



**POLITÉCNICA**

"Engineering the future"

INTERNATIONAL  
CAMPUS OF  
EXCELLENCE

**UPMCOMIC**  
THE HIGHER EDUCATION ADVENTURE

**REAL UPM PROJECTS**

**7**  
July 2013

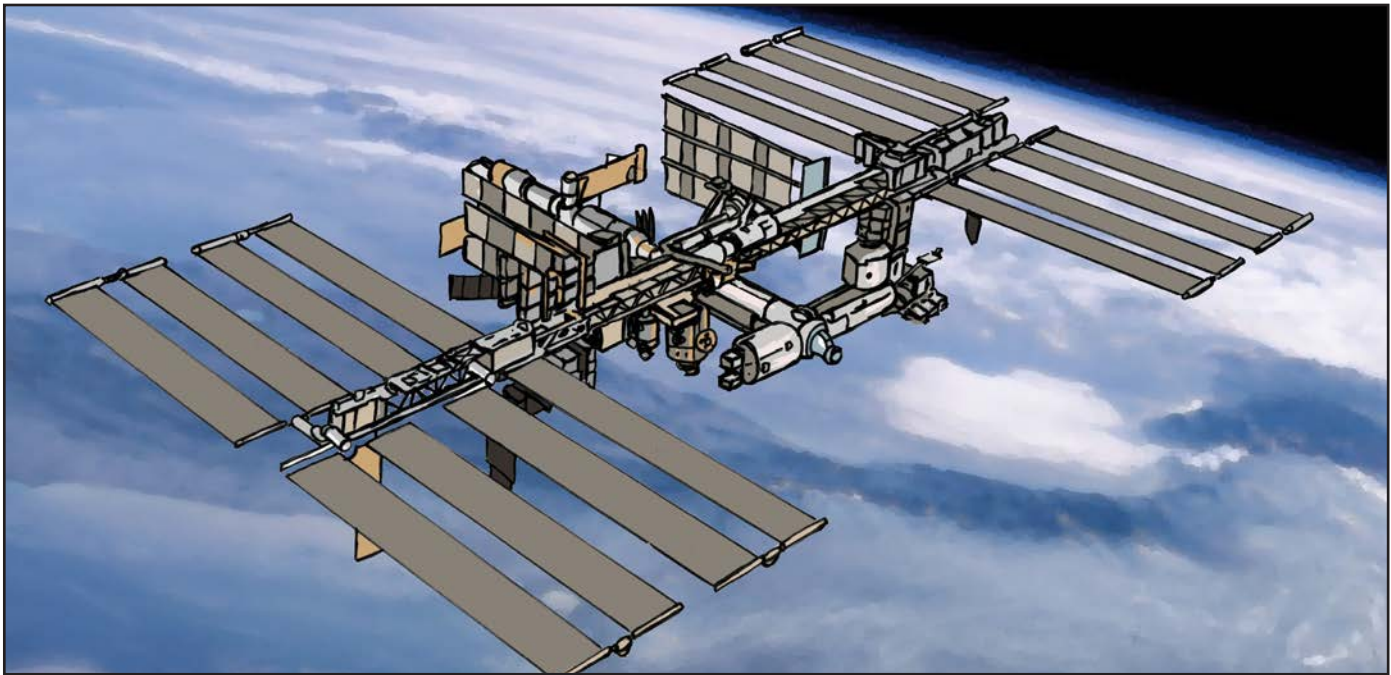


# E-USOC Projects

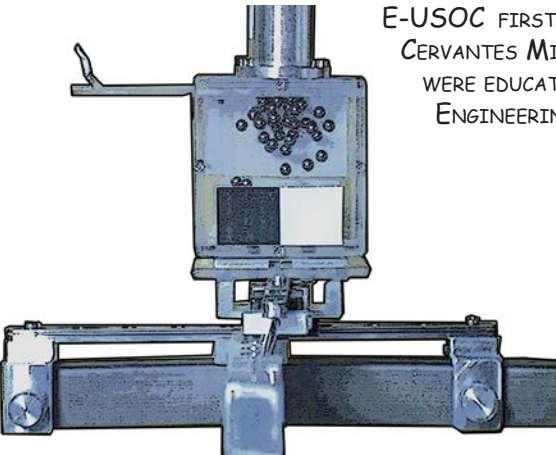
EXPERIMENTS AT THE INTERNATIONAL SPACE STATION (ISS)  
School of Aeronautical Engineering (ETSI Aeronáuticos)



USOCS (User Support and Operations Centres) are European Space Agency (ESA) delegations located in several European countries. USOCS are responsible for preparing and conducting European experiments on board the International Space Station (ISS). ESA decides which experiments each USOC should conduct. Spain's USOC is attached to Madrid Technical University (UPM).

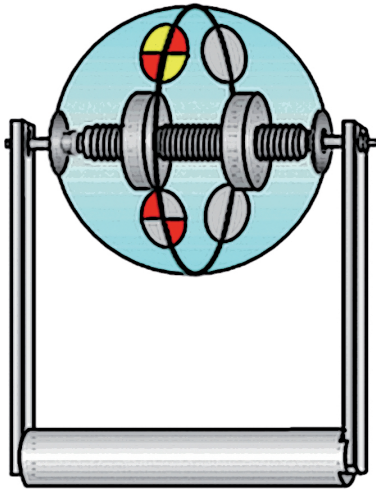


E-USOC first provided operational support for experiments conducted during the Cervantes Mission in October 2003. Two of the experiments, APIS and THEBAS, were educational experiments, designed and built by UPM School of Aeronautical Engineering members of staff.



THEBAS

THEBAS illustrated the basic principles of mechanics, namely, the passage from the dynamics of a discrete set of particles, like billiard balls, to the dynamics of continuous media (fluid), like water or a gas.



APIS

APIS was designed to demonstrate how the rotational motion of a solid body depends on its inertia properties. It is very important for aeronautical engineers to understand this phenomenon. After solar panel deployment, for example, satellite inertia properties change. This destabilizes their rotation whereupon they run out of control.

After the two experiments had been designed and accepted by ESA, Professors Ana Laverón and Victoria Lapuerta travelled to the Star City Astronaut Training Centre (near Moscow). There they met up with the Spanish astronaut Pedro Duque, a UPM graduate in aeronautical engineering, who was to run all the European experiments during the Cervantes Mission.



The professors explained the procedures for running the experiments to Pedro. These procedures are an essential part of the documentation to be generated and critical for the success of any mission. Any mistake in experiment execution could lead to the failure of the whole project. Neither would they get the chance to repeat the experiment as part of another mission because the hardware of both experiments had to be destroyed at the end of the mission to lighten the load carried by the Soyuz spacecraft on the astronauts' return voyage.

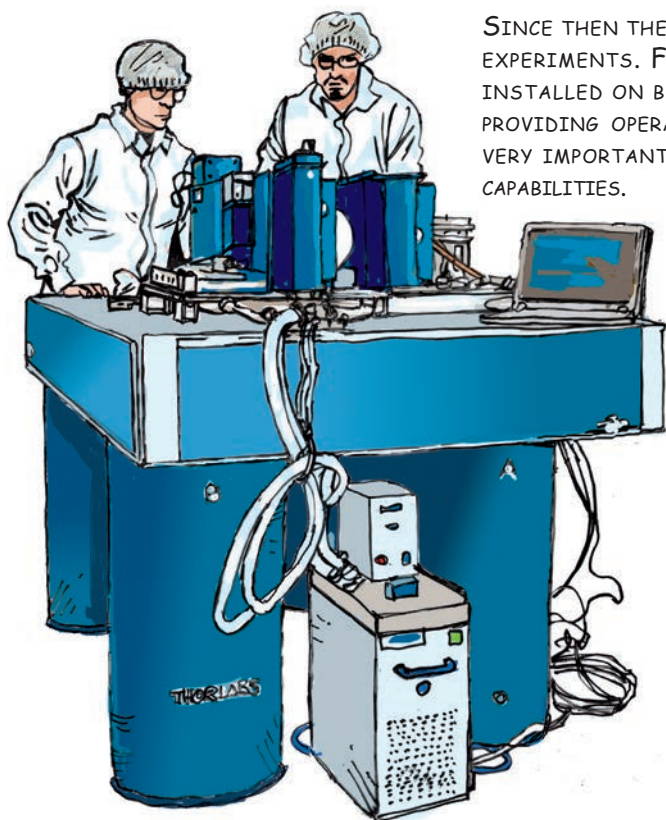


AND FINALLY THE LONG-AWAITED MOMENT CAME! A SOYUZ SPACECRAFT TRANSPORTED PEDRO DUQUE AND THE TWO MEMBERS OF THE EIGHTH ISS CREW THAT WERE TO SPEND THE NEXT SIX MONTHS AT THE STATION.

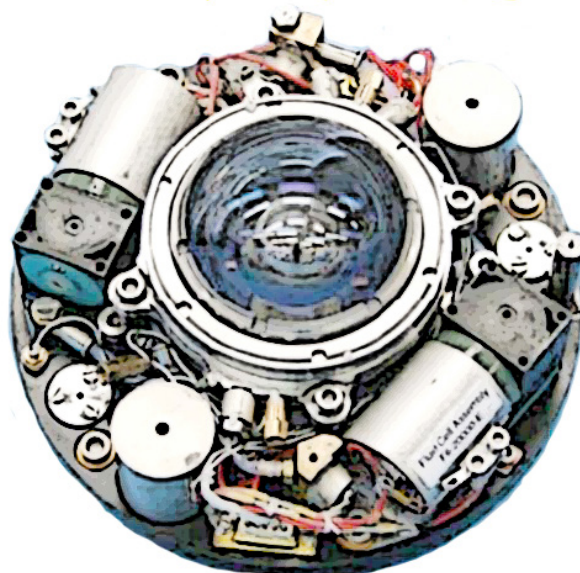


Pedro spent eight days at the station and conducted a total of 25 experiments. There was much expectation at the E-USOC as they followed the mission's tight work schedule. Finally, the Spanish astronaut brought back the videos recording the experiment results from his spaceflight.





SINCE THEN THE E-USOC HAS PROVIDED OPERATIONAL SUPPORT FOR MANY OTHER EXPERIMENTS. FOR EXAMPLE, WHEN THE EUROPEAN COLUMBUS LABORATORY WAS INSTALLED ON BOARD THE ISS, THE SPANISH USOC TEAM WAS CHARGED WITH PROVIDING OPERATIONAL SUPPORT FOR GEOFLOW. GEOFLOW WAS PART OF A VERY IMPORTANT MISSION DESIGNED TO DEMONSTRATE COLUMBUS'S TELESCIENCE CAPABILITIES.



## GEOFLOW

GEOFLOW'S AIM IS TO STUDY THE BEHAVIOUR AND MOVEMENT OF GEOPHYSICAL FLUIDS. IT IS COMPOSED OF TWO CONCENTRIC SPHERES SEPARATED BY A FLUID SUBJECT TO A TEMPERATURE GRADIENT AND A RADIAL FORCE GENERATED BY MEANS OF ELECTRICAL FIELDS SIMULATING THE GRAVITY OF THE EARTH.

THE E-USOC TEAM RECEIVED RECOGNITION AT THE 2013 ESA ISS AWARDS FOR THE SUPERB WORK THEY DID AT PROVIDING OPERATIONAL SUPPORT FOR THE GEOFLOW EXPERIMENT, ANOTHER OUTSTANDING ACHIEVEMENT BY PROFESSORS AND RESEARCHERS AT THE UPM, A FORWARD-LOOKING HIGHER EDUCATION INSTITUTION.



WHEN AN EXPERIMENT IS TO BE RUN ON THE ISS, E-USOC ENGINEERS GIVE THE ASTRONAUT INSTRUCTIONS ON HOW TO SET UP THE EXPERIMENT FROM THEIR CONTROL ROOM. FROM THE E-USOC FACILITIES, THE TEAM OF SCIENTISTS WHO DESIGNED THE EXPERIMENT CAN MAKE PROMPT DECISIONS IN THE EVENT OF ANOMALIES.

