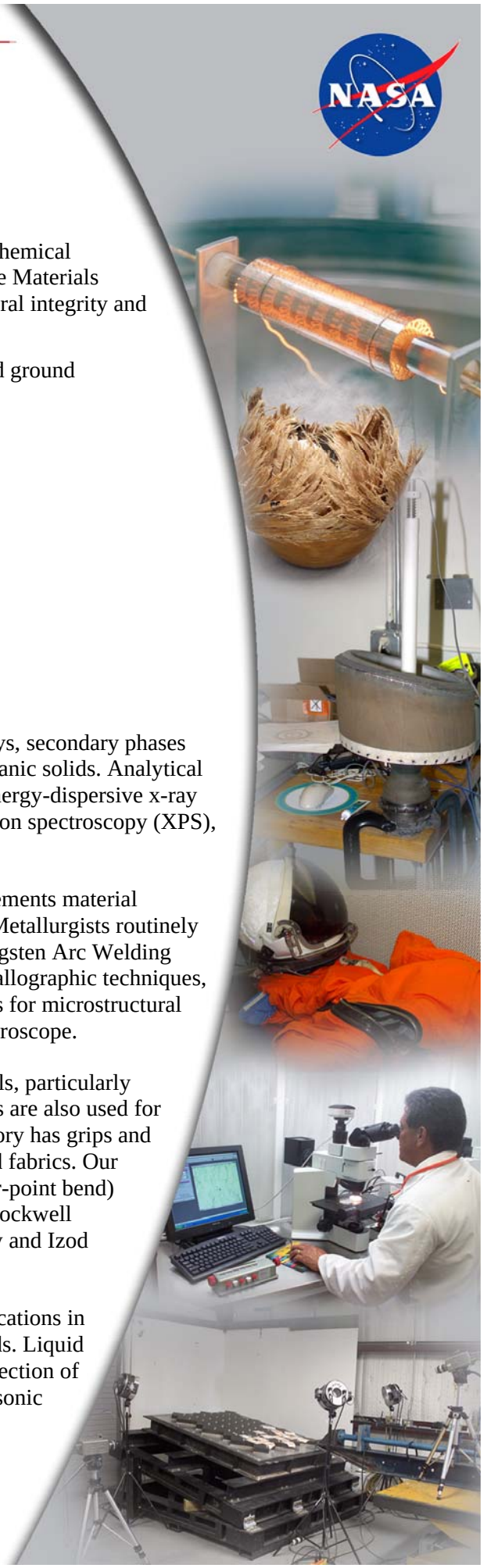

# MATERIALS LABORATORY

## SUMMARY

The Materials Laboratory provides a variety of analytical functions including chemical analysis, microstructural analysis, and mechanical and nondestructive tests. The Materials Technology Group has experience in experimental design to investigate structural integrity and characterize materials for:

- Material acceptance testing for fabrication of NASA flight components and ground support equipment
- Welding process and operator qualification testing
- Material environmental degradation testing
- Pressure vessel and piping inspections
- Alloy heat treatment
- Materials selection
- Failure analysis

## CAPABILITIES

Spectroscopic chemical analysis is used to identify ferrous and nonferrous alloys, secondary phases such as inclusions and precipitate particles, corrosion products, and other inorganic solids. Analytical techniques presently available include optical emission spectroscopy (OES), energy-dispersive x-ray spectroscopy (EDS), x-ray fluorescence spectroscopy (XRF), x-ray photoelectron spectroscopy (XPS), and Auger electron spectroscopy (AES).

Microstructural analysis is used extensively in failure investigations and supplements material performance tests such as corrosion studies and welding qualification testing. Metallurgists routinely section and examine manual Shield Metal Arc Welding (SMAW) and Gas Tungsten Arc Welding (GTAW), automatic GTAW, and electron beam weldments. Conventional metallographic techniques, supplemented by a fully equipped machine shop, are used to prepare specimens for microstructural analysis using a research-grade optical metallograph and scanning electron microscope.

Mechanical tests are often used to assess environmental degradation of materials, particularly caused by exposure to hazardous fluids, including propellants. Mechanical tests are also used for acceptance testing and to qualify welding processes and operators. The laboratory has grips and fixturing to permit testing of metal alloys, polymer composites, elastomers, and fabrics. Our capabilities include uniaxial tension, compression, and flexural (three- and four-point bend) testing using universal test machines with up to 270 kN (60,000 lb) capacity. Rockwell hardness, superficial hardness, microhardness, durometer hardness, and Charpy and Izod impact tests are also available.

Materials Technology Group personnel maintain current ASNT level III certifications in the liquid penetrant, magnetic particle, radiographic, and ultrasonic test methods. Liquid penetrant and magnetic particle methods provide inspection capabilities for detection of surface and near-surface discontinuities in ferrous and nonferrous alloys. Ultrasonic methods for volumetric inspection include contact, pulse-echo, A-scan flaw

detection and thickness measurement, and immersion C-scan flaw detection. Radiographic techniques include conventional film radiography using half-wave, constant potential, and high-frequency x-ray machines up to 450 kV. We use these x-ray machines for examination or inspection of components and weldments fabricated from exotic aerospace alloys, up to 7.6 cm (3 in.) of steel equivalent thickness. An image intensifier permits real-time radiography for in-motion imaging, while flash radiography is used to study high-speed events, such as ballistics studies. X-ray computed tomography permits visualization of internal test article features in a reconstructed cross-sectional image. Many of these nondestructive test methods are portable, permitting testing at remote field locations.

**CONTACT**

Darren M. Cone, NASA White Sands Test Facility, Project Manager
darren.m.cone@nasa.gov, (575) 524-5493