Project Introduction

Our approach to high-pressure carbon dioxide storage will directly address the challenges associated with storage of compressed carbon dioxide - the need to reduce power consumption, mass and volume while limiting acoustic impact. Successful implementation will reduce gas compressor power by over 50% and required maximum tank pressure by over 80% while maintaining storage tank footprint and total standard volume of gas. This is accomplished through the use of our high gas capacity physisorptive support architecture employing tailored zeolite sorbents. Added benefits include facile regenerability, equal applicability to other gases including oxygen and nitrogen, improved thermal management to control heats of desorption and adiabatic cooling during filling and emptying cycles. In addition to the energy savings, we expect that more compact, efficient, and less intrusive compression devices can be utilized. This approach is based on a novel regenerable high capacity physisorptive media storage system that will adsorb CO₂ from a compressor system and store it at a relatively lowered pressure. On demand, the CO₂ can be desorbed at a constant rate and released. For example, we can store an equivalent volumetric amount of CO₂ at about 500 psi, compared to the current 3600 psi. There is a potential for substantial weight savings as well – while we add the mass of sorbent and support, mass reductions from use of thinner wall tanks and smaller compressors are likely to be larger, specific savings will be addressed as part of the proposed task plan. At the end of Phase I we will have demonstrated our approach in our in-house bench scale equipment, bringing the technology to TRL 3 with detailed performance information needed to go to TRL 4 in Phase II, including the delivery of suitable equipment to a NASA facility.

Anticipated Benefits

Potential NASA Commercial Applications: The proposed technology will provide a novel regenerable high capacity physisorptive media storage system capable of accepting CO₂ obtained from a compressor system, storing it at a relatively lowered pressure, and desorbing the CO₂ on demand at a constant rate. The lower pressure of the system as compared to conventional technologies will have superior advantages in energy savings and reduced system noise. Even more, the lower pressure gas storage vessels and more compact compressor offer to reduce the system mass and volume. Also, extended service life and lower maintenance improves mission flexibility and reduces the need for spares. Overall, the approach offers a safe, compact, quiet, long-lived, and efficient way to compress, store, and deliver gaseous carbon dioxide within an AR subsystem.
Primary U.S. Work Locations and Key Partners

- **Organizations Performing Work**
  - Johnson Space Center (JSC)
    - Role: Lead Organization
    - Type: NASA Center
    - Location: Houston, TX
  - Precision Combustion, Inc.
    - Role: Supporting Organization
    - Type: Industry
    - Location: North Haven, CT

**Organizational Responsibility**
- **Responsible Mission Directorate:** Space Technology Mission Directorate (STMD)
- **Lead Center / Facility:** Johnson Space Center (JSC)
- **Responsible Program:** SBIR/STTR

**Project Management**
- **Program Director:** Jennifer L Gustetic
- **Program Manager:** Carlos Torrez
- **Project Manager:** Jeffrey J Sweterlitsch
- **Principal Investigator:** Jeffrey Weissman

**Technology Maturity (TRL)**
- Start: 1
- Current: 2
- Estimated End: 3

**Closeout Documentation**
- Final Summary Chart
  - [Link](https://techport.nasa.gov/view/14044)
Energy Saving High-Capacity Moderate Pressure Carbon Dioxide Storage System, Phase I
Completed Technology Project (2014 - 2014)

Images

Project Image
Energy Saving High-Capacity Moderate Pressure Carbon Dioxide Storage System Project Image (https://techport.nasa.gov/image/4746)

Technology Areas
Primary:
- TA7 Human Exploration Destination Systems
  - TA7.1 In-Situ Resource Utilization
    - TA7.1.2 Resource Acquisition

Other/Cross-cutting:
- TA6 Human Health, Life Support, and Habitation Systems
  - TA6.1 Environmental Control and Life Support Systems and Habitation Systems
    - TA6.1.1 Air Revitalization

For more information and an accessible alternative, please visit: https://techport.nasa.gov/view/17991