Cognitive Readiness and Advanced Distributed Learning

This article discusses the Cognitive Readiness focus area, and how the Department of Defense (DoD) Advanced Distributed Learning initiative will provide crucial and timely near- and mid-term enabling capability.

Ensuring that the warfighters of today and tomorrow have superior, affordable technology to support their missions is the DoD Science and Technology objective. To that end, five key focus areas have been identified where DoD corporate investment in multidisciplinary experiments and demonstrations could leverage existing programs that address:

1. Chemical and biological defense
2. Hardened and deeply buried targets
3. Smart Sensor Web
4. Information assurance
5. Cognitive Readiness

The Cognitive Readiness vision is to optimize the human contribution to joint warfighting, and achieve the revolutionary war-winning capability articulated in DoD's Joint Vision 2010. In operational terms, achieving Cognitive Readiness ensures that:

- The warfighter is *mentally prepared* for accomplishing the mission.
- The warfighter is *performing* at his/her optimal performance level.
- The tools and techniques for *preparing* the warfighter are the most effective and affordable.
- The tools and techniques the warfighter *uses* are the most effective and affordable.

Fundamentally then, Cognitive Readiness focuses our science and technology efforts on addressing the critical need for increased capability and adaptability from the human component of weapon systems in a progressively more complex, dynamic, and resource-limited environment. Although there is now a lessened risk of facing a single massive threat, the joint warfighter is challenged by the potential of simultaneous, multiple, geographically separate, high- or low-intensity conflicts, as well as peacekeeping, counterterrorism, and disaster support missions—all with tightly constrained operations and acquisition resources.

These post-Cold War challenges have compelled adaptive adjustments by the services. Today's forces are deployed more frequently and for longer periods of time, often in urban situations where the individual warrior is the weapons platform of choice. These changes in military context and capability, as exemplified in Figure 1, even now routinely stress the capacities of individuals and teams across a spectrum of tasks and operations.

- High personnel and operational tempos (PERSTEMPO, OPTEMPO)
- Flying time issues
- Safety
- Operating space availability
- Dwindling exercise $$
- Few joint training opportunities
- Complex rules of engagement
- Classified capabilities
- Restricted weapons/electronic warfare envelopes
- Environmental concerns

Figure 1. *A Sampling of Training Constraints/Challenges*

The Cognitive Readiness focus area employs a multidisciplinary systems approach to address these performance challenges. As shown in Figure 2, it draws upon the human systems and biomedical areas of the DoD science and technology programs, integrating scientific and applied contributions from health, psychology, sociology, and human factors engineering fields.

- **Education -** Teaching generalized knowledge (cognitive)
- **Training -** Teaching specific tasks/ knowledge (cognitive, psychomotor)
- **Human Systems Integration-** Modifying system inputs/outputs and environment to optimize human performance and understanding cognitive processes
- **Sociology -** Family, group, and culturally defined issues
- **Health -** Mental acuity, physiological wellness

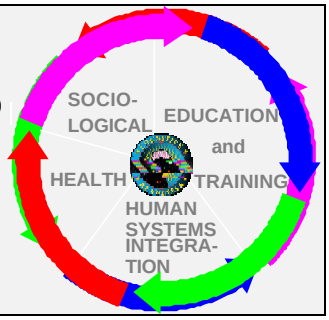

Figure 2. *Cognitive Readiness: A Multidisciplinary Research Program*

Although a variety of research efforts develop and apply technologies toward improving human performance, it is seldom that resulting demonstrations and deliverables leverage or generalize beyond specific applications, missions, or components. Cognitive Readiness provides the integrating mechanisms for coordinating, overseeing, and supplementing focused research across the DoD, industry, and academia. An initial high-payoff area is the technologies necessary for the DoD's education and training missions.

We are greatly interested in achieving the capability to train and educate our military and civilian workforce, anytime and anywhere it is required, with systems tailored to individual needs. Today's tremendous advances in information technology put us on the verge of an enabling environment for Advanced Distributed Learning (ADL). In the end-state, ADL hardware and software must have the characteristics of accessibility, interoperability, durability, reusability, and cost effectiveness. While communications and computing technologies are on an evolutionary track to accommodate ADL accessibility, technologies to accommodate the other characteristics are severely limited. Most computer-based and Web-enabled training and education systems are static, single-point answers to a single need. They are difficult to scale or adapt to large and diverse learner communities. Content and "courseware" are rigid, not designed for reuse. Knowledge management and search tools are mostly inadequate for all but the most superficial uses. Many educational technologies are high in cost, low in reliability, and difficult to adapt to special usability needs. A review of software industry trends indicates that many companies now believe that an object-based approach will provide the basis for platform neutrality and software reusability needed for the large-scale development and dissemination of powerful and cost-effective learning content. To achieve the ADL objective, it is important to initiate research that enables platform neu-

trality and software reusability.

A recent front-end assessment and workshop identified key components for a research agenda to achieve a robust, national ADL capability by the end of the decade. Participants represented a cross-section from the services, government, industry and academia. These people were recognized experts in areas that included education, training, curriculum development, software engineering, hardware engineering, educational research, cognitive, and behavioral science. The four key research areas that were identified as necessary to enable the ADL vision of a readily available instructional environment to support anytime, anyplace, anyone, anything learning were:

- Intelligent Computer-Aided Instruction.
- Authoring Tools.
- Distributed Simulations.
- Dynamic Learning Management.

We are embarked upon establishing a comprehensive, multidisciplinary research program to address these fundamental research areas.

This program will serve as the basis for providing accessible, tailorable, and affordable training and education to military and DoD civilian employees through advanced distributed learning. Underlying achieving the ADL vision by the end of the next decade is the requirement for a supporting hardware and software infrastructure. ADL will be enabled by an open, evolving learning technology environment based on a ubiquitous, distributed infrastructure with interoperability of components and learners across a multitude of bounds (e.g., spatial, temporal, organizational, technological). The DoD software engineering community will be a key to this strategic initiative's success.

In sum, Cognitive Readiness is both a critical component and a criterion for the DoD's Science and Technoogy strategy for achieving the national defense capability articulated in Joint Vision 2010. It forces emphasis on achieving national advantage through optimizing the capability and employment of our people—our nations greatest asset—for peace, as well as war. ADL, in turn, provides a supportive strategy that will contribute to the achievement of cognitive readiness. Accelerated and sustained S&T investment in ADL should yield near- and mid-term dividends that will dramatically enhance our forces' cognitive readiness. The challenge is daunting, not only because of the infrastructure and human resource S&T requirements but also because of the organizational, cultural, and security issues that must be addressed. Clearly, realizing the promise and the potential of ADL will be dependent upon a shared vision and a nation-wide, multidisciplinary team effort.◆

About the Authors

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Sorry to See You Go, Joe

CROSSTALK bids farewell to Lt. Col. Stanley Joseph Jarzombek Jr. this month. After nearly four years as the sponsor of *CROSSTALK*, Jarzombek is retiring as the Director of the Computer Resources Support Improvement Program (CRSIP [formerly ESIP]).

As the CRSIP director, he headed the Air Force software technology and software knowledge management initiatives and provided $16 million a year infrastructure to support technologies of Air Force organizations. His many tasks included sponsoring and directing CRSIP efforts in the Software Technology Support Center. In that position, he oversaw technology information services in addition to this journal: online web information services, and the Software Technology Conference, the Department of Defense's premier software conference that draws 3,500 attendees annually.

With Lt. Col. Jarzombek at the helm since July 1996, *CROSSTALK* has evolved from a black-and-white digest to today's journal with its signature purple signifying tri-service coverage of software issues, professionally created cover art, and a more reader friendly and usable format. Thanks to his support, readers will soon see another major publishing step: a full-color cover.

His software involvement and interest are far-reaching. At CRSIP he sponsored Air Force Research Lab software technology research, development, and evaluation services to provide solutions for software support environments and migration of software legacy systems. He directed tasks and studies with SEI on best practices, SPI efforts, and documentation. He provided corporate direction for software readiness programs through sponsorship of SEPGs in software divisions within AFMC centers. He directed the upgrade of the Air Force's network of software control centers. His other activities include membership on Web editorial boards to provide coordinated software technology initiatives, policies and practices, and service on the DoD-sponsored CMMI® Product Development Team. Thanks, Lt. Col. Jarzombek, for your valuable support!