

HUMAN SPACEFLIGHT SYMPOSIUM (B3)  
Utilization & Exploitation of Human Spaceflight Systems (3)

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ESA SCIENCE AND APPLICATIONS PROGRAMMES ON ISS

**Abstract**

The European Columbus laboratory allows the European Space Agency (ESA) to permanently exploit the unique possibilities for research and applications in space in a broad range of areas. The focal areas are the life and physical sciences ranging from human research, biology and astrobiology to material and fluid science and fundamental physics. In addition technology demonstrations cover areas such as Earth services and future space systems to acquiring the skills and knowledge necessary for future human exploration in space. Since 2008 ESA has performed more than 130 experiments on the ISS namely within the scientific context of ELIPS (European Programme for Life and Physical Sciences in Space). Selected highlights of research performed in the ISS laboratories will be presented to show the latest accomplishments of the European user community, including international science cooperation.

The most rewarding part of ISS utilisation lies ahead with challenging plans for the next years' experimental programme. A variety of important new experiments are ready to be deployed and operated on the ISS. In human research – essential for human exploration as well as for Earthbound health problems – the second generation of experiments is in progress in the areas of neurophysiological/cardiovascular/respiratory/musculoskeletal/etc science and the next batch of experiments is under final preparation. In biology a variety of new plant, cell and developmental experiments will be performed in Columbus. A new long-duration astrobiology experiment package will also be deployed outside the ISS and exposed to open space. In physical sciences applied materials and processes research will commence with the FASTER payload for adsorption measurements and the ElectroMagnetic Levitator (EML) for thermophysical properties measurements of industrial alloys will complement the solidification research done in the Material Science Lab. In fundamental physics the next generation of complex plasma research will commence with PK-4 and the unique Atomic Clock Ensemble in Space (ACES) will provide universal unprecedented time and frequency accuracy and test Einstein's theory of general relativity. The SOLAR payload will continue to acquire unprecedented data throughout a full solar cycle until 2016.

International collaboration has already shown great benefits and an increasing number of joint experiments is planned. The already acquired scientific knowledge and operational experience allows the full

exploitation of the ISS for fundamental science, applications and technology demonstrations in space with an increasing yield year by year.