THE MICHIGAN MARS ENVIRONMENTAL CHAMBER: DETERMINING THE CONDITIONS AT WHICH LIQUID BRINES FORM ON MARS. H. M. Elliott, G. M. Martinez, D. G. Halleaux, S. F. Braswell, and N. O. Renno. Department of Atmospheric, Oceanic and Space Sciences, University of Michigan, 2455 Hayward St., Ann Arbor, MI 48109-2143 (helliott@umich.edu)

Introduction: The Michigan Mars Environmental Chamber (MMEC) will be used to test the hypothesis that salts present in the Martian soil at concentrations of about 1 wt% can deliquesce and form microscopic brine pockets that can be concentrated into larger pockets or layers by freeze-thaw cycles. This is relevant to exobiology because these brine pockets have the potential to be habitable. The MMEC principally consists of a thermal vacuum system with a chilled mirror hygrometer and a microwave soil moisture sensor.

Motivation: The idea that liquid brines are ubiquitous in the Martian polar region [1,2,3] is exciting because many microorganisms thrive in terrestrial brines, and in particular brines from subglacial environments. The discovery of sulfur and iron cycling microbial communities in the subglacial brine that episodically drains from Taylor Glacier in Antarctica's Dry Valleys [4] is particularly relevant to the understanding of the habitability of Mars. Boetius and Joye [5] present an overview of hypersaline habitats and the microorganisms that inhabit them.

Laboratory Apparatus: The MMEC has been designed to simulate the environmental conditions at the Mars Phoenix landing site during diurnal and seasonal temperature cycles. The system consists of a vacuum chamber with six internal thermal plates. The plates are arranged to form a cubic thermal cavity that can be cryogenically cooled by liquid nitrogen. Additional thermal control is attained through the use of resistive patch heaters, which are fixed on the thermal plates. The vacuum chamber inlet is connected to a carbon dioxide dry gas stream, which can be throttled to control the chamber's humidity. The vacuum chamber outlet passes through a chilled mirror hygrometer to measure the chamber humidity before the air exits the vacuum pump.

The MMEC, seen in Fig. 4, will enable research on the influence of water on physical, chemical and biological processes, which are relevant for planetary research. Further, it can aid in the development, testing and calibration of sensors for applications under extreme conditions on the Earth and Mars.

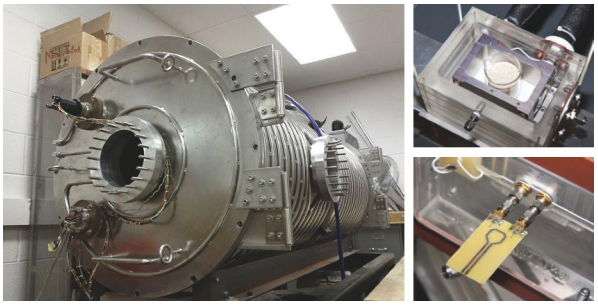

Fig 4. (Left) The MMEC Vacuum Chamber. (Right, top) A small sample chamber with 250 mL soil sample. (Right, bottom) The microwave soil moisture sensor.

Specifications: The MMEC was designed to meet the following specifications:

- Sample Volume: 30 cm x 30 cm x 30 cm
- Atmospheric Pressure: 10 Pa to 10^5 Pa
- Water Vapor Pressure: 0.05 Pa to 45 Pa
- Temperature: -170^o C to +230^o C
- Temperature Cycle Time: Hours to Days
- Solar Simulation: UV to near-IR

References: [1] Renno, N. O. et al (2009) *JGR,* 114, E00E03. [2] Zorzano, M.-P. et al (2009) *GRL,* 36, L20201. [3] Möhlmann, D. and Kereszturi, A. (2010). *Icarus,* 207, 654-658. [4] Mikucki, J. A., et al (2009) *Science,* 324, 397. [5] Boetius, A. and Joye, S. (2009) *Science,* 324, 1523-1525.