PREPARING MARS-C FOR FLIGHT:

Electrochemical ISRU Testing for Partial Gravity

OBJECTIVE

Operate the MARS-C electrochemical cell in a simulated Martian environment.

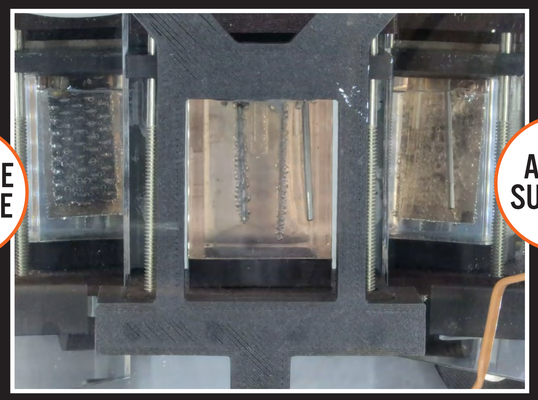
- Study bubble dynamics during electrolysis in partial gravity and reduced temperatures
- Quantify ethanol production rates
- Advance the technology to TRL 5

MOTIVATION

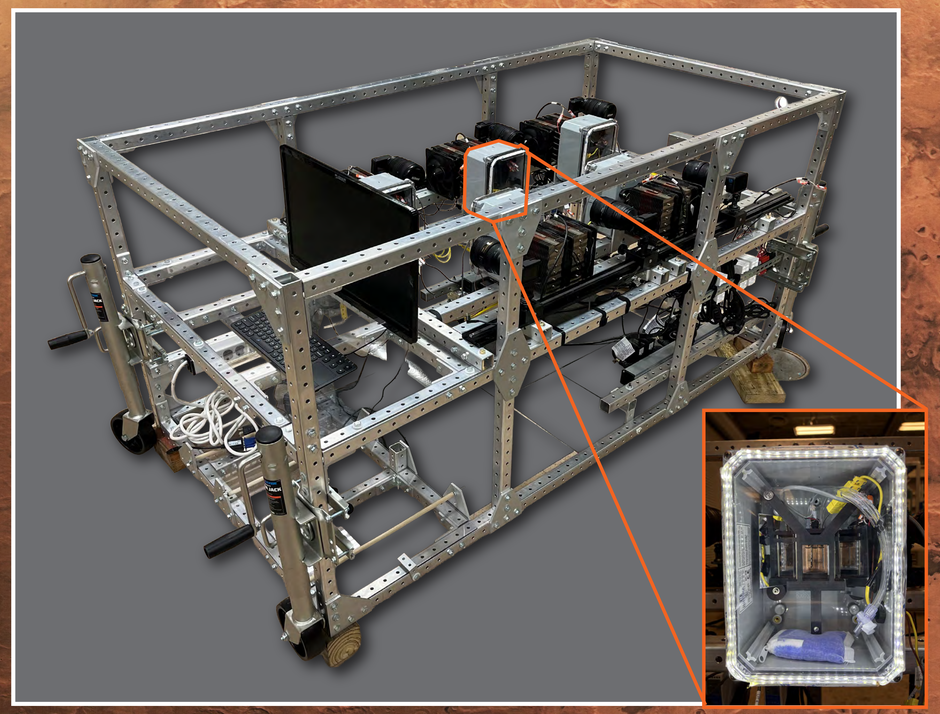
Martian brines and atmospheric carbon dioxide can be used in an electrochemical process to produce ethanol, oxygen, and other valuable chemical precursors.

TECHNOLOGY

Mars Atmospheric Reactor for Synthesis of Consumables (MARS-C) is a patented CO_2-brine electrolysis process designed to operate at ambient Martian conditions.



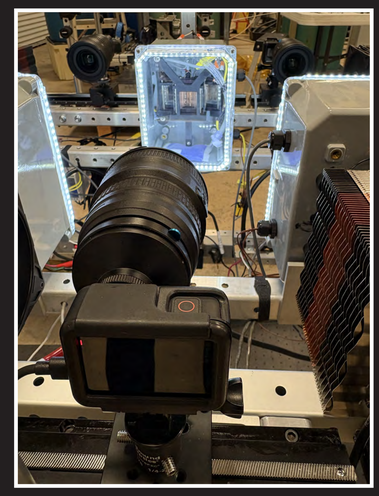
This photograph shows the cell operating at -20°C. The bubbles on the cathode and anode surfaces are the products of the electrochemical process.



PARABOLIC FLIGHT RIG CONTAINING SIX ELECTROCHEMICAL CELLS

GROUND TESTING

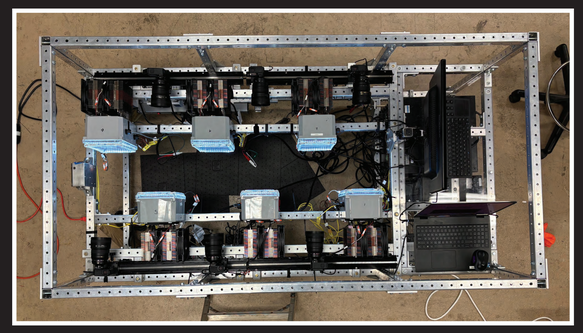
Ground testing of the payload containing all six electrochemical cells has been completed. The cells successfully operated at a temperature of -20°C and produced ethanol during the anticipated duration of reduced gravity during flight.



GoPro cameras operating at high frame rates will visually capture the bubble dynamics.

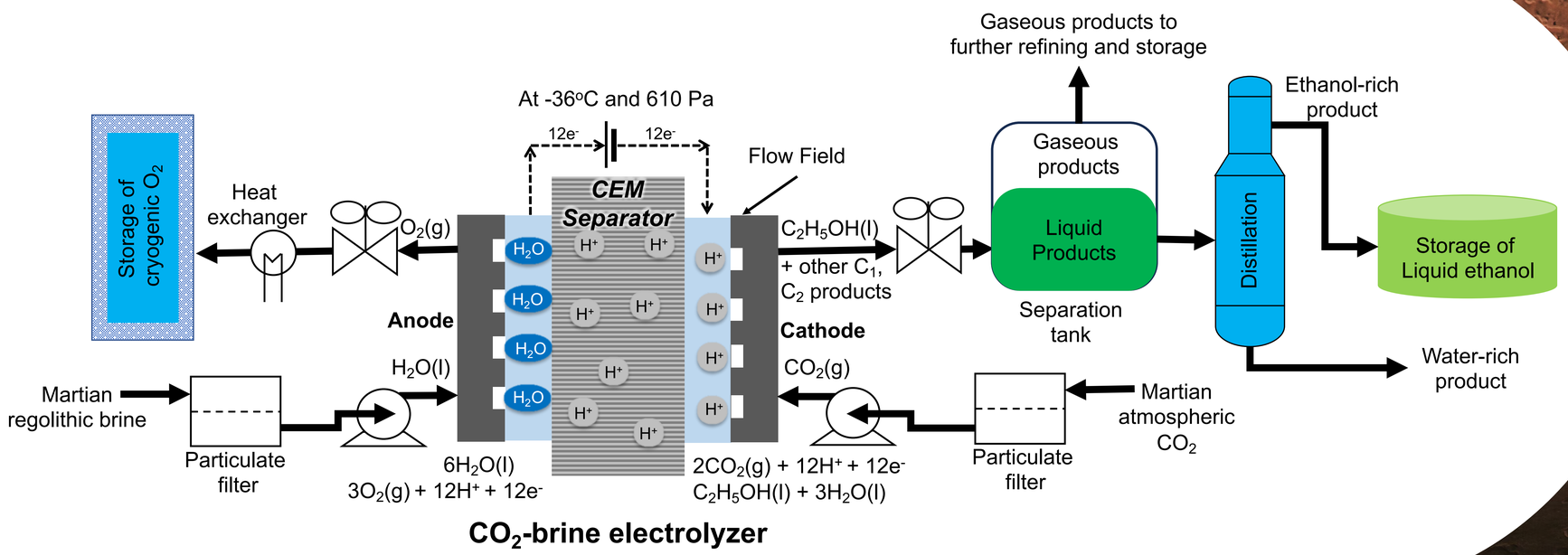
PARABOLIC FLIGHT TESTING

UTSA and SwRI will be flying the electrochemical cells aboard a parabolic aircraft simulating partial gravity. The experiment will monitor bubble dynamics and cell currents to determine gravitational effects on the process.



Overhead view of the payload's six-cell layout. These cells will operate under simulated Martian, lunar, and microgravity environments to quantify the effects of buoyancy on chemical production.

MARS-C ELECTROLYSIS SCHEMATIC



CO_2-brine electrolyzer

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