ULISSE : a knowledge management project for life and physical sciences from the International Space Station.

Christian Muller, Didier Moreau, Etienne Haumont and the ULISSE consortium.

B.USOC

Belgian User Support and Operation Centre.

Avenue Circulaire, 3, B-1180 Brussels
Belgium
EMail: christian.muller@busoc.be

ABSTRACT

ULISSE (USOCs KnowLedge Integration and dissemination for Space Science and Exploration) is an FP7 European Commission project proposed by the USOC (User Support and Operation Centre) network in charge of the European operations on the International Space Station. The partners are led by TELESPAZIO in Italy and include as well knowledge management experts as data providers in all the related disciplines, life sciences have an important weight through the in involvement of the MEDES consortium, a space medicine group organised by CNES and university hospitals in Toulouse. The ULISSE project is still in its commencement but intends to continue as a data use and preservation tool for the different research activities performed on the International Space Station.

Keywords: life sciences, microgravity, manned flight, space environment, knowledge management.

INTRODUCTION

ULISSE concerns primarily all the European data obtained in the ISS in life sciences, physical sciences, earth and space sciences. It is designed also for other scientific data bases relating to space environment and space conditions as the data obtained in related studies like bed rest tests. The objective of the project is to lead to a better dissemination of the results obtained in space and to a knowledge increase through the simultaneous use of several data sets. The methodology preserved the original data sets with their full content; it differs in this respect from the data bases built since the International Geophysical Year (1957-1958) and the beginning from the space age. To resume, ULISSE intends to supersede the data sets with a header set in a mark-up language, the user manages the data through this header and can treat simultaneously data sets of different origins. The different web tools used in this project will be discussed as well as the proposed user interfaces.

EXAMPLE: B.USOC AS A ULISSE DATA PROVIDER.

The ULISSE project might appear as abstract or as more related to human sciences than to exact sciences, so in order to make it more accessible, the different steps from data collection to the final knowledge production by the ULISSE users will be described in the case of one of the participating USOC's.

The USOC's and their role.

The USOC network originates from the European agreements on the use of the International Space Station, the User Support and Operation Centres support the scientific users of the station in the participating countries, they communicate with either the COLUMBUS Control Centre or the Marshall Space Flight Centre according to the location of the payload (either in the American or European part of the station). The USOC's obtain the data through the ESA IGS (Interconnected Ground System) and distribute it after agreed processing to the users in their User Home Bases, this distribution is made through local or European academic networks. The USOC's follow also instrument operations and can have a commanding capability. In practice, the USOC's prepare command files which are uploaded either from ColCC or MSFC after approval by the payload operation director. These changes correspond to modification of science operations decided by the scientists or corrective actions in case of malfunctions. If the scientists request it, the USOC's have also data storage function. In the case of samples, USOC's assist also the PI's in their preparation before launch and in some cases receive them after return. In most cases however, the samples are directly analysed at the UHB's where typically analytical equipment which could never be flown in space is deployed.

In any case, the USOC's play a role in the processing of electronic data and have the capability to store them and perform treatment according to the requirements of the PI's. It was thus natural to use this network when the synergistic use and preservation of all ISS data was envisaged.

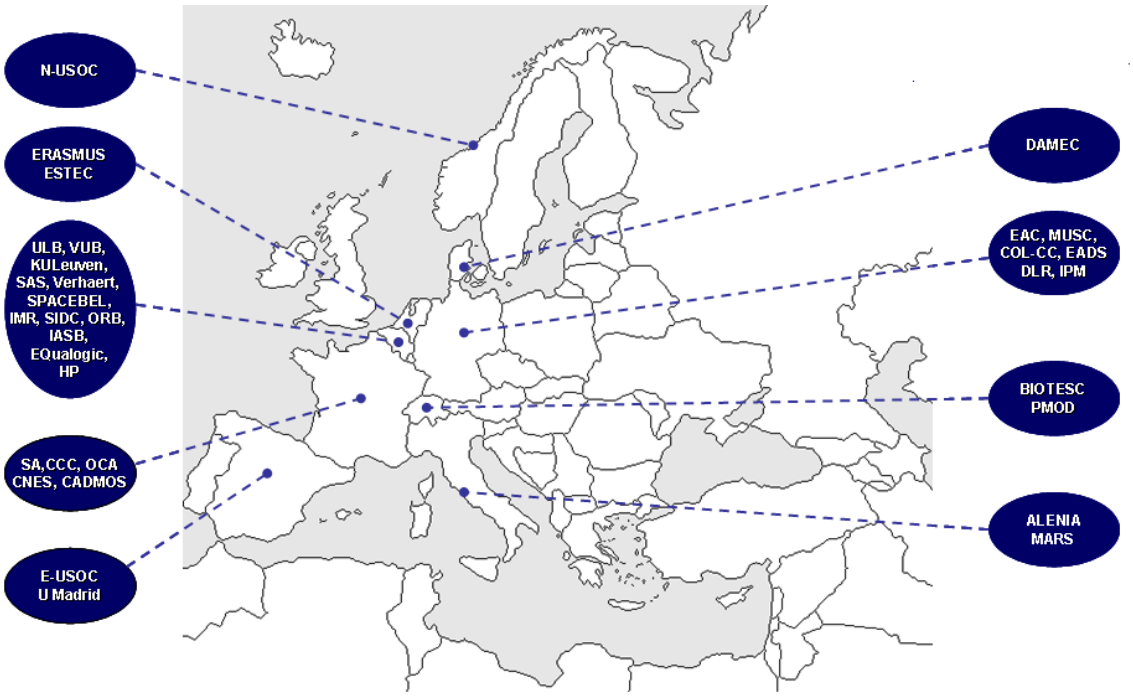

Fig.1: the current partners of B.USOC, N-USOC, ERASMUS, CADMOS, E-USOC, DAMEC, MUSC, BIOTESC and MARS are USOC's, COL-CC is the COLUMBUS control centre and the others are academic and industrial partners which have User Home Bases. Unsurprisingly, most of the partners of this second category are situated in Belgium. The ESA IGS connects only ESA facilities and the USOC's.

In the USOC organisation, the ESA management (Human Space flight, Microgravity and Exploration (HME)) assigns Facility Responsible Centres (FRC) and Facility Support Centres (FSC), B.USOC is FRC for the SOLAR package of COLUMBUS, a set of three instruments monitoring the solar output

from the far-UV to the infrared. B.USOC is FSC for the PCDF (protein crystallisation diagnostics facility), a module inside the European Drawer Rack inside COLUMBUS. In both cases, the B.USOC experience antedates COLUMBUS as space solar instrument are operated by teams of all three institutes present in Uccle since 1983 (Belgian Institute for Space Aeronomy, Royal Meteorological Institute and Royal Observatory). Similarly, B.USOC operates protein crystallisation experiments since 2002. In the future, B.USOC will operate also for CNES the solar science monitoring satellite PICARD to be launched in 2010.

Fig.2: COLUMBUS in flight, SOLAR is indicated by the arrow (NASA document).

Data provided by B.USOC to ULISSE.

B.USOC intends at project end to provide the SOLAR package data base as well as protein crystallisation data obtained on the ISS. Later, B.USOC will use its Belgian Institute for Space Aeronomy connection to add space science data from other platforms. This is unfortunately not possible at this stage because these data are still owned by ESA and the PI's and thus cannot yet be released to ULISSE and the synergistic studies that will be initiated by the existence of the tool. Thus, in order to begin without waiting for the release of the data rights, a ground base network of solar UV measuring station in Belgium and Luxembourg will be first introduced in the ULISSE data base. This network provides already an operational UV index and climatology of the solar radiation received at the surface in Belgium. The five stations operate continuously and the Belgian Institute for space Aeronomy is fully owner of the data and has authorized B.USOC to diffuse it. This project is called SUVIM.

The specificity of ULISSE is to define for each data set topics maps and ontology; these will be then translated by the knowledge management partners in the XML language and will allow an access to the data without altering its original format.

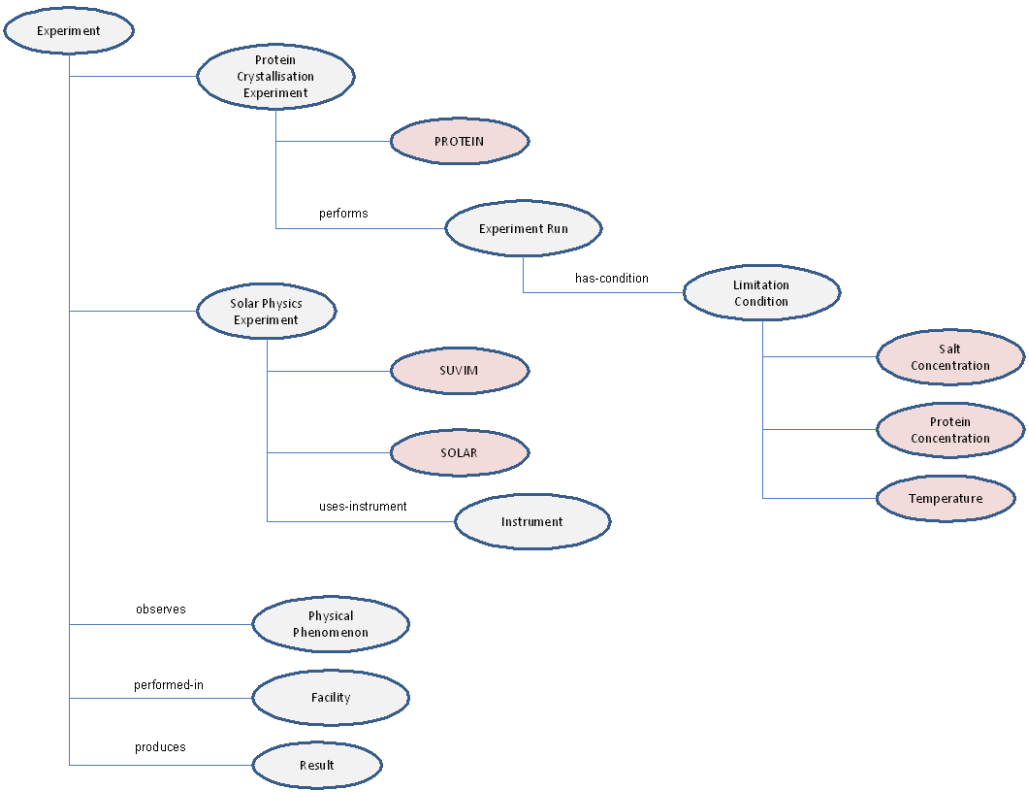

Fig.3: Ontology diagram of the data introduced by B.USOC, only SUVIM can be entered now in the project.

CONCLUSIONS

The ULISSE project is an important part of the future exploration programme as it will emphasize both the use and the preservation of the different data sets generated during the operations of the ISS.

List of partners.

Microgravity Advanced Research and Support Center S.r.l. (MARS), Italy, Telespazio S.p.A., Italy, Belgium Users support and Operation Centre, Belgium, Consiglio Nazionale delle Ricerche (CNR-ISTC), Italy, Institut de Médecine et de Physiologie Spatiales (MEDES), France, Space Applications Services (SpaceApps), Belgium, Centre National d'Etudes Spatiales (CNES), France, Università degli Studi di Roma "La Sapienza", Italy, Damec Research Aps - Danish Aerospace Medical Centre of Research, Denmark, Stichting Nationaal Lucht- en Ruimtevaartlaboratorium (NLR), The Netherlands, Deutsches Zentrum für Luft- und Raumfahrt (DLR), Germany, Eidgenössische Technische Hochschule Zürich (ETH), Switzerland, NTNU Samfunnsforskning AS, Norway, Centrum Badań Kosmicznych Polskiej Akademii Nauk (SRC PaS), Poland, Universidad Politécnica de Madrid, Spain, Werum Software & Systems AG, Germany, European Low Gravity Research Association (ELGRA), The Netherlands.

Acknowledgements: B.USOC is funded through the ESA Prodex programme by the Belgian Science Policy Office and hosted by the Belgian Institute for Space Aeronomy. This work has received funding from the European Commission through the Seventh Framework Programme (FP7/2007-2013) under the Space Theme, under grant agreement n°218815 within the ULISSE Project (USOCs KnowLedge Integration and Dissemination for Space Science Experimentation).