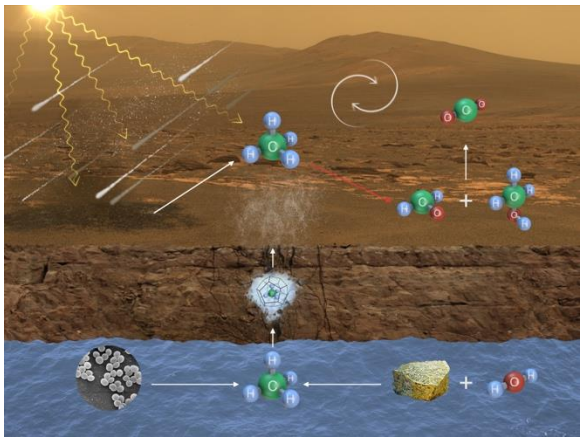
Help NASA with Methane Production on Mars



Name of Technology:
Methane Production on Mars

Participating NASA Centers:
JSC (Lead); ARC, GRC, JPL, KSC, MSFC

Technological Area:
TA7 Human Exploration Destination Systems

Vision for the Technology:
For human exploration of Mars surface to be successful it will require collecting and converting local resources into critical consumable products. Research has shown that Carbon Dioxide (CO2) is readily available and would be a critical resource to produce Methane (CH4) for propellants, life support, and more.

Fuel for ascent vehicle propulsion must be delivered from Earth; this decreases payload mass delivery and eliminates reusable surface hopping and surface-to-orbit transportation options.

Innovative technologies are sought to collect, separate, pressurize, and process gases from the Mars atmosphere. NASA seeks to enable large-scale production of methane propellant.

Challenges:
To date, the technologies explored either are inefficient or too complex. NASA has interest in regenerable gas drying technologies since Oxygen and Methane produced from Mars CO2 must be dried before it is liquefied and stored. Technologies need to be such that there is no service required for these units. In addition, recuperation of the removed water for subsequent use is highly desired.

Carbon dioxide processing may occur between 55 and 517 KPa (8 and 75 psi) and nominally at 103 KPa (15 psi) depending on the processing technology selected. Atmospheric pressures are between 700 to 1000 Pa (0.1 to 0.14 psi) and surface temperatures may be at a high of 20°C (293K) at equator noon or -153°C (120K).

NASA Seeks to Meet the Following Specs:
- Environmental compatibility and processing at almost any location on Mars, throughout the year and day/night cycle
- CO2-to-Methane processing
- Operation >435 days continuously
- Time average production of CH4 at 0.68 kg/hr
- Methane purity and dryness to propellant grade specifications

Overview of Student Project:
NASA seeks innovative Methane (CH4) production technologies processed from Carbon Dioxide (CO2) within the Mars atmosphere. These resources will be utilized for propellants and life support systems.

Innovative Areas Student Projects Can Address:
- Efficient (minimal energy/thermal/ chemicals required)
- Scalable (enabling large-scale production)
- Low weight

- Low mass (can have multiple unit systems)
- Continuous operation

Research Funded by NASA on this Topic:

Proposal Number: 12-1 H1.01-9162
EMG System for Production of Methane From Carbon Dioxide

Proposal Number: 16-2 H1.01-8191
In-Situ Ethylene and Methane Production from CO2 as Plastic Precursors

Proposal Number: H2.01-9707
Direct Electrochemical Methanol Production for Mars

References:

(H1.01) Mars Atmosphere ISRU for Mission Consumables

(T2.05) “Advanced Concepts for Lunar and Martian Propellant Production, Storage, Transfer, and Usage”

(T14.01) “Advanced Concepts for Lunar and Martian Propellant Production, Storage, Transfer, and Usage”

Mars Water In-Situ Resource Utilization (ISRU) Planning (M-WIP) Study

Sabatier System Design Study for a Mars ISRU Propellant
Production Plant