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## ASU Flexible Display Center pushes computer graphics to new levels

Phoenix Business Journal - by [Patrick O'Grady](#)

Imagine a world where combat soldiers look at a paper-thin, bendable electronic device sewn onto their uniforms to get real-time readouts of military positions and battle operations.

How about one where everyday consumers carry around a similar device that can download the latest news and headlines from around the world?

These are among the concepts the Flexible Display Center at Arizona State University hopes to turn into reality in the near future.

Since opening in 2004, the Tempe-based center has taken the lead in developing that technology through a consortium of businesses and government agencies. This week, the center and Hewlett-Packard Development Co. LP announced a breakthrough in the manufacturing process that could bring flexible displays to market soon.

The center, the only one of its kind in the U.S., is about halfway through its 10-year product development plan, according to Greg Raupp, who stepped down this month after serving as the center's director since its inception.

"It's just good, old-fashioned engineering to get it to this point," he said.

It hasn't been easy. Computerized displays typically come in one of two varieties: the cathode-ray tube, a legacy of the first television sets; and the liquid-crystal display. Both come with lots of glass and break long before they will bend.

The center started with a simple, yet daunting goal: to create a display on plastic by layering transistors on it, like what manufacturers do on glass for LCD displays. The problem is that plastic warps under high temperatures, which usually are necessary for displays, Raupp said.

"We had to find completely new processes and protocols to do this in plastic," he said.

The center's engineers initially experimented with stainless steel because it is a pliable material, but rougher than either plastic or glass, so ultimately it would have some flaws.

The joint announcement this week represents the latest step toward mass production: A newly developed machining technique makes it easier to develop plastic for the displays without distorting it, said Carl Taussig, director of informational surfaces for HP Labs.

"Plastic itself is very unstable," he said. "If you heat it or get it wet, it tends to change its shape."

The center partnered with the U.S. Army to develop a display that could handle the rigors of combat. It also enlisted the help of companies that were looking to build flexible displays and were willing to pool their resources to get the job done.

The HP announcement is one example of the collaboration that exists at the center, said Nicholas Colaneri, the center's newly promoted director. He served as associate director for three years.

"For us, it was an opportunity to leverage our infrastructure to get a partner somewhere they wanted to go," he said.



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Nicholas Colaneri, the new director at the Flexible Display Center at Arizona State University, shows the displays the center is helping to develop in collaboration with businesses and the government.

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While it looks like LCD, the flexible technology is very different. The center uses technology developed by partner **E Ink Corp.** of Cambridge, Mass., that enables transistors to charge the ink embedded in the display to form just about any kind of image.

E Ink's technology differs from LCD in that it doesn't need a backlight for the images to be readable. LCD users often struggle to see the display in bright sunlight.

"There are many applications where flexible is the only way to go," said Sriram Peruvemba, vice president of marketing for E Ink, which has licensed its technology for development of products ranging from electronic books to USB devices.

The ASU center and its partners are developing the tools and techniques at a state-of-the-art plant developed by **Motorola Inc.** in the ASU Research Park in Tempe. There, companies work to develop the tools and processes needed to take small-scale pilot productions and apply them to mainstream manufacturing.

"The net effect is that you get things to industry more quickly," Colaneri said.

HP is looking at the displays as an alternative to paper. Taussig said he envisions more mainstream production of the devices in two to three years, thanks to cooperation with the center.

"HP is always looking for ways to print on more sheets of paper, but we also realize that may not be the approach you want to take," he said.

Although the technology was developed initially for the Army, Colaneri said commercial applications are possible on multiple fronts.

"We need to figure out those things, and see that we have the right tools so that we can address them," he said.

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