

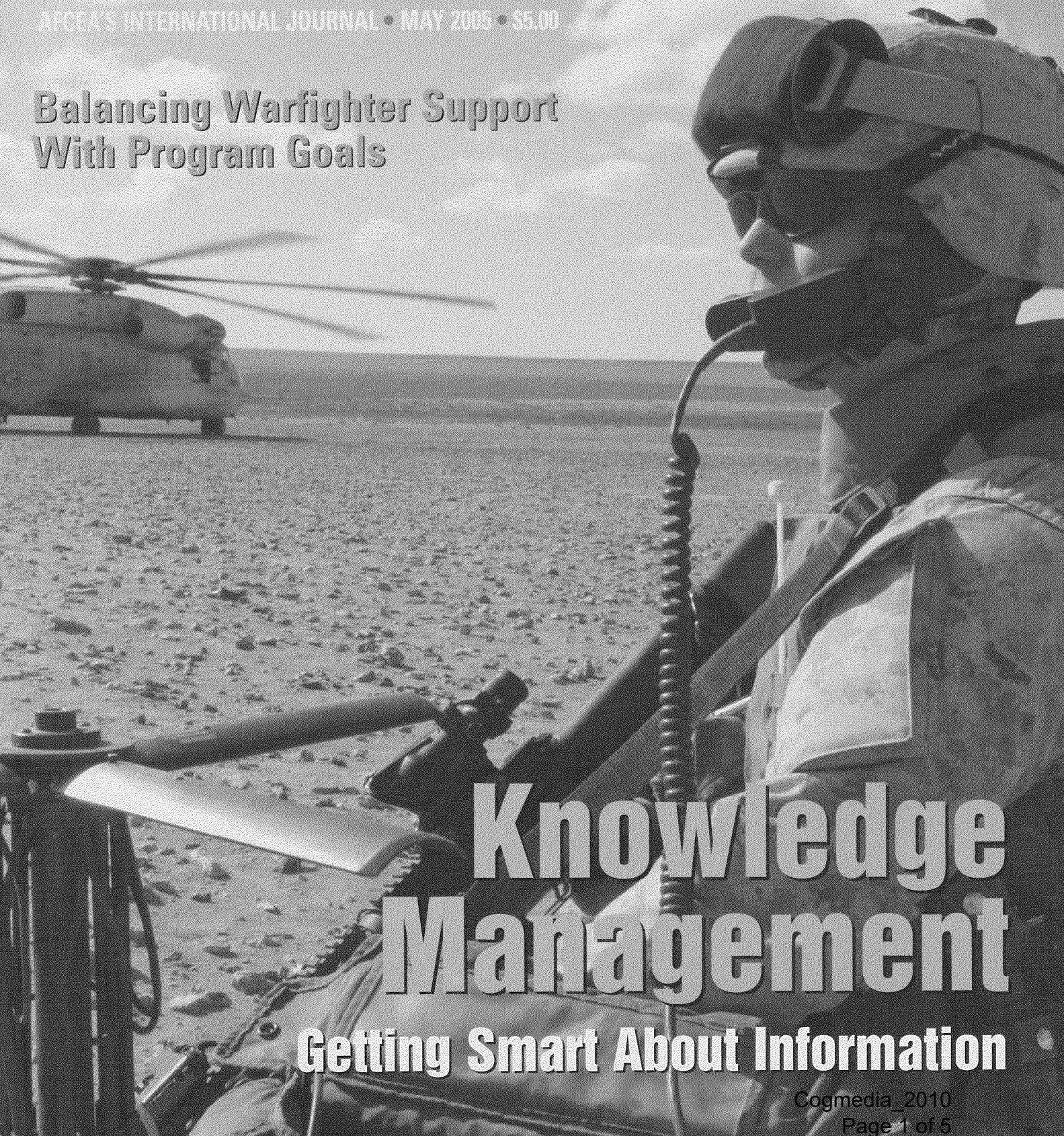
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SPECIAL REPORT:
Reserves

**Balancing Warfighter Support
With Program Goals**



Knowledge Management

Getting Smart About Information

Researchers Investigate Cognitive Collaboration

Military, industry and academia lay the groundwork for effective knowledge management tool designs.

The restructuring of U.S. troops into small, agile fighting forces and the multinational, multicultural nature of today's decision making military teams are adding entirely new dimensions to knowledge management and collaboration in the military. Command and control decision makers must discard the strategies that worked for large forces prepared to fight on a designated front line and explore new tactics. Concurrently, they find themselves working in a collaborative environment rife with language barriers, experiential differences and hidden agendas. Technology can help break through some of these barriers, so researchers are examining team decision-making dynamics so they can determine which knowledge management tools are likely to be most effective.

The work involves the entire range of shared planning elements—from exploring the technologies that present information in the best format for mutual understanding to measuring the effectiveness of different collaboration

By
Maryann
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methods. The program itself is a true collaborative effort. Experts in industry, academia and the military are conducting all of the research. The goal is to figure out how individuals build and use data and the intricacies of team dynamics.

Coordinating the effort is Dr. Michael Letsky, program manager, collaboration and knowledge management program, Office of Naval Research, Arlington, Virginia. He allows that while the Naval Air Systems Command, Patuxent River, Maryland, and the Space and Naval Warfare Systems Command (SPAWAR), San Diego, provide the technical support for the effort, the real work takes place at universities and in the commercial sector, particularly by small businesses. Approximately 80 percent of the program's budget supports university research, while 20 percent is awarded through the Small Business Innovation Research program. The funds are dispersed generally in the form of three-year grants of approximately \$500,000.

Letsky's group focuses on the cognitive, neural and social sciences—primarily in the areas of discovery and invention—to understand, measure and improve team collaboration. "Knowledge management has many meanings to different folks. My view is trying to figure out how individuals build and use data. What are the dynamics in a team? What should occur to make it work well? The requirements are being driven by transformation. The military is moving away from platforms, and there is more focus on small units," he says. In addition, today's multinational teams bring a multicultural dimension to team efforts, he notes, and decision makers must address more urgent and ad hoc situations and problems.

Yet another impetus for examining how teams work together is the U.S. Navy's FORCEnet initiative, Letsky contends. The emphasis on network-centricity demands that everyone is plugged not just into the network and information but also into how to work together.



The Office of Naval Research funds a number of programs at universities, military commands and small businesses that are examining how members of a decision-making team manage information, add personal knowledge and collaborate to create tactics.

"The first thing that I feel was neglected in FORCENet was the human issue. Human decision-making interoperability and understanding team cognition are at the heart of our program," he states.

During the three years the program has been in existence, work has focused on building a conceptual model to help understand team performance, and technology has been aiding in this effort. Several tools have been developed that explore how people take in and share knowledge, then develop a plan in data-rich environments. The tools fall into the three categories that the program has chosen to highlight: representation and transfer of meaning, team cognition, and collaboration models and computational methods.

In the first category, a project called Modeling Computer-Mediated Joint Activity at Brandeis University, Waltham, Massachusetts, is developing tools and interface technology that structure the activities of planners situated in different locations. It simplifies coordination of team information sharing so that the time required to share meaning, understanding and assessment of a situation is reduced.

Letsky explains that the work is based on the observation that when individuals work together as a team, they develop signals of understanding called coordinating representations (CRs). One example of this phenomenon is a baseball team's catcher and pitcher. Without using words, the two are able to communicate and understand each other quickly. By developing tools that would enable group members to share information through CRs of repeatable information exchanges, a command and control team, for example, could respond faster to a crisis situation despite the fact that they may not even speak the same language.

Letsky explains that members of a decision-making team often do not communicate information because they believe it is irrelevant. A total of five projects focus on the team cognition aspect of collaboration and knowledge management to address this issue. For example, researchers at SPAWAR are working on a program called the Decision Making Constructs in a Distributed Environment, which involves assessing tools that encourage team members to share information.

The project's goal is twofold. First, researchers will determine which knowledge elicitation tools and procedures are most effective when a team's members are working on a problem asynchronously. Second, techniques will be developed that will help team members quickly uncover differences in their individual knowledge so collective intelligence can be made available to all team members. The project involves three technical issues: knowledge elicitation, agent-based methods for information sharing and agent-based methods for integrating shared information.

Researchers at Colorado State University are working on how to develop tools that improve pattern matching in the



Naval reservists, scientists and engineers work in the Integrated Command Environment Human Performance Laboratory at the Naval Surface Warfare Center. The laboratory focuses on U.S. Navy human performance testing and human systems integration, which includes hardware and software as well as knowledge management tools designed by sailors.

decision-making process so that they can be incorporated into the design of groupware. Letsky explains that the work is based on a seven-year study conducted under the auspices of the ONR called Tactical Decision Making Under Stress. "People who make decisions under stress do it by matching pat-



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terns they recognize from their own personal experience. When they recognize a pattern, they don't analyze; they just go into action. The question is, Can this be extended into a team environment?" he says.

The researchers are working on a project called Shared Information Virtual Surfaces. The display screen allows all team members in different locations to view data simultaneously. Participants play an experimental game on the surface, and teams engage in pattern recognition, collaboration and action. The experiments are designed to test whether certain methods, such as "information chunking" and "push-pull information exchanges," facilitate pattern sharing among team members.

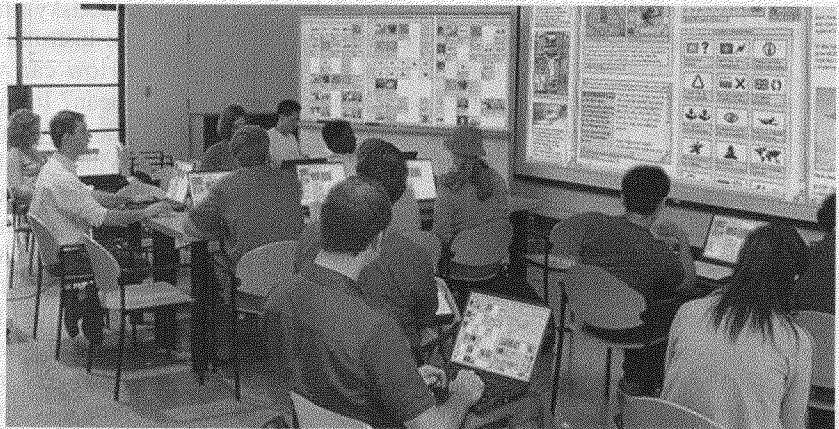
"If this happens, can we build tools to encourage it? This is a hot topic for the military now because we have small, agile multinational teams that have to make decisions quickly. Almost everything is an international effort. What tools can we provide to them to facilitate teamwork?" Letsky explains.

Similar work is taking place at the University of Massachusetts. Called Mental Model Convergence, this research is based on the premise that humans create representations of their world—termed mental models—that are simpler than the entities they represent. These models allow people to screen and classify information then choose the data that is important in a given situation. Researchers at the university are attempting to measure how similar the mental models of individual team members become when people work together for a long period of time. Letsky believes that if these metrics can be determined, they would be extremely applicable in a military environment.

Technology and information sharing play a large part within the collaboration models and computational methods scope of the ONR's knowledge management program. Letsky describes the Electronic Card Wall, also known as the EWALL, as an automated decision-making tool that can eliminate decision-makers' practice of writing ideas and information on notes that are then stuck on a board for other team members to see. Technology not only automates this process but also improves it.

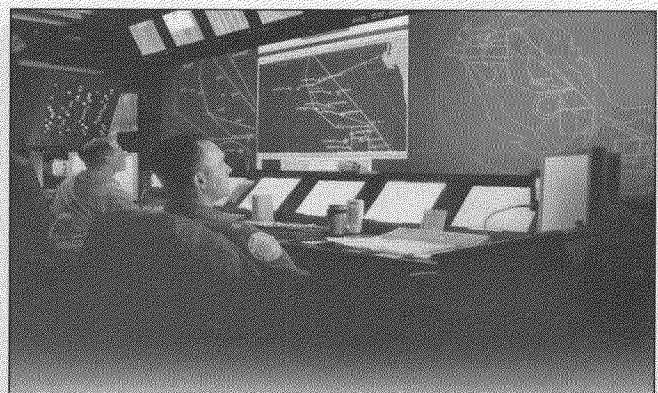
Using the EWALL, team participants input their thoughts and information so algorithms can arrange and prioritize them. As a result, patterns of common thought threads emerge while atypical ideas fade into the background. In addition, because the EWALL is a Web-enabled technology, team members can query for the latest information on a specific topic—for example, the latest news from Baghdad—and the information is delivered to them.

Letsky notes that this technology is now in the testbed stage and is being examined at the Naval Postgraduate School in Monterey, California, where the U.S. Navy is working on the Global Information Grid. In addition, it is being assessed at the Naval Air Systems Command. A handheld device that could be used by Navy SEAL teams also is being explored.



The Electronic Card Wall, or EWALL, allows team members to solve problems using a Web-based environment.

The multitude of collaboration support tools on the market today challenges organizations searching for the best technologies to support their work. What is required to make these choices, particularly when the individuals collaborating are in different locations, is an examination of how distributed decision making differs from co-located decision making. Arizona State researchers are exploring this topic to recommend tech-



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nical approaches that enhance distributed collaboration as well as to determine how to assess team performance.

Letsky says that one of the ONR's problems is getting these tools to the appropriate users once they are developed. During the past several years, the office has been encouraged to move forward faster on developing tools that help knowledge management, particularly in light of the increased number of multinational operations including humanitarian missions. However, it is the commands that must incorporate these tools into their budgets and operations and, because development can take several years, commanders are not always willing to commit to methods and technologies that will not be available until after their tour of duty is over, Letsky relates.

"The transition of the products to the commands is the biggest challenge. If I had enough data to prove to someone at PACOM [U.S. Pacific Command], for example, how these tools would improve decision making, it would be easier. But what we do here is early research and testbed-level products," he says.

Because this knowledge management and collaboration research is still in the early stages, Letsky says, none of it is being used in current operations. However, the ONR is considering injecting it into exercises such as Trident Warrior where it could be examined and evaluated further.

Letsky predicts that effective visualization of data will be instrumental to knowledge management in the future. "How can we digitize what we learn, and what does it mean? In the future, we may be able to identify this. But should we use symbols, icons, devices, annotated video? Which are the best tools? This is all cognitive—being able to capture how people think," he says.

The commercial sector can help solve this puzzle, Letsky proposes. First, when companies are developing software, he suggests that it be designed in such a way that users can teach themselves how to use it "because nobody reads all those manuals." Second, he maintains that industry needs to understand how individuals work as teams to be able to visualize how they think and develop tools that pull the information out of team members' memories.

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WEB RESOURCES

Office of Naval Research, Collaboration and Knowledge Management Program: www.onr.navy.mil/sci%5Ftech/personnel/342/342%5Fckm/default.htm

The Knowledge Management Forum: www.km-forum.org

AT&L Knowledge Sharing System:
<http://akss.dau.mil/jsp/default.jsp>

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