**Programmable Pulse-Position-Modulation Encoder**  
*NASA's Jet Propulsion Laboratory, Pasadena, California*

A programmable pulse-position-modulation (PPM) encoder has been designed for use in testing an optical communication system utilizing dense wavelength-division multiplexing (DWDM). This encoder is capable of generating subnanosecond pulses. The stored state machine and code book can be updated by means of a simple text interface through the serial port of a personal computer.

**Wavelength-Agile External-Cavity Diode Laser for DWDM**  
*Lyndon B. Johnson Space Center, Houston, Texas*

A prototype external-cavity diode laser (ECDL) has been developed for communication systems utilizing dense wavelength-division multiplexing (DWDM). This ECDL is an updated version of the ECDL reported in “Wavelength-Agile External-Cavity Diode Laser” (LEW-17090), NASA Tech Briefs, Vol. 25, No. 11 (November 2001), page 14a. To recapitulate: The wavelength-agile ECDL combines the stability of an external-cavity laser with the wavelength agility of a diode laser. Wavelength modulation is modulated by modulating the injection current of the diode-laser gain element. The external cavity is a Littman-Metcalf resonator, in which the zeroth-order output from a diffraction grating is used as the laser output and the first-order diffracted light is retroreflected by a cavity feedback mirror, which establishes one end of the resonator. The other end of the resonator is the output surface of a Fabry-Perot resonator that constitutes the diode-laser gain element. Wavelength is selected by choosing the angle of the diffracted return beam, as determined by position of the feedback mirror. The present wavelength-agile ECDL is distinguished by design details that enable coverage of all 60 channels, separated by 100-GHz frequency intervals, that are specified in DWDM standards.

**Pattern-Recognition Processor Using Holographic Photopolymer**  
*This processor would operate in real time with high resolution.*  
*NASA's Jet Propulsion Laboratory, Pasadena, California*

A proposed joint-transform optical correlator (JTOC) would be capable of operating as a real-time pattern-recognition processor. The key correlation-filter reading/writing medium of this JTOC would be an updateable holographic photopolymer. The high-resolution, high-speed characteristics of this photopolymer would enable pattern-recognition processing to occur at a speed three orders of magnitude greater than that of state-of-the-art digital pattern-recognition processors. There are many potential applications in biometric personal identification (e.g., using images of fingerprints and faces) and nondestructive industrial inspection.

In order to appreciate the advantages of the proposed JTOC, it is necessary to understand the principle of operation of a conventional JTOC. In a conventional JTOC (shown in the upper part of the figure), a collimated laser beam passes through two side-by-side spatial light modulators (SLMs). One SLM displays a real-time input image to be recognized. The other SLM displays a reference image from a digital memory. A Fourier-transform lens is placed at its focal distance from the SLM plane, and a charge-coupled device (CCD) image detector is placed at the back focal plane of the lens for use as a square-law recorder. Processing takes place in two stages. In the first stage, the CCD records the interference pattern between the Fourier transforms of the input and reference images, and the pattern is then digitized and saved in a buffer memory. In the second stage, the reference SLM is turned off and the interference pattern is fed back to the pattern-recognition processor. The correlation image is a cross-plot of the input and reference images. This image con-