DOD ADVANCED DISTRIBUTED LEARNING NETWORK

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Abstract

Consider this hypothetical scenario. Another major training exercise is beginning at the Joint Warfighting Center. This simulation-based exercise is designed to prepare a European-based Joint Task Force commander and his staff in warfighting operations within the combustible European theater. Over five hundred participants have been brought to Suffolk, Virginia to participate. Component staff response cells have been established as far as Fort Hood, Texas to the west and Ramstein AFB to the east. The exercise will result in participants being out of their operational area for over three weeks over a two-month period while planning the operation and executing the exercise. By all accounts this is a very cost effective way to train JTF commanders, but is it the most cost effective? As this exercise is unfolding political unrest in a nation in the US Central Command s Area of Responsibility has caused CENTCOM to go into an alert status. Although intelligence studies have provided the CINC a thumbnail sketch of what he will face should he have to move his troops in country, there is no way for him to model and rehearse potential courses of action in the days prior to deploying his forces.

In-theater training and exercises coupled with a responsive mission rehearsal capability are just two of the major operational capabilities being addressed by the Advanced Distributed Learning Network (ADLN). Joint Vision 2010 clearly states the need for such a capability: Simulations must be interconnected globally - creating a near-real-time interactive simulation superhighway between our forces in every theater. Each CINC must be able to tap into this global network and connect forces worldwide that would be available for theater operations. The ADLN vision is to create a global architecture that integrates and shapes related DoD initiatives, programs, and operational requirements providing the capability for worldwide participation in advanced distributed learning on demand.

Advanced Distributed Learning, with joint training applications and content riding on a high speed, robust network promises to be such a boon to cost effective training it is currently being investigated by every Service and a multitude of government agencies. To date, the result has been the creation of many stand alone and non-interoperable networks, services, and tools. This has led to duplication of effort and a waste of resources. The ADLN program will provide a comprehensive, cohesive, and requirements-based joint training and education capability for the CINCs, Services, and defense agencies. It will leverage existing stove-piped networks and ensure interoperability and seamless transfer of information in the joint battlespace.

This paper will describe the overarching concepts of this global Advanced Distributed Learning Network and how it will be implemented for use by US forces and agencies to increase joint training readiness.

Author s Biography

Mr. Gregory F. Knapp, an employee of the Space and Naval Warfare Command (SPAWAR) System Center, San Diego, is assigned as the director of advanced programs for the US Joint Forces Command s Joint Warfighting Center. His responsibilities include strategic planning, concept development, program definition, and program management for advanced technology concepts and methods to support the warfighter s needs. Strategic thrusts include the Advanced Distributed Learning Network, Regional Engagement Networks, and the Training Center for Joint Interoperability. Mr. Knapp has over seventeen years of experience in the Department of Defense with emphasis in the areas of test and evaluation, modeling and simulation, system engineering, in-service engineering, and information technology. Prior responsibilities include the management of all advanced submarine combat system in-service engineering programs, director of projects consisting of over 2 million source lines-of-code development, Chief Engineer for the Submarine Multi-Mission Team Trainer, and NAVSEA test & certification director. Mr. Knapp possesses a Masters of Engineering degree from Old Dominion University, has been awarded a patent, and is a widely recognized speaker in the DoD community.

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INTRODUCTION

The Advanced Distributed Learning Initiative is DoD s principal vehicle for developing a broad range of plans and programs that use advanced communications and learning technologies to modernize how we will educate and train the U.S. armed forces. Advanced Distributed Learning s primary goal is to implement the Secretary of Defense s training vision -- to provide access to the highest quality education and training that can be tailored to individual needs and delivered cost effectively, anytime and anywhere. [1]

Many U.S. forces deployed worldwide cannot meet their joint training requirements without great expense and a significant disruption to their daily operations. The fact that most deployed forces must travel long distances to train jointly means considerable cost in travel dollars and significant time away from other duties. Operational tempo (OPTEMPO) and personnel tempo (PERSTEMPO) also increase when training is required for globally deployed forces. The lost time must be recovered, usually upon return from the training event. For these reasons, the ability to conduct worldwide joint training and education using distributed resources is critical to the future of the Chairman of the Joint Chiefs of Staff (CJCS) Joint Training Program. Advanced Distributed Learning helps lower costs and tempo by delivering the training to the warfighters, reducing the time and money that must be committed toward joint training and professional military education requirements.

Although the joint community and individual Services are pursuing a variety of distributed education and training initiatives today, there is no coherent strategy to bring synergy and economy to these diverse programs. No focused effort exists to ensure the required information can be seamlessly transmitted to the users of the training and education applications worldwide. The Director of the Joint Staff originally assigned the United States Joint Forces Command (USJFCOM) as lead agent in the development of a distributed joint training architecture that would enhance the training of all U.S. forces and provide an easily understandable approach to distributed joint training by using an existing Department of Defense (DoD) Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) architecture development model as a foundation for common solutions. In May 2000 the Deputy Undersecretary of Defense (Readiness) designated USJFCOM as lead for the development of the joint Advanced Distributed Learning Network (ADLN). USJFCOM is now in the concept development and requirements generation phase of network development to meet the joint advanced distributed learning requirements of the CINCs and Services.

The vision of the ADLN is a global distributed architecture that integrates and shapes related DoD initiatives, programs, and operational requirements to link service and joint programs and to provide the capability for worldwide warfighter participation in joint training and education on demand. Implementation will take place in three phases: (1) Initial Operational Capability (FY03), (2) Full Operational Capability (established in FY067), and (3) Sustainment and Transition (FY07 and beyond).

When the ADLN program is implemented, it will enable globally distributed training and education of U.S. forces at all levels, from the individual soldier, sailor, airmen, or marine to the joint task force commander and his staff. It will leverage technological advances in computers and communications systems, taking the training to the trainee regardless of his/her location around the world. Finally, it will establish a global network of learning centers and learning resources, standardizing and enhancing the efforts of the CINCs to deliver quality training and education to their personnel and staffs. This global network will enable a logical extension of learning services to Allies and Partners around the globe.

BACKGROUND

The overarching operational requirement for the ADLN is contained in Joint Vision 2010. This document states in part: Simulations must be interconnected globally - creating a near-real-time interactive simulation superhighway between our forces in every theater. Each CINC must be able to tap into this global network and connect forces worldwide that would be available

[1] Quoted form the body of letters of transmittal to members of Congress, attached to the DoD Implementation Plan for Advanced Distributed Learning.

for theater operations. The creation of a global training network was originally assigned to USJFCOM in a memorandum signed by the Director on 25 June 1998. This memorandum identified the following specific tasks for USJFCOM:

1. Define operational requirements in coordination with users.
2. Develop system/technical architecture requirements in coordination with the Joint Staff, the Service headquarters, and supporting agencies.
3. Demonstrate proposed distributed joint training concepts derived from these requirements.

Upon receipt of this tasking, the USJFCOM Joint Warfighting Center began the analysis to conduct a Concept Feasibility Study. Some of the findings of that analysis were:

- All CINCs are planning a wide variety of distributed capabilities to support exercises.
- Billions of dollars are being spent for distributed programs and networks that are not interconnected and may not be interoperable.
- Congressional plus-up programs are not being coordinated nationwide.
- No cohesive program exists for the development of a global learning network infrastructure and facilities.
- U.S. and multinational distributed learning activities are not converging into one global program.
- Multiple standalone simulation centers have been created.
- There is no reliable, robust capability for rapid, just-in-time training and rehearsal.
- Distribution of network services and simulation to OCONUS sites is very poor and not robust.
- Today s distributed network services do not adequately support some categories of joint training (e.g. Joint Interoperability and Interagency).
- The Defense Simulation Internet, Defense Information Services Network Leading Edge Services and Defense Research and Engineering Network are used operationally; however, they are not permanently funded with a migration path.
- More sites are making plans for Joint Simulation System (JSIMS) installation when distributed simulation from simulation centers could support this.
- Sufficient on call bandwidth will be available through industry and is increasing.
- Security is an issue - today s Internet is not secure.
- DoD infrastructure is insufficient to support distributed joint training without separate point-to-point additions.
- Existing communications infrastructure will be insufficient to meet the demand for joint training.
- There is no network infrastructure that is part of the JSIMS program.
- No improvements to our capability to distribute training have been made in the last five years.

Moreover, JFCOM is currently independently engineering distributed training and simulation networks on an exercise-by-exercise and site-by-site basis. To a large part, this is necessitated because there is no reliable, robust in-place capability for distributing simulations and other exercise support for joint training. Additionally, we have learned the hard way, during Exercise Coherent Defense 97, that the distribution of exercise information and data on the SIPRNET can have an adverse impact on real world operations.

US JOINT FORCES COMMAND S CHAIN OF AUTHORITY

In the 1996-97 Quadrennial Defense Review (QDR), the Office of the Secretary of Defense (OSD) Comptroller established targets for annual cost savings from the Services institutional training accounts. Subsequent analysis indicated that savings would be possible if the Department were to develop and implement the next generation of learning technologies. The Deputy Secretary directed the Under Secretary of Defense for Readiness (USD(R)) to develop a strategy to achieve these savings. The Department has received the following additional direction from the White House, Congress, and the Secretary/Deputy Secretary of Defense:

- The President s Economic Advisor s memorandum (7-98) requested that the Department accelerate and expand the ADL initiative.

- The President s Executive Order 13111 (1-99) tasked the DoD with developing technology standards to ensure the interoperability of federal learning systems.

- The FY 1999 DoD Authorization Act (S2060) directed the Secretary of Defense to develop a

strategic plan, to include an assessment of the estimated costs and benefits, a statement of planned investments, and a description of the mechanisms that are to be used to develop and coordinate learning technologies on a broad scale in the DoD.

- In a memorandum dated 23 November 1998, the Deputy Secretary of Defense directed the Under Secretary of Defense for Personnel and Readiness (USD(P&R)) to work with the Services, Joint Staff, and OSD Comptroller to develop and implement ADL policy across the Department; develop an ADL master plan addressing the plans, programs, and procedures to carry out that policy; and coordinate with the Services, the Under Secretary of Defense for Acquisition and Technology (USD(A&T))[2], and the Under Secretary of Defense (Comptroller) (USD(C)) to ensure that sufficient program resources are made available to implement the ADL master plan.

In the DoD Implementation Plan for Advanced Distributed Learning, dated 19 May 2000, the USD(R) designated USJFCOM as the lead for development of the joint Advanced Distributed Learning Network. USJFCOM's responsibilities include coordinating, consolidating, and maintaining worldwide operational requirements and transforming those requirements into a end-to-end global network. This would include defining joint training and professional military education requirements in coordination with the users and developing appropriate operational and technical architectures.

WHAT IS THE ADL NETWORK

Providing distributed training and education is a necessary means of lowering the high cost and tempo associated with training globally deployed forces. The ADLN will provide that capability. The requirements driving the ADLN program include the need for greater synergy among current programs; reduced cost and setup time for training networks; and improvements in training, education, and rehearsal programs. These needed improvements include the ability to assess training effectiveness and student learning, and most importantly, the ability to meet the warfighting needs of the regional CINCs.

[2] This is now the Under Secretary of Defense for Acquisition, Technology, and Logistics.

Moreover, without a common infrastructure in place, the cost of developing new networks and establishing connectivity is making training programs inefficient. Network design and setup are time-consuming and costly, with the lead-time to buy bandwidth and deploy communications systems extensive. It is too expensive to create temporary training and testing networks – systems that are stood up only for a short time and then torn down immediately following the exercise. Furthermore, travel costs are excessive with the constant setup and stand-down of equipment, and the intensive short-term response effort means interference with other activities. In contrast, the ADLN will facilitate reuse of the network, applying common technologies, standards, and processes. It will have a minimum development effort. Existing programs will be leveraged, creating connectivity and interoperability among established architectures and facilities. Content will be reused whenever possible, as will sharable courseware and learning objects.

Education and training also must be available to everyone regardless of location. The disposition of U.S. forces demands the development of an advanced distributed learning capability that is accessible anytime, anywhere. A truly global training and education requirement exists today, including for locations outside of any existing infrastructure. Similarly, there is no mission rehearsal capability available today. The ability to stand up and rehearse a real-world operation is of vital importance to the CINCs and Joint Task Force Commanders.

In response to these requirements, the ADLN focuses on the use of remote approaches to train geographically distributed personnel by leveraging information superiority. It therefore directly supports JV 2020 through the creation a seamless data service network architecture that will allow shared learning at a wide range of levels from the individual to entire JTFs. One of the key goals of this effort is to enable forces to participate in major joint training events from their home locations, thereby avoiding the cost of deploying to a central training site. However, the current military environment is dynamic; forces must be trained at a moment s notice in unpredicted areas and scenarios. Training requirements are unpredictable and change continuously. Therefore to meet all emerging requirements, the ADLN must establish flexible standards and best practices that are adaptable to change. The standards and practices will constantly undergo evaluation through lessons learned.

Security is the primary concern for the ADLN. The potential for unauthorized access presents a real challenge in a network of this kind. Also, the ADLN

must serve as a vehicle for training in Information Assurance (IA). Thus, it will establish unique security enclaves and make use of firewalls and other security technologies to keep the network secure. The ADLN will be designed to make information available to users connecting to it through approved nodes. Effective integration of multinational participants in the training audience is another problem that will be solved. Multiple levels of security inside of trusted enclaves will be used as a way to enable this coalition training.

Scalability, or how well the solution to a problem will work when the size of the problem increases, is another key issue. Considering the potential for training audiences to increase considerably from event to event, the ADLN must be able to accommodate additional data sources or increases in data bandwidth.

Availability of information is critical to an effective training program. Models and other systems must be available to the training audience, with limited unscheduled downtime occurring, to ensure an efficient training experience. Thus, the ADLN will be capable of providing the required bandwidth and distribution, making data accessible from any required location.

The ADLN must provide a high degree of *usability*. It must use web-based technology to provide a common look and feel and enable ease of use. An off-the-shelf approach to setting up a distributed joint training event will enhance the usability of the system, enabling audiences to focus on the training event itself. It also must provide features that enhance the training process, such as a searchable index of data and the capability to store and retrieve all posted training reports and assessments that have been released.

The ADLN must offer *adaptability* as well. It must use an open standards-based architecture to promote interoperability among all required applications and databases and to comply with Defense Information Infrastructure Common Operating Environment (DII COE) guidelines. It must follow a modular development process to allow step-wise growth and updating. Applications should be independent of the hardware platform so that current investment in hardware can be replaced during normal attrition. It also must have a level of expandability that accommodates use by Service components for Service training if required in the future.

The ADLN must offer *affordability* to ensure future program success. It must improve the efficiencies of all categories of training, education, and related missions through reusability of applications, infrastructure services, and content, and must provide cost-effectiveness per net increment of time. More cost-effective distribution of joint training will be achieved through less costly communication links, reducing setup labor costs and recurring link costs through economies of scale.

Finally, *network performance* must be considered, including the accuracy, efficiency, and complete throughput of information. The transfer of information must be seamless and efficient, providing for as real a training experience as possible. Network management must not interfere with the training exercise itself. And downtime must be kept to a minimum.

When fully operational he ADLN will enable new capabilities for:

- Collaboratively scheduling and planning exercises
- Rehearsing missions
- Distributing simulations and exercise control
- Sharing training data and analyzing lessons learned
- Providing distance learning
- Providing global skills training (e.g., for GCCS operators)
- Developing tactics, techniques, and procedures
- Developing and testing joint doctrine
- Providing training opportunities for allies and partner nations

The ADLN will support a vast array of capabilities and users. However, the ADLN will not exist only for the joint community. Additional consumers might include individual Services; OSD, who provides training to the National Military Command Authorities (NMCA); DoD agencies; and counterdrug, Weapons of Mass Destruction (WMD), and counterterrorism forces. Developers of the training content and M&S tools such as JSIMS also require access to the ADLN.

The facilities required to implement the ADLN run the gamut from a small electronic classroom to a specially designed and outfitted training and simulation center (see table 1). The equipment that is required to outfit each facility is dependent upon the type and scope of training to be provided. This concept is based on the ability to electronically connect facilities around the globe such that various levels of training could be elevated to a larger scale (see figure 1). This demonstrates that any type of training facility can be connected and interactive with any other type in almost any location globally. It also provides a great deal of flexibility in how the training events are designed and the audiences served. For example, while a Type I facility would not be able to actively participate in a

high-level exercise employing simulations personnel, the facility could observe via distributed VTC capabilities and thus gain enhanced understanding of the overall joint warfighting problem. Similarly, a classroom can be used to teach a small group of staff officers in tactics and doctrine, but by incorporating advanced distributed learning technologies, this same training can be given, just as dynamically, to hundreds of officers worldwide. Once the training facilities are defined based on their operational requirements, technological advances in simulation distribution, advanced network concepts, high bandwidth communications systems, and information management tools can be employed to create the training distribution infrastructure.

Table 1. ADLN Facility Definitions

Type	Description	Functional Capabilities
I	Interactive Classroom	Internet, SIPRNET, VTC
II	Operator/Team Training Facility	C4I, Service Systems
III	Service Training/PME Facility	Internet, SIPRNET, VTC, C4I Systems
IV	Response Cell	Internet, SIPRNET, VTC, C4I Systems, Simulation Interfaces
V	Service Training & Simulation Facility	Internet, SIPRNET, VTC, C4I Systems, Operations Center, Service Simulations
VI	Joint/Service Training/JPME Facility	Internet, SIPRNET, VTC, C4I Systems, Joint Operations Center
VII	Joint Training and Simulation Facility	Internet, SIPRNET, VTC, C4I Systems, Joint Operations Center, Simulation, Simulation Databases

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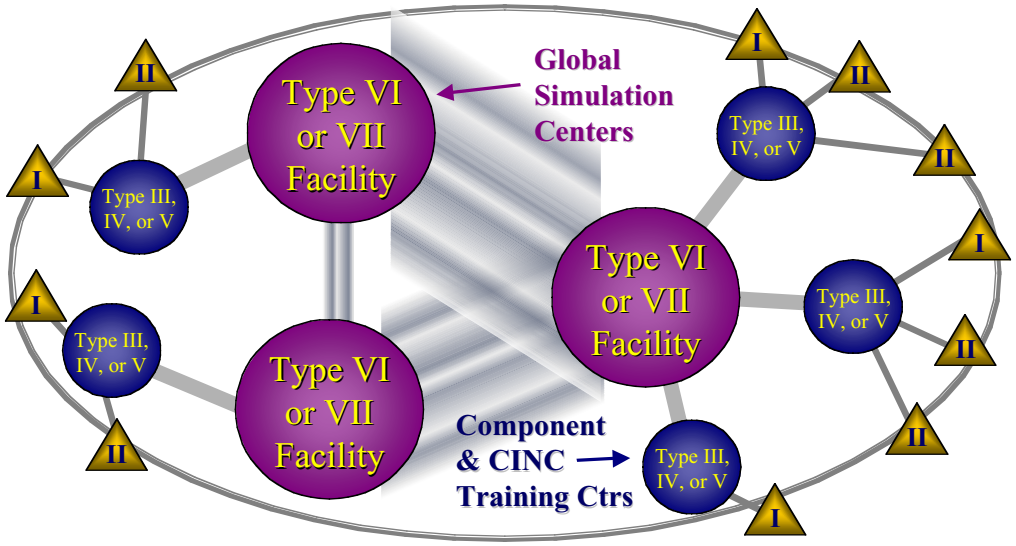

Figure 1. The Worldwide ADLN Infrastructure Framework

THE WAY AHEAD

USJFCOM is concluding the Concept Definition Phase of program development and is now about to enter the Joint Requirements Generation Process. A list of desired operational capabilities for the ADLN has been developed, and the CINCs have been surveyed to construct an initial list of operational requirements. This next phase includes conducting a Mission Area Analysis and follows through with a Mission Need Analysis and the creation of a Mission Need Statement (MNS). This MNS will be submitted to the Joint Requirements Oversight Council for review and approval, and the ADLN will enter the DoD Acquisition Process.

Concurrent with these efforts, an Advanced Distributed Learning / Joint Interoperability Training Advanced Concept Technology Demonstration (ACTD) has been proposed for Fiscal Year 2001. This ACTD establishes a collaborative, interactive, global learning environment by linking learning resources with distributed staffs, units, teams, and individuals. ACTD partners will develop embedded training tools and mission-focused, learning materials to common standards. Centralized and regional electronic libraries will gather and index learning material and other resources. Supported instructors, trainers, and mentors will oversee the synthesis of mission-focused instructional packages. Curriculum and training development teams will leverage collaboration tools and techniques to design and develop training events and learning opportunities. Joint, Service, and other agency centers will host courseware and maintain records for anytime, anywhere learners as they access this courseware to execute just-in-time training focused on mission requirements. Joint training centers will support these efforts with modeling and simulations, mission-focused training teams, observer teams, analysis teams, and/or after-action review teams. Joint Task Force and component commanders will monitor and evaluate performance in candidate training exercises to evaluate unit training proficiency, demonstrating how this integrated global learning environment can directly support and enhance readiness.

This ACTD will employ cutting-edge networking techniques to establish mission-focused quality of service connectivity for the core hub of the global learning environment. From the start, the core hub will incorporate multiple, mission-focused or process-centric security enclaves. Likewise, the core hub will be tailored to enhance active monitoring and real time assessment to enable network adaptations to support active IA measures and to provide real time performance support. At the end of the first phase of development, the ACTD will extend the reach of this core hub with gateways to the Internet to support anywhere, anytime access. Throughout all phases, the ACTD will leverage the OSD-sponsored Advanced Distributed Learning Collaboration Laboratories (Co-Lab) to test and integrate Defense Advanced Research Projects Agency, Service, or industry-developed technologies and will then inject proven solutions that meet mission needs into the ACTD s integrated learning environment.

Department of Defense networks and leased circuits will provide the initial backbone connectivity for the high-speed ADL core hub. However, the need for anytime, anywhere support drives extension of this hub with bridges to the Internet. This ACTD will field gateways to the Internet with built-in defense in depth and active IA countermeasures. This effort sparks development of the follow-on ADLN Program by validating the envisioned architecture of interconnected type 1 through 7 learning facilities. Selected facilities at each level will provide the baseline for demonstrating and scaling specific gateway architectures, determining the locations of resources within the core hub, establishing real time simulation of the ADLN to project performance and detect anomalies, and establishing viable boundary layer protocols. Protocol development and validation includes identifying extensions to the DII COE and Joint Technical Architecture, building an metadata-tag registry, and establishing reusable standard base object models to enable rapid development High Level Architecture federation object models.

Other capabilities to be demonstrated in this ACTD include individual training and education (e.g., Joint Professional Military Education courses), Joint Experimentation assessments, and multinational and interagency training. The ACTD will include participants from each Service, from regional and functional CINCs, from numerous Joint Forces, and from multinational forces. It will also include the Advanced Distributed Learning Co-Labs, National Defense University, the Joint Staff, and representatives from civilian academia. Scenario events during joint training exercises will require participants to reach-back to government agencies and other subject matter experts. Moreover, the lessons learned while training and operating in an active IA environment will contribute significantly to joint readiness and operational performance in the face of an active Information Operations/Information Warfare threat. IA techniques and training procedures become more important during multinational training and operations as non-U.S. forces are directly or indirectly connected to our command or logistics networks. This ACTD will serve to place new advanced distributed learning

technologies and capabilities into the hands of the warfighter more expeditiously.

SUMMARY

Advanced distributed learning afforded by the revolution in information technology is radically changing the way people learn. Computer-based training provides on demand interactive courseware, video teleconferencing enables remote instruction, advances in modeling and simulation create abilities to exercise personnel in virtual environments, and digital libraries enable rapid research on almost any topic. While these varied technologies are available in various forms they have not been integrated among the Services and other agencies in the government.

When the ADLN program achieves complete operational capability, it will enable global distributed training and education of U.S. forces at all levels, from the individual soldier, sailor, airmen, or marine to the JTF commander and his staff. It will leverage technological advances in computers and communications systems, taking the training to the trainee regardless of his/her location around the world. Finally, it will establish a global network of learning centers and learning resources, standardizing and enhancing the efforts of the CINCs to deliver quality training and education to their personnel and staffs. This global network will enable a logical extension of learning services to Allies and Partners around the globe.

The ADLN will directly contribute to and enhance operational readiness by creating the capabilities for on-demand, distributed training and rehearsal. The ADLN will link training exercises (vertically and horizontally), reduce training PERSTEMPO and OPSTEMPO, enable rapid reachback to learning resources, reduce exercise life cycle times, foster cooperative courseware development, prototype knowledge management processes, and provide an environment for IA training. These capabilities will have a direct payoff for the warfighter as we seek to make Joint Vision 2020 a reality.