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Computers That Even Soldiers Can't Break

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BlackBerries, iPhones and laptops, move over. In a few years, soldiers could pull from their pockets paper-thin mini computers that they can unfold or unroll to display maps, streaming video and the latest mission briefings. The display screens someday could be sewn into their uniform sleeves.

That is the Army's goal in funding the Flexible Display Center at Arizona State University. It is investing $50 million to continue research and development efforts there to speed the concept onto the battlefield.

"Our vision is to create a new class of displays that we believe will benefit the individual soldier," says the Army's chief scientist, Thomas Killion.

Today's widespread flatscreen technology is the LCD, or liquid crystal display. But because it is built on a glass plate, which makes devices heavy and power hungry, such displays are not ideal for the Army's portable needs, says the flexible display center's director, Nicholas Colaneri. Soldiers want lightweight, low power and durable displays. But the commercial market has not delivered products that meet the military's demands. Dominated by companies in Asia, the display industry remains focused on the consumer electronics arena and has lacked incentives to enter the defense market.

With its force becoming ever reliant on networked technologies, the Army has decided to take matters into its own hands. By sponsoring the development of the center as a consortium of industry, government, academia and military partners, advancements in materials, manufacturing processes and engineering have taken place to allow flexible display technologies to become reality, says Colaneri.

"This is a chance for American industry to step up," says Killion.

So far, the center's scientists, housed in a manufacturing facility formerly owned by Motorola, have produced 4-inch flexible displays that fit in the palm. They have a resolution of 240 by 320 pixels in black, white and gray scale. Researchers expect to do the same in color very soon, says Colaneri.

Through a process called "bond-debond," thin pliable materials such as specialty polyester or stainless steel are glued to rigid carriers and then are sent through conventional semiconductor processing equipment. Once the microelectronics are put on the flexible substrate, the display is simply peeled off, or debonded.

"We have created the most viable architecture for taking that technology to mass manufacturing in a flexible format," says Colaneri.
The idea down the road is to produce such technologies in long rolls, like wallpaper, which would then be cut into individual units.

"If we can achieve that level of production capability, we'll have been successful," says Killion.
Even before the displays attain mass production capability, industry partners are building prototype devices for soldiers to test out.

General Dynamics is working on a "mission briefer," a PDA-size device that incorporates an "electronic paper" display made by E-Ink Corp. L-3 Communications has incorporated Universal Display Corp.'s organic light emitting diode, or OLED, flexible display technology into a computer designed to be worn on the wrist.

The functionality of the prototypes is expected to be simple, such as providing maps that show the locations of

friendly forces, or photos of wanted persons or a house before a raid, says David Morton, display technology manager at the Army Research Laboratory. "Initially, we want to provide the soldier with additional information in the field to do his job better," he says.

Eventually, members of a squad will carry larger displays that can be laid down together to make a single tabletop screen where they can receive briefings on the move. With touchscreen interfaces, the soldiers may be able to control ground or aerial robots from their individual computers and view and disseminate video and pictures from the battlefield. Flexible displays also will be incorporated onto vehicles, officials say.

In the next three years, the Army will conduct more technology evaluations, says Morton. In 2011, it plans to field-test devices in anticipation of technology insertion at the end of the cooperative agreement with the center in 2013.

Colaneri says the center plans to develop bigger, full-color displays with faster speeds and also will focus on production processes. "Developing the capability to make larger displays really addresses some of central issues associated with transitioning something to mass manufacturing," he says. OLED displays require far more sophisticated microelectronics than other types, so researchers need to make better transistors as well as develop manufacturing and packaging methods so that the displays are not degraded by environmental factors, such as oxygen and moisture.

"In many ways, I think some of our toughest technical challenges lie ahead of us," says Colaneri.

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