ELGRA 2001 Biennial Meeting and General Assembly

After two big cities, Paris (1997) and Rome (1999), the "ELGRA Meeting-01" took place in quite a small town, Banyuls sur mer, located at the French western Mediterranean sea close to the Spanish border. For many ELGRA members and non-members, this was by no means a less attractive place. One would even like to say, on the contrary! From the hundred of persons, who registered until early September, over eighty attended actually the congress (nearly all "last minute" cancellations were directly or indirectly related to the September 11th events) and most of them contributed very actively to the success of the meeting by making an oral presentation, by displaying a poster or by presenting new research facilities.

As well justified tradition during ELGRA meetings, an attractive scientific program was structured around the two main research fields of the participants, the "Life Sciences and Physical Sciences". Within the cornerstones of the opening ceremony on September 25 and the closing session of September 28, four invited lectures initiated the individual sessions. In total, 47 scientific communications were given and 17 posters exhibited. For further details and abstracts on all these presentations, one is referred to "ELGRA News" (Vol. 22) and/or the ELGRA web site (http://www.elgra.org/index).

One of the main topics of the "ELGRA General Assembly" (AG) was the election of the Management Committee (MC). The present committee, with the President Dr. M. Cogoli-Greuter, was re-elected for two more years. Other topics were the activity report of the president and the financial report of the treasurer. Longer discussions focused particularly on the status of the ELGRA members. The MC is charged to study until the next AG (2003 in Germany) whether modifications of the statutes were desirable and possible (one remembers that ELGRA has a "Full and Associate member" statute - with a corresponding membership fee - and that only full members have the right to vote).

As highly appreciated "social events", where also quite a number of "Accompanying persons" showed up, have to be mentioned: - a reception in the town hall of Banyuls, offered by the maire, and where one could taste the "Banyuls", this famous local wine and – the official "Banquet" with exquisite regional specialities. At this occasion, the ELGRA medal was awarded to Professor Dr.-Ing. Julius Siekmann (+), Baden-Baden (D) from the "Physical Sciences" and Dr. Wolfgang Briegleb, Wachtburg (D) from the "Life Sciences". "Honorary Guest" of the Meeting was ESA Astronaut Dr. Jean-Jacques Favier. Finally, due to the proximity of the congress site, the "Observatoire Océanologique" (Laboratoire Arago) and the hotels and restaurants, numerous informal contacts among the congressists were possible.

Last but not least, the sponsorship of ESA, CNES and ASTRIUM and the hospitality of the Direction of the Laboratoire Arago is well acknowledged by the ELGRA MC and the organizers.

Hans-Jürg Marthy
(For the local organising crew)

Banyuls sur mer, Winter 2001/02

Minutes of the ELGRA General Assembly held in Banyuls sur mer, on 26/9/2001

The President, Dr. Marianne Cogoli-Greuter opens the assembly at 5:30 p.m. in the Laboratoire Arago at Banyuls sur mer, Building B, Conference Hall. 20 full members and several guests are present.

The following agenda is adopted unanimously:

1) Opening by the president / Adoption of the agenda
2) Approval of the minutes of the previous GA
3) President's report
4) Treasurer's report
5) Auditors' report
6) Discharge of treasurer
7) Change of membership fee from DM to EURO
8) Acceptance of new members
9) Election of two Auditors
10) President: Change between Life and Physical Sciences
11) Elections of Management Committee Members
12) Any other business

The minutes of the GA 1999 in Rome are accepted.

The President thanks all members for the good cooperation offered during the last two years and lists the major activities of the MC during her term as President:

a. cleaning-up of membership list;
b. contacting members via email
c. contacting ESA
d. installation of the web pages (April 2000) by Jack van Loon
e. taking in serious consideration the advice given by M. Heppener and P. Clancy to increase the number of members in order to be more representative for the microgravity user community;
f. issue of ELGRA information leaflet, folder and poster and preparing stickers with ELGRA logo;
g. preparing the joint ASGSB-CSA-ELGRA Meeting in Montreal in October 2000, to which 30 European biologists participated
h. issuing of two Newsletters, a cheaper and quicker information means than ELGRA News, using xerox-copies
i. starting a Discussion Forum on the ELGRA web site in July 2001
j. preparation of a questionnaire for an ELGRA Data Base
k. sending out to 32 selected members a letter drafted by M. Heppener from ESA to be used for lobbying in view of the Ministerial Conference

The financial report is given by the Treasurer, H. Kuhlmann, who is happy to say that generous donations by ESA and other entities, like Astrium, allowed a positive balance despite ELGRA running two congresses during the term (Rome and Montreal).
He informs the audience that the Auditors recommended to change the bank due to the high rates for bank transfers and its incapacity to present lists on the individual payments. Thus for the near future the only solution is to encourage the members to use the credit card for the payment of the membership dues, which is cheaper and easily identifies the sender.

H. Dittus could not attend and asked the other Auditor, G. Perbal, to present their report, concluding that no problems were found in the Treasurer's calculations and in the various in and out money movement certifications. The Auditors, judge the job made by H. Kuhlmann and his secretary, Mrs. K. Pilat, very effective and suggest them to go on with their task for the following term too.

The assembly accepts the financial report and discharges the Treasurer.

Due to the need to switch from DM to Euro, the following new - slightly higher - membership fees were accepted by the assembly:

- *70 □ for (full) members*
- *30 □ for associate members*
- *600 □ for supporting members.*

One minute of silence is called for Drs. Padday, Briskman and Saiki who recently died.

A number of new full and associate members is accepted.

The 2 Auditors H. Dittus and G. Perbal are confirmed for another term.

The President proposes to abolish the distinction between the fields of material, fluid and life sciences within ELGRA and to adopt the ESA rules which differentiate between Life and Physical Sciences only. As a consequence the President should alternatively be either from the Physical or Life sciences. This also reflects the almost equal distribution of ELGRA members between the two areas. The proposal which does not need a change of the statutes is adopted by the assembly. The only consequence of that is the need to decide whether or not to reduce to one the number of the Vice-Presidents which than should be from the other discipline. Recommendations are expected from the members in the next future by Forum discussions and no definite rules are given at the moment w.r.t. this item.

In secret ballot the assembly elects the following members for the MC for the next 2 years:

President:	Marianne Cogoli	19 votes
Vice-Presidents:	Antonio Viviani	19 votes
	Felice Strollo	19 votes
General Secretary:	Libero Liggieri	20 votes
Treasurer:	Hendrik Kuhlmann	20 votes
Members:	Hans Jürg Marthy	20 votes
	Thodoris Karapantsios	18 votes
	Gilbert Gasset	14 votes
	Joachim Richter	13 votes

Jack van Loon receives 12 votes and is thus not elected. The assembly appreciates that he will anyway continue his work as webmaster.

A discussion on the different membership categories, especially on the full and associate members, revealed, that there are quite some problems. On one hand only full members have the right to vote and thus the Management Committee is elected only by part of the ELGRA members. On the other hand the associate members pay a much lower annual fee. This means that the full members should have some special benefits. The Management Committee accepts the task to elaborate and propose a change of the statutes to satisfy the demands of all members in the future.
According to the present statutes they only can be changed when 50% of full members are present at the General Assembly; letter-voting is not allowed. This item will be further analyzed by the Management Committee.
A. Passerone raises the problem of publication preferences: should we use only peer-reviewed journals or try to support another one dedicated to ELGRA? The impact factor seems to be leading the vast majority of the members and this cannot be blamed. The President clarifies that it was not the intention of the Management Committee to give preference to a special journal.

The date and site of the next General Assembly and ELGRA Meeting will be established in the future.

The President closes the assembly at 7:30 p.m

Rome and Zürich, October 10, 2001

The General Secretary
Felice Strollo

The President
Marianne Cogoli-Greuter

ELGRA 2003 Biennial Meeting and General Assembly Munich (D), April 2-4, 2003

Every two years ELGRA organizes its meeting as a forum for discussions and exchange of ideas among scientists from materials and life sciences. The 2003 Biennial Meeting and General Assembly will take place at April 2nd - April 4th, 2003, in Munich. The "Kuenstlerhaus" is a pleasant conference site in the city of Munich, Lenbachplatz 8, easily to get to by plane, train, and car. Hotels will be pre-booked in blocks. The members of the local organizing committee are:
Dr. Kurt Kemmerle
Dr. Christoph Bartscher
Mrs. Arlette Janssens
Mrs. Annette Witte
all from Kayser-Threde GmbH, Munich (D)
and on behalf of the ELGRA Management Committee: *Prof. Dr. Joachim Richter, RWTH Aachen (D).*

Due to our discussion in Banyuls, the ELGRA MC intends to change the statutes concerning the membership status. So our idea is to assemble as many members as possible at a central meeting place like Munich. That is the reason why we announce the 2003 Biennial Meeting so early and ask you to join us in Munich. The dead-line for abstracts submission is foreseen end of november 2002.

Joachim Richter

Intospace Research Services in preparation for the Space Station exploitation

C. Mirra, H. Sprenger
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sprenger@intospace.de

Intospace GmbH is a company established in 1985 with offices in Hannover, Germany and Leiden, the Netherlands. Its mission is to open up an easy gateway into space for every commercial customer, with focus on the International Space Station.

The company objective is to become the European Company for Marketing & Sales to commercial users of the International Space Station. To achieve this goal, the Intospace team is composed of a balanced mix between science and space technology know-how, marketing and sales and professional project management.

Intospace has gained experience in the management of research projects for industry and the European Union, as well as providing turn-key engineering services to space agencies (e.g. ESA, DLR, NASDA). Intospace was the pathfinder company in the commercial utilisation of the Chinese retrievable capsule, Foton, Spacelab and Mir and it goes without saying that the company is the world best seller of SPACEHAB products and services.

With the focus on the ISS commercial business potential, Intospace has based its business plan on so-called cornerstone projects in a mix of industrial research and consumer product marketing. This situation is reflected in the company's structure by the establishment of the following business units:

- Research Management; engaged in business development for industrial research using the ISS (studies, pilot projects, agency support)
- Infrastructure Sales and Services; specialized in marketing and sales of flight opportunities and payloads, including coordination of services.
- Marketing and Sales; engaged in business development for ISS utilization with focus on non-R&D and complementary activities.

This short article focuses on the research related services. As a consequence, it will highlight only the first two business fields mentioned above[1].

Applied Research

In recent years Intospace has developed a number of ideas and projects aiming at the development of the utilisation of microgravity for industrial research. It turned out, however, that the direct benefits that would be expected from space experiments are rather of fundamental nature, therefore should be subject of academic research.

It was found that more promising industrial activities may be related to the provision of commercial instruments for use on the ISS. Such instruments are useful for selected research in materials science and biology in space but so far are not available for use on the ISS and are therefore expected to find a number of new users in fundamental and applied research.

The provision of latest technology for research and analysis on the ISS should also result in the penetration of ISS utilisation into advanced research fields, e.g.
- nanotechnology,
- physical mechanisms of biological processes,
- human physiology,
- medical research.

Therefore it would be a means to overcome the unsatisfactory situation that many research ideas could not be considered for execution on the ISS because suitable instrumentation was lacking.

It has been shown that commercially available instruments that are routinely used in scientific laboratories are able to fulfil this purpose.

1.For more general information see http://www.intospace.de.

Modification efforts to accommodate the instruments to operation on the ISS are mostly restricted to weight reduction of the power electronics and the design and construction of closed experiment cells needed to handle liquids in a safe manner onboard the ISS.

It is the intent of Intospace to demonstrate the added value capability of the benefits in demonstration missions as precursor projects in advance of permanent use on the ISS. Income is expected by leasing the instrument to scientific ISS users but also from sponsors who would get the possibility to use the attractiveness of space involvement for communication purposes in return. Thus the first commercial research facilities will serve as a focus and starting point for the establishment of similar business cases which could be part of a concept to use commercial instruments on the ISS with the goal to enhance the research capabilities and to make the ISS more attractive for applied and industrial research.

The financing principle is to establish the initial investment through a combination of in kind contribution (instrument provider), sponsoring (secondary product) and potential credits to be financed from income of future lease.

The utilisation of commercially available instruments would lead to substantial cost savings for ESA, due to different reasons:
- strongly reduced development and construction cost,
- reduced need for sample storage and return to earth,
- project management on cost/benefit optimisation.

For the successful start of the projects and for giving the investors decision criteria for the validity of the business plan it would be of great importance that ESA would use the facilities within their existing utilisation programmes. It should be emphasised that the instruments selected are on the front-end of present possibilities for research and analysis in their fields. On the other hand, they are reliable and robust enough to be operated without larger risk in the environment of the Space Station.

Two demonstration projects are presently under elaboration. They are dealing with placing a commercial "Scanning Probe Microscope on ISS" and with the provision of a "Biochip for Genomic Analysis in Space". It is estimated that the availability of those instruments on the ISS would greatly extend the research possibilities on the ISS.

Flight Opportunities Services

Through a consolidated partnership with SPACEHAB Inc, Intospace has gained qualified experiences in the field of flight opportunities organisation and management.

Without accounting for the earliest experiences on retrievable capsules, Spacelab and Mir, Intospace has contributed to several Shuttle missions and recent ISS flights of hardware for scientific (and marketing) purposes.

The forthcoming STS-107 mission will bring several European payloads in space. The ARMS (from ESA) and the CEBAS (from DLR) flights were secured through Intospace. The same will apply for a second DLR locker after STS 107 and the ESA Favorite payload, scheduled for a flight in the second half of 2003.

At the same time, it is also worth to mention that Intospace and ESA signed an ISS Flight Opportunities agreement in June 2001. Through this agreement, Intospace is purchasing flight services from ESA to be sold to commercial customers. The flight of the BOSO GmbH TM2430PC blood pressure measurement device (BMI) was secured within this framework. The BMI was launched on a Progress in mid March 2002 and it will be operated by the Italian Astronaut, Roberto Vittori, on the occasion of the next Russian taxi flight in April.

Intospace, as a true international company, has also gained experiences in flying hardware to the Russian segment of the ISS through commercial arrangements with Russian partners. The technological demonstration of the LEGO Mindstorms® robot, for example, was a rather challenging task that revealed to be very successful and entertaining, at the same time.

It is rather apparent, then, as far as flight opportunities are concerned, Intospace has the experience and the instruments necessary to provide its customers with the best available flight opportunities at the best economic conditions.

This aspect is key to the success of the end-to-end services approach fulfilled by the Company and it is at the basis of the working scheme of what will soon be the Commercial Agent of the International Space Station.

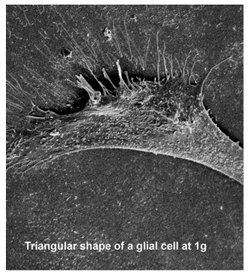
Nervous cells in microgravity: ..... from a chat to a successful research.

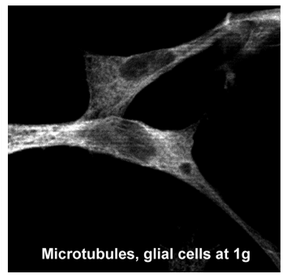
B.M.Uva
DIBISAA. Genua University, Italy

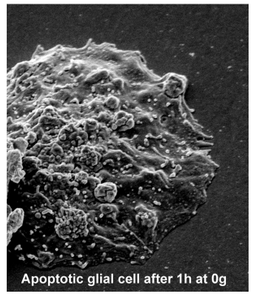
What is going on in weightlessness at cellular level?
This was the topic of a discussion that involved a number of biologists happily chatting in front of an aperitif at an ELGRA meeting. The discussion turned from quiet to excited and viceversa from time to time and took a long time that day and the days after, whenever we had a chance to meet again somewhere. Suddenly, ours became quite an exclusive fan club.....
Those who had an experience on low gravity effects on lymphocytes reported their data pointing to the cytoskeletal alterations both in ground conducted experiments and in flight. Being neurobiology my mania, beside being my main field of research, I asked who might had any experience on nervous tissue alterations due to altered gravity: it turned out that only a limited number of experiments were carried out and none at the cellular level.
The discussion went on and involved the possibility that a series of functions, as for instance equilibrium and postural adaptation, were temporarily impaired. This had been observed in astronauts during and immediately after space flights, might be due to some kind of negative impact upon different nervous system elements.
Many of those present got interested in such discussion and all together we decided to perform a project of research on the possible alteration of the intimate architecture of nervous cells in microgravity. And immediately another discussion started, what kind of nervous cell? Nervous tissue is composed of two types of nervous elements: the conducting neurons, the high society of the nervous population, and the glia, considered as the working class, a network of cells linked together and to the neurons. The latter are responsible of the good functioning of the entire nervous system, so that, if glial cells are damaged all the nervous system is impaired: high society always depends on working class.
So we decided to focus upon the glial cells, and we carried out our research (with a grant from ASI) on a ground-conducted experiment which showed that microgravity causes severe alterations in the glial cell cytoskeleton. These alterations are temporary and after only 30h the cells are able to reorganise their architecture again. These results produced successful communications at several meetings (ELGRA and others) and produced full papers accepted by distinguished scientific journals as Brain Research and European Journal of Histochemistry.

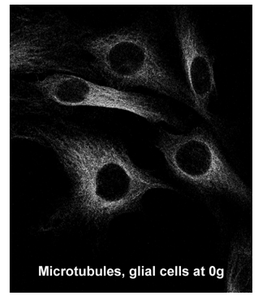
For the sake of science, we attach the abstracts and two interesting pictures of our latter published paper.

Summary
Apoptosis is a form of naturally occurring cell death that plays fundamental roles during embryonic developement. In adults it neatly disposes cells damaged by injuries provoked by external causes like UV radiation, ionisation and heat shock. The alteration of gravity vector may be one of the external apoptosis inducers. Neurophysiological impairment signs were shown during space flights in astronauts, but very few studies were carried out on the nervous system and none at cellular level. In this study we submitted cultured C6 glioma cells to microgravity (0xg) of varying duration, obtained by clinorotation in a Fokker three-dimensional clinostat for 15min, 30min, 1h, 20h or 32h. After 30min at 0xg numerous nuclei underwent the classical morphological alterations (chromatin condensation, nuclear fragmentation, apoptotic bodies) that lead to the programmed cell death. After 30min at 0g immunostaining for the enzyme Caspase-7 was present in the cytoplasm of many cells concurrently with DNA fragmentation identified with the TUNEL method. At 32h the number of apoptotic nuclei was much reduced indicating the ability of glial cells to adapt to altered gravity.


Triangular shape of a glial cell at 1g


Microtubules, glial cells at 1g


Apoptotic glial cell after 1h at 0g


Microtubules, glial cells at 0g

Eur. J. Histochem. 2002, in Press

What to say? A cocktail with friends sharpens one's wits?

Microgravity-induced apoptosis in cultured glial cells

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Galileo Avionica S.p.A
Activities and Related Expertise in the Micrograviy Field

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Company Profile

Galileo Avionica S.p.A., a Finmeccanica company, is the Italian leader in Avionics Mission Systems, Airborne Radar and electro-optics. The Space Equipment Business Unit covers all space activities of the Company, and controls Tecnospazio S.p.A.

Galileo Avionica, Space Equipment Business Unit.

Galileo Avionica pioneered space activities in Europe in the beginning of the '60s (at FIAR in Milan and at Officine Galileo in Florence). Tecnospazio S.p.A. is a recognised European leader in space robotics and automation since 1987.
Today, with 450 employees fully dedicated to space activities and a turnover of 50 millions Euro per year, the Space Equipment Business Unit (former Officine Galileo B.U. Spazio), offers to world-wide Customers a large and sinergetic basket of products for institutional and commercial space projetcs, with five products lines:

- Electro-optical sensors
- mission payloads
- electrical power generation & conditioning
- RF equipment
- Robotics and automation (by Tecnospazio S.p.A.)

Headquarters are located in Florence and operations take place at two sites, Florence and Milan, were all design, development, manufacturing and testing activities are carried out on an area totalling 18,000 m2, a large amount of which hosts clean rooms and laboratories equipped with appropriate space simulators for space characterisation. In next table the main products of the Space Equipment Business Unit are summarised.

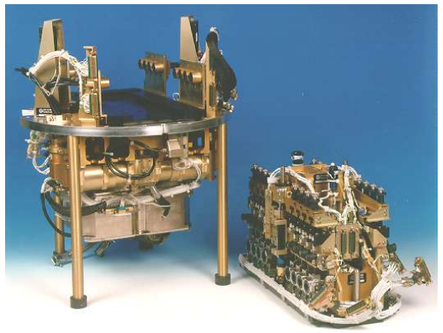
Space Equipment Busines Unit

Galileo Avionica - Space Firenze	Galileo Avionica - Space Milano	Tecnospazio S.p.A. - Milano
• Earth Sensors • Sun Sensors • Star Trackers • Optical Cameras • Instruments for Mission Payloads • Precision Mechanisms	• Power Generation • Power Control & Distribution • Frequency Generation • RF Power Amplifiers (S S P A, T W T A, M P M) • RF Equipment • Radar Equipment	• Robotics • Space Automation

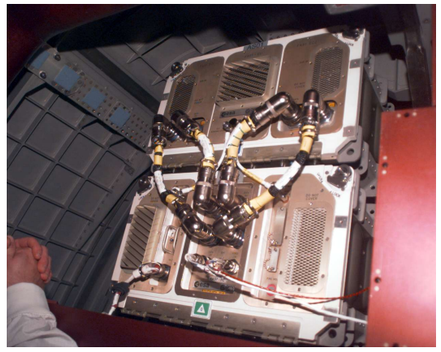
Galileo Avionica Experience in the Micrograviy Field

Among the various scientific payloads, attitude sensors and the other business lines, the microgravity facilities have been representing, since the mid 80's, a business of remarkable importance.
The various technological competencies existing in the Company, as: fine mechanics, optical components for astronomical applications, electromechanical scanners, high integration IC, ASICs, cooled FPA control systems, HW and SW for driving of CCD and microprocessors, hydraulics/vacuum etc., allow to develop and manufacture on board equipment of instruments for space research and operation. The main products developed by Galileo Avionica Space Equip. B.U. in the microgravity field are described herebelow:

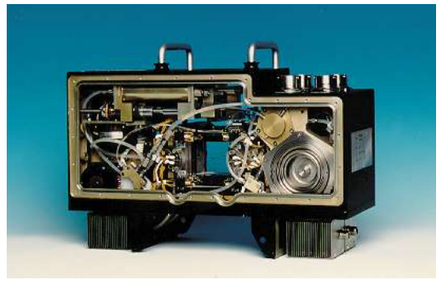
• Experimental Cells and Subsystems for space labs and re-entry modules
PCF (Protein Crystallization Facility): Galileo has designed and produced the Optical Video System for Protein Crystallization Facility payload, which has flown on EURECA platform. The aim of this system is to observe the growth of the protein crystals in microgravity environment.
BDPU Test Containers: design and manufacturing of four test containers for the BDPU facility as subcontractor of Astrium (Dornier) . The purpose of these TCs, flown on IML2 and LMS Programs on July 94 and June 96 respectively, has been to perform experiment dedicated to the thermocapillary migration and interaction of bubbles/drops under controlled temperature gradient
ESS (Eye Stimulation System): Design and Manufacturing of the electro-optical stimulator for neuro-physiology experiment. Contract with ADSC (Aerospatiale) in the frame of the ESA developed elements for NEUROLAB program (flown on 1998)
• Instruments for Optical Bio-diagnostic and automatism & parts remote control
Optical set-up for linear dichroism detection for Electrophoresis Orientation Experiment (sounding rocket module), optical video systems for EMEC, BB of optical and video observation system for APCF ecc.
• Complete experiments or subsystems for Sounding Rockets
MITE 1&2 (Measurement Interfacial Tension Experiment): for the sounding rockets MASER and TEXUS program. Responsibility for design, development and manufacturing of a facility for the study of interfacial phenomena (launched on March 1990 and on November 94).
INEX MAM (Interactive Experiment on Maragoni Migration): design and manufacturing of the mechanics and optics systems for Sounding Rocket facility with the objective to carry out experiments on thermocapillary migration and interaction of bubbles/drops under controlled temperature gradient. For this module, flown on November 93 and on March 96 on the MASER VI and TEXUS 34 Sounding Rockets, is scheduled a further reflight in the year 2003.
EMEC (Effect of Microgravity on Enzyme Catalysis): Study and development of facility for the observation of the microgravity influence on the molecular interactions of biological samples. It has been successfully flown on May 1996 with MASER VII Sounding Rocket and on May 2000 during a Parabolic Flight campaign.
• Multi-user and/or custom "drawer like" Facilities
FAST (Facility for Adsorption and Surface Tension Studies) - Study and development of a multi-user facility, dedicated to the interfacial phenomena studies, for accommodation on SPACEHAB. Its has flown on October 1998; in the Summer 2002 will be a reflight. This Facility is also candidate for the ISS: for this purpose studies of I/F with EDR and for a new cell are ongoing.
• Studies
Among the several studies performed both with the ASI and ESA and in autofunding, we mention the following two: Feseability study of multiuser Bioreactor (ASI contract); Multiuser Facility for Exobiology Research (ESA contract)



EMEC module



FAST on Spacehab



Test Container for BDPU

The Italian Space Agency (ASI) participation in the ISS 4S Taxi Flight mission "MARCO POLO"

F. Bracciaferri°, S. Di Pippo°, E. Ceglia*, L. Anniciello^, R. Fortezza*

°ASI - Italian Space Agency - Rome, Italy
**MARS - Microgravity Advanced Research and Support Center – Naples, Italy*
^MARS personnel located at European Astronaut Center – Koln, Germany

1 Introduction

On May 9, 2001 the European Space Agency (ESA) and the Russian Aviation and Space Agency signed a framework agreement regarding the organisation of flight opportunities for ESA astronauts using Russian flight opportunities to the International Space Station (ISS). Following this agreement, one of the 3 crewmembers selected for the Soyuz 4S taxi-flight mission to the ISS (which has been given the name "Marco Polo") is the Italian Roberto Vittori, who forms part of the ESA astronaut corps. The 4S mission has as its main objective the substitution of the Soyuz module (the ISS "life-boat") to be utilised by the primary crew in an emergency as an Earth return capsule. The secondary crew on board of the Soyuz TM (208) module – comprised of Vittori (Flight Engineer), the Russian Commander Yuri Gidzenko and the South African civilian participant Mark Shuttleworth – will be launched on April 25, 2002 and is scheduled to dock with the ISS on April 27, 2002. The Soyuz crew will undock from the ISS on May 5, 2002 and will return to Earth on board the Soyuz TM (207) which arrived at the ISS on October 23, 2001 during ISS mission 3S. The Soyuz TM 208 will be left behind as a fresh crew return vehicle for the ISS Expedition 4 and successively ISS Expedition 5. This will be the fourth Soyuz flight to the station, but only the third where the Soyuz crew returns in an older capsule. The mission profile of the Soyuz - ISS rendez-vous is illustrated in Figure 1.

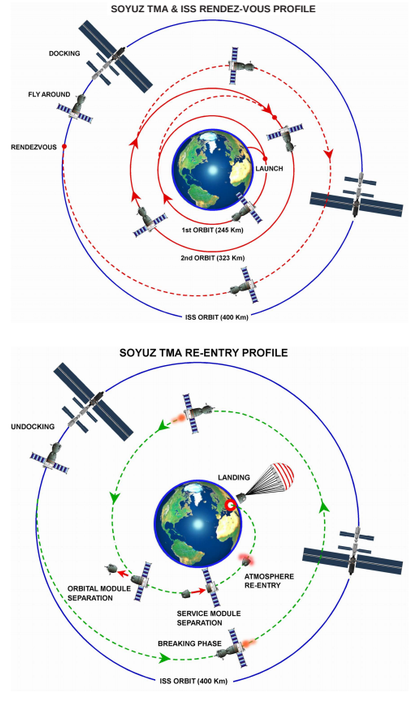


Figure 1: Flight Profile of Soyuz TMA Capsule rendez-vous with ISS (top) and re-entry (bottom).

The participation of Vittori to the 4S mission has led to a special agreement between the Italian Space Agency (ASI) and the Russian Space Agency, which allows for 3 Italian payloads, CHIRO, ALTEINO and VEST to be operated during the mission. This agreement builds on a previous understanding signed by ASI and the Russian Space Agency on the "Co-operation in the Exploration and Use of Outer Space for Peaceful Purposes", signed on February 10, 1998. Two of the 3 Italian payloads, namely CHIRO and VEST, have been transported to orbit onboard the resupply Russian module Progress, during the ISS 7P mission, launched on March 21, 2002. The third payload, ALTEINO, will be flown onboard the 4S mission.

2 "Space For Health"

The "Marco Polo" mission falls within the framework of ASI's "Space for Health" Pilot Project. The objective of this project is to focus on the social benefits deriving from the research carried out on board the ISS and manned spaceflight in general. From past space research in human physiology it is now well known that there is a correlation between the human ageing process and human exposure to the microgravity environment. Based on this knowledge, ASI has evaluated the possibility of developing various experiments essentially aimed at the physical preparation and rehabilitation of astronauts, which can provide benefits for the older population. Furthermore, ASI has focused its attention on the use of space medicine in general, on the public image of spaceflight and on the astronaut himself, as health promotional tools to create a basis for strategic developments to improve the quality of life on Earth. The "Space for Health" concept relative to the "Marco Polo" mission will be implemented according to the following:

- *Pre-flight preparatory activities and post-flight rehabilitation*: this foresees the application of forefront methodologies for physical training as well as the rehabilitation and monitoring of the human cardiovascular and neuromuscular behaviour.
- *Execution of the scientific programme in orbit*: the scientific programme of the mission foresees the execution of medical sciences experiments. In particular, the experiments deal with the study of the effects of cosmic radiation on the central nervous system ("Alteino"); the analysis of the effects of microgravity on upper limb forces ("CHIRO"); the evaluation of the effectiveness of specially designed clothes ("VEST"); the effects of microgravity on the Nerve Growth Factor ("NGF") and on blood pressure ("BMI"); and the study of the cognitive process via 3-D sensory perception in microgravity ("COGNI").
- *Health promotional activities and transfer of acquired knowledge to improve the quality of life on Earth*: this foresees the development of specific initiatives to exploit space medicine as a health promotional factor and to allow for the transfer of specific know-how to areas such as health care programs for the elderly.

3 ASI Payloads

The following paragraphs provide a brief description of the three ASI payloads that will be operated during the ISS 4S mission.

3.1 CHIRO (Crew's Health: Investigation on Reduced Operability)

The CHIRO program has been established to provide early data within a wide range of researches on human upper limb behaviour and performances, promoted by ASI in the framework of the utilisation of the ISS. The payload has been developed by Kayser Italia in collaboration with CHIRO's Principal Investigator Prof. Paolo Pastacaldi of the Azienda Ospedaliera Pisa.

The aim of this particular aspect of the research is to monitor the impairment of muscle function in weightlessness, if any, and to clarify its physiopathology through an analysis of the different steps of electro-mechanical mechanisms of muscle contraction events. The observations relevant to this activity will be carried out during the grip maintenance of held objects, for example during grasping or lifting tasks, by comparing the performance of the weightless conditions to those recorded on ground, before and after the execution of the orbital flight.

The main elements of the CHIRO payload are the HandGrip Dynamometer (HGD) and the Pinch Force Dynamometer (PFD) - see Figure 2. These elements are based on those developed for NASA's Human Research Facility (HRF). The HGD is a hand held device capable of measuring instantaneous hand strength (between 40 and 1000 Newtons) as a function of time for periods of up to 300 seconds. The principle components of the HGD are a transducer capable of measuring the handgrip force, instrumentation amplifier, and associated cables. Dynamic voltage representing instantaneous hand strength is taken from the output of the instrumentation amplifier and sent to a laptop computer or to a data acquisition system for data manipulation, display, correlation with other data sources, and/or storage.

The PFD is a hand held device capable of measuring instantaneous strength (between 0 and 270 Newtons) of the thumb and opposing finger or groupings of fingers as a function of time for periods of up to 300 sec. The principle components of the PFD are a pinch force transducer, instrumentation amplifier, and associated cables. Dynamic voltage representing instantaneous finger(s) pinch strength as a function of time will be taken from the output of the instrumentation amplifier and sent to a laptop computer or to a data acquisition system for data manipulation, display, correlation with other data sources, and/or storage. In both instruments the measurement of the applied compression force is taken by using a beam load cell based on a full bridge strain gauge that is sensitive to the transverse shearing stress applied to the beam. Two protocols of experimentation will be carried out.

First Protocol:

The purpose of these experiments is to determine how the control of grip force is affected by exposure to weightlessness, and to quantify the adaptive normalisation later during a mission. To this end, a sequence of force levels on a monitor will be presented, and subjects will be asked to reproduce those profiles with their own hand. The speed and accuracy of their responses will be determined, as well as the associated resource demand. The latter will be quantified using the dual-task approach, by calculating the decrement in grip control when subjects execute a concurrent isometric tracking task.

Figure 2: CHIRO's HandGrip Dynamometer (HGD) and Pinch Force Dynamometer (PFD).

Second Protocol

The purpose of this protocol is to take advantage of the possibilities offered by the CHIRO dynamometer to monitor the control of timing of grip and pinch forces in response to different time profiles of target force changes.

3.2 VEST

The VEST project (integrated wardrobe system) is a joint initiative of Playlife, the Benetton Group's sporting gear brand, the Italian Space Agency and the Milan Polytechnic. Its purpose is to improve living and working conditions in space by designing innovative fabrics suitable for life inside the ISS while keeping style a priority. During the mission Vittori will contribute to the VEST project by testing clothing made of groundbreaking fabrics, conceived specifically to improve living and working conditions in space.

There are pieces for all aspects of a mission in space: work, rest and exercise. The set of clothing to be tested by Vittori consists of two polo shirts (one long-sleeved and one short-sleeved) and zip-off pants for working, shorts and T-shirts for fitness, T-shirts for relaxation, and a complement of briefs and socks.

How the clothes would perform under the various working and living conditions in the ISS was the key criterion for selecting fibres and design. Playlife have chosen heat-adjusting fibres for work pants, bacteriostatic fibres for other work clothes and underwear, and bactericidal fibres for exercise gear. Many of the clothes are made from hollow fibre to render them as lightweight as possible. When it came to design, the starting point was a basic model that simulated the neutral-like posture typical of the microgravity conditions in the ISS. The fitness clothes ensure a comfortable thermal range and easy fit while killing off bacteria, and the underwear is made from a tubular weave whose elasticity makes the pieces highly comfortable and quickly adaptable to the wearer's body shape and position in low-gravity environments. The results of the experiment, which goes by the name VEST, will be used to design clothing for more comfortable daily wear.

3.2.1 ALTEINO

The *Alteino* project is an experiment aimed at: a) studying cosmic particles in the ISS – as revealed by an Advanced Silicon Telescope (AST) – and b) studying the effects that such particles, and more in general the space environmental conditions, have on cerebral functions – as monitored by an advanced electrophysiological recording system – ElectroEncephaloGrapher (EEG).

The scientific objectives of the program feature therefore two major aspects: i) radiobiological / Particle physics studies; ii) electrophysiological studies.

Alteino is the precursor of *ALTEA* (Anomalous Long Term Effects in Astronauts) which will determine the risk factors linked to cerebral functions during long space missions.

I) Radiobiological / Particle physics aspects. Several measurements of radiation environment in different locations inside the Russian Space Station MIR and in the Shuttle have been performed in the recent past. The analysis of data received shows a 10% accordance between calculated dose and quality factor and experimental data. While there is agreement for Galactic Cosmic Ray doses, calculations for trapped protons doses is a factor 2 higher then measured one; calculated quality factors result 1.4 times smaller then the measured ones. *Alteino* will be able to provide additional information about trapped radiation (energy distribution, pitch angle distribution) needed to construct improved radiobiological models.

It is known that a significant part of solar cosmic ray nuclei are generated by the solar flares reaching Earth vicinity (400 km of altitude). They are partially ionised and have energy larger then hundreds of MeV/n. *Alteino* will provide measurements and time-spectral analysis of the solar cosmic ray nuclei from 100 MeV per nucleon. It will therefore play an important role in understanding particles acceleration in the corona and interplanetary space and during for the development of solar flare models. It will also help in the investigation of the correlations of non-stationary flux of charge particles with geophysical as well as geomagnetic phenomena.

II) Electrophysiological aspects. The electrophysiological objective of *Alteino* is a preliminary study of the combined effects of microgravity and cosmic particles on brain functions – specifically on the visual system. The often-reported phenomenon of anomalous perceptions of phosphenes by astronauts since the Apollo missions, is, in fact, an evidence for the existence of interactions between cosmic particles and brain functions. *Alteino* will also study those functional conditions that may help in generating such phenomenon. In order to study these effects the EEG baseline in the experimental conditions of ISS microgravity will be defined, including the investigation of the effects on EEG and brain functions of the launch, transfer to the ISS and adaptation to prolonged microgravity. During the orbital period the following operations will be carried out:

a) EEG monitoring of spontaneous or environment-induced changes in the brain functional state (e.g. level of vigilance) will be performed, both in relation to and independent of the wakefulness/sleep pattern;
b) EEG recording of changes in the brain functional state (e.g. level of vigilance) occurring in concomitance of the observation of phosphenes will be carried out;
c) identification of EEG functional patterns possibly related to phosphenes will be performed;
d) EEG recording of the brain electrophysiological responses to the impact of particles, regardless of reports of subjective phosphenes will be executed.

4. Astronaut Training

Roberto Vittori started his training as *Soyuz Flight Engineer* in August 2001 in GCTC (Gagarin Cosmonaut Training Center) located near Moscow. He is the first Italian Astronaut to fly on the Soyuz TM vehicle. As Flight Engineer he will occupy the left seat of the Soyuz TM and his role is to provide support to the Commander during the pre-launch test, to control the Life Support System during the flight and to assist the Commander during Automated or Manual Docking to the ISS. For this reason most of his training sessions are performed in the Soyuz TM Simulator dealing with all kinds of possible emergencies together with the other crewmembers. Also, as crewmember of a Russian Flight he had to learn Russian because all the communication and the on-board procedures are available only in Russian. And, of course, he received the basic knowledge of the ISS subsystems that he will use during his stay on the ISS.

The exchanging of the Soyuz on ISS allows our astronaut, with the help of the Russian cosmonaut, to perform science on the ISS for eight days. During his training he also received the scientific background and the procedures necessary to operate the Italian experiments. During these eight days he will perform more than one session on each experiment to collect data during the mission. This will allow the scientists to compare the data during the adaptation period in microgravity

condition.

5. Conclusions

As ESA awaits the completion of the development phase of the Columbus module, currently foreseen for early 2005, Italy continues to increment its participation in International space activities by creating new opportunities to access space both via its membership to ESA and via a bilateral agreement with the Russian Space Agency. The "Marco Polo" mission is an important step in the implementation of ASI's "Space for Health" Pilot Project, aimed at developing social benefits here on Earth from results obtained during manned spaceflight. Roberto Vittori will become the first Italian cosmonaut/astronaut to receive training both at NASA's Johnson Space Center in Houston (for ISS training) and at Starcity in Russia (for Soyuz training). CHIRO, ALTEINO and VEST represent the first Italian facilities to fly during the ISS Program, and are precursors to future Italian payloads, which will fly onboard the ISS.

Studies on Renal Function in Space at the Medical Faculty of the SUN - Second University of Naples

Low Urinary Albumin Excretion in Space: A Novel Effect of Microgravity on the Kidney.

[1]Natale G. De Santo,[1]Massimo Cirillo, [2]Martina Heer, [3]Christian Drummer, [4]Peter Norsk, [5]Luigi Bellini, [1]Davide Stellato, [6]Benny Elmann-Larsen.

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An international team organized by the Chair of nephrology (Prof. Natale G. De Santo) at the Second University of Naples has studied urine albumin excretion in astronauts during space flights and has presented interesting data at the International Society of Nephrology in San Francisco. The contribution appeared in abstract form in J Am Soc Nephrol 2001: 12 as it follows.

Several changes occurr during space missions, including changes in renal function as high urinary calcium, sodium and water retention, and high glomerular filtration. Risk of proteinuria was hypothesized during space missions but research data are missing. Urinary albumin excretion was measured as index of renal protein excretion in 4 astronauts during missions onboard space station.

A total of 24 complete 24h urine collections were obtained in space (1-14 collections per astronaut), 26 on ground as control (2-12 per astronaut). Venous blood samples were collected in some of the days selected for urine collections. Urinary albumin was measured by double-antibody radioimmunoassay, urea and uric acid by automated biochemistry. Data collection included body mass and dietary protein intake. Individual averages were lower in space than on ground for 24h urine volume (-33.3%, p=0.028) and urinary albumin (-27.4%, p=0.017). Plasma albumin was higher in space than on ground (+3.3%, p=0.333). In the presence of similar protein intake and body mass, 24h urinary urea was higher, not significantly, in space than on ground (+29.4%, p=0.129); 24h urinary urea related to protein intake on ground (r=0.569, p<0.005) not in space (r=0.157, p>0.5). For uric acid, 24h urinary excretion and plasma levels were reduced, not significantly, in space than on ground.

In conclusion, urinary albumin excretion is reduced in space missions in the presence of normal plasma albumin and protein intake. The hypothesis is made that low urinary albumin excretion is an effect of exposure to weightlessnes (microgravity). The mechanisms underlying low urinary albumin excretion in space could be of interest for the knowledge of the processes regulating renal albumin handling on ground.

Latest News

Ph.D. Program on Biomedical Aspects of Space Missions at the Second University of Naples

The Faculties of Engineering and Medicine at the Second University of Naples have developed a unique Ph.D. program on Biomedical Aspects of Space Missions. This Ph. Program is a Branch of the long lasting Ph. Program on Space Sciences and Technologies organized at the Engineering Faculty. The Ph.D. program lasts 3 years and gives access to physician and biologists. A total of 3 scholarships are provided for each course. The head of the Program is Professor Francesco Scaramuzzino at the Department of Aerospace Engineering directed by Professor Carmine Golia. The prestigious Faculty includes Professor Sergio Vetrella, President of the Italian Space Agency, Professor Antonio Viviani, Vice-president of Elgra. The Medico-Biological group includes Natale G. De Santo, Michela Galdieri, Francesco Rossi, Dean of the Faculty of Medicine, Libero Berrino, Alessandra Perna, Luca De Nicola, Luigi Bellini, Massimo Cirillo. The international group of tutors and teachers includes Drs Rupert Gerzer, Martina Heer, Peter Norsk, Niehls J. Christensen, Jacques Regnard, Herbert J. Kramer, Vesco Nenov, Karl Kirsch and Christian Drummer.

Further information available by the Editor.

Synopsis on renal function in Space

The ESA Topical Team for Body Fluids and Kidney Function has published a synopsis on renal function in Space which appeared in American Journal of kidney Diseases 2001; 38: 664-698. The synopsis was coauthored by Natale G. De Santo, Christian Drummer, Peter Norsk, Martina Heer, Niehls J. Christensen, Herbert J. Kramer, Jacques Regnard and Massimo Cirillo. The synopsis includes papers on Fluid balance and renal function in space, Validity of microgravity models on Earth, Renal hemodynamics in space, Renal and sympathoadrenal responses in space, water and sodium balance in space, Body mass changes, energy and protein metabolism in space. The last paper provides a Revised hypothesis and future perspectives.

Natale G. De Santo

June 2 - 7, 2002

2002 Life in Space for Life on Earth
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8th European Symposium on Life Science Research in Space
23 Annual International Gravitational Physiology Meeting
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June 25 - 27, 2002

2002 Materials Science Conference
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July 15 - 18, 2002

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July 23 - 29, 2002

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August 14 - 16, 2002

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E-mail: bhim.singh@grc.nasa.gov
URL: http://www.ncmr.org/events/fluids2002.html

September 8 - 13, 2002

Symposium on "Nonlinear Dynamics in Polymeric Systems"
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Sponsored by: American Chemical Society National Meeting
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The University of Southern Mississippi
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October 10 - 19, 2002

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Summer 2003

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