National Aeronautics and Space Administration

NASA

Marshall Space Flight Center's X-ray and Cryogenic Facility



Marshall Partnerships Forum
24 October 2023

Jeff Kegley
Chief, Science Test Branch / ST15
jeff.kegley@nasa.gov

MARSHALL
SPACE FLIGHT CENTER



Constructed in 1990 to perform ground test & calibration of Chandra optics and instruments

Adaptable, multi-capable space simulation facility

- Large thermal vacuum chamber
- 500m^2 ISO6 cleanroom

World's largest grazing-incidence optic test facility

- 518m evacuated beamline; 1.46m diameter beam with < 3 mrad divergence

Agency's premier cryogenic direct-incidence optic test facility

- Mirrors up to 4.25m in diameter with RoC < 22.5m to 20 Kelvin

Facility Background

- Highly utilized throughout 30+ year history for technology development, maturation, and pre-flight verification activities for programs including:



Chandra

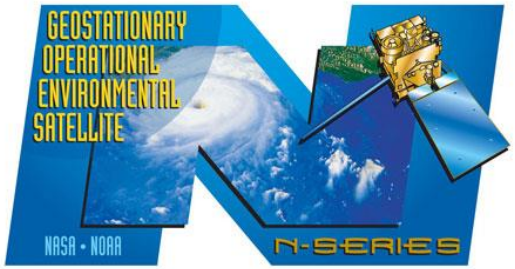


Hinode X-ray Telescope

Webb Space Telescope



Solar X-ray Imagers



Notable Missions

Images: nasa.gov

- Grazing Incidence (X-ray) Optics & Instruments
  - Development, Characterization, and Telescope Calibration
- Normal Incidence Optics in relevant thermal environments
  - Development, technology maturation
- Thermal Vacuum Testing
  - Thermal balance testing
  - Dynamic characterization of an inflatable structure at varying temperatures
  - Structural stability verification at temperatures < 80K
- Cleanrooms
  - Hardware Assembly & Integration
- Beamline
  - Long, evacuated path length: Advanced Video Guidance System, LiDAR

Utilization Summary

Space Simulation Chamber

XRCF Chamber	
Test volume	20 ft ⌀ x 62 ft deep
Vacuum	10^{-7} Torr
Temperature range	-200F to +200F
Thermal control	55 individually controllable heater zones backed by liquid nitrogen shrouds
Cleanliness	IEST-STD-CC1246D Level 300A
Rail system	Seismically insulated
Optical benches	Two 10 ft x 12 ft





Cleanrooms and Lifting Equipment	
ISO6 (Class 1K) 5400 ft^2	20-ton overhead bridge crane
ISO7 (Class 10K) 2000 ft^2	3-ton overhead hoist





Cleanrooms

X-ray Beam Line	
Guide-tube dimensions	5 ft ⌀ (max) x 1700 ft
Pressure at vacuum	< 10^{-6} Torr
Beam size @ chamber entrance	1.46-m ⌀
Beam divergence	< 10 arc min
Knife-edge annular baffles along length	Eliminate undesirable reflections











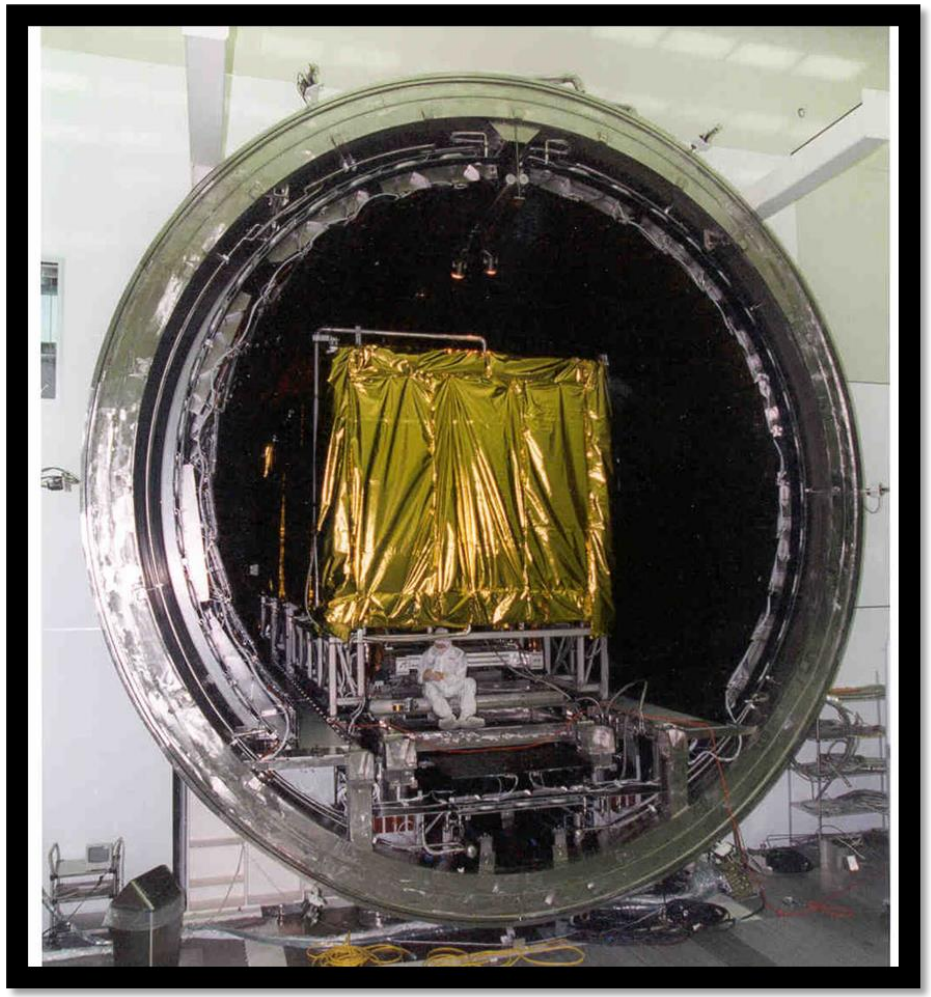




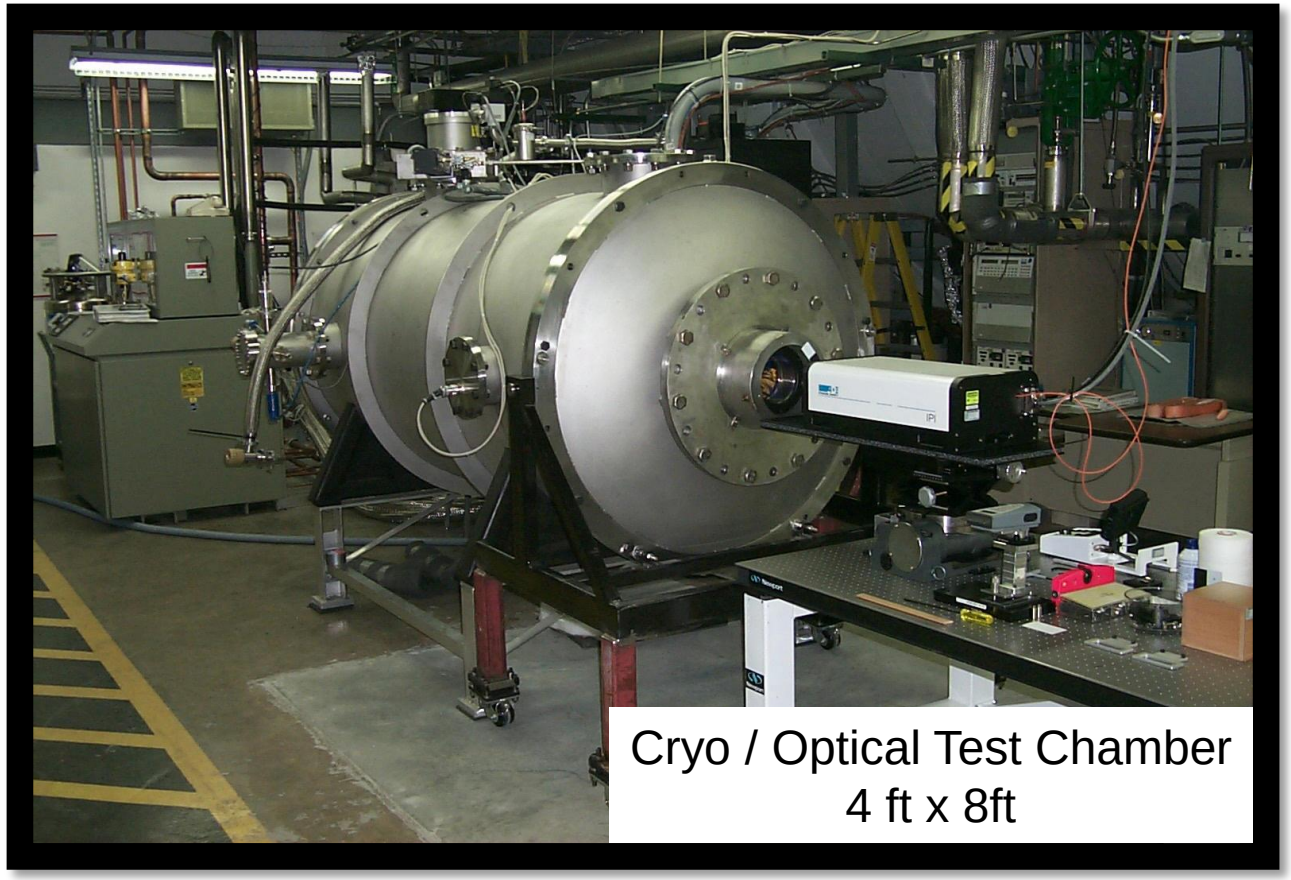
X-ray Beam Line

Sub-LN2 Temperature Capability	
Two Gaseous Helium Refrigerators	Linde 1620 / RSX
Temperature Range	300K – 20K
Capacity	2,000W at 20K
Helium-cooled enclosures	18 ft ⌀ x 31 ft 9 ft x 11ft x 42 ft





Helium Systems



Cryo / Optical Test Chamber
4 ft x 8ft

Additional Capability

jeff.kegley@nasa.gov

