these cryogenic fluids in the area of propulsion offers challenges. Due to their extreme low temperatures, these fluids induce contraction of the materials they contact, a potential cause of leakage. Among them, hydrogen is of particular concern.

Small sensors are needed in multiple locations without adding to the structural weight. The most vulnerable parts of the engine are the connection flanges on the transfer lines, which have to support cycles of large thermal amplitude. The thermal protection of the engine provides a closed area, increasing the likelihood of an explosive atmosphere. Thus, even a small leak represents an unacceptable hazardous condition during loading operations, in flight, or after an aborted launch.

Tapered fibers were first fabricated from 1/1.3-mm core/cladding (silica/plastic) optical fibers. Typically a 1-ft (≈30-cm) section of the 1-mm fiber is cut from the bundle and marked with a pen into five 2-¼-in. (≈5.7-cm) sections. A propane torch is applied at every alternate mark to burn the jacket and soften the glass core. While the core is softening, the two ends of the fiber are pulled apart slowly to create fine tapers of ¼- to ½-in. (≈6- to 12-mm) long on the 1-mm optical fiber. Following this, the non-tapered ends of the fibers are polished to a 0.3-micron finish. Then these fibers were coated with indicators sensitive to hydrogen.

The tapered hydrogen detection system with its unique flexibility is the only system that can be placed in many locations inside the vehicles and detect the exact location of leaks, saving millions of dollars for launch vehicle industries.

This work was done by Kisholoy Goswami of Innosense LLC for Kennedy Space Center. Further information is contained in a TSP (see page 1). KSC-13436

Submillimeter Planetary Atmospheric Chemistry Exploration Sounder

NASA's Jet Propulsion Laboratory, Pasadena, California

A report describes the Submillimeter Planetary Atmospheric Chemistry Exploration Sounder (SPACES), a high-sensitivity laboratory breadboard for a spectrometer targeted at orbital planetary atmospheric analysis. The frequency range is 520 to 590 GHz, with a target noise temperature sensitivity of 2,500 K for detecting water, sulfur compounds, carbon compounds, and other atmospheric constituents. SPACES is a prototype for a powerful tool for the exploration of the chemistry and dynamics of any planetary atmosphere. It is fundamentally a single-pixel receiver for spectral signals emitted by the relevant constituents, intended to be fed by a fixed or movable telescope/antenna. Its front-end sensor translates the received signal down to the 100-MHz range where it can be digitized and the data transferred to a spectrum analyzer for processing, spectrum generation, and accumulation.

The individual microwave and submillimeter wave components (mixers, LO high-powered amplifiers, and multipliers) of SPACES were developed in cooperation with other programs, although with this type of instrument in mind. Compared to previous planetary and Earth science instruments, its broad bandwidth (≈13%) and rapid tunability (≈10 ms) are new developments only made possible recently by the advancement in submillimeter circuit design and processing at JPL.

This work was done by Erich T. Schlecht, Mark A. Allen, John J. Gill, Choonsup Lee, Robert H. Lin, Seth Sin, Imran Mehdi, and Peter H. Siegel of Caltech; and Alain Maestrini of the Observatoire de Paris for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-48207