

Development of a Hermetically Sealed Canister for Sample Return Missions, Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



ABSTRACT

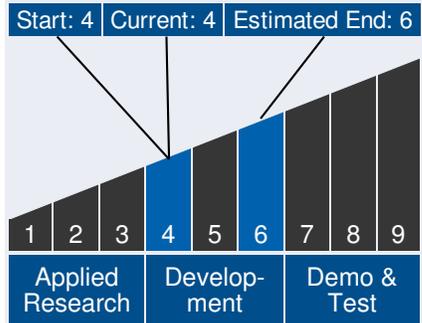
The goal of this project is to develop hermetic sealing technologies which can be used for the return of samples from planetary bodies such as Mars, the Moon, Comets and Asteroids, with a primary focus on induction brazing as a means of sealing a Mars Sample Return Orbiting Sample (OS) after it has been recovered by the MSR Orbiter spacecraft. During Phase 1, Honeybee Robotics investigated several techniques for providing hermetic sealing such as Knife Edge, Shape Memory Alloy, C-ring, O-ring and Induction Brazing. These were identified as promising hermetic sealing approaches which can be applied to Sample Return (SR) missions, such as the Flagship Mars SR, New Frontiers (NF) Comet SR and the Lunar South Pole-Aitken Basin SR, identified by the NRC Decadal Survey as the primary missions for the next decade. The sealing system would be used to store samples of rocks, soils, atmospheric gas, ice or icy-soil. Based on Phase 1, we determined that a brazing approach is the optimum method of sealing planetary samples and should be used as a primary seal. Knife edges and O-rings should be pursued as secondary and redundant (backup) seals, respectively. Therefore, we propose to design and fabricate hermetic sealing canisters and test their hermeticity to achieve leak rates of 10⁻⁷ atm cc/sec He. The canisters will be exposed to dust and thermal cycles to reach TRL 5/6 at the end of the Phase 2.



Table of Contents

Abstract	1
Anticipated Benefits	1
Technology Maturity	1
Management Team	1
U.S. Work Locations and Key Partners	2
Technology Areas	2
Image Gallery	3
Details for Technology 1	3

Technology Maturity



ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: Future robotic astrobiology and geology missions such as Mars Sample Return, as well as Lunar, Comet and Asteroid sample return missions will benefit greatly from the ability to hermetically seal samples in a dusty environment. A robust sample canister that is dust tolerant will greatly reduce the complexity of support equipment that may otherwise be required to clean containment

Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

Program Manager:

- Carlos Torrez

Continued on following page.

Development of a Hermetically Sealed Canister for Sample Return Missions, Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



vessels prior to sealing.

To the commercial space industry:

Potential Non-NASA Commercial Applications: Terrestrial uses of robust hermetically sealed containers might include telerobotic inspection and sampling of hazardous materials: chemical, biological, or nuclear. Tele-operated robots can go into many hazardous areas which humans cannot. These robots could be outfitted with canisters with hermetic seals which function in the presence of dirt, dust and chemicals. The canisters could be robotically filled with hazardous material, and hermetically sealed using the induction brazing technique. For example, when using a double walled cylinder approach, the outer contaminated sleeve could be separated, leaving the internal chamber sealed and safe for human handling and laboratory analysis.

Management Team (cont.)

Principal Investigator:

- Kris Zacny

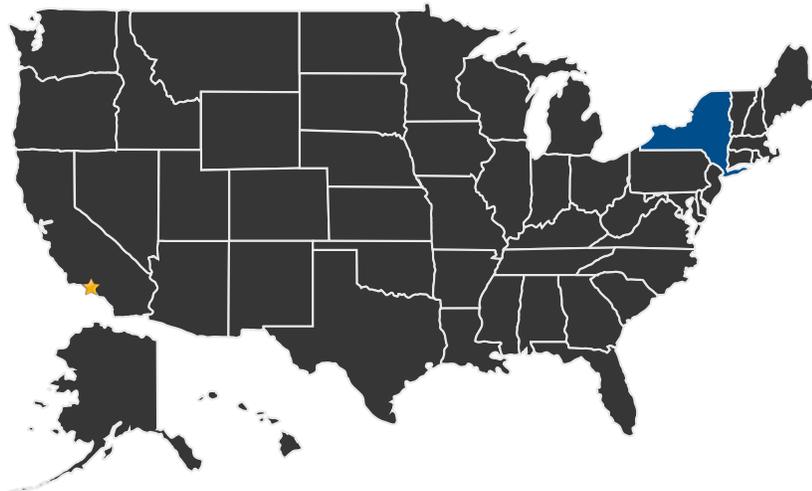
Technology Areas

Primary Technology Area:

Robotics and Autonomous Systems (TA 4)

└ Systems Engineering (TA 4.7)

U.S. WORK LOCATIONS AND KEY PARTNERS



■ U.S. States
With Work

★ Lead Center:
Jet Propulsion Laboratory

Development of a Hermetically Sealed Canister for Sample Return Missions, Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)



Other Organizations Performing Work:

- Honeybee Robotics, Ltd. (New York, NY)

PROJECT LIBRARY

Presentations

- Briefing Chart
 - (<http://techport.nasa.gov:80/file/23264>)

IMAGE GALLERY



*Development of a Hermetically Sealed
Canister for Sample Return Missions,
Phase II*

DETAILS FOR TECHNOLOGY 1

Technology Title

Development of a Hermetically Sealed Canister for Sample Return Missions, Phase II

Potential Applications

Future robotic astrobiology and geology missions such as Mars Sample Return, as well as Lunar, Comet and Asteroid sample return missions will benefit greatly from the ability to hermetically seal samples in a dusty environment. A robust sample canister that is dust tolerant will greatly reduce the complexity of support equipment that may otherwise be required to clean containment vessels prior to sealing.