 2, 2008 for theoretical background.

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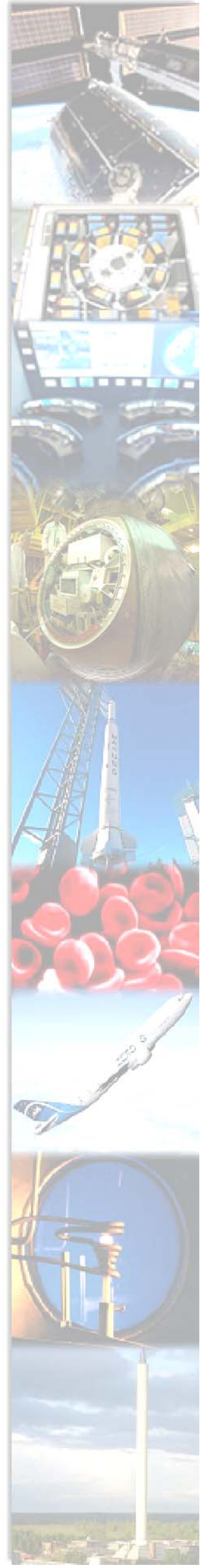
[2] NRLMSISE is an empirical, global model of the Earth's atmosphere. It models the temperatures and densities of the atmosphere's components. *NRL* stands for the US Naval Research Laboratory. *MSIS* stands for Mass Spectrometer and Incoherent Scatter Radar respectively, the two primary data sources for development of earlier versions of the model. *E* indicates that the model extends from the ground through exosphere. Go to the NRL website here.
Other models referred to: MET: Marshall Engineering Thermosphere Model, form 1987. DTM: Density and Temperature Model, from 1977. These models are to a large extent based on the initial Jacchia models, starting in 1965



PLEGPAY, Plasma Electronic Gun Payload for Plasma Discharge

Starting up the PLEGPAY instrument was initially hampered by some problems. Hence a troubleshooting event was scheduled for 14 March, and on 19 March, the commissioning of the instrument was successfully completed.

PLEGPAY monitors electrostatic charging phenomena on large space structures, so that it was decided to let the instrument measure actively during the time of docking of the Shuttle STS-123 to the ISS, as that event would influence the gas environment around the station. The first long duration test was next, planned to start 25 March. Eventually, on 26 March the first 100-hours monitoring period was started and successfully completed.

Another external instrument, SOLACES as part of the SOLAR facility, releases a gas mixture during its sensor calibration. As this gas release affects the concentration of atomic oxygen around the external platforms it was considered necessary to protect PLEGPAY's plasma contactor by releasing Xenon (Xe) gas from PLEGPAY during the SOLACES gas releases. This activity required coordination between the ERASMUS USOC as EuTEF FRC[3], the Belgian USOC (B-USOC) as SOLAR FRC, and Col-CC, the Columbus Control Centre, a challenging task considering the limited supply of Xe gas in PLEGPAY and the short duration of the SOLACES gas releases (1 minute). Nonetheless, the coordination worked perfectly.

On 19 April, in conjunction with undocking of Soyuz 15S, the Langmuir probe[4] (LP) was activated. The instrument functioned nominally and produced science data.

Earth Viewing Camera (EVC)

The EVC was successfully commissioned and took good pictures of the Earth. Further calibration activities to fine-tune the camera settings were performed. Sadly since the commissioning no fully successful image transmission could be achieved, and today no data can be received through the high rate data link, a 125 Mb serial interface (TAXI).

Troubleshooting on the dedicated link is being performed, but still without result. EVC can be commanded, all other functions, e.g. the lens heater, are functioning normally and the housekeeping telemetry does not indicate any errors. The technical failure investigation focuses now on the functionality of this dedicated data link. The outcome of this investigation and failure remedy is also of great importance for future external payloads that might use the same TAXI link.

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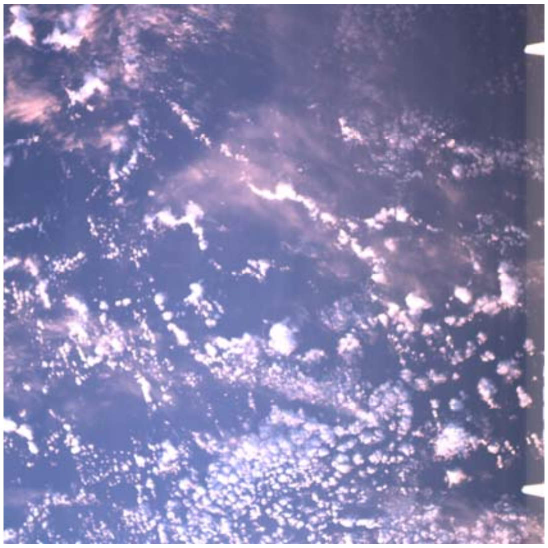
[3] Facility Responsible Centre, for EuTEF as a whole, ESTEC, Noordwijk. B-USOC is the Belgian User Support Centre, the FRC for the SOLAR facility.

[4] A Langmuir probe is used to determine different characteristics, such as electron temperature, electron density, and electric potential of a plasma



Left: one of the first photos taken by the EVC (Courtesy ESA)

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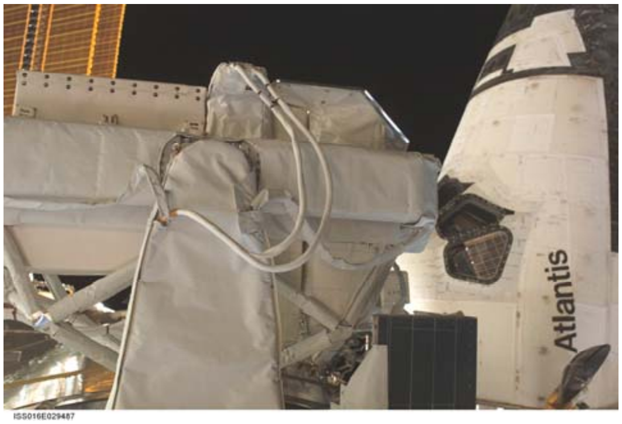
SOLAR – ON-ORBIT COMMISSIONING AND SCIENCE OPERATION ASPECTS



SOLAR in front, in a side-view, showing the movement bracket (CMA support) holding the scientific instruments (courtesy NASA)

The sun monitoring observatory – SOLAR – has been deployed on 15 February this year on the Columbus External Payload Facility. The three advanced spectrometer instruments are in function, and providing science data.

The accommodation of the SOLAR facility onboard the International Space Station puts some restrictions on the sun observation periods, as the ISS attitude relative to the location of SOLAR allows to monitor the sun for only roughly 1/3 of the time. Thus, sun observation can be expected for about 10 days per month. Initially SOLAR has been struggling with technical problems, which to a certain extent also constrained the useful observation time, as those periods are the ones where it can be tested whether the system works nominally, relative to the position of the sun.
A description of the individual instruments and their 'tasks' was provided in Newsletter N^{o}. 2, 2008.

It is recalled, that the tasks of the three instruments comprising the SOLAR facility, are

- to measure the absolute spectral irradiance of the full disk of the sun in the Extreme UV to UV region (15 nm - 220 nm) (SOLACES)
- to measure the absolute solar spectral irradiance from 180 nm to 3000 nm, and to study the solar variability over both short and long time scales (SOLSPEC), and
- to measure the solar spectral irradiance with filter-radiometers in the near UV (402 nm), visible (500 nm), and near IR (862 nm), and the total solar irradiance in the range from 200 nm to 100 µm (SOVIM)
- For further details, please refer to Newsletter N^{o}. 2, 2008.

In addition to the key science task of these instruments, the Coarse Pointing Device (CPD) is the common accommodation frame, and is central to the functioning of the integrated facility, making the perfect tracking of the sun possible.

During the early equipment set-up preparation period, a number of functional incidents have been bothering the SOLAR operations and science teams. The finding was that closed loop control of the CPD did not use the sun sensor signals as intended and therefore required a software update.

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Meanwhile a pre-programmed sun pointing mode has been used to facilitate science operations. In preparation of the STS-123 docking, SOLAR was put in safe mode and the SOVIM covers were closed.

After EVA#3 SOLACES and SOVIM were both reactivated on 18 March. On 21 March, after EVA#4, SOLAR was powered up again successfully. On 26-27 March the W1 and W2 lamps in SOLSPEC were calibrated.
In preparation of the ATV docking on 3 April, the SOVIM covers were closed again, and in general, science acquisition by all three instruments was being foreseen to start on 9 April.

A number of tests pertaining to the sun tracking precision were performed up to that date. Commissioning of SOLACES was started on 8 April but the day after a problem was encountered: Suddenly the command execution of the instrument stopped and as a precaution the B-USOC chose to abort the activity, until troubleshooting could be performed. In the meantime SOVIM went through a successful set of command sequences.

The commissioning of the SOLSPEC was successfully completed on 9 April, and preparation of a synchronous solar spectrum measurement by SOLSPEC and SOLACES to take place simultaneously with that done by a NASA sounding rocket, planned for 14 April was initiated. A last test was performed the day before this event.

On 12-13 April the commissioning of the SOLACES instrument was successfully completed. Unfortunately the Coarse Pointing Device went into stand-by on the day of the synchronised event, following an inadvertent reboot of the SOLAR facility the day before. This had the effect that the planned event could not be performed. A period followed with no science observations, and in preparation of the Soyuz 15S undocking on 19 April, the instruments were put in safe mode, in particular closing the SOLACES and SOVIM covers.

On 22 April the plan for the upcoming sun observation period was laid out by the B-USOC. That opportunity would be starting or started on 30 April.

During the early sun observation period a number of smaller problems were encountered, which gave basis for review of the functioning of some of the command sequences. Finally, on 3 and 4 May, all three instruments have been brought to function very near to nominally, and good science data acquired. Now SOLAR is again in a semi-passive mode until the next sun observation period will commence. Meanwhile the data will be analysed for further science yield optimisation of the next active period.

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BIOLAB COMMISSIONING AND WAICO EXPERIMENT OPERATIONS

ESA Astronaut Hans Schlegel working on Biolab (courtesy NASA)

BIOLAB, an extremely versatile facility for research on biological samples, has been starting its work onboard the International Space station. The European astronauts Hans Schlegel and Leopold Eyharts handeled Biolab and WAICO during all phases since the Columbus deployment on ISS.

The first BIOLAB experiment, WAICO (Waiving and coiling behavior of Arabidopsis roots) experiment was started as planned, immediately after the succesful on-orbit commissioning of the Biolab facility using a set of Reference Experiment Containers. The WAICO-1 experiment could be completed and the 0-g samples returned to Earth for detailed laboratory analysis, despite some problems with the WAICO and Biolab HW functioning. the BIOLAB Facility is presently going through an on-orbit troubleshooting action in order to correct the technical problems encountered on-orbit. In parallel, the optimised WAICO-2 experiment hardware is being prepared for the second experiment run.

The WAICO experiment has been assembled on-orbit by Leopold Eyharts in the so-called BioGloveBox by carefully installing the seeds of wild and mutant Arabidopsis plants in the 8 Experiment Containers. After insertion of the integrated sample Experiment Containers (ECs) inside the Biolab incubator on the two separate centrifuge rotors, these were set to 1g reference conditions and 0g (=stall) conditions. The plant growth from the seeds started nominally through controlled temperature and humidity atmosphere conditioning. At this stage some humidity condensation was gradually building up inside the growth chambers which constrained the continuous plant growth observation as a core experiment scope. The Facility Responsible Centre MUSC and the Biolab engineering support team tried in different ways to correct the situation. The incubator was flushed with cabin air for an extended period, in order to facilitate an improved condensation situation where the planned images could be made during the Arabidopsis plant growth progress.

On 10 March Leopold Eyharts removed the Experiment Containers from the incubator and acquired high-resolution pictures from the plants in the final stage of growth before the planned chemical fixation on-orbit as the end of the experiment. However problems with activating the 1g centrifuge rotor had the effect that the plants were without temperature control and rotor

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impact for 4 hours initially and that situation continued the following day, adding up the lack of 1g-reference to more than 37 hours.

The final science milestone, automatic chemical fixation of the WAICO samples in Biolab planned for 12 March could not be met as a consequence of the blocked fixation mechanism. A number of work-around solutions were implemented also on 13 March, in order to slow down the plant growth (illumination off and lowering of the incubator temperature).

Finally the Rotor A could however be unlocked via a ground command and the 0-g ECs were transferred to Biolab Temperature Controlled Unit (TCU1). Rotor B, the 1-g reference centrifuge, could not be unlocked and the crew could not access the ECs, which were still placed in the rotor.

Prior to the return of the Shuttle Flight 1J/A the 4 zero-g Experiment Containers were removed from the TCU and put inside NASA's active MERLIN refrigerator unit in the Shuttle Mid Deck for conditioned downloading. Meanwhile the WAICO lead scientist Prof. Scherer is analyzing the plant samples from his first ISS experiment in detail.

At the Materials Review Board (MRB), it was substantiated that the problem with the Rotor B locking pin has to do with a technical failure of the related mechanism. A spare centrifuge locking mechanism was therefore sent to the Station with Progress (29P) on 14 May. This exchange and on-orbit check-out of Biolab's automatic fixation mechanism (using again the Reference Experiment Containers as during commissioning) constitute the pre-requisites of functionality proof prior to the WAICO-2 experiment execution.

In the meantime also the WAICO experiment hardware for the second run is under preparation to take place during the ongoing ISS Increment 17, The Biolab Facility Responsible centre, MUSC/Cologne and Facility Support Centre BioTesc/Zurich are planning for the execution of a full Experiment Sequence Test to secure the success of WAICO-2 with the modified experiment configuration. The experiment containers, seed samples and thermal conditioning bags material will be tentatively launched by the Shuttle and the Russian cargo ship Progress.

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FLUID SCIENCE LAB (FSL) COMMISSIONING

ESA Astronaut Leopold Eyharts working on the Optical Diagnostics Module of the Fluid Science Lab (FSL) (Courtesy ESA)

THE FSL SETUP HAS BEEN LARGELY PERFORMED BY ESA ASTRONAUT LEOPOLD EYHARTS DURING THE 1E FLIGHT. FSL REQUIRED QUITE SUBSTANTIAL INSTALLATION OF SENSITIVE STOWAGE ITEMS AND REMOVAL OF LAUNCH LOCKS FOR THE COMPLEX OPTICAL DIAGNOSTICS SYSTEM IN THE SO-CALLED CENTRAL EXPERIMENT MODULE (CEM). HOWEVER WHEN IT CAME TO THE FUNCTIONAL ACTIVATION OF THE RACK A, MAJOR DAMAGE OF THE TELEMETRY DATA HARNESS (ETHERNET AND MIL-BUS) WAS OBSERVED BY THE CREW. AN OTHERWISE ROUTINE ACTIVITY TURNED INTO A SIGNIFICANT PROBLEM WHICH REQUIRED MAJOR CONNECTOR REPAIRS ON-ORBIT BY THE ISS CREW.

A further technical problem was realised, after FSL had been activated: In one of the telemetry connectors, the redundant MIL1553 Bus, two pins were missing, which led to an automatic power-down of the rack upon each activation attempt.

On 18 March this telemetry problem was circumvented by switching to the redundant MIL Bus B and the rack could be successfully activated, followed by a likewise successful rack check-out activity. Further check-out of the optical fibre link was initiated but initially not completed due to some command errors. On 25 March it could be confirmed that the high speed optical link was now fully functional.

The Ethernet LAN cable and MIL-bus A connector repair activities were planned in parallel, but the general safety considerations needed some time to review and approve the procedures.

The repair kit for the LAN connectors was already uploaded on STS-123 (1J/A) flight in March and the spares for the MIL connector repair will be launched on STS-124 (1J) by end of May. Meanwhile the LAN connector repair has been successfully performed by the ISS crew and by use of the MIL-B line the pending FSL checkout and commissioning completion can commence. With the repair of the MIL-Bus the road should be open for performance of the GEOFLOW experiment which is considerably delayed.

The planned FSL checkout activities were initiated as planned on 23 April but after a part of the automatic sequence certain problems were encountered regarding the functioning of a lamp unit in the upper CEM Module.

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Power cycling didn't lead to the desired result. Further data analysis on the ground led to a detailed FSL repair plan where the initial lamp installation would be reversed and a spare lamp unit installed upon upload on STS-124 (1J) flight end of May.

The FSL facility problems encountered have a significant delaying effect on the start and execution of the experimental programme, with the GEOFLOW experiment in particular impacted. The establishment of full FSL functionality and proof of the optical performance with dedicated targets must however have absolute priority. As planning stands, it will be difficult to find sufficient time to perform all the envisaged experimental runs before the end of the presently ongoing ISS Increment 17 in October 2008.

MARS in Naples, has the role as User Support Centre, USOC, for FSL, whilst the Spanish USOC, E-USOC at the Polytechnic University in Madrid, Spain, functions as Facility Support Centre (FSC) for FSL.

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EUROPEAN PHYSIOLOGY MODULES (EPM) AND EUROPEAN DRAWER RACK (EDR)

commissioning close-out, waiting for science operations

European Physiology Modules (EPM) to the left of ESA Astronaut Hans Schlegel in front of of Biolab (courtesy NASA)

European Physiology Modules (EPM)

is a facility built for investigation of the adaptation of the human organism to the microgravity environment. The facility offers a host of data acquisition options, related to the activities of the crew, both in regard to cardiovascular data, neurological data and others, when the crew is involved in physiology experiment activities. Typically these activities have to do with the adaptation of the circulatory system, the muscles, bone and nervous system, when under the influence of weightlessness. It is foreseen to obtain electronic data as well as supporting blood, saliva and urine samples in principle.

For the first flight of EPM, however, a subset of three modules have been selected, namely

- Cardiolab (developed by DLR and CNES for cardiovascular research)
- MEEMM (Multi-Electrode EEG measurement Module) and
- PORTEEM (Portable EEG Measurement Module)

Impedance check of single electrodes in the MEEMM head cap

The first experiment activity will involve use of the very advanced and state-of-the art Multi-electrode EEG Monitoring System (MEEMM) in the service of the NEUROSPAT experiment. That system offers the use of in principle up to 128 electrode derived EEGs, whilst most applications probably will apply a sub-set of these, e.g. 64, 32 or less. The EPM was commissioned immediately after Columbus module activation at which time, a basic set-up and check-out was performed. At that time the science modules Cardiolab and MEEMM were checked in terms of the rack mounted interfaces, without activating the many peripheral measurement units.

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Next week the Facility Control Computer (FCC) will be tested by transfer of a log file, and later the calibration of a MEEMM electrode amplifier box will be performed in advance of the NEUROSPAT experiment. This involves sending, receiving and incorporating data from that amplifier into the calibration reference data set in the computer, and is a test of the principle functionality the EEG acquisition chain.

The NEUROSPAT experiment series could start in Increment 18 based on a new science cooperation agreement with Russia. It will continue with further ESA, NASA, CSA (Canada) and JAXA (Japan) crew members to acquire the datasets necessary for medical statistics.

European Drawer Rack (EDR) Training Model with the two PCDF units middle right

THE EUROPEAN DRAWER RACK (EDR)

is a rack facility onboard the Columbus module, which offers a high degree of flexibility, regarding type of instruments that can be flown, as long as the power, date and cooling interfaces are respected in the instrument design.

The first instrument that will make use of the EDR is the Protein Crystallisation Facility (PCDF) the Processing Unit (PU) of which will be brought to the ISS later this year. The Electronic Unit (EU) is already installed onboard.

EDR has been commissioned immediately after Columbus activation in February and March of this year, and the first experiment-related activity to take place is the check out of the Electronic Unit of the PCDF.
Even if the PCDF Processing Unit is not onboard yet, the EU is being checked out, and the activity in that respect is scheduled for 26 and 27 May.

The activity planned involves the crew with some minor actions. Thus the crew will be:

- connecting two optical fibre cables to the EU, to be used for Dynamic Light Scattering (DLS) diagnostics, and they will be switching the PCDF EU on.

The ERASMUS USOC will operate the activation and deactivation of the EDR. On the ground the following actions will be taken in that context:

PCDF Electronic Unit (EU)

- verification of the EU in terms of telemetry monitoring, verification of the H&S cycle,
- verification of time synchronization between the ground and the onboard computer,
- verification of test pattern image acquisition: The electronic unit holds a test image that can be used for testing data acquisition without having a real image from the experiment unit.

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- verification of the Light Scattering Unit (LSU) in terms of activation, data acquisition on channel 1, acquisition on channel 2, and consecutive deactivation)

PCDF Processing Unit (PU)

- After these aspects have been tested the crew will deactivate and disconnect the system in the opposite order of the activation.

- The Belgian USOC (B-USOC) is responsible centre for the PCDF facility.

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