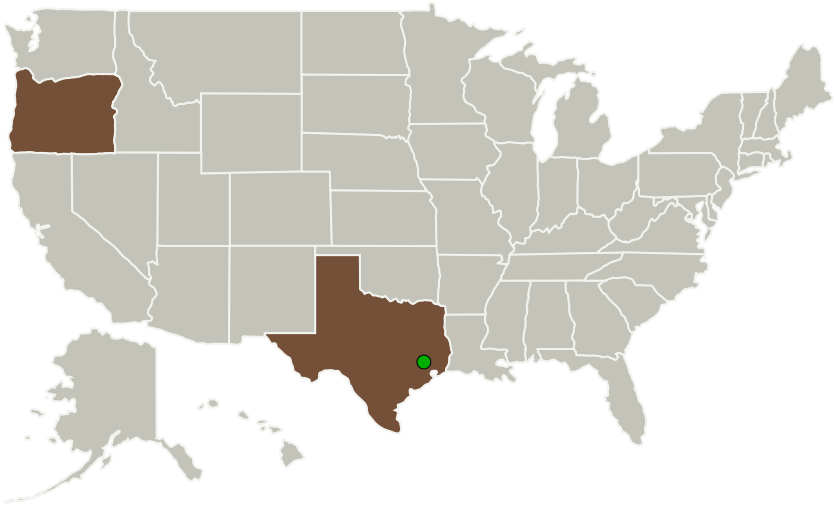
Scaleable, High Efficiency Microchannel Sabatier Reactor, Phase I

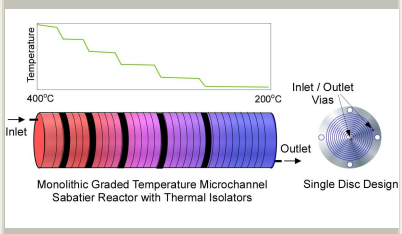
Completed Technology Project (2014 - 2014)

Project Introduction

A Microchannel Sabatier Reactor System (MSRS) consisting of cross connected arrays of isothermal or graded temperature reactors is proposed. The reactor array enables nearly complete single pass carbon dioxide reduction using the Sabatier reaction, allowing efficient recovery of oxygen from in situ carbon dioxide resources on Mars or other Near Earth Objects. Arrays of microchannel reactors with decreasing temperatures and increasing residence times can be optimized to maximize reaction kinetics and overcome thermodynamic limits (85% conversion at 400 C)of the Sabatier reaction resulting in 99% conversion of carbon dioxide and hydrogen to water and methane. Alternatively, monolithic graded temperature reactors can be developed that will optimize reaction kinetics with respect to the thermodynamic limitations of the Sabatier reaction in a compact and efficient design. The Phase I efforts will focus on design and construction of the microchannel reactors. The Phase II effort will build upon the feasibility demonstration resulting in the development of a prototype MSRS consisting of a microchannel reactor array and a graded temperature microreactor capable of 99% single-pass, carbon dioxide conversion to methane and water capable of processing 1 kg hr-1.

Primary U.S. Work Locations and Key Partners





Scaleable, High Efficiency Microchannel Sabatier Reactor Project Image

Table of Contents

Project Introduction 1
Primary U.S. Work Locations and Key Partners 1
Project Transitions 2
Images 2
Organizational Responsibility 2
Project Management 2
Technology Maturity (TRL) 2
Technology Areas 3
Target Destinations 3

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Completed Technology Project (2014 - 2014)

Organizations Performing Work	Role	Type	Location
UMPQUA Research Company	Lead Organization	Industry	Myrtle Creek, Oregon
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
Oregon	Texas

Project Transitions

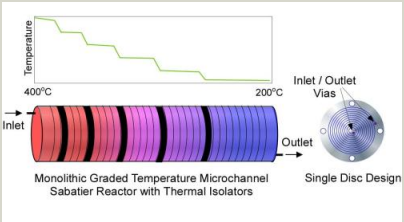
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137682)*

Images



Project Image
Scaleable, High Efficiency Microchannel Sabatier Reactor Project Image
(https://techport.nasa.gov/image/135538)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

UMPQUA Research Company

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

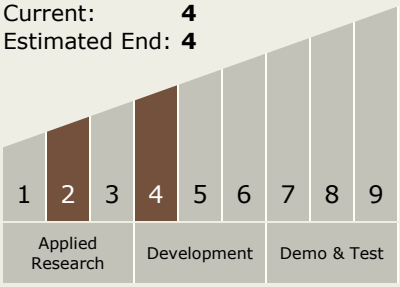
Carlos Torrez

Principal Investigator:

John O Thompson

Technology Maturity (TRL)

Start: **2**
Current: **4**
Estimated End: **4**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
  └ TX07.1 In-Situ Resource Utilization
    └ TX07.1.3 Resource Processing for Production of Mission Consumables

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System