

# Mechanical Measurements and Calibration

## Manufacturing Technologies

The Measurement and Calibration teams perform precision mechanical calculations using state-of-the-art equipment in a controlled temperature laboratory. Capabilities include in-process and final dimensional measurements, pre-testing and post-testing of data, measurement consultation, solid model inspection, and calibration of length, mass, and force. Complex characterization of known and unknown geometries is performed to accuracies within millionths of an inch and 0.2 arc seconds.

### Capabilities

#### Mechanical Measurements

- In-process and final dimensional measurements from microscopic components to large 72 inch diameter structures
- Pre-testing and post-testing measurement data of containers and test hardware for the Nuclear Regulatory Commission
- Complex characterization of known and unknown geometry to accuracies within millionths of an inch
- Measurement consultation and engineering drawing interpretation assistance of dimensioning and tolerancing in accordance with ASME Y14.5M
- Computer numerical control inspection programs created from PRO-Engineer solid model

- Data collection and sampling for Statistical Process Control

#### Calibration

- Calibration of length, mass, force and dimensional reference standards
- Precision dimensional measurements to microinches, 0.1 micrograms and 0.2 arc seconds in a 68° F. temperature controlled lab
- Linear, profile, roundness, surface texture, force and optical measurements



*Precision alignment of a seven positioning goniometer using a CMM*

## Resources

### Mechanical Measurements

- Coordinate Measuring Machines (CMMs):
  - Zeiss Prismo Vast (fast scanning)
  - Zeiss Contura
  - Large Precision Mauser KMZ 201210 (measuring envelope of 78 x 47 x 39 inches)
  - Universal MC 550
  - Zeiss Precision UMM 500
  - Ultra precision Zeiss UPMC 550 with a resolution of 0.000008 inches
  - Portable CMM with a six-foot diameter measuring envelope
- Formscan 3000 roundness machine with a resolution of 0.00001 inches
- Thirty-inch optical comparator with a rotary table
- Leitz universal measuring microscope
- Taylor Hobson surface/form measurement to nanometric resolution



*Portable CMM used to scan an ellipse on a vessel component*



*Fast scanning, variable accuracy PRISMO VAST CMM used to measure satellite hardware*

- Deep bore diameter electronic gauging (1/2-17.9 in. diameter range and up to 40 ft. depth range)
- Wilson Instron Hardness testers
- Non-contact laser measuring system
- Avant 300 optical video inspection system
- Precision pins in 0.0001 increments (.004-1.0120 inch)
- Ultrasonic thickness testers
- Straightness measuring system
- Laser Tracker

### Calibration

- Zeiss Universal Precision Measuring Center UPMC 550 CMM and UPMC 850 CMM
- Non-contact profile acquisition system
- Moore universal measuring machines
- Surface finish analyzer
- Zeiss Precision microscope
- Sheffield roundness machine



*Bomb Impact Optimization System polycarbonate nose tip inspection*

- Gage measuring centers (SIP 305M and Heliocom)
- Precision mass comparators
- Federal gage block comparators
- Spring and force testers
- Mahr non-contact surface analyzer
- Lion spindle analyzer
- API 5D and 6D laser systems
- Mahr roundness tester
- OGP Avant and Apex 200 optical video measuring systems

## **Accomplishments**

### **Mechanical Measurements**

- Provided 0.001 tolerance profile measurement on complex neutron tube hardware.
- Provided quick (1 hr. notice) measurement services (tolerances to  $\pm 0.0005$ ) on critical complex geometric shaped flight hardware to support over a dozen satellite programs.
- Successful completion of the first Model Based Product Acceptance project.

### **Calibration**

- Provided gage and calibration support for Neutron Generator Program.
- Primary Calibration Laboratory Extension (PCLE) for length, mass, and force.
- PCLE for torque.
- Machine tool alignment and machine tool characterization studies.

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