NASA SBIR/STTR Technologies

An Efficient Heat Exchanger for In Situ Resource Utilization

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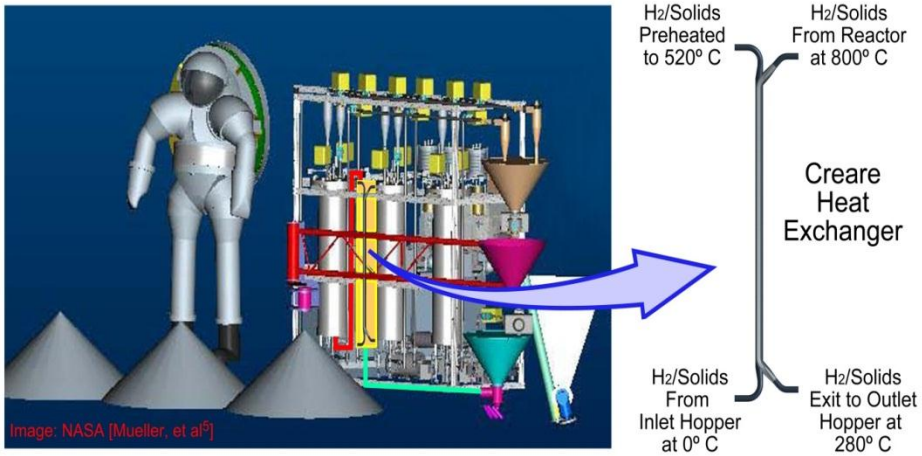
Identification and Significance of the Innovation

- NASA envisions that in situ resource utilization (ISRU) will be essential for future manned Mars and Lunar missions as well as for sample return missions.
- Typical ISRU designs involve heating reactants to high temperature. Currently, this thermal energy is not recovered from the spent reactant, which leads to a low overall energy efficiency of the ISRU.
- Creare proposes to develop, design, build, and test a robust, high efficiency passive counter-flow heat exchanger that will recover more than 50% of the thermal energy used.

Expected TRL Range at the end of Contract: TRL-6



Technical Objectives and Work Plan

The technical objectives of this research program are to design, fabricate, test and deliver a heat exchanger that can be seamlessly integrated into the baseline ISRU plant currently being developed by NASA for oxygen extraction from Lunar or planetary regolith. The goal is for the heat exchanger to recover more than 50% of the thermal energy used to heat the regolith to reaction temperatures.

Work Plan

Task 1: Heat Exchanger Modeling
Task 2: Heat Exchanger Design
Task 3: Heat Exchanger Fabrication
Task 4: Heat Exchanger Test
Task 5: Manage and Report

NASA and Non-NASA Applications

The main application area for NASA for the proposed heat exchanger for ISRU plants will be for future missions to Mars and the Moon. Martian sample return missions and manned missions to Mars may be prohibitively expensive, technically exigent, and unacceptably risky unless resources can be produced on Mars.

Many commercial processes involve the heating of particulate matter to high temperatures to affect a certain reaction, e.g., Portland cement kilns, drying processes in the agricultural and paper sectors, etc. As energy costs increase and with the focus on limiting greenhouse gas emissions, more emphasis will be placed on improving the overall energy efficiency of such processes.

NON-PROPRIETARY DATA

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