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Public Affairs Office
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# News Release

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February 20, 2014

## Projecting the Transparent Future:
### ECBC Partners with MIT and Harvard to Develop Innovative Displays

**ABERDEEN PROVING GROUND, Md**. – An Air Force pilot follows a map projected on his aircraft's cockpit windshield to safely navigate to a location. Warfighters in the field display vital information on an armored vehicle window. Even a company can utilize the window space on skyscrapers or subway trains to advertise a new product. All of these scenarios are on their way to becoming real-life situations due to a research collaboration between the U.S. Army Edgewood Chemical Biological Center (ECBC), the Massachusetts Institute of Technology's Institute for Soldier Nanotechnologies (MIT-ISN), and the Harvard University Department of Physics. The collaboration led to the development of a novel transparent display technology.

Through ECBC's In-House Laboratory Independent Research program, ECBC researchers are able to collaborate with the MIT-ISN on various projects. One of those projects is to explore how particles scatter and absorb light efficiently. Work like this is especially important in the development of Warfighter obscurants, which utilize particles to absorb or scatter light in order to block a warfighters' visibility over several bands of light. As the team researched the use of nanoparticles in obscurants, Marin Soljacic, a physics professor at MIT and leader of the team, had the idea of putting this technology to use in a different setting.

"The work on nanoparticles in the obscurants project is closely related to the development of this transparent display technology," said Brendan DeLacy, an ECBC researcher in the Toxicology and Obscurants Division. "In our obscurants project, MIT provides computational models that predict the optimum size and shape of nanoparticles that are required to absorb and scatter light. ECBC is responsible for creating the particles that are predicted by those models."

Typically, when an image is projected onto a transparent material such as glass, it simply goes through the glass and the image cannot be viewed. By coating the glass with a polymer containing silver nanoparticles with the appropriate size, images can be reflected back and viewed as it if were on a screen. Additionally, the transparency of the glass is still retained. Advantages of this technology also include a wide viewing angle and the ability to scale the materials onto large display areas.
Each of the silver nanoparticles used in this technology is designed to scatter or reflect one color while

rejecting the rest. In the current technology, blue light was successfully displayed, but researchers are working to be able to display red and green colors in the future. In order to create the additional colors, researchers will need to control the size and shapes of the nanoparticles. Each observable color is actually scattered light from a nanoparticle with a specific shape, size, and composition. Currently, a silver particle is used for scattering and imaging blue light. In order to simultaneously scatter red, green, and blue light, DeLacy said, researchers have one of two options: they can use three different nanoparticles for scattering red, green and blue, or they can create a clever particle with the correct properties that can display all three of the colors.

"The best part about this technology is how inexpensive it is. It costs much less than the other transparent display technologies and it can be coated onto virtually any material that is transparent," DeLacy said. "It's such a great opportunity to be able to work with MIT and Harvard to develop this type of technology that could make an impact across so many different disciplines."

While the team is working on the next step in evolving the transparent display technology, their research was recently described in the paper, "Transparent Displays Enabled by Resonant Nanoparticle Scattering," which was published in *Nature Communications*.

MIT-ISN serves as one of the U.S. Army's University Affiliated Research Centers (UARC). This status means that the Army funds these university centers to research and develop new technology for them. The research for this project was funded by the U.S. Army Research Office and by the National Science Foundation.

For more information about ECBC, visit http://www.ecbc.army.mil/.

*ECBC is the Army's principal research and development center for chemical and biological defense technology, engineering and field operations. ECBC has achieved major technological advances for the warfighter and for our national defense, with a long and distinguished history of providing the Armed Forces with quality systems and outstanding customer service. ECBC is a U.S. Army Research, Development and Engineering Command laboratory located at the Edgewood Area of Aberdeen Proving Ground, Maryland. For more information about the Edgewood Chemical Biological Center, please visit our website at http://www.ecbc.army.mil or call (410) 436-1159*

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