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Commissioning of the Liquid Nitrogen Thermo-Siphon System for NASA-JSC Chamber-A

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NASA's Space Environment Simulation Laboratory's (SESL) Chamber A, located at the Johnson Space Center in Houston Texas has recently implemented major enhancements of its cryogenic and vacuum systems. The new liquid nitrogen (LN2) thermo-siphon system was successfully commissioned in August of 2012. Chamber A, which has 20 K helium cryo-panels (or "shrouds") which are shielded by 80 K nitrogen shrouds, is capable of simulating a deep space environment necessary to perform ground testing of NASA's James Webb Space Telescope (JWST). Chamber A's previous system used forced flow LN2 cooling with centrifugal pumps, requiring 200,000 liters of LN2 to cool-down and consuming 180,000 liters per day of LN2 in steady operation. The LN2 system did not have the reliability required to meet the long duration test of the JWST, and the cost estimate provided in the initial approach to NASA-JSC by the sub-contractor for refurbishment of the system to meet the reliability goals was prohibitive. At NASA-JSC's request, the JLab Cryogenics Group provided alternative options in 2007, including a thermo-siphon, or natural flow system. This system, eliminated the need for pumps and used one tenth of the original control valves, relief valves, and burst disks. After the thermo-siphon approach was selected, JLab provided technical assistance in the process design, mechanical design, component specification development and commissioning oversight, while the installation and commissioning operations of the system was overseen by the Jacobs Technology/ESC group at JSC. The preliminary commissioning data indicate lower shroud temperatures, 70,000 liters to cool-down and less than 90,000 liters per day consumed in steady operation. All of the performance capabilities have exceeded the design goals. This paper will outline the comparison between the original system and the predicted results of the selected design option, and the commissioning results of thermo-siphon system.