AFFORDABLE TEST ENVIRONMENTS FOR SIMULATED LUNAR DAY/NIGHT CYCLING. J. Tucker[1] W. Parks[1], G. Daspit[1] and M. C. L. Patterson[1], [1](Kratos SRE, 757, Tom Martin Drive, Birmingham, AL, 35211)

Introduction: A new testbed for thermal-vacuum testing[1] for atmospheric and planetary environmental simulation has been setup to support "dirty" vacuum test requirements. Many vacuum chambers are setup for cryogenic testing and are kept at extreme cleanliness condition for satellite testing. This new testbed seeks to fill a void by being specifically designed to allow "dirty" and extreme environments temperature (15K under special small volume conditions, through 2000K) testing in vacuum and at partial pressures. The chamber has a 30" internal diameter and can hold parts up to 36" long, or more. It has a LN_2 shroud and large roughing and cryo-pump for rapid article exchange. The chamber is shown in Figure 1. Various internal configurations are illustrated in Figure 2.

Figure 1. 'Dirty' vacuum chamber external view.

Cryogenic characterization to 90K: Test applications include distortion measurement of vehicle structures and simulation of lunar environments including temperature cycles, vacuum, and presence of simulated lunar regolith.

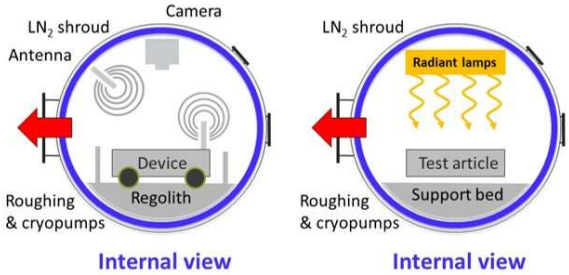

Figure 2. Image showing various internal test configurations for the 'dirty' vacuum chamber.

Cryogenic characterization to 10K: An additional capability has been built utilizing cryocoolers to generate test temperatures down to 10K in approximately 90 minutes. Cryocoolers represent a significantly lower cost approach that liquid helium and have been shown to be useful to provide environments of 10K for aluminum and 15K for polymer test specimens. The cryocoolers can e utilized in a single test from as shown in Figure 3 or associated with a smaller volume of space within the larger chamber.

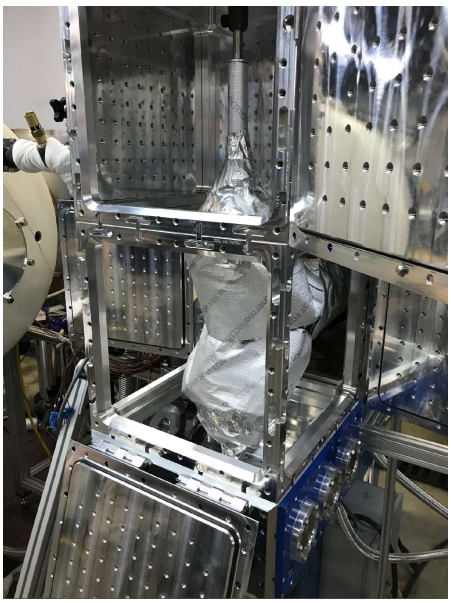

Figure 3. Vacuum test configuration as cooled to 10K by use of a Cryocooler.

Acknowledgments: The development effort under which this equipment was built was supported by a Southern Research Institute internal IR&D program.

References:

[1] J.Tucker and M.C.L.Patterson, "Thermal-Vacuum Chamber for Atmospheric and Planetary Environmental Simulation", Poster Presentation, Green Valley Ranch in Henderson, Nevada June 24-27 2019

[2] J. Tucker, "Application of a Cryocooler for Materials Testing" Symposia, June 27 through Jun 30, **2022, Madison,** WI, .