

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

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DESIGN, BREADBOARDING AND TESTING OF A BIO-CONTAINMENT SYSTEM FOR MARS  
SAMPLE RETURN MISSION**Abstract**

A Mars Sample Return (MSR) mission foreseen in the 2020s envisages the collection of some tens of samples of Martian soil for return to Earth. Once collected, each sample will be stored and capped into dedicated vessels and finally fixed into a dedicated container (Orbiting Sample - OS). After the storage of all samples, the OS will be launched into Mars orbit and transferred to the Earth Re-entry Capsule (ERC) for the return trip to Earth.

The transfer of the OS into the ERC, the return phase, Earth re-entry and samples curation are subject to stringent constraints with respect to Planetary Protection requirements.

As part of this transfer system, the main objective of the Bio-Containment activity is to develop, breadboard and test a safe bio-barrier and the relevant monitoring system.

As soon as the OS is captured any contamination of the spacecraft and in particular of the ERC with Martian material must be avoided. In order to achieve this goal, a system capable to position the OS into the Bio-Container and break the chain with Mars has been put in place. It consists of sealing gaskets combined with a sterilization process. These operations are all actuated by dedicated mechanisms. Once the chain with Mars is broken, the Bio-container will be closed with two level of gasket based sealings. One of the two containment compartments is pressurized in order to enable a monitoring system the detection of possible major failures by pressure measurement. Dedicated mechanisms have been designed to execute all these operations.

Once closed, the Bio-Container will be inserted into the ERC ready for the return flight.

During the whole return phase the pressurized compartment of the Bio-container will be constantly monitored to allow for a final decision on Earth re-entry to be taken at the end of the return phase.

In order to verify all these technologies appropriate verification steps have been foreseen:

- Leak tests
- Particle tests
- Mechanisms verification
- Power/data transmission from/to S/C and Biocontainer

The proposed paper will provide an overview of the developed Bio Container, description of the manufactured BBs and some achieved test results.