

# Mars Atmosphere And Regolith COLlector/PrOcessor For Lander Operations Project

Center Innovation Fund: KSC CIF Program

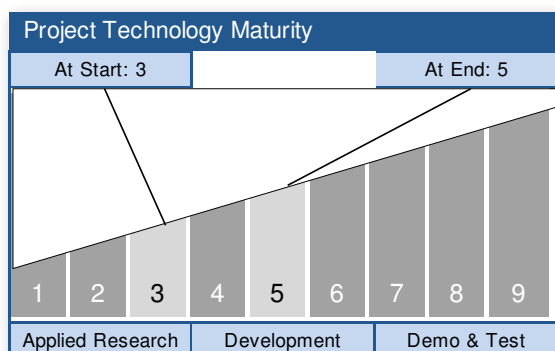
Space Technology Mission Directorate ( STMD )

National Aeronautics and  
Space Administration



## ABSTRACT

Proving a propellant production plant that can process the Martian atmosphere (and soil) will provide engineers with performance and operational control data that can be used for designing next generation and flight systems for future missions.



Technology Area: In-Space Propulsion Technologies TA02 (Primary)  
Launch Propulsion Systems TA01 (Secondary)

## ANTICIPATED BENEFITS

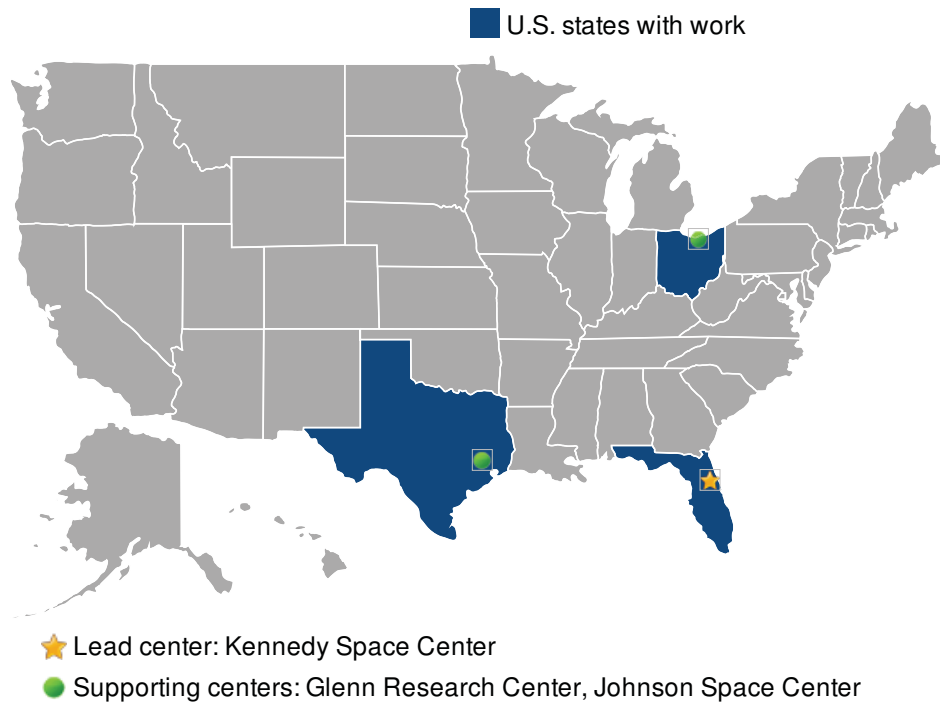
### To NASA funded missions:

There is potential for an ISRU payload to fly to Mars on the proposed ARC/SpaceX Red Dragon mission under study for a 2018 Discovery mission and this combined ISRU system test would be the initial step in refining the design and moving towards a flight system demonstrating ISRU and life/biohazard detection.

### To NASA unfunded & planned missions:

Similar ISRU hardware could be used at the lunar poles to convert lunar CO into ...

Read more on the last page.



## DETAILED DESCRIPTION

In order to maximize scientific payload and minimize launch mass, future missions to Mars will utilize in situ resource utilization (ISRU) to live off the land, and provide consumables for propulsion, power, and life support. MARCO POLO (Mars Atmosphere and Regolith COLlector/PrOcessor for Lander Operations) provides a combined test bed to demonstrate this technology. The addition of a drill to the baseline MARCO POLO system in the future would add the ability to take samples for a life-detection instrument to the overall mission.

### MANAGEMENT

**Program Executive:**  
Burton Summerfield

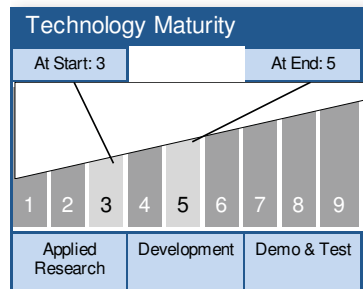
**Program Manager:**  
Nancy Zeitlin

**Project Manager:**  
Nancy Zeitlin

**Principal Investigator:**  
Anthony Muscatello

## TECHNOLOGY DETAILS

### Mars Atmosphere and Regolith Collector/PrOcessor for Lander Operations (MARCO POLO)



### TECHNOLOGY DESCRIPTION

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This technology is categorized as a hardware system for other applications

- Technology Area
  - TA02 In-Space Propulsion Technologies (Primary)
  - TA01 Launch Propulsion Systems (Secondary)

### CAPABILITIES PROVIDED

This is an evolutionary process to refine in situ resource utilization technology, increase confidence, and scale up to support future sample return or crewed missions to Mars.

The purpose of the MARCO POLO project is to demonstrate the conversion of Martian CO<sub>2</sub> and water from regolith into methane/oxygen bipropellant on the scale needed for a Mars Sample Return mission.

## ANTICIPATED BENEFITS

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### **To NASA unfunded & planned missions: (CONT'D)**

storable methane fuel using local water ice as a source of hydrogen and oxygen.

### **To the commercial space industry:**

Commercially, the ability to convert CO<sub>2</sub> into methane has a wide ranging applicability as a green technology by converting CO<sub>2</sub> from chemical or power plants, or metabolic CO<sub>2</sub> from closed loop systems into methane to be used as fuel or for power.

