termined in a single layer that has multiple points of interface to maximize critical current. The lead rails that overlap the TES sensor element contact both the superconducting underlayer and the TES normal metal.

This work was done by James Chervenak of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15915-1

Spacecraft Attitude Tracking and Maneuver Using Combined Magnetic Actuators

A paper describes attitude-control algorithms using the combination of magnetic actuators with reaction wheel assemblies (RWAs) or other types of actuators such as thrusters. The combination of magnetic actuators with one or two RWAs aligned with different body axis expands the two-dimensional control torque to three-dimensional. The algorithms can guarantee the spacecraft attitude and rates to track the commanded attitude precisely.

A design example is presented for nadir-pointing, pitch, and yaw maneuvers. The results show that precise attitude tracking can be reached and the attitude-control accuracy is comparable with RWA-based attitude control. When there are only one or two workable RWAs due to RWA failures, the attitude-control system can switch to the control algorithms for the combined magnetic actuators with the RWAs without going to the safe mode, and the control accuracy can be maintained.

The attitude-control algorithms of the combined actuators are derived, which can guarantee the spacecraft attitude and rates to track the commanded values precisely. Results show that precise attitude tracking can be reached, and the attitude-control accuracy is comparable with 3-axis wheel control.

This work was done by Zhiqiang Zhou of Langley Research Center. Further information is contained in a TSP (see page 1). LAR-17862-1

Coherent Detector for Near-Angle Scattering and Polarization Characterization of Telescope Mirror Coatings

A report discusses the difficulty of measuring scattering properties of coated mirrors extremely close to the specular reflection peak. A prototype Optical Heterodyne Near-angle Scatterometer (OHNS) was developed. Light from a long-coherence-length (>150 m) 532-nm laser is split into two arms. Acousto-optic modulators frequency shift the sample and reference beams, establishing a fixed beat frequency between the beams. The sample beam is directed at very high f/# onto a mirror sample, and the point spread function (PSF) formed after the mirror sample is scanned with a pinhole. This light is recombined by a non-polarizing beam splitter and measured through heterodyne detection with a spectrum analyzer. Polarizers control the illuminated and analyzed polarization states, allowing the polarization dependent scatter to be measured.

The bidirectional reflective or scattering distribution function is normally measured through use of a scattering goniometer instrument. The instrumental beam width (collection angle span) over which the scatterometer responds is typically many degrees. The OHNS enables measurement at angles as small as the first Airy disk diameter.

This work was done by Steven A. Macenka of Caltech and Russell A. Chipman, Brian J. Daugherty, and Stephen C. McClain of the University of Arizona for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to the Patent Counsel, NASA Management Office–JPL. Refer to NPO-47310.