

SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 2 (3B)

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A DETAILED DESIGN, OPERATION AND ASSESSMENT TECHNOLOGY DEVELOPMENT
REQUIRED FOR A MARS SAMPLE RETURN (MSR) SAMPLE RECEIVING FACILITY (SRF)

Abstract

COSPAR Planetary Protection Policy places very stringent requirements on Sample Return missions and ‘breaking the chain of contact’ between Earth and the celestial body from which the sample is returned. This must be continued after return to Earth and –at the same time- any contamination or damage to the sample must be avoided until such time as it can be confirmed as not presenting a biohazard and available for subsequent curation and scientific investigation. Such a facility has never before been built and an investigation has been made to determine the requirements for a Mars Sample Return (MSR) Sample Receiving Facility (SRF) from first principles using a Biohazard Assessment Protocol (BAP) rather than the modification of an existing BSL-4 facility. This approach fully takes in to account cleanliness requirements to avoid sample contamination.

This paper will present the results from the second, and final, part of an ESA funded study starting with detailed requirements and detailed procedures for a MSR SRF derived from the BAP by means of a trade-off and preferred concept. These requirements and procedures were used to create a complete detailed design. The design process revealed areas of uncertainty in the detailed requirements and the risk associated with the major areas of uncertainty were reduced by means of detailed operational analysis and a Failure Mode, Effects, and Criticality Analysis (FMECA) analysis. Finally, from the shortfall between design performance and requirements, key European technologies that needed to be developed were identified and a broad development strategy was formulated taking in to account potential synergies with other applications at all levels.

The results of the MSR SRF study by SEA (as well as the results of another parallel study) will be taken into account by ESA to define the requirements for a follow-on procurement action in the future. There will be a review of the results from both studies and an agreement on the requirements based on

these parallel studies. Therefore, the views expressed herein should not be taken to reflect the official opinion of the European Space Agency.