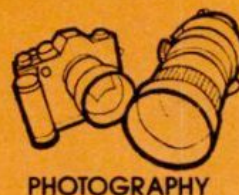
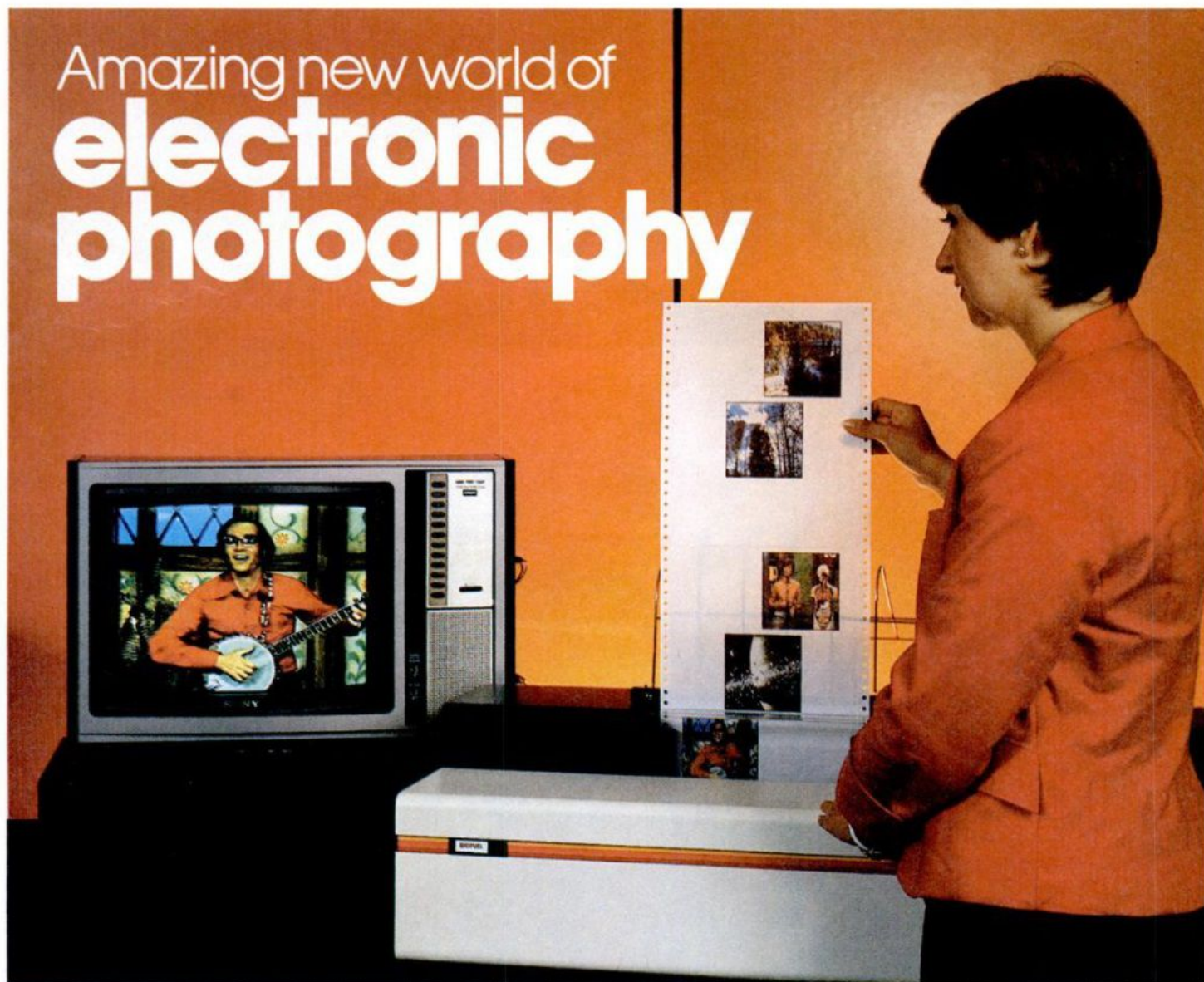


# Beginning here: PS special photography section

Will electronic imaging and magnetic tape replace silver-based film in the camera of the future? For the amazing developments in electronic still photography, read the article starting below. On the pages following, you'll read about other fascinating developments: the new superlenses—some here now and others to come; the handy little clamshell 35's; the new flash units that tie into your camera's electronic systems; and Kodak's new Ektaflex no-mess color-print system.



## Amazing new world of electronic photography



Plain-paper video printouts record standard TV images off the air. Biofuel, Inc., is planning a similar consumer-model printer.

Filmless cameras offer instant video snapshots—with low-cost home prints

By JOHN FREE

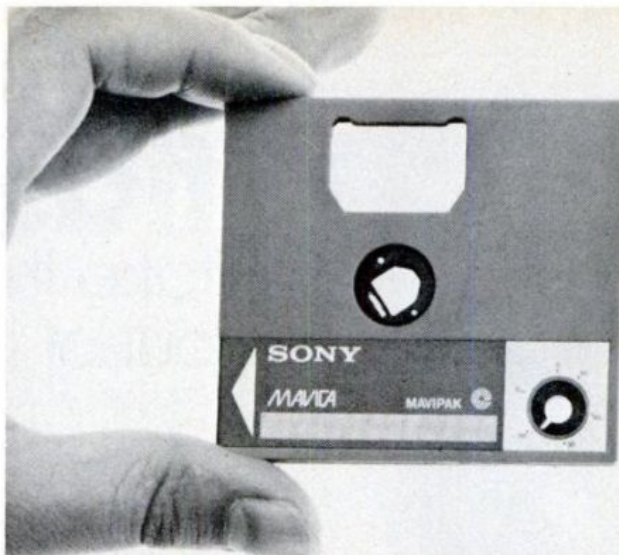
Sony Corporation chairman Akio Morita stepped before a press conference in Tokyo this summer. Something big was brewing. Tables nearby creaked with hardware: large color-TV monitors, a compact electronic "black box," a tiny portable TV—plus what looked like 35-mm SLR cameras.

First came a capsule history of video

and photography. Then the news: "Today we are announcing the world's first magnetic video camera," Morita said. Sony's newest miniaturized marvel is called Mavica. "We don't use film," he explained, holding up a credit-card-size package. "Instead we use this small Mavipak."

*Continued*





**Filmless video camera** from Sony, called Mavica, looks like a standard 35-mm SLR but records images as video signals on tiny Mavipak magnetic discs (above, right). Mavica pictures (50 per disc) are viewed on TV through Mavipak playback adapter or converted to hard-copy video prints. Pictures can be sent by phone.

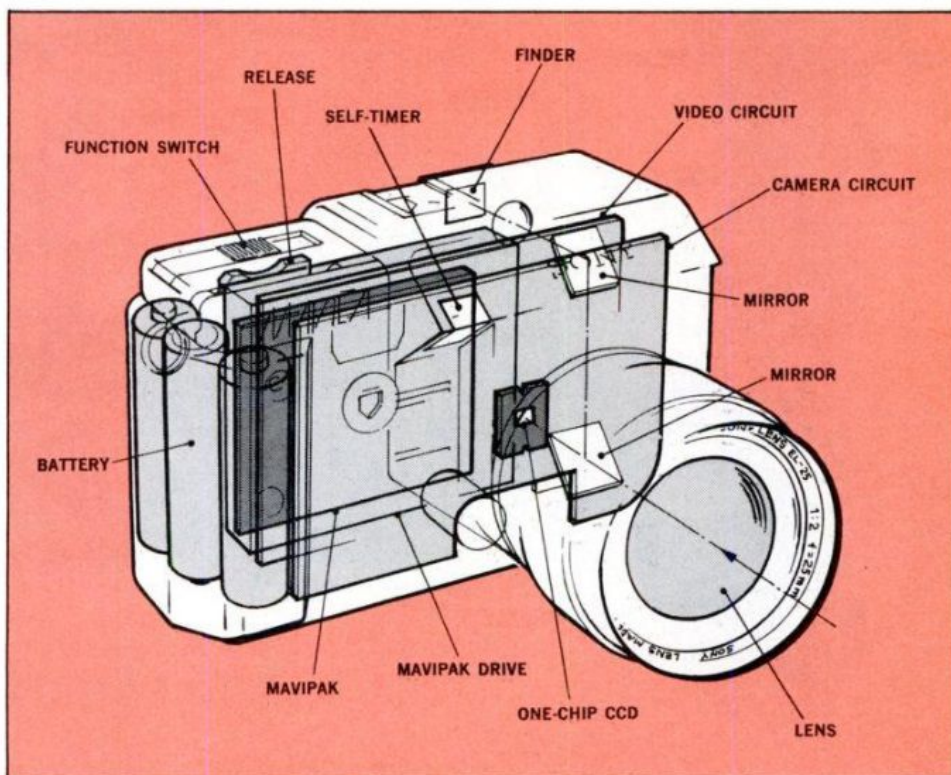
**Charge-coupled device (CCD)** converts image from lens into electronic signal for storage on Mavipak disc. Prototype Mavica has CCD with array of 570 horizontal and 470 vertical picture elements. CCD sensitivity is equal to 200-ASA film. Indoor/outdoor Mavica switch acts as filter to set color temperature.

A Mavipak is a 1¼-inch-diameter magnetic disc that spins inside a Mavica camera (see diagram) to record "snapshots" as color video signals. A light-sensitive silicon chip converts images into signals.

"We'd like to show you some pictures we took outside," Morita said. A Mavipak disc was slipped into the black box, a turntable-size playback machine. Purple, yellow, red, and white flowers flashed by on the monitors. Sony says it is also developing a hard-copy printer for permanent pictures.

Mavica, called a "revolution in photographic history" by Morita, won't be sold for 15 to 24 months. By then, you may see more still-picture electronic cameras. Major camera companies and other electronics firms are developing filmless cameras, too. A related technology, portable VCR's and color-TV cameras [PS, Nov. '80], has already had a major impact on the eight-mm home-movie market.

Sony says it is not attempting to replace conventional film photography. Instead, it hopes to create a new form of home entertainment. The Mavica announcement comes just as other photographic techniques, not involving the electronic conversion of images but avoiding expensive silver



for film, are emerging ["Photography without Silver," PS, Dec. '80].

Steep hardware prices and limited picture sharpness compared with film could limit electronic photography based on standard-TV images. Sony's Mavica may cost about \$660; the playback unit would run about \$220.

Pictures themselves would be cheap. A Mavipak will cost about \$2.65, so snapshots viewed on TV are only pennies each. There's no estimated price yet for the printer. But if Sony adopts a plain-paper model, prints would be a fraction of the cost of standard photo enlargements.

How good are Mavica TV pictures? Sony says production models will have somewhat better pictures than its prototypes. These early Mavicas can capture 350 picture elements—350 lines of horizontal resolution—for each of the 483 scan lines on standard TV.

That's just over 169,000 picture elements (pixels), short of the 210,588 that each 1/30-second picture frame in a broadcast-quality color-TV signal can carry.

Even with picture-enhanced production Mavicas, this first electronic-photography entry can't approach the sharpness of film images. That would require storage of over a million pixels per picture frame. While Sony and other firms are developing high-resolution TV with this capability [PS, Nov.], special color-TV sets and professional tape recorders are needed.

Sony has engineered its Mavica with top-grade color sets in mind: An optical filter for the imaging (CCD) chip, similar to filters in ordinary one-tube TV cameras, breaks the lens image into separate color signals for processing by the camera's video cir-

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## Electronic photography

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cuit and storage on the Mavipak disc.

Mavica has a nonstandard red-green-blue (RGB) signal-encoding system that enhances resolution. The camera records twice as much color information (one MHz) and, overall, 50 percent more picture information than most home VCR's. But few receivers in homes or on the market can display superior-resolution TV.

While Sony didn't demonstrate the feature, it says a Mavica could also double as a motion-picture camera for VCR's.

### Sony's competition

Sony apparently thinks its hard-copy printer will be superior to a model being planned by Biofuel, Inc. (Costa Mesa, Calif.), and Ramtek Corp. (Santa Clara, Calif.). Biofuel's printer would be a spinoff of an industrial model (see color photo).

According to Biofuel, it could make TV-quality pictures up to eight by 10 inches on plain paper. The Biofuel printer would use a 100-print cassette for four-color printing. Biofuel says it uses "unique energy modulation of pins that are raster scanned [like TV images] over paper" to make prints.

Polaroid, in a patent application for an all-electronic camera, is more precise about a printing mechanism to be *built into* its camera. A printing head has three tiny needles that pierce a so-called transfer sheet atop high-quality plain paper. The transfer sheet has a series of cyan, magenta, and yellow pigment stripes. Colored-dot size on the print paper depends on the amplitude of the signals energizing the needles.

Printing paper and a transfer pigment sheet would be inside a slip-in magazine for the camera. Prints would be made on a cylindrical drum and the transfer sheet advanced to unused stripes for each new print.

Polaroid's design also calls for one or more CCD imaging chips, plus separate RGB signal processing. A tiny built-in tape recorder, using tape perhaps only  $\frac{1}{5}$  inch wide, would store separate red, green, and blue picture signals. And most remarkably, Polaroid's camera would have a built-in flat-screen TV [PS, June] for previewing pictures stored in its memory.

Industry observers expect film to remain the dominant photographic medium throughout the 1980's. But as electronic techniques for storing and displaying high-resolution video images are improved, film will see stiff competition. ■ 5