CU-LASP Test Facilities
and Instrument Calibration Capabilities

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Multiple Optical Beam Instrument (MOBI)

- Largest of LASP’s vacuum chambers
- Ideal for performing top-level instrument tests
  - Thermal Vacuum tests
  - In-band light testing (EUV-IR)
- Independently temperature-controlled shroud and platen
- Optional 4-axis precision gimbal
  - pitch, yaw, x, y

- Interior dimensions:
  - 60” diameter x 72” length
- Temperature range:
  - -180°C to +150°C
- Base pressure:
  - $1 \times 10^{-7}$ Torr
East and West Bemco™ Chambers

- Two similar chambers
  - One located inside Class-10,000 cleanroom
- Platen temperature controlled via recirculating chiller
- Optimal for smaller-scale tests
  - Mechanism performance
  - Burn-ins
  - Life tests

Thermal Vacuum Test Facilities

- Interior dimensions:
  - 30“ Diameter x 48” length
- Temperature range:
  - -75°C to +80°C
- Base pressure:
  - 1 x 10^-7 Torr
• Three vacuum chambers
  – Vacuum bake flight & non-flight components
  – Verify cleanliness and characterize outgassing properties
  – RGA, TQCM and CQCM

• Acceptable materials include:
  – Metals, PC boards, harnesses, optics, plastics, polymerics, elastomers

• Air-bake chamber
  – Room temp to +200°C

• Size ranges
  – 13”H x 13”W x 16”D to 22”H x 21”W x 33”D

• Temperature range
  – +30°C to +125°C
Calibration and Test Equipment 2 (CTE 2)

- Used to calibrate detectors and detector subsystems
- Optimized for 120 – 400nm
  - Computer-controlled monochromator for wavelength selection
  - Deuterium lamp is primary light source
  - 2 axis steerable beam
- Incorporates NIST-traceable photodetector for absolute measurements

- Internal dimensions
  - 15”H x 23”W x 48”D
- Temperature range
  - -180°C to +80°C
Calibration and Test Equipment 3 (CTE 3)

- Characterization of detectors and detector modules
- Optimized for 0.1 – 200nm
- Two monochromators
  - Grazing, normal incidence
- Multiple light sources
  - X-ray: Manson, Fe-55
  - EUV: hollow cathode with various process gases
    - H, He, Ar, N, Ne, etc.
    - UV: deuterium
- Internal dimensions
  - 24”H x 20”W x 32”L
- Temperature range
  - -180°C to +80°C
Spectral Radiometer Facility (SRF)

- Absolute spectral irradiance & response calibrations
- Cryogenic radiometer provides NIST-traceable primary radiometric reference standard
- Tunable lasers
  - 210 – 3300nm
  - 40mW-18W output power
- Five-axis vacuum manipulator
  - Pitch, yaw, roll, x, y

- Internal dimensions
  - 23”H x 29”W x 40”L
- Temperature range
  - +5°C to +50°C
Total Solar Irradiance Radiometer Facility (TRF)

- Total Solar Irradiance (TSI) instrument calibrations
  - 0.01% absolute accuracy
- 532nm laser light source
- Cryogenic radiometer provides NIST-traceable primary radiometric reference standard

- Internal dimensions
  - 24”H x 20”W x 32”L
Heliostat Lab

- 3-mirror system directs sunlight into black optics lab
- Equatorial mount in closed-loop control
  - Quad-diode provides real-Sun time tracking
  - <10 arc-second tracking error
- Lab contains class 10,000 clean area with 4’ x 8’ optical bench for sensitive instruments
Environmental Test Chambers

Temperature & Humidity Testing in Atmosphere

- 4 programmable test chambers
- Dry N₂ purge available
- Temperature range
  - -73°C to +200°C
- Interior dimensions
  - Range of sizes from 13” x 16” x 17” to 30” x 32” x 36”
Optical Design & Analysis

- Design and analysis includes:
  - Imagers
  - Spectrographs
  - Hyperspectral imagers
  - X-ray to IR spectrometers
  - Photometers
  - Star tracker
  - Solar position sensors
  - Test & calibration applications
  - End-to-end instrument performance modeling

- Stray light analysis
- Tolerance & STOP analysis
- Industry-standard software
  - Zemax, FRED
3-D Magnetic & Radiation Dose Modeling

- Magnetic designs
  - Electron rejection magnet arrays
  - Rejection efficiency models

- Radiation shielding and dose models
  - Analyze 3-D Solidworks models of instruments
  - High-Z, Low-Z material models
  - Dose, background signal & noise estimates
Instrument Calibration & Characterization

- Optical focus & alignment
  - In-band temperature-dependent characterization & adjustment of imaging performance

- Absolute & Relative Radiometric sensitivity
  - Absolute to 0.01% through NIST-traceable standards

- "Test as you fly"
  - Characterize instrument performance under thermal & vacuum conditions expected on orbit
Custom Detector Design & Fabrication

- **Electronic Substitution Radiometer**
  - Solar Spectral detector
  - >1% absolute accuracy at μW power levels
  - 100ppm absolute accuracy at total Solar signal levels

- **Dust Detector**

- **Photomultiplier Tubes (PMTs)**

- **Develop Custom detectors with vendors**
  - Large-format CCDs
  - Photodiode & diode arrays
  - Hyperspectral CMOS arrays