

20 K Helium Refrigeration System for NASA-JSC Chamber-A

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A new 20 K helium refrigerator installed at NASA Johnson Space Center's Space Environment Simulation Laboratory (SESL) was successfully commissioned and tested in 2012. The refrigerator is used to create a deep space environment within SESL's Chamber A to perform ground testing of the James Webb Space Telescope. The chamber previously and currently still has helium cryopumping panels (CPP) and LN2 shrouds used to create Low Earth Orbit environments. Now with the new refrigerator and new helium shrouds (45' x 65') the chamber can create a deep space environment. The process design, system analysis, specification development, and commissioning oversight were performed by the cryogenics department at Jefferson Labs, while the contracts and system installation was performed by the ESC group at JSC. Commissioning data indicate a inverse coefficient of performance better than 70 W/W for a 18 KW load at 20 K (accounting for liquid nitrogen precooling power) that remains essentially constant down to 1/3 of this load. Even at 10 percent of the maximum capacity, the performance is better than 140 W/W at 20K. The refrigerator exceeded all design goals and demonstrated the ability to support a wide load range from 10kW at 15 K to 100 kW at 100K. The refrigerator is capable of operating at any load temperature from 15K to ambient with tight temperature stability. The new shroud (36 tons of aluminum) can be cooled from room temperature to 20 K in 24 hours. This paper will outline the process design and commissioning results.