


A close-up photograph of a hand holding a magnifying glass. The lens of the magnifying glass is focused on a small, pixelated green globe, which appears to be a digital representation of Earth. The background is a soft, out-of-focus image of a person's face, suggesting a human element in the technology.

Touch and Go

COMET Project Brings
Multitouch Technology to the
Military

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hey started with the makings of a high school science project: plywood, paint, butcher paper, slide projector, handheld camera, and duct tape. They worked nights and weekends, building a prototype that wasn't yet feasible in the commercial world: a large, touch-screen table that military commanders could use to collaboratively plan and analyze their battles.

"This was something where my wife went out and picked the color of the paint because it looked like a Jeep," said Tim Chase, a technical advisor to the project. "But the results were stunning."

It was enough to impress soldiers during experiments at Fort Dix, N.J., and to engage industry giant Microsoft® in a rare joint research agreement. Now, just 2 years later, the same team of engineers and developers are on the cutting edge of multitouch technology for the armed forces.

Known as Command and Control Multitouch Enabled Technology (COMET), the effort aims to make face-to-face collaboration more productive and interactive. Unlike the paper maps, acetate layers, and sand tables currently used for wargaming and other group activities, COMET can record and save information for future analysis and after-action reviews. It can also synch data feeds and changes in real time with other military systems, enhancing existing capabilities rather than replacing them.

The Electronic Sand Table

COMET provides all the advantages of a digital environment but does not sacrifice the intuitive properties of hands-on tools. The software takes on "real-world" properties, allowing users to pan across or zoom in on a map by "grabbing" and manipulating the screen—just as they would with any of the touch-enabled smartphones that dominate today's marketplace. Providing a familiar user interface could cut training time significantly for current and future warfighters, said Nicholas Palmer, one of the architects of the COMET project.

"Warfighters are very in touch with technology and expect to have those capability sets available to them, whether they're in garrison or out in the field," Palmer said. "The warfighter will also expect the tools to behave in the way they think the tools should behave."

The result is that COMET offers a powerful collaborative environment that invites users to grab and move things around and discuss data, pictures, and video with each other rather than sitting at a separate machine or looking over the shoulder of another user, Palmer said.

The "electronic sand table," however, is just one piece of the COMET vision. Ultimately, COMET is seeking to create a government-owned, open-source software developers kit that will provide a framework for applications to run on multitouch platforms of all sizes—from a tabletop to handheld devices.

"I see enormous potential for the military to leverage touch-, gesture-, and speech-based technologies," said Michael Anthony, chief of the Mission Command Division for the U.S. Army Research, Development and Engineering Command Communications-Electronics Research, Development and Engineering Center (CERDEC) Command & Control Directorate (C2D), which oversees the COMET project. "Our research



Capt. Ramon W. Almodovar, commander Alpha Co. EXFOR, First Battalion, 29 Infantry Regiment, Fort Benning, Ga., uses a COMET prototype to plan a mission during the C4ISR On-The-Move Event in 2008.

U.S. Army photo

has turned towards maturing, militarizing, and adding military applications to facilitate the use of this technology as a force multiplier."

COMET's success has sparked partnerships with Army organizations such as the Intelligence Center of Excellence; the Tank Automotive Research, Development and Engineering Center; the Armament Research, Development and Engineering Center; and the Training and Doctrine Command. The COMET team has also conducted experiments to bring existing applications like Tactical Ground Reporting (TIGR) and Command Post of the Future (CPOF) capabilities into a multitouch environment. TIGR is a collaborative software tool that uses a "Google Earth"-like interface, pictures, and text to provide a searchable database of unit activities. CPOF is the primary common operational picture viewer used by the Army in all theaters, providing a wide array of real-time situational awareness and collaboration tools.

Multitouch technology could also help overcome barriers to joint collaboration. For example, the COMET group created framework extensions for a network operations (NetOps) "team workbench" that would allow personnel from different branches to dynamically manage and allocate bandwidth and network resources despite having trained on different systems, Chase said. In collaboration with the CERDEC Space and Terrestrial Communications Directorate, C2D recently demonstrated the concept to representatives from the Joint Readiness Training Center, whose enthusiasm for the technology has sparked further development in the coming year.

"Now we're looking at how you can display information such that it makes sense to people who may not be super-expert in the NetOps field, so that they can better understand what's happening with their networks," Chase said. "A table looks like it's a really good way to provide that information."

Anchoring all of the initiatives is the Multitouch Mission Command Working Group, spearheaded by Palmer, and that includes more than two dozen organizations from government, industry, and academia. One recent meeting at Aberdeen Proving Ground, Md., was so crowded that some attendees had to be turned away to prevent a fire hazard.

"If that doesn't tell you how relevant and important this technology is, then I don't know what does," said Ron Szymanski, the C2D chief architect for software and technology. COMET is one of the technologies and capabilities under development as part of the Collaborative Battlespace Reasoning and Awareness Army Technology Objective.

The Future of Face-to-Face

With rapid changes in communications technology and the nature of battle, the Department of Defense is increasingly focused on networking warfighters spread across the globe. Still, some situations demand face-to-face collaboration—and the existing technology was not up to par.

Wargaming was still conducted with paper maps and Post-it® notes. Storyboards were still printed out and e-mailed back and forth.

"No matter how many technological advancements we've already made or will make, nothing can substitute for face-to-face collaboration. It is the most efficient and effective means of information sharing," Szymanski said. "At its core, the use of COMET is a way to enhance face-to-face collaboration mechanisms."

While the C2D engineers believed a multitouch table could improve the collaborative environment, very few were commercially available in 2008. The few that were available fell outside their price range.

They decided to create their own, buying supplies from big box hardware and electronics stores and identifying the right combination of camera, surface material, and infrared light. The team built and fine-tuned the necessary hardware and software components, and 6 months later, brought their creation to the Army Team Command, Control, Communication, Computers, Intelligence, Surveillance, and Reconnaissance On-The-Move Event at Fort Dix (now the C4ISR Network Modernization Event) where it received positive feedback from warfighters.

Soon afterward, C2D demonstrated COMET to Microsoft, which agreed to enter into a cooperative research and development agreement. Although the U.S. government represents Microsoft's single biggest customer, the agreement with CERDEC was just the second joint research project for Microsoft throughout the federal government and DoD. "The agreement allows both organizations to share resources and intellectual property to advance the state-of-the-art in touch- and gesture-based technologies," Anthony said.

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—Michael Anthony, chief of the Mission Command Division for CERDEC C2D

Using the Microsoft Surface—a tabletop platform that detects touch commands—version of the technology, the COMET project continued to grow in its scope and capabilities. Today, it allows for collaborative planning through simultaneous user input and direct manipulation of digital objects, while sharing tactical graphics, unit locations, freehand drawing, and text chat with other systems, including CPOF; TIGR; and Force XXI Battle Command, Brigade-and-Below.

With TIGR, a collaborative software tool used to collect and analyze patrol and other operational data at the company level and below, the C2D team "took it a step further and did some development to really take advantage of the multitouch capabilities," said John Gillette, program manager and Force XXI Battle Command, Brigade-and-Below lead for TIGR.

First, they networked the table with other multitouch devices—including tablet laptops and smartphones—so they could seamlessly transfer data between them by simply setting the device on the table.

"The soldier would put the data in the handheld phone, and then the handheld phone would be laid on the multitouch table, and the information on the handheld phone would then be distributed to the table environment," Gillette said.

Also layered in was a timeline tool at the bottom of the screen, which allows users to touch and scroll back and forth in time to place TIGR data in historical context.

"You can easily have that TiVo replay effect," Palmer said. "That gives you the ability to quickly pan back in time and replay it, and try to understand what the enemy is doing, try to get a better idea of what your next move needs to be."



Data from the Tactical Ground Reporting (TIGR) system is seamlessly transferred between a smartphone and multitouch table using COMET.

U.S. Army Photo

A Multitouch Tool Kit

In the 2 years since C2D built its table from scratch, the commercial sector made significant advancements in multitouch technology, leading the Army to leverage commercial off-the-shelf hardware platforms, Anthony said. That spawned a new focus for COMET: develop a software developers' kit that will enable the military and federal community to easily and inexpensively develop, deploy, and share new capabilities across multitouch platforms.

To develop some of the initial tools for the framework, CERDEC has partnered with three universities, said Michael Sullivan, deputy project leader for COMET. Students at Morgan State University in Baltimore are working on a link analysis tool that will allow soldiers to import data from other Army systems, then explore how the data are connected.

"You can find connections that you didn't know existed before," said Dr. Kofi Nyarko, a professor at Morgan State. "And people can gather around this table, this environment, and actually share thoughts about how different entities are related to one another and make new discoveries."

A wargaming tool, sponsored by the Mission Command Battle Lab (MCBL) at Fort Leavenworth, Kan., and under development at Northwest Missouri State University in Maryville, Mo., will improve the digital planning environment and automate the reporting process.

"In my mind, it's all about getting capabilities to soldiers faster, and in order to do this, we have to work across organizational boundaries," said Calvin Johnson, deputy director of the MCBL. "As part of the COMET effort, MCBL's sponsorship of the wargaming application development is a valuable exercise in building diverse teams that are getting new mission command capabilities to the warfighter. We have to keep this kind of R&D [research and development] work and operational partnering the norm rather than an exception." At Drexel University in Philadelphia, students are creating a

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"mash-up" solution that will facilitate communication between different programs—and allow soldiers to adjust the multitouch applications to meet their needs. For example, a soldier trying to format reams of incoming data—such as coordinates on a map—could manually enter one set of coordinates, and the program would automatically follow the pattern for the remaining data, said Max Shevertalov, a graduate student at Drexel leading the effort.

"That's what makes COMET fairly special," Shevertalov said. "It's so flexible—and yet it provides fairly uniform access for everybody."

Eventually, all the applications will speak the same language and preserve their data within the COMET framework, Shevertalov said. "It will be up to the soldier in the field to figure out, 'Well, I like this thing best for my task right now, but I might like something else next time,'" he said. "You're always picking the best tool for the job, instead of picking the best Swiss Army knife."

That philosophy also applies to the platforms warfighters will use to access those tools, Palmer said. By equipping the large tables, tablet computers, and handheld devices with the same capabilities, users at all echelons can benefit from multitouch technology.

Conclusions

"The key to our research is enabling warfighters to access and collaborate on any data no matter what platform they are using," Szymanski said. "It could be CPOF at a thick client work station, or large table-based systems, or handheld systems, or thin client systems. Each hardware platform has different advantages and disadvantages. Our job as Army engineers is to conduct research to maximize the advantages and reduce the disadvantages. The end result is a more powerful warfighter."

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