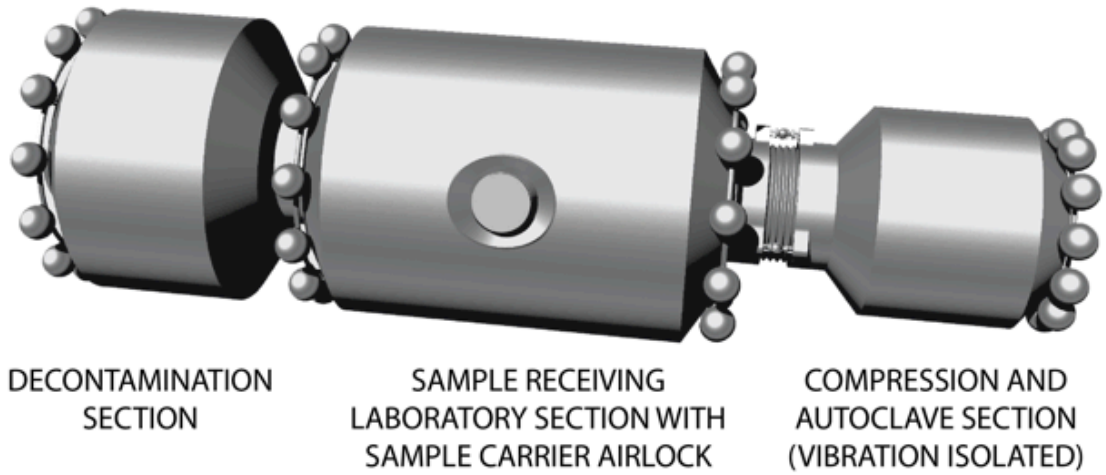
**SAMPLE RECEIVING LAB AND PLANETARY QUARANTINE FACILITY FOR THE DEEP SPACE GATEWAY.**

M. M. Cohen[1], S. Bianco[1, 2], 1.The Space Cooperative, marc@space.coop; 2. University of Houston.




**Planetary Quarantine Facility** Attaches to the Deep Space Gateway at the Decontamination Section

**Introduction:** The Deep Space Gateway (DSG), a space station in orbit around the Moon would offer advantages for staging missions to Mars and for receiving spacecraft returning from Mars or the Asteroid belt. These trajectory advantages make the DSG an ideal location for planetary protection to install and operate a Planetary Quarantine Facility (PQF) to receive and perform analysis of returned cryogenic lunar samples and Mars samples with biological potential.

**Off-Planet Quarantine Facilities:** NASA first began studying an orbital quarantine facility with the Antaeus Report (1981) that placed the PQF in low Earth orbit in a manner similar to then-current space station concepts [1]. In the 1990s, the Center for Mars Exploration at Ames evaluated the challenges of receiving and handling extraterrestrial samples with biological potential. One focus was on developing a sample-handling chamber that could contain the samples without the risk of leakage or escape of materials. This chamber would incorporate a "vacuum jacket" through which any leakage of gas would pass through an autoclave, destroying any organism that escaped. This system became referred to as BSL-5 to describe it as advanced beyond the Centers for Disease Control's highest standard of "Biosafety Level 4."

However, the most challenging aspect might be "writing the environmental impact statement to locate a MRSH laboratory on Earth." One participant's not entirely sardonic solution was to return Mars samples to an orbital storage module, until such time as it was possible to complete construction of the BSL–5 Mars sample receiving and handling facility. Estimates for the completion of the Earth-based facility ranged up to three times as long as the entire Mars sample return mission itself.

Further studies addressed how to identify the appropriate landing site on Earth and where to transport the samples from there to a permanent curatorial facility. [4,5]. However, it would be far more efficient, economical, and safe to process and analyze Mars returned samples in a space-based laboratory.

**The Deep Space Gateway:** The DSG would afford the ideal space-time coordinates for the Mars returned sample science receiving lab. It provides the essential Bioisolation from Earth to prevent back contamination. Surgical robots are now sufficiently advanced to provide all the capabilities a scientist could need to manipulate, slice, dice, and assay a Mars sample. It would also be feasible for scientist-astronauts to work directly on Mars samples at the Deep Space Gateway, in concert with remote researchers.

**Planetary Sample Receiving Lab:** The PSRL would attach to the DSG station via a dedicated airlock, with decontamination capability, including showers and evacuation to vacuum. The operational design for the PSRL mission would concentrate on teleoperated or autonomous operation of the analytical capabilities, while being crew tended in terms of sample selection, loading, unloading, and packaging for return of sterile samples to Earth.

**References:** [1] D. L. DeVincenzi (1981). The Antaeus Report, NASA SP-454. [2] M. M. Cohen (2002 July). Mission Architecture Considerations for Mars Returned Sample Handling Facilities (SAE 2002-01-2469) [3] (2003 July). Global Overview: Returned Astrobiology Sample Mission Architectures (SAE 2003-01-2675).