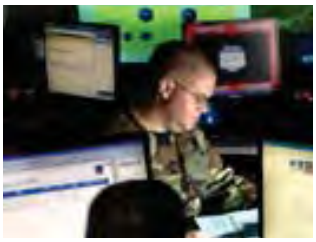
Merging Data for Better Decisions Under Pressure

Tracking the movement of suspicious persons or vehicles in a combat environment, such as Iraq, is difficult. Making a successful capture is even harder. The chance to do so usually pops up unexpectedly, and you may have mere hours—or minutes—before the objects of interest could disappear. Perhaps most challenging of all, a multitude of parties must instantly pool their resources and knowledge to get the job done, in hopes that no one misses a key call to action on the time sensitive target (TST).



Enhancing communications flow and knowledge sharing among distributed forces is critical to mission success.

It's a scenario military and intelligence officials continually prepare for—and researchers at MITRE hope the collaboration technology they're developing will improve the success rate.

"Pressure is immense, because time is short, and lives are at stake. Tasks and resources must be prioritized, and the process to do so depends on collaboration," explains Lindsley Boiney, a principal information systems engineer at MITRE. "No one person has all the information or resources needed to make a decision. One person manages the intelligence, surveillance, and reconnaissance [ISR] assets, such as a Predator unmanned aircraft taking video. Others are determining what weapons platforms can be diverted. Meanwhile, still others are working out the rules of engagement, the potential consequences of using available assets for a new purpose, and of course, the possible threat to friendly forces."

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To complicate matters, these teams are often distributed across several locations—even several countries—and typically span different military services.

"A shared understanding among everyone involved is the only way a sound decision can be made," says Brad Goodman, a principal scientist and artificial intelligence engineer. "Yet it's critical to be able to make an assessment quickly when there's a chance to carry out the mission. Group processes are becoming more dependent on collaborative technologies." Chat has emerged as the tool of choice for communication, but it's used so often that operators easily become overloaded, and critical information might slip by.

Boiney and Goodman lead a team of MITRE engineers who are gaining a better understanding of the complex tasks performed in these joint environments. Their ultimate goal is to enhance the communication flow and knowledge sharing that's critical among various parties—including intelligence sources and the military—as they carry out their missions.

Many Inputs, One Decision

The group's research focuses on collaborative decision making for net-centric warfare (NCW). NCW (also known as net-centric operations) is a concept surrounding the relationships among assets and people on the battlefield. Its main tenet is that an increase in power is achieved by networking sensors, decision makers, and shooters into a shared awareness for information superiority—that is, getting the right information to the right place at the right level of precision and accuracy, at the right time.

Clearly, many elements must merge seamlessly to apprehend a moving TST. "For example, military operators typically use multiple chat windows—as many as 10 to 15 or more at a time—to monitor ongoing communications among forces," explains Boiney. "The chat communications help them determine what military assets are available or could be diverted to pursue this new mission." With map displays and other technology also vying for operators' attention, it is easy to miss an important request or response due to data overload.

During the first year of research, a MITRE team of four engineers developed a Dynamic Chat Manager (DCM) prototype, which uses both open source software and MITRE-developed technology. "The open

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source tool we use collects and displays social networks," Goodman explains. Meanwhile, the team also developed complementary algorithms that ferret out particularly relevant, important members of a given social network. Such "who's who" information is vital when the pressure is on to find relevant information quickly.

The DCM allows operators to minimize most onscreen chat windows, while retaining a high-level view of all open chat rooms. "There are three features to this high-level view," Boiney states. "First, the tool reveals which rooms are becoming active with a lot of message traffic. If a room suddenly heats up, users want to detect this because it indicates that something important might be happening."

The next feature to DCM is that it monitors for operator-specified keywords across chat rooms. High-level keyword alerts are provided even for chat windows that are minimized, so the operator knows to go check that chat room.

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Third, the DCM has a "smart" feature built in, whereby it builds a user's social network by learning over time who is in contact and whose input is valued. "These real-time dynamic 'cues' provide more context for the chat data flows so users can find what they need, while reducing overload and distractions," Boiney says.

The impact the researchers hope to make is less missed information for operators. "We don't want them to overlook critical data," she adds. "It's easy to be distracted by information that's not as important, especially when something unexpected arises. We want to help people in these situations make effective decisions faster."

The DCM project takes place within MITRE's corporate research program as an Air Force-supported Mission-Oriented Investigation and Experimentation project. Such projects apply innovative technology to solve the needs of the company's sponsors.

Field Testing and Operator Evaluation

The MITRE engineers have been busy demonstrating this collaborative chat technology to subject matter experts within several MITRE sponsor programs, tailoring the tools as needed to pave the way for a smooth transition to the field.

The MITRE team has deployed the DCM prototype at three military operational exercises. In spring 2008, it was tested with subject matter experts at Virtual Flag, a large combat employment exercise conducted in a virtual battlespace, designed to provide operational and tactical warfighter training in a combat environment.

Another important test took place shortly thereafter, when the MITRE team participated in the Joint Expeditionary Force Experiment (JEFX) in Nevada. JEFX is an Air Force experiment that accelerates research, development, and fielding of new combat systems in a simulated wartime environment. For this event, the group partnered with the Applied Physics Lab at Johns Hopkins University by integrating the DCM with the Lab's performance assessment system and deploying the joint capability during experimental trials.

The dynamic chat tools were used again in the summer of 2008 at the Empire Challenge Exercise at the China Lake Naval Air Warfare Center in California. Participants evaluated tactical challenges and intelligence collection systems for joint and coalition operations. "There were positive outcomes of these experiments," says Goodman. "Commanders and warfighters found the information very useful." The team continues to extend the prototype's design, based on testing and evaluation scenarios.

The DCM research group itself provides a model of collaboration. Goodman and the other two project members have deep expertise with natural language processing and artificial intelligence. Boiney complements the team with her thorough understanding of the sponsor's problem and her expertise in collaboration and decision support. She also has direct experience in the field observing and interviewing end users. "Because of our positive relationships with the sponsors, we have been invited to demonstrate our collaborative technologies at these test exercises and make improvements based on their feedback," Boiney notes.

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