

## HOLOGRAPHIC MEMORY SPEEDS ACCESS

Today's specialized computer applications demand extraordinary data storage capacity and quick access. Despite the recent capacity and performance improvements of magnetic and optical disks, these emerging applications still require more—a fundamentally different approach that combines a quantum increase in storage with faster access. Holography provides such an approach.

Aided by a BMDO SBIR contract, Holoplex, Inc. (Pasadena, CA), has developed a holographic memory system that combines quick access with dense storage. The system, dubbed HM-100, can store up to 1,000 gray-level images, each with 1,000 × 1,000 8-bit pixels, for a total of 1 gigabyte of storage. The HM-100 has a very fast internal image processing rate, so that many images can be compared quickly. The entire database of 1,000 images can be scanned in one second.

Applying the data storage technology for security applications, Holoplex recently delivered its first HM-100 to Hamamatsu K.K. in Japan for real-time fingerprint identification. This system functions as a holographic "lock" that can store up to 1,000 fingerprints as holograms. To gain entry to a room, one places a finger on a glass plate. The fingerprint must match one of the holograms in the system's memory. The fast memory of the HM-100 minimizes the delay while the system searches for a match.

In addition to fingerprint identification, the HM-100 offers a compact and low-cost alternative to the large, expensive CD-ROM "jukeboxes" that now store data for hospitals, libraries, and banks. Holoplex's system could save businesses both time and money, replacing their systems with a single 3-D holographic disk. Other uses for this technology include archival storage, government systems, military intelligence networks, and the ever-popular video game. Holoplex aims to capture a significant portion of the holography market, which it estimates at \$20 billion worldwide.

On a futuristic note, Holoplex's holographic memory may someday steer vehicles. One of the company's founders, Demetri Psaltis, used the holographic memory to drive a small car through the corridors of the California Institute of Technology. Psaltis is now designing a different vehicle with enough memory to travel around the campus.

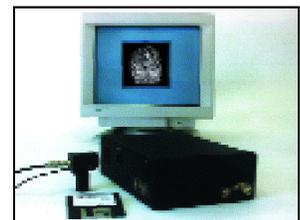
### ABOUT THE TECHNOLOGY

The HM-100 module writes once, but reads many times and holds information in the form of 3-D holograms. Viewing the cube from various angles with the probe laser allows access to the image data stored as 2-D pages. The memory of the HM-100 module includes a temperature-controlled laser diode operating at 680 nanometers, a prerecorded holographic medium (a DuPont photopolymer) mounted on a motor, a two-beam steering mirror, and a tracking mechanism.

The data are converted into a pattern of clear and opaque squares on a liquid crystal display screen, then imprinted on the device. Then, lenses focus a blue-green laser beam shining through this crossword-puzzle-like pattern, or page, to create a signal beam. Next, a second beam, the reference beam, meets the signal beam, creating a hologram of the page of data in a photosensitive medium. Illuminating the hologram with the reference beam used to record it retrieves any stored page. Charge-coupled devices, which produce a current in response to light, read the reconstructed page.

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HOLOPLEX AIMS TO CAPTURE A SIGNIFICANT PORTION OF THE HOLOGRAPHY MARKET, ESTIMATED AT \$20 BILLION WORLDWIDE.



■ Holoplex's HM-100 module, pictured above, is being used by one company as a holographic "lock" to store up to 1,000 fingerprints as holograms.