Project Introduction

MTSA technology specifically addresses the thermal, CO2 and humidity control challenges faced by Portable Life Support Systems (PLSS) to be used in NASA's Constellation Program. Metabolically-produced CO2 present in the ventilation gas of a PLSS is collected using a CO2-selective adsorbent via temperature swing adsorption. The temperature swing is achieved through cooling to well below metabolic temperatures. The coolant can be water, liquid CO2 (LCO2), or any cryogenic fluid. Water or LCO2 is used as coolant by expanding the liquid to below sublimation temperatures when exposed to low pressure or vacuum environments. Subsequent super heated vapor, as well as additional coolant, is used to further cool the astronaut. The adsorbent is warmed using moist ventilation gas, producing condensation which is recycled at the habitat. The overall objective of the Phase 2 effort is to develop and test in a relevant environment a full-scale lunar PLSS MTSA subassembly Engineering Development Unit (EDU) comprised of a condensing ice heat exchanger (CIHX), a sorbent bed and a sublimation heat exchanger (HX). This will be achieved by developing high fidelity models and designs of the three functions, validated with test data available from previous work. At the completion of the effort, the EDU will have been manufactured and tested. The MTSA subassembly will be at TRL 5 and the EDU can be used for off-nominal operational testing as well as MTSA system integration tests.

Primary U.S. Work Locations and Key Partners

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Center / Facility:
Johnson Space Center (JSC)

Responsible Program:
SBIR/STTR
SBIR/STTR

Metabolic Heat Regenerated Temperature Swing Adsorption for CO2, Thermal and Humidity Control, Phase II

Completed Technology Project (2009 - 2011)

<table>
<thead>
<tr>
<th>Organizations Performing Work</th>
<th>Role</th>
<th>Type</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>Johnson Space Center (JSC)</td>
<td>Lead Organization</td>
<td>NASA Center</td>
<td>Houston, TX</td>
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<tr>
<td>Paragon Space Development Corporation</td>
<td>Supporting Organization</td>
<td>Industry</td>
<td>Tucson, AZ</td>
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Primary U.S. Work Locations

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<tbody>
<tr>
<td>Arizona</td>
<td>Texas</td>
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Closeout Documentation

Final Summary Chart

(https://techport.nasa.gov/file/13713)

Project Management

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Jennifer L Gustetic

Program Manager:
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