Books & Reports

Research and Development in Optical Communications

A report in the form of lecture slides summarizes the optical-communications program of NASA's Jet Propulsion Laboratory (JPL) and describes the JPL Optical Communications Telescope Laboratory (OCTL) and its role in the program. The purpose of the program is to develop equipment and techniques for laser communication between (1) ground stations and (2) spacecraft (both near Earth and in deep space) and aircraft. The OCTL is an astronomical-style telescope facility that includes a 1-m-diameter, 75.8-m-focal length telescope in an elevation/azimuth mount, plus optical and electronic subsystems for tracking spacecraft and aircraft, receiving laser signals from such moving targets, and transmitting high-power laser signals to such targets. Near-term research at the OCTL is expected to focus on mitigating the effects of atmospheric scintillation on uplinks and on beacon-assisted tracking of ground stations by stations in deep space. Near-term experiments are expected to be performed with retroreflector-equipped aircraft and Earth-orbiting spacecraft techniques to test mathematical models of propagation of laser beams, multiple-beam strategies to mitigate uplink scintillation, and pointing and tracking accuracy of the telescope.

This work was done by Keith Wilson of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*
NPO-30575

Tests of Multibeam Scintillation Mitigation on Laser Uplinks

A report presents additional details about parts of the program of research and development that is the topic of the immediately preceding article. The report emphasizes those aspects of the program that pertain to the use of multiple uplink laser beams in a ground-to-spacecraft optical communication system to reduce (relative to the case of a single uplink laser beam) the depth and frequency of occurrence of fades in the uplink signal received at the spacecraft. The underlying multibeam scintillation-mitigation concept was described in "Multiple-Beam Transmission for Optical Communication" (NPO-20384), *NASA Tech Briefs*, Vol. 22, No. 11 (November 1998), page 56. The report discusses the need for mitigating uplink scintillation; briefly describes the Optical Communications Telescope Laboratory and its role as the ground station in the research; summarizes prior experiments in uplink scintillation and multibeam mitigation of scintillation in ground-to-spacecraft laser communications; and describes key experiments planned to be performed in the next five years. The report then elaborates somewhat on the initial experiments, which are to be dedicated to understanding and perfecting the multibeam scintillation-mitigation strategy.

This work was done by Keith Wilson of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*
NPO-30548

Spaceborne Infrared Atmospheric Sounder

A report describes the development of the spaceborne infrared atmospheric sounder (SIRAS) — a spectral imaging instrument, suitable for observing the atmosphere of the Earth from a spacecraft, that utilizes four spectrometers to cover the wavelength range of 12 to 15.4 μm with a spectral resolution that ranges between 1 part per 900 and 1 part per 1,200 in wavelength. The spectrometers are operated in low orders to minimize filtering requirements. Focal planes receive the dispersed energy and provide a spectrum of the scene. The design of the SIRAS combines advanced, wide-field refractive optics with high-dispersion gratings in a solid-state (no moving parts), diffraction-limited optical system that is the smallest such system that can be constructed for the specified wavelength range and resolution. The primary structure of the SIRAS has dimensions of 10 by 10 by 14 cm and has a mass of only 2.03 kg.

This work was done by Thomas Pagano, Steven Macenka, and Thomas Kampe of Caltech for **NASA's Jet Propulsion Laboratory.** *Further information is contained in a TSP (see page 1).*
NPO-30202