

# Building a flexible future

## ASU, Army open new Flexible Display Center

By Skip Derra

**I**n a world where information plays a crucial role, continually updated information can literally save lives.

This is no place truer than on the battlefield, where troop movements, enemy lines and weather conditions are as fluid as the battle itself.

Now, in a major effort to revolutionize on-field command and information exchange, the Army has teamed up with ASU to establish the Flexible Display Center (FDC).

A dedication for the opening of the FDC, located at the ASU Research Park, will be at 10 a.m., Feb. 4. Officials from Arizona, the Army and ASU will be on hand to mark the opening.

"The FDC brings together academia, industry and government to develop what, in essence, will be revolutionary information portals – devices that are small, light-weight, rugged and consume very little power," says ASU President Michael Crow. "But they will be very powerful in that they will hold the key to successful military operations: real-time information."

### Increasing the pace

Crow says the center will accelerate research, development and manufacture of flexible display technologies, which will boost commercialization of flexible displays. As an early adopter, the Army will use the technology developed in the center to accelerate the pace of its transformation, which cannot be achieved with existing glass-based displays. In addition, the Army's investment will lead to low-volume manufacturing that meets its needs while ensuring the technologies become the industry's commercial standard.

"Flexible displays are the next revolution in information technology that will enable lighter-weight, lower-power, more-rugged systems



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The Army anticipates using the new flexible display technology in a variety of ways, including displays built into the next generation of battlefield uniforms.

for portable and vehicle applications," says Brig. Gen. Roger Nadeau, commanding general of the Army's Research, Development and Engineering Command.

Nadeau says flexible display technology will enable new applications for the soldier and Army platforms that cannot be realized with current glass-based displays. These will include body-worn displays that conform to the uniform; displays that can be rolled up and put in a pocket when not in use and unrolled for large-area, high information content; and many other applications that Army engineers and scientists are considering.

The displays essentially are extremely thin computer screens, says Army Research Laboratory Director John Miller. He says they will be "integrated with computation, communications and global positioning subsystems to significantly enhance the soldier's situational awareness, survivability and effectiveness."

### Overlapping technology

The Flexible Display Center is the result of a \$43.7 million, five-year cooperative agreement between the Army Research Laboratory (ARL) and ASU. The February 2004 agreement has a performance period of five years, with an option for an additional \$50 million over an additional five-year period.

Although the Army provides core funding for the center, the center's focus is on commercial applications. The Army is leading the effort because there is strong overlap between military needs and potential civilian markets.

For example, flexible displays also are expected to be used in a variety of consumer products, including small-scale displays in personal communication devices such as cell phones and mobile e-mail, personal health and fitness monitors; medium-scale displays in automobiles and small trucks; and large-scale displays for advertising and business conferencing activities.

"We will be developing the

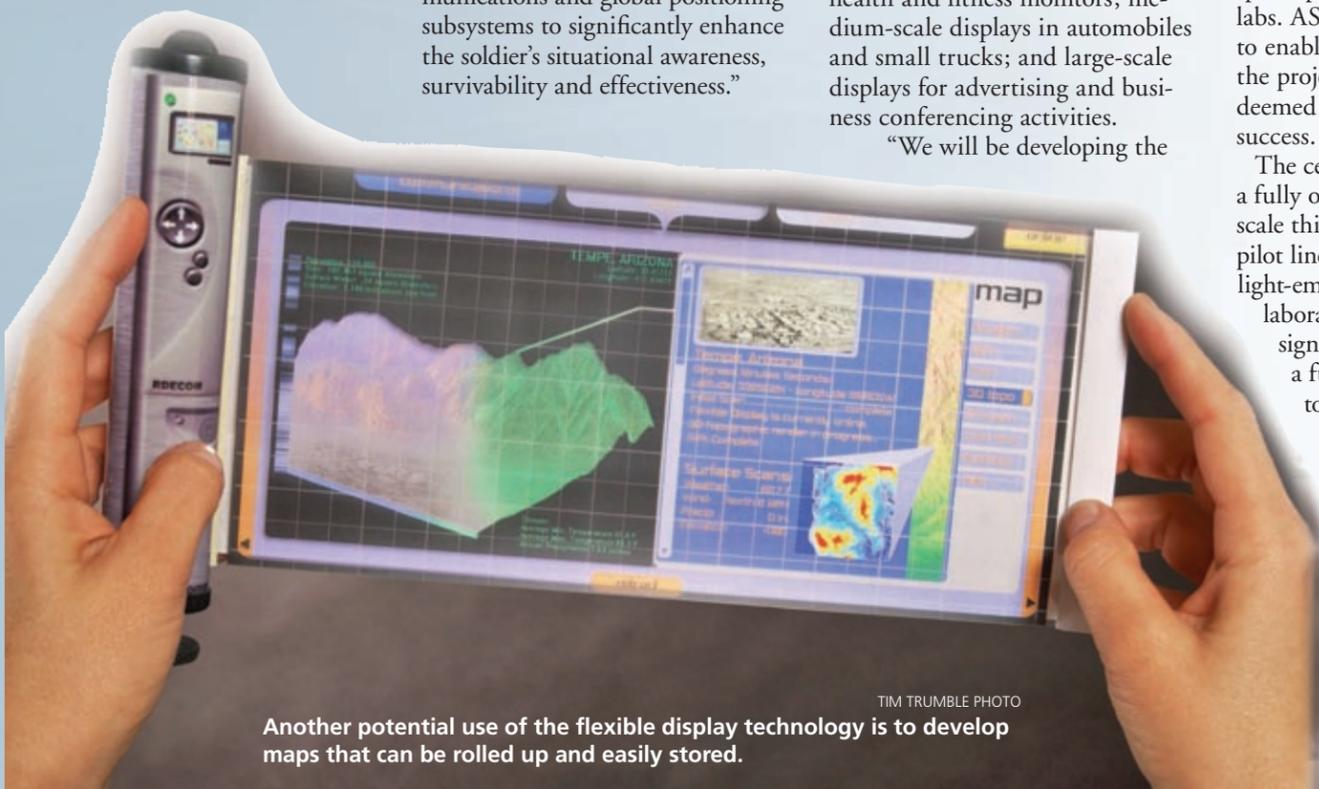
technology for flexible displays, improving it to the point of commercialization, so military developers will be able to buy them off the shelf and integrate them into their systems," says FDC Director Greg Raupp.

### State-of-the-art facility

ASU was awarded the center after an intense national competition that lasted almost a full year. As a result of the contract, ASU bought a state-of-the-art, multi-functional display manufacturing research and development (R&D) facility in the ASU Research Park.

The signature 250,000-square-foot facility originally was designed for flat-panel display R&D to manufacturing. It includes 43,500 square feet of advanced clean room space, plus extensive wet and dry labs. ASU acquired the facility to enable a very rapid startup for the project, a scenario the Army deemed important to the project's success.

The center already has established a fully operational, 6-inch wafer-scale thin film transistor (TFT) pilot line, a leading edge organic light-emitting diode (OLED) R&D laboratory, TFT and display design and testing capability, and a full suite of characterization tools. A GEN II pilot line processing 370 mm x 470 mm (14.5 inch x 18.5 inch) substrates will become operational in 2006. Additional capabilities in design, process tool development and display assembly will be provided by FDC member companies leasing space in the facility.



TIM TRUMBLE PHOTO

Another potential use of the flexible display technology is to develop maps that can be rolled up and easily stored.

**Technological hurdles**

By the middle of this year, Raupp says, the center will have produced its first limited-flexibility 4-inch diagonal concept devices. The overall goal is to continue improvements to display functionality (with increases in size, reliability and flexibility), with final display sizes possibly being as large as 15 inches to 17 inches diagonally.

Initially, the displays will be monochrome but will be developed into full-color displays. In terms of degree of flexibility, the initial rugged displays will evolve into conformal displays, then rollable, and finally into foldable devices. The center also will develop the associated manufacturing processes required to efficiently and cost-effectively produce integrated flexible display demonstrators.

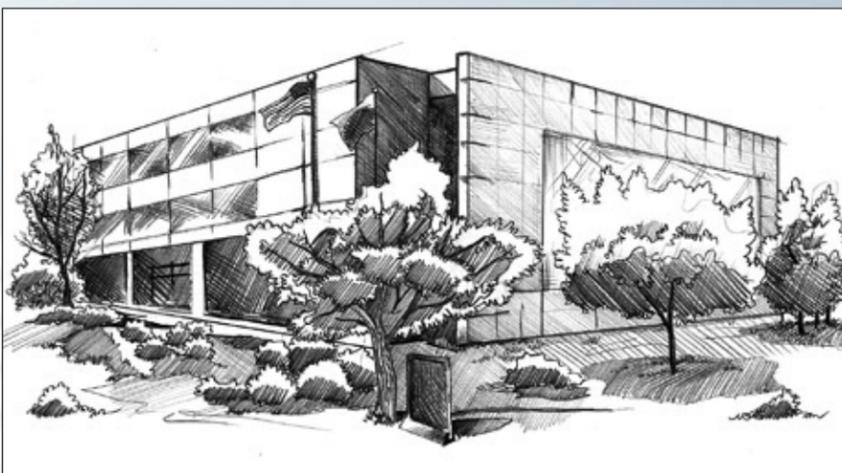
“There are multiple technical challenges to making these devices fully flexible, lightweight and extremely low power,” Raupp says. “But we have the right university, industry and government team in place, and we are confident that we can meet those challenges.”

**Strategic partnerships**

Working within the center will be researchers from a strategically formed team of military, industry and academic partners. Army partners include the ARL and the Natick Soldier Center. Industry partners include EV Group, Honeywell, Universal Display Corporation, Kent Displays, E Ink, Ito America, General Dynamics, Rockwell Collins, Abbie Gregg Inc. and the U.S. Display Consortium. University collaborators include Cornell University, the University of Texas and Waterloo University. Additional partners will be added as the center matures.

“The outstanding capabilities of our facility and its manufacturing R&D infrastructure will enable us to work side by side with our partners to intensively develop new breakthrough technologies,” Raupp says.

As part of the flexible display initiative, a suite of candidate display technologies will be developed and evaluated. Select technologies



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**The new Flexible Display Center is located in the former Motorola facility in the ASU Research Park. The facility was specifically designed for flat-panel manufacturing and gives the center a head start on the development process.**



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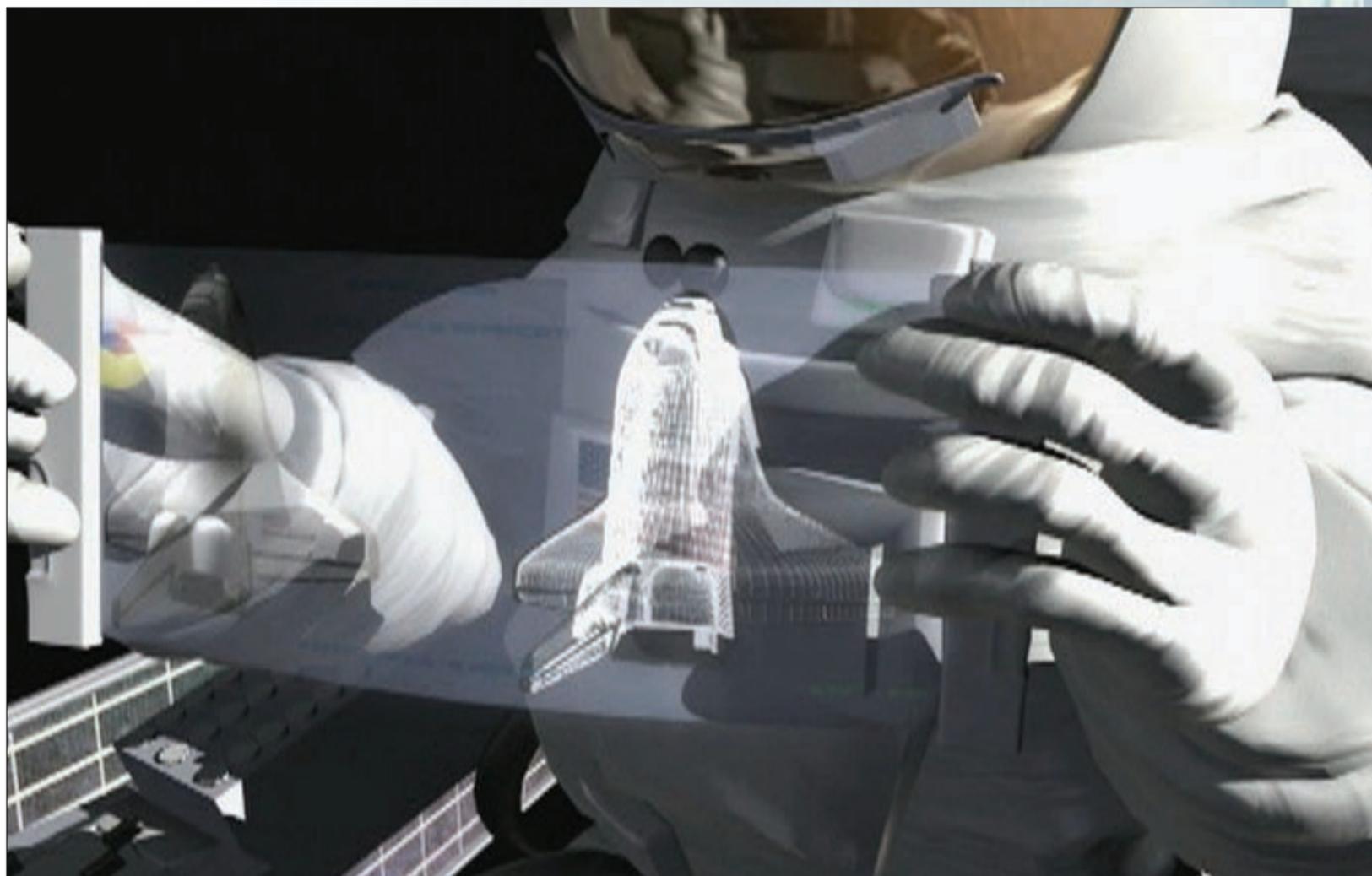
will be integrated into working prototypes and demonstrators for controlled field testing by the Army and partner companies. Learning gained through the prototyping activities will feed back into the research program to drive further advances in display size, capability and performance.

Flexible display technology promises to boost U.S. display companies by helping to create many significant commercial applications.

“The FDC is more than a single-purpose center,” says Jonathan Fink, ASU vice president

for research and economic affairs. “This center will not only aid the Army in a very important quest to significantly update its IT capabilities, but it will spawn a new industry, largely based in Arizona, that will specialize in flexible intelligent displays. These can be used in commercial devices and in a host of new products that will increase productivity and enhance leisure-time activities.”

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Although the core funding for the new Flexible Display Center comes from the Army, the center will focus on commercial applications. Potential uses for the devices include displays for a variety of consumer products,

such as cell phones and mobile e-mail, personal health and fitness monitors and automobiles. Larger-scale applications such as advertising and business conferencing activities are also possible.