SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND DEVELOPMENT (D3)
Systems and Infrastructures to Implement Future Building Blocks in Space Exploration and Development (2)

Author: Dr. Lucy Berthoud
University of Bristol, United Kingdom, lucy.berthoud@bristol.ac.uk

Mr. John Vrublevskis
Systems Engineering & Assessment Ltd, United Kingdom, jbv@sea.co.uk
Mr. Mike Guest
Systems Engineering & Assessment Ltd, United Kingdom, michael.guest@sea.co.uk
Ms. Hilde Schroeven-Deceuninck
European Space Agency (ESA/ECSAT), United Kingdom, Hilde.Schroeven-Deceuninck@esa.int
Prof. Monica Grady
Open University, United Kingdom, m.m.grady@open.ac.uk
Dr. Caroline Smith
Natural History Museum, United Kingdom, caroline.smith@nhm.ac.uk
Prof. Mark Sephton
Imperial College London, United Kingdom, m.a.sephton@imperial.ac.uk
Prof. Mark Sims
University of Leicester, United Kingdom, mrs@star.le.ac.uk
Dr. John Bridges
University of Leicester, United Kingdom, j.bridges@le.ac.uk
Dr. Allan Bennett
Health Protection Agency, United Kingdom, allan.bennett@hpa.org.uk
Mr. Robert Baker
Strategic and Technical Consulting, United Kingdom, robert.baker@stc-org.com
Mr. Alistair Pope
M+W UK, United Kingdom, alistair.pope@mwgroup.net
Dr. Brian Crook
Health and Safety Laboratory, United Kingdom, brian.crook@hsl.gov.uk
Mr. Charles Taylor
M+W UK, United Kingdom, charles.taylor@mwgroup.net

CONCEPT FOR A MOON AND ASTEROID SAMPLE RETURN FACILITY

Abstract

The objective of this European Space Agency funded study was to examine an initial concept and requirements for a Lunar and Asteroid Receiving Facility (LaARF). Then to investigate the evolution from a facility dealing with only Moon and asteroid returned sample material to a facility dealing with Mars returned sample material with potential biohazard. The LaARF concept and requirements were broadly derived from requirements including Infrastructure, Equipment, People Knowledge. The facility concept was required to deal with samples from a number of possible missions returning from Asteroids

or the Lunar surface. A number of past and planned missions were outlined to draw both general features that can be used to develop the concept, and more importantly to derive the range of likely hardware / samples to be handled by the facility. Requirements for the general sample quantity and make-up expected were given, specifically; the facility will be able to accommodate 500g of samples comprising dust, grains and rocks of varying composition and sizes. The initial concept was evolved using review of literature and inputs from a dedicated Concept Definition Workshop involving scientific and industry experts. A functional architecture was established and technologies techniques were assessed. It was recognised that tele-operations are especially needed. Information flow through the facility was analysed. Commonality with a Mars Sample Receiving Facility (MSRF) was assessed and possible evolutions to a MSRF were considered. Then Scenario Definition Workshops were held with leading scientists and industry experts to determine the optimal scenario to evolve the LaARF to an MSRF. The result of this analysis was that independent facilities without 'future-proofing' prior to expansion were the optimal solution. This approach maximised the potential future capability in a cost-efficient manner. Finally, analysis of potential users for the facility showed that Planetary Protection (PP) Hardware Samples, Meteorites planetary analogues were the most promising users for a shared facility. In addition non-space samples, such as those from widely dispersed geological collections, may also benefit from the facility.