NASA SBIR/STTR Technologies

S4.03-9814 - A Miniature Compressor for In-Situ Resource Utilization on Mars

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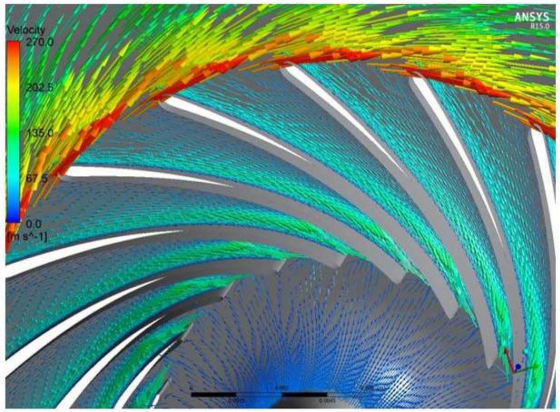
Identification and Significance of Innovation

A key objective for NASA's next rover mission to Mars is the demonstration of oxygen production from atmospheric carbon dioxide. Such a technology demonstration may pave the way for a future sample return mission to the Red Planet, as well as possibly a future manned mission to Mars. A necessary component in such a demonstration system is a blower or compressor that can deliver the necessary carbon dioxide mass flow to a production plant. Creare proposes the development of a radial flow compressor that is capable of a mass flow rate of 400 g/hr. The compressor will be a turbomachine based on our space qualified vacuum pump technology currently operating on the Curiosity rover in Gale Crater on Mars.



The Gas Flow Around the Compressor Impeller Blades Is Modeled in CFD

Estimated TRL at beginning and end of contract: (Begin: 4 End: 6)

Technical Objectives and Work Plan

Technical Objectives:
The overall goal of this technology development program is to build, test, and deliver an extremely small, highly efficient compressor for Martian atmospheric carbon dioxide compression and to qualify the compressor to TRL 6. During Phase II, the project aims to answer the following questions:

1. What design changes will improve compressor build and lifetime?
2. What is the performance over pressure and temperature?
3. What is the compressor lifetime?

Work Plan:

Task 1. Design Single-Stage compressor
Task 2. Build Prototype Compressor
Task 3. Test Prototype Compressor to TRL 6
Task 4. Deliver Compressor and Support NASA Testing
Task 5. Manage and Report

NASA Applications

The primary application for the compressor proposed is to compress Martian atmospheric carbon dioxide as part of an ISRU plant. Furthermore, the same technology will be applicable for larger production plants for a Mars sample return and an eventual Mars human mission. This space qualified compressor may also have applications for other planetary missions such as gas storage and filtration systems.

Non-NASA Applications

The potential commercial applications for a small, high efficiency compressor are numerous. We foresee that this unit will mainly be incorporated in high value analytical instruments for atmospheric sampling and for systems to detect airborne chemical, biological, and nuclear warfare agents.

Firm Contacts

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