

Creating the Thermal Environment for Safely Testing the James Webb Space Telescope at the Johnson Space Center's Chamber A

Jonathan L. Homan, John Lauterbach, Sam Garcia
NASA Johnson Space Center, Houston, Texas, 77058, USA

Abstract

Chamber A is the largest thermal vacuum chamber at the Johnson Space Center and is one of the largest space environment chambers in the world. The chamber is 19.8 m (65 ft) in diameter and 36.6 m (120 ft) tall and is equipped with cryogenic liquid nitrogen panels (shrouds) and gaseous helium shrouds to create a simulated space environment. The chamber was originally built to support testing of the Apollo Service and Command Module for lunar missions, but underwent major modifications to be able to test the James Webb Space Telescope in a simulated deep space environment. To date seven tests have been performed in preparation of testing the flight optics for the James Webb Space Telescope (JWST). Each test has had a unique thermal profile and set of thermal requirements for cooling down and warming up, controlling contamination, and releasing condensed air. These range from temperatures from 335K to 15K, with tight uniformity and controllability for maintaining thermal stability and pressure control. One unique requirement for two test was structurally proof loading hardware by creating thermal gradients at specific temperatures. This paper will discuss the thermal requirements and goals of the tests, the original requirements of the chamber thermal systems for planned operation, and how the new requirements were met by the team using the hardware, system flexibility, and engineering creativity. It will also discuss the mistakes and successes to meet the unique goals, especially when meeting the thermal proof load.

Key Phrases / Topics: Thermal testing, deep space simulation, James Webb Space Telescope, cryogenics