would collect light into a multimode optical fiber, which would guide the light through a fiber-selection switch to a reflection/fluorescence spectrometer. The switch would have four positions, enabling selection of spectrometer input from the targeting lens, from either of one or two multimode optical fibers coming from a reflectance/fluorescence-microspectrometer optical head, or from a dark calibration position (no fiber). The switch would be the only moving part within the instrument.

For reflection spectroscopy, light from an incandescent lamp would be focused onto another multimode optical fiber, would pass through a mode scrambler, and would illuminate the specimen through a microscope head. Light reflected from the specimen would be collected through the same optical fiber and would be directed into the reflection/fluorescence spectrometer via beam splitter 1. To illuminate the specimen for fluorescence spectroscopy, light from an ultraviolet laser would be directed, via beam splitter 2, into the same optical fiber used to illuminate the specimen for reflectance spectroscopy. The fluorescent light from the specimen would be collected and sent to the reflection/fluorescence spectrometer in the same manner as that of the reflected light.

For Raman spectroscopy, light from a laser diode would be focused onto a single-mode optical fiber and would pass through fiber Bragg grating 1, which would lock the wavelength. This light would be guided through two directional couplers to the microscope head. Raman-shifted light captured by the lens would be collected through the same single-mode optical fiber, and would be guided to the Raman spectrometer through one of the directional couplers and fiber Bragg grating 2, which would reject the reflected (unshifted) light. The Raman spectrometer and its associated optical components were described in "Confocal Single-Mode-Fiber-Optic Raman Microspectrometer" (NPO-20932), *NASA Tech Briefs*, Vol. 25, No. 4 (April 2001), page 10a.

The imaging portion of the instrument would include a charge-coupled-device (CCD) color camera, which would be used to provide contextual information for the point-imaging (confocal) subsystems. The lens for this camera and the lens for confocal imaging would be different but integrated into a single unit in the microscope head, as depicted in the detail at the bottom of the figure. The aforementioned multimode optical fiber used for reflection and fluorescence spectroscopy and the aforementioned single-mode optical fiber used for Raman spectroscopy would also be used for confocal imaging at a lower and a higher resolution, respectively.

This work was done by Pantazis Mouroulis of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*
NPO-30650

Position-Finding Instrument Built Around a Magnetometer

A coarse indication of position is derived from a relatively inexpensive instrument.

Goddard Space Flight Center, Greenbelt, Maryland

A coarse-positioning instrument is built around a three-axis magnetometer. The magnetometer is of a type that is made of inexpensive hardware and is suitable for use aboard spacecraft orbiting no more than 1,000 km above the surface of the Earth. A data processor programmed with suitable software and equipped with a central processing unit, random-access memory, programmable read-only memory, and interface circuitry for communication with external equipment are added to the basic magnetometer to convert it into a coarse-positioning instrument. Although the instrument was conceived for use aboard spacecraft, it could be useful for navigation on Earth under some circumstances.

A major feature of the proposed instrument is an ability to generate a coarse estimate of its position in real time (that is, without start-up delay). Algorithms needed to solve the position equations have been developed. These include algorithms to work around gaps in measurement data that arise from a singularity near the minimum in the magnetic field of the Earth.

Some work has been done to develop a prototype of this instrument incorporating a standard three-axis flux-gate magnetometer and a Pentium P-5 (or equivalent) processor with a clock frequency of 120 MHz. Alternatively, the processor could be of the '486 class. A computer model of the instrument has been completed and tested.

This work was done by Eleanor Ketchum of **Goddard Space Flight Center**. *Further information is contained in a TSP (see page 1).*

This invention has been patented by NASA (U.S. Patent No. 6,114,995). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to the Patent Counsel, Goddard Space Flight Center; (301) 286-7351. Refer to GSC-13880.

Improved Measurement of Dispersion in an Optical Fiber

The lower limit of measurability is extended.

NASA's Jet Propulsion Laboratory, Pasadena, California

An improved method of measuring chromatic dispersion in an optical fiber or other device affords a lower (relative to prior such methods) limit of measurable dispersion. This method is a modified version of the amplitude-modulation (AM) method, which is one of the prior methods. In comparison with the other prior methods, the AM method is less complex. However, the AM method is limited to dispersion levels ≥ 160 ps/nm and cannot be used to measure the symbol of the dispersion. In contrast, the present modified version of the AM method can be used to measure the symbol of the symbol of the