Instant Replays for Researchers

Television viewers are already used to seeing slow-motion replays of football plays and other sports events. Now, high-speed video equipment has improved to the extent that researchers can routinely study motions too quick for the human eye, such as details of missile flights, automobile crash tests, machinery failures and human and animal movement, with the advantage of instant replay.

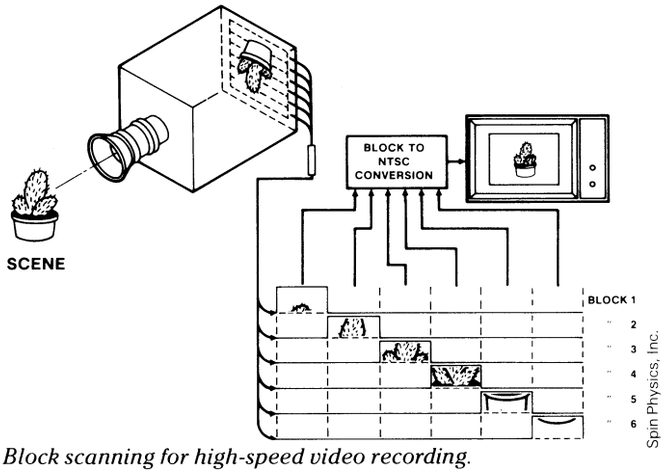
At the 15th International Congress on High-Speed Photography and Photonics held recently in San Diego, Calif., Charles E. Miller of the Massachusetts Institute of Technology said, "I see a definite acceptance of high-speed videography as a viable image-gathering technique as it has not been accepted in the last ten years." Recent widespread use of the term "videography" to describe the technique also indicates growing interest, he said.

What Miller called "strobe TV" is a closed-circuit television system with a camera, monitor and recorder. However, anything moving quickly through a camera field produces a blurred image unless the image is pulsed. "An easy way to get a pulsed image is to use a stroboscope or a shutter in front of the camera," Miller said.

High-speed videography has been around since about 1963, but technical problems have held recording rates at 60 to 240 frames per second, compared to 30 frames per second for conventional video recording. A new system from Spin Physics, Inc., in San Diego raises the rate to 2,000 frames per second and opens up the possibility of many new applications. One expert said the system allows recording of high-speed events that occur unpredictably (but within a minute or less) without the expense and waste of processing film. One example is recording the failure of metal or concrete specimens as loads are increased.

The Spin Physics system is the result of three significant advances: a new solid-state electronic image sensor, improved magnetic tape and a 17-track recording head. The sensor, only three-eighths of an inch across, provides a 192 by 240 array of individual picture elements (pixels). The pixels are arranged in blocks of 32 elements each, so that in six scans across the chip, all the data from one image may be put into storage, and then the chip is ready for the next exposure. Unlike conventional video recording systems, which scan one line at a time, this camera handles 32 lines of video information simultaneously. The diagram indicates how a scene is imaged. The last step is conversion of the signal to a standard video format for display on a normal TV monitor. The system requires special magnetic tape that packs a complete image into one-tenth of an inch of tape, and a multitrack, microgap recording head that skims the half-inch width tape and gives 34 complete tracks, including two tracks for recording and timing additional data.

A system from NAS of Japan that records 200 frames per second in color on a standard video cassette also attracted the attention of congress participants. The Spin Physics camera records in black and white.



Block scanning for high-speed video recording.

This developing technology is putting video systems in direct competition with film cameras. Hallock F. Swift of Physics Applications, Inc., said, "Film cameras have a clear advantage over video cameras in spatial resolution and in dynamic range over which they operate. Video cameras have a distinct advantage over film cameras because the pictures come out in an electronic format. They're available immediately, and they're already ready for post-imaging processing." This extends from enhancing the contrast and overall picture quality electronically to building a composite picture, he said.

George Silberberg of the U.S. Navy Naval Weapons Center has found that for recording high-speed motions of missiles, rockets and aircraft almost 90 percent of the work can be done with video. He also uses video along with high-speed cameras to determine which rolls of film to process, saving time and money.

Miller has taken advantage of videography's capability for mass storage of data to study the characteristics of tennis rackets. "By using high-speed videography, it was possible to shoot balls into the racket while moving the racket in a controlled manner," he said. An enormous amount of data can be collected on a single reusable roll of videotape.

Charles R. Smith of Lehigh University in Bethlehem, Pa., has used high-speed videography to study water flow and vortices. Videography provides instant access to the visual data for immediate playback and analysis, he said, eliminating uncertainties in camera position, focus and lighting because a scene is viewed just as it will be recorded.

Swift said future meetings will see more advances in videography and the determination of which sort of experiments are best with film and which to do with videography. *—I. Peterson*

Hominoid history: Filling the fossil gap

Two paleontologists working in Kenya have announced the discovery of an 8-million-year-old fossil that they hope will provide new information about the vast gap in the human evolutionary record. Richard E. Leakey of the famous fossil-hunting family and Hidema Ishida of Osaka University in Japan said last week that they had unearthed a "humanlike" jawbone with five teeth. Based on a preliminary analysis that must be confirmed, the paleontologists say that the fossil seems to have both human and ape-like characteristics but that it resembles neither modern humans and apes nor the more ancient human ancestors. At 8 million years, the fossil would provide the only evidence about human evolutionary history from 12 million years ago to 4 million years ago — the date at which hominids first started walking. The dating of the fossil is also preliminary, according to Leakey, who is director of the National Museums of Kenya. But if it is indeed 8 million years old, the fossil may provide evidence about the evolutionary divergence of apes and humans; Leakey has described the maxilla fragment as a "critical specimen."

But according to Harvard University anthropologist David Pilbeam, the chances of uncovering evidence of the last common ancestor of hominids and apes are remote. He says that although he would expect to find that hominoid creature living in tropical Africa somewhere between 6 million and 12 million years ago, it was only one of many hominoid species that lived in Africa during that period. □