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**EDUCATING TODAY'S WARRIORS ON THE
INFORMATION BATTLEFIELD**

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USAWC STRATEGY RESEARCH PROJECT

**EDUCATING TODAY'S WARRIORS ON
THE INFORMATION BATTLEFIELD**

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ABSTRACT

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The adoption of Information Operations as a Doctrine and the introduction of Functional Area 30 (Information Operations) in the U.S. Army have led to the creation of a new breed of warrior, skilled in the art of war and the science of technology. The integration of art and science is not new to the battlefield. The rapid pace of technological advancements defines today's battlefield. FA 30 Officers must become the operational integrators of the multiple disciplines that make up their area of responsibility. Each of these disciplines has become more automated and technical in recent years. Since the conflicts of tomorrow will not be fought alone, per JV 2010, we need to maximize the efforts of all the services in the development and delivery of this training. An integrated approach to training development will provide for better integration, more effective utilization of personnel and money, and produce increased synergy in training and execution. The training mechanisms, techniques, and delivery methods used should include synchronous and asynchronous methods. The objective is to maintain the skills of the officers in a continuously changing information environment while limiting the time they are removed from duty. Learning should be considered a life-long endeavor, not a requirement to be fulfilled.

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EDUCATING TODAY'S WARRIORS ON THE INFORMATION BATTLEFIELD

The education of military officers has been a standard in western cultures since 1810, "when General Gerhard Von Scharnhorst founded a military institution for the higher study of war in Prussia that was latter called the War College."¹ Never has the need for education been more dramatic than today. Computer technology has been integrated into all aspects of daily operations. The rapidity of change in both technology and information has dramatically reduced the time available to make decisions. We no longer have the luxury of attending professional schooling periodically, as currently described in the Officer Professional Development guidelines. However, today's technology allows for education to be conducted at a distance, therefore rendering it timelier.

The new career field of Information Operations is an excellent test environment for exploring a change in our educational paradigm. The field is new, and the determination of requisite knowledge and skills is still being decided. Officers in the Functional Area are focused on learning and understanding the very technology that has become ubiquitous in the profession. Today's Information Operators, while charged with coordinating and synchronizing the technologies, must also learn continuously and stay abreast of an ever changing inventory of software, hardware, applications, and telecommunications capabilities.

Change is not new in the business of keeping peace or making war. Warriors, when not engaged in battle, spend their time preparing for it. In preparation they practice their art and search for new and better ways of increasing their effectiveness. From the crossbow, to the laser, warriors have always sought tools to inflict greater devastation on the enemy and bring about a quicker termination of the conflict. This principle will undoubtedly still hold true into the 21st century. What has changed is the rapidity with which the cycle is occurring, the skills required to take advantage of the latest tools and the amount of time allowed between the introduction of new tools and their required use. "To be sure, the frenetic pace of technological change in the modern world has served to compress the intervals and stretch the amplitude of the cycles of change."²

The creation of the Information Operations Functional Area in the United States Army is a significant indication that a Revolution in Military Affairs (RMA) and a Revolution in Business Affairs (RBA) are currently underway. Technological advancements are pervasive in the business community and are helping to define and force the military revolution. Revolution differs from evolution in that it requires major changes in doctrine and tactics, in addition to the integration of new technology with old business practices. Information Operations in support of Information Superiority is the doctrinal change that has already been adopted. "Information Superiority is the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversaries ability to do the same."³ We have become tactically and operationally dependent on databases and automation systems. Examples of this dependence include ordering supplies (Logists systems), determining our location and the location of others (Global Positioning Systems), and analyzing the battlefield and issuing

orders (ABCS). We even use CNN to assist in Battle Damage Assessments (BDA) and to gather real time intelligence. We use video teleconferencing to determine Courses of Action and handheld computing devices to issue orders to the troops in the field. Technology has required the creation of this new functional area, and technology is what Information Operations officers need to understand. To make effective operational use of the available technology, FA 30 officers should possess empirical combat arms experience. Information Operations integrate and synchronize information to support the commander's planning and decision-making capabilities.

Technology has made the world more connected and more co-dependant. This co-dependence and connectivity have begun to blur national borders and redefine the concept of sovereignty. In the nuclear age the participants were limited to a small group, but in the information age anyone with a computer could become an international player. Information has joined diplomacy, economics and military force as an instrument of national power. The interruption of information flow today could be just as devastating to a country as an interruption to the flow of ships, trucks, or airplanes. Instead of a naval blockade or an invasion force, a computer located thousands of miles away can accomplish the interruption of the information flow.

We must structure an education program to prepare our leaders to be effective at employing Information Operations at the operational and strategic levels of war. The education program must be focused on integrating the capabilities of all the services in support of the Joint Task Force Commander or Regional Commander in Chief. These educational requirements should be spelled out in the Joint Military Professional Educational requirements of the Department of Defense. We must identify the skills needed to effectively direct and integrate the activities of a variety of functional areas at different levels of war and across the spectrum of contingencies. "We have already discovered that we can no longer train our soldiers to be only warfighters. The majority of the operations in which the US military has participated in the last 20 years have been operations other than war (peace keeping, humanitarian assistance, and security)."⁴ Each of the operations included an information operations component.

It must be determined to what extent Information Operations are a unique Army mission and when the army's role is a part of a mission that applies to all services. In each case we must determine the Army's role in training personnel for Information Operations. However, Information Operations could conceivably become a joint function with the development of education and training managed by the Department of Defense and not the services themselves. These issues need to be discussed as the functional area is put into operation and its missions refined by practice and lessons learned.

The purpose of this paper is to focus on the skill sets required in the Information Operations functional area, and to identify techniques and training mechanisms appropriate to developing these skills. It also examines means to maintain the currency of knowledge in the ever-changing technical subjects that make up those skills. The paper also makes the argument that Information Operations and its' associated skills will grow to become a major specialty and necessarily include governmental and non-governmental participants.

AN IDEAL CANDIDATE FOR A NEW EDUCATIONAL PARADIGM

The Information Operations (FA 30) Officer Qualification Course is an ideal candidate for determining the educational requirements of the future and thus introducing a new educational paradigm. The course recipients represent a new generation of warriors whose mission is heavily technology based. Whether they are integrating deception plans or defending the computer network from hackers, they either target or defend technology. They must constantly keep up with changes and advances in the civilian as well as the military technological arena. The technologies that they employ are in many cases the same that the civilian population uses. The military does not control the rate or direction of change, but instead must react to it. It also means that the military no longer has the luxury of ignoring civilian research advances until they have military applications. The information technology area creates new products and services almost continually. "Ten years ago the personal Computer was rather new. Today one is purchased every three seconds."⁵ Maintaining a professional standard in this area requires familiarity with the new products and services. Adding to this torrent of new knowledge are the programs and protocols that are used by hackers to exploit the weaknesses in new products and services.

To introduce the functional area, we consider the Army organizational elements and missions that have been identified as requiring Information Operations-qualified individuals. There are three main organizations that directly support the land component commander, namely, the Field Support Team, the Vulnerability Assessment Team, and the Divisional IO Section, which can be modified to support a Task Force or Brigade.

"Field Support Teams (FST) are 10 person teams that provide support to the land component commander, major Army commands, separate Army commands and, active and reserve components in facilitating the planning and execution of information operations by providing specialized subject matter experts in all information operations elements... FST's support offensive and defensive IO training by assisting commands in planning, conducting and evaluating IO during joint, combined and service specific exercises. They maintain a regional focus on EUCOM, PACOM, SOUTHCOM, CENTCOM and JFCOM..."⁶

"Vulnerability Assessment Teams (VAT) are 10 person teams that provide direct support to deployable army units and organizations in garrison, deployment, and exercises by conducting operational and technical vulnerability assessments. VAT's focus on the command's susceptibility to an adversary's information operations through operational and technical vulnerability assessments and risk analysis on the tactical commander's information flow infrastructure. They also maintain a regional focus on EUCOM, PACOM, SOUTHCOM, CENTCOM and JFCOM."⁷

"The Divisional Information Operations Section has 6 personnel assigned to provide dedicated Information Operations staff support to the division through either the G3 or the Chief of Staff. They

assist the warfighters in successfully executing the mission by planning and synchronizing information operations through the division's military decision making process to support the commander's intent." ⁸

The missions of the organizational elements involve planning, training, and assessing both military and technical aspects of the unit they are supporting. They are responsible for both offensive and defense aspects of Information Operations. The FST and the VAT also have a regional focus so that they maintain a knowledge base on the infrastructure capabilities and vulnerabilities in a given geographical area. In so doing the teams are better prepared to immediately provide value added to the commander they are supporting. The members must be well educated on military and civilian technologies, military operations, regional infrastructure and customs, and must possess subject matter expertise in one or more topics.

The focus of Information Operations is to enable faster decisions making for friendly commanders and influence the decision making of our adversary. To do this effectively we have to know what the enemy knows, how he thinks, and how he values his resources. We must keep up with the latest weapons that can be used against us, whether developed by a recognized enemy, a computer manufacturer in Silicon Valley, or a teenage hacker in another country. Because of this unbounded environment, the services are still struggling to define exactly what Information Operations includes and what skills the new warrior will need.

The Department of Defense definition contained in Joint Publication 3-13 (Information Operations) is "actions taken to affect adversary information and information systems while defending one's own information and information systems".

To understand this definition we must know what is meant by information and information systems. "Information is defined as facts, data or instructions in any medium or form. It is the meaning that a human assigns to data by means of conventions used in their representation". ⁹

Information Systems are those technical components that connect information to the people who need it, and thereby assist in the decision making process. Those include computers, telecommunications lines, hardware, software, and firmware. It also includes tactical and commercial systems and software.

"The IO functional area links operations security (OPSEC), military deception, psychological operations (PSYOP), electronic warfare (EW), physical destruction, civil affairs (CA) and public affairs (PA) capabilities to achieve IO objectives. IO officers synchronize IO actions to help fulfill the commander's intent, provide critical information for expeditious decisions and exploit information advantages. The IO functional area supports commanders of the unified commands; the joint staff; Department of Defense (DOD) agencies; Department of the Army (DA) and its major commands..."¹⁰

The information Operations Officer is responsible for the integration and synchronization of all assets available to the commander to successfully complete the mission. The Information Operations officer plays a key role in assuring asset availability by protecting all these assets from computer attack. The assets available to a CINC or even a Division Commander will include assets owned by allies,

civilians, non-governmental organizations, and other governmental organization. This implies that the Information Operations Officer must be knowledgeable of the capabilities and vulnerabilities of all the information systems that may be present in the area of operations. Today however, because of the wide range of information systems and technologies, the area of operations has expanded to the entire world and the immediate space surrounding it. Technology and the interconnectedness of the Global Information Infrastructure (GII) have made access to assets anywhere a possibility. The assets employed will differ depending on the type of mission and geographical location, but will always include the vast amount of computer systems and technologies organic to the supported organization and will be connected to the GI.

In short, Information Operations is the integration of all resources and assets available to achieve Information Superiority. "Information Superiority is the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same."¹¹ Information Superiority leads to information Dominance. Information dominance is "the degree of information superiority that allows the possessor to use information systems and capabilities to achieve an operational advantage in a conflict or to control the situation in operations short of war, while denying those capabilities to the adversary".¹²

The focus of Information Operations Officer like the environment in which they work, is difficult to bound, including as it does private citizens, non-governmental agencies, military and other governmental agencies and allies. The Information Operations Qualification Course needs to describe and explain this unbounded and difficult to define environment and prepare its graduates to synchronize and integrate the complex and diverse technologies contained therein.

THE CASE FOR CONSOLIDATION UNDER THE DEPARTMENT OF DEFENSE

Information Operations present an opportunity to develop a truly joint functional area whose educational content, training mechanisms, and certification should be developed by the National Defense University (NDU) with guidance provided by the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence (ASD (C3I)). This method of development would best meet the needs of the Department of Defense and the services by standardizing the content of the instruction, saving development costs, ensuring integration, and increasing synergy within the functional area and on the Joint and Unified Command staffs.

Information Operations as a separate and distinct functional area is new to the armed services. Only within the last few years has work begun to formalize the force structure and determine the skill requirements for these new warriors. Each service has set out to develop doctrine and reclassify its internal positions to fulfill the functional requirement. Each is determining separately what existing positions will be eliminated and replaced with the information operators within the constraints of static or diminishing end strength. They are independently determining what benefit the service will receive from the presence of information operators. They are also attempting to determine what career path should be designed to get maximum utilization from the specialized training and experience these individuals will have. This bottom up approach has served the services well in the past in the development of service unique requirements. But the time has come for a new more integrated approach.

Technology and information integration is not service-specific. Joint teams will fight all levels of war in the 21st century. The Airland Battle Doctrine of the 1980's was the last doctrinal attempt at identifying the importance and indispensability of combined arms warfare. Joint Vision 2010 states that "To achieve integration while conducting military operations we must be joint: institutionally, organizationally, intellectually and technically."¹³ We should use the training requirements of Information Operations to support and institutionalize this concept within the services.

All senior level Information Operations education should be jointly developed and taught in accordance with the Joint Professional Military Education (JPME) standards. Only then can we hope to achieve technical and intellectual integration. We should immediately capitalize on the existing innovations and strengths of the services and optimize their efforts.

We should identify NDU as the one academic institution responsible for the development and preparation of Information Operation education. "NDU institutions enhance the education of selected officers and civilian officials in national security policy and strategy, national resource management, information resource management, information warfare, and joint and multinational campaign planning and warfighting".¹⁴ By so doing we can maximize the benefits obtained from all Information Operations and ensure that the service members who participate in these operations will be knowledgeable of all the assets and capabilities in the joint inventory. This will allow them to bring the right resources to bear at

the critical point to achieve victory. This integration process must include doctrinal development and organizational adaptations, as well as tactics.

The danger of not fully integrating all aspects of a technological advancement is evidenced by the following examples. "In the 1870's the French military had the advantage of a precursor to the machine gun in their war against the Prussians, the Gatling-like *Mitrailleuse*. However, because it rode on a carriage like a cannon it was placed with the artillery rather than up front with the infantry where it could have been able to better support the combined arms operation. The French organization had not adapted to new technology to its best advantage. In 1940 France had better tanks with larger guns and armor thicker than the opposing Panzers but limited their effectiveness by tying them to infantry support."¹⁵ In both cases the French did not fully integrate a technological advantage, opting instead to isolate the technology in one sector of their armed force. This is the lesson to be learned for joint development and implementation.

The business case for consolidating IO in the Department of Defense can be made by analyzing three key areas: Applicability, Integration, and Synergistic Effects.

Information Operations as an independent functional area or discipline is most applicable at the strategic and operational levels of war. At these levels IO supports the informational instrument of national power and plans for the use of the military instrument of national power. At this level of war the organizations responsible for executing these responsibilities are the Geographic Commanders in Chiefs (CINC's). The CINC's are joint organizations and are responsible for the implementation of all assets available amongst all the services. The IO planning cell on a Joint Staff would be made up of multi-service staff members at the O5 to O6 level. This level of war also corresponds with the intermediate and senior level of military education.

The Joint Professional Military Education (JPME) emphasis at the Intermediate level is on Joint Doctrine, Joint and Multinational Forces at the Operational Level of War, Joint Planning and Execution Process, and Systems Integration at the Operational Level of War. Information Operations is about the integration of systems in planning and execution. "The JPME for the senior level of military education emphasizes National Strategy, National Planning Processes, National Military Strategy and Organization, Theater Strategy and Campaigning, and Systems Integration in the 21st Century Battlespace."¹⁶ Therefore Information Operations is most applicable where it can be planned and executed by individuals who have been trained to make the best use of its capabilities, those joint staff officers on the CINC's Staff.

Integration has been mandated by the Goldwater-Nichols Act of 1986, and most recently articulated in Joint Vision 2010 and its corresponding implementation Guidance. The integration of the services will better achieve interoperability and reduce unnecessary redundancy. An additional supporting argument for integration can be made regarding cost and personnel. By developing the training at one location and making the training applicable to all the services, individual services will save the personnel and cost that they would have expended developing the courseware.

Integration must be considered in the context of all future military operations. Future engagements will be conducted jointly with the services supporting each other. These future joint operations, however, will not consist of only the four services, they will include our allies, coalition partners, and other governmental and non-governmental agencies. All of these participants will bring with them diverse operational capabilities, new and old tools, and different ways of combining the tools and capabilities to execute the mission at hand.

This collection of participants and their unique tools and capabilities must all be properly integrated to achieve synergistic effects. In Information Operations, synergy is achieved by successfully coordinating and timing the effects of all the supporting disciplines to influence the decision making capability of the enemy, while maintaining the timely and accurate flow of information and input to the decision making capability of our leaders. This is called Information Dominance, and to achieve it we must gain a knowledge advantage over an adversary.

An additional supporting argument for synergistic effects can be made by considering the time it takes for a joint IO staff to be at its highest state of training and readiness. If all the members had the same education, their knowledge baseline would be much higher than if each of the staff members were trained individually and separately by the services. They would also be more familiar with the capabilities of the other services and how to employ joint assets. Hence, in the event that a particular service was not represented at the time of a crisis, the other members would be able to sufficiently continue without detrimental effects from the lack of service-specific knowledge.

An immediate need is to determine which organization is best suited for developing Information Operations training in light of the complicated mix of participants involved. The Department of Defense is the one organization that does not have embedded within it the parochialism of the individual services. The Department is also familiar with the integration of other governmental and non-governmental agencies. For example, they write the policies on the use of civilian personnel and contractor utilization and defend those policies to Congress. In that the key to successful Information Operations is the integration and synchronization of all assets available (not just military assets) to achieve Information Dominance, such experience on the part of the Department of Defense will prove valuable.

NEW TECHNIQUES AND MECHANISMS FOR EDUCATION

Assuming that the National Defense University with guidance from ASD (C3I) was responsible for all Information Operations education and training, how could it effectively accomplish that mission? The frequency of update would have to be high, considering the speed of technical changes within the services and in the civilian sector.

Change has always been present in warfare, however the increasing pace of change is driving the educational requirements of today. Technology is changing rapidly and its impact on the equipment and systems utilized by the military are also changing at an ever-increasing rate. Because of "recent reductions in the military forces of the United States (approximately 33% since 1985) and an increase in the number of real missions and deployments (300%)"¹⁷, the traditional training mechanisms and techniques may no longer be adequate. To maintain the required knowledge base expected of today's information warriors, while allowing them to continue performing their mission, new methods and techniques must be explored.

As the reserve components (RC) are asked to take on a greater role in assisting the active component in meeting the mission requirements of the National Security Strategy, there is an even greater need for training. However, the inclusion of the Reserve Components also dramatically increases the training resources available to the Armed Forces of the United States. These reservists provide a huge knowledge base of current technology and procedures that can be transferred from the private sector for inclusion in military applications. Who is better able to provide the training than the individuals who work with the technology on a daily basis? "This has been an untapped resource the Department of Army identified in 1998 when it became apparent that the services could not maintain a trained and capable technology workforce without the use of private sector contractors."¹⁸

Reservists have always been managed by the formal training (military specialty) that the services provided them. They have very rarely been used for the skills that they have acquired through their civilian occupations. An example of this type of skill not being utilized occurred when the military needed linguists. The official mechanism for recognizing language skill was by the recording on the official military record of the Defense Language Aptitude score. However, this score was only present for personnel who took the test. It did not account for the literally hundreds of reserve component personnel who could read, write and speak Croatian or Serbian, as a result of ethnic upbringing. Utilizing the reservist in this capacity is a new technique that should be combined with the new mechanisms of distance learning and web based training to provide training to the individuals who need it.

New mechanisms and techniques are required to instill the knowledge needed in a timely fashion. "New challenges or technologies have rendered the response time of traditional professional education unacceptably long. By the time the research is done, the texts written, the faculty trained and the

curriculum change approved, a problem may have reached epidemic proportions.”¹⁹ Knowledge has a shelf life and that shelf life is growing shorter.

Problems in the technical industries are compounded by the shorter shelf life of knowledge. At Sun Microsystems they believe that shelf life of their employees knowledge is one to two years. “In fact over 75% of Sun Microsystems revenue in 1996 was generated from products in the market less than two years.”²⁰ Many international corporations have identified the requirement to maintain the skills and knowledge of their technical workforce. To accomplish this they have created corporate universities that use a combination of technologies to educate their employees in this constantly changing knowledge environment. “The projections for the year 2000 were that 50% of all training in these universities would be accomplished using the technology.”²¹

New techniques are needed to ensure that personnel are not kept away from their duty stations for too long. These separations tend to degrade proficiency and affect the operational tempo of the military unit. The new techniques and mechanisms must make use of the technology while maintaining the proven theories and principles of adult education. Conventional, instructor-delivered training is still relevant and required for many subjects. The current educational paradigm should not be completely eliminated – only modified to take advantage of the new technologies. “Figure 1 shows the attributes and benefits of e-learning”²². Today’s complexities and changes require knowledge to be updated more frequently and with less interruption of mission.

e-learning Attributes	Benefits
Dynamic	Continually Updated content repository insures up-to-date information Access to experts and learning community supports continually evolving knowledge base.
Current	Web links to other resources - like libraries, software applications, the press, etc. – keep us in touch with rapid changes in the environment. Performance support tools expedite on-job learning process to improve individual productivity and organizational responsiveness.
Systematic	Enables continuous learning to prevent employee obsolescence. Systems approach supports job transfer and incorporates new experiences back into the organization's knowledge base.
Collaborative	Virtual learning communities within the system encourage peer relationships and learning teamwork. Access to on-line mentors encourages use of experts when problem solving and

	making decisions.
Personal	Personalization engines and assessments create tailored learning experiences that evolve in response to increased learner competency. Personalized access creates individualized programs designed to accomplish specific tasks.
Comprehensive	Curriculum paths enable learners to manage their own career development Access to internal and external courseware creates comprehensive and complete curriculums.
Empowering	Encourages us to take responsibility of our learning journey by giving us control over our learning experiences. Enables a networked organization by supporting frontline employees with instant access to information and knowledge resources

TABLE 1

Some of the new techniques and mechanisms to be considered can be separated into two types: synchronous and asynchronous. Synchronous refers to training that is delivered and received at the same time. An example would be conventional classroom instruction, where the instructor provides and delivers the knowledge while the students receive. Currently we provide this type of instruction in our training bases and schoolhouses at specifically scheduled intervals. This type of instruction requires the students, the instructor, and the facilities all to be available at the same time and limits the subject matter to that which has been prepared for the specific course.

Asynchronous training allows students and instructor to be geographically separated and participating in the learning process at different times. An example is Web-based training. In Web-based training the instructor provides the information on a Web site and the students read the information or receive the information at a time of their choosing. Questions are submitted as they are conceived via e-mail, and the instructor provides the answers as his or her schedule permits.

This technique allows for a more thorough and timely exchange between student and instructor than is possible in the traditional setting for the following reasons: 1) The student has time to consider the question in solitude without trying to keep up with what is being said in the classroom. 2) The question is documented (typed in the email), allowing time for reflection on the part of the student to ensure the question is written properly and expresses the thought that was conceived. 3) The instructor checks email between class sessions and therefore are more available to the student, which shortens the time between contacts. 4) The instructor now has the opportunity to leverage the full power of the Web to help

answer the questions, and can provide pictures, documents or other references that the student can explore for deeper understanding of the subject matter.

Chat sessions and discussion rooms are used to have real time discussions with classmates with or without the instructors' presence. These sessions do require synchronous timing but do not require geographic relocation. This technique maximizes the use of time of many individuals and can still be controlled with the use of deadlines and schedules. Chat sessions provide the dynamic interaction of multiple people with different perceptions and understandings without requiring them all to be located in the same geographical space. By eliminating the geographical requirement, more people from dispersed physical locations can participate in the discussion. Another benefit of the on-line chat is the artifact or documentation of the discussion. The ability to document what has been said is useful for future study as well as a tool to eliminate occasional misunderstanding of the spoken word.

CD-ROM based training: In this training, the information is placed on a CD-ROM by the instructor or the technical support staff of the school. Additional thought and preparation is required of the instructor and a support staff or contractor is needed to produce this training. The CD-ROM training allows for the integration of text, video, images, and dynamic links to other information.

Depending on the subject, a lecture can be placed on the CD with the text of the lecture scrolling across the bottom of the screen just as in closed caption television. Images such as pictures or presentation slides can be displayed simultaneously with the video, or can replace the picture of the video with the slide while the audio part of the lecture continues. The CD-ROM based training is advantageous to the student because of its ability to replay a particular segment and have the lecture and text as an artifact that can be returned to as often as needed during the course.

Once the training is documented on the CD-ROM, it can be delivered to multiple students in different locations. The education process occurs at the pace of the individual student, and the students proceed through the CD-ROM material until they have completed the course. The software built into the CD-ROM can allow for self-grading of quizzes and tests, as it can also identify incorrect answers. It allows is for quicker updating of the material and durability on the part of the courseware. When combined with e-mail, the transaction time between student and instructor is reduced, thereby increasing the efficiency of this asynchronous technique.

Simulations and Virtual Reality (VR) are two other techniques that could be used to train the warriors of the future. Both of these mechanisms could be used in a synchronous or asynchronous mode. These mechanisms utilize situational involvement to transfer knowledge to the students. "Marshall McLuhan, one of the gurus of the 1960s is reported to have said, "Those who draw a distinction between education and entertainment don't know anything about either".²³

Simulations and Virtual Reality (VR) are currently employed more for entertainment than for education. However, training pilots on a flight simulator definitely is considered educational not entertainment. In certain ways it can also provide a better educational experience than being in a real airframe because instructors can program the simulator to operate in conditions which may only happen

once in a lifetime in a real airframe. This allows the pilot to make a mistake, learn from that mistake and try the scenario again with minimal cost to the government (airframe and pilot).

How could simulators be used in the information operations arena? One scenario that has proven useful thus far is to evaluate how a virus would travel once in a system, based on the routine usage of that system. By knowing how and where it may travel, network engineers could identify places where the network connections could be disconnected to isolate the virus until it could be eliminated.

A second scenario could be the use of virtual reality to represent a data packet flowing through a network and observe where the packet goes and if there were any programs (sniffers) on the network that copied the contents of the packet prior to arriving at its final destination. The trace capability is currently available, the VR scenario would make it easier for the operator to track.

These techniques and mechanisms allow for the education process to be continuous, not just periodic. Continual education supports the concept of lifelong learning. Lifelong learning should be the goal of all Department of Defense personnel. It is a requirement for Information Operation officers just to maintain proficiency in their field.

CONCLUSION

In today's rapidly changing world innovation is the key to success. Knowledge has a short shelf life. Computer processing speeds are getting faster than ever imagined, and standards for software and interoperability are being created and agreed to that will provide the tools needed to create a robust Global Information Infrastructure.

We live in an interconnected world. In this world statecraft is conducted electronically and alliances and coalitions are virtually maintained. The next major battle for vital national interests will be fought and the instruments of national power wielded in this global information environment. This is the information battlefield where Information Operators are already engaged on a daily basis.

Information Operations integrates all information to achieve Information Superiority and provide the commanders and combatants the information needed, when it is needed, and where it is needed, regardless of where or in what form the information resides.

Information Operations uses the assets of all the services, other governmental agencies, non-governmental agencies and civilian infrastructures. In light of the boundless scope of this environment the responsibility for the development of educational content and training distribution should reside with the National Defense University with guidance from the ASD (C3I). This initiative would increase the integration and synergy of our joint operations and meet the intent of Joint Vision 2010.

New techniques and mechanisms should be utilized to maintain the knowledge level of Information Operations officers. New mechanisms include Web based training, CD-ROM training, simulations and Virtual Reality. These mechanisms allow for quick update and easy accessibility, and support the concept of life long learning.

Information Operations Officers are the warriors of the future. We should employ today's best technologies to educate, train and support them for their vital mission.

WORD COUNT = 5958

ENDNOTES

¹ Addington, Larry H. "The Patterns of War Since the Eighteenth Century", Indiana University Press, Bloomington, IN, 1984, p. 34

² Scales, MG Robert H. Jr, "Future Warfare", US Army War College, Carlisle Pennsylvania, 1999, p. 3

³ Chairman of the Joint Chiefs of Staff, Joint Vision 2010, p.16

⁴ MG Joseph K. Kellogg Jr, Acting Deputy Chief of Staff For Operations and Plans, United States Army, Briefing to AWC Fellows, Pentagon, Arlington, VA. 28 JUL 1999

⁵ Ballmer, Steve, President and CEO of Microsoft Corporation made this statement in a television advertisement in May 2000 on network TV.

⁶ National Guard Bureau, Information Operations Concept of Operations, Arlington VA, p. 5-1

⁷ *ibid.* p. 3-1

⁸ *ibid.* p. 4-1

⁹ Joint Publication 3-13, "Joint Doctrine for Information Operations", 9 October 1998 p. 1-9

¹⁰ <http://www-cgsc.army.mil/dao/fa30/WhatisFA30.htm> The FA 30 Proponent Web Site

¹¹ Chairman of the Joint Chiefs of Staff, Joint Vision 2010, p.16

¹² US Army Information Operations Brochure, Department of the Army, Washington DC 1997

¹³ *ibid.* p. 4

¹⁴ Chairman of the Joint Chiefs of Staff Instruction, 1800.01 1 March 1996, p. A-1

¹⁵ Mark A. Johnstone, Stephen A. Ferrando and Robert W. Critchlow, "Joint Experimentation: A Necessity for Future War", Joint Forces Quarterly Autumn/Winter 1998-99, p. 15-24

¹⁶ Chairman of the Joint Chiefs of Staff Instruction, 1800.01 1 March 1996, p. A-B-2

¹⁷ MG Joseph K. Kellogg Jr, Acting Deputy Chief of Staff For Operations and Plans, United States Army, Briefing to AWC Fellows, Pentagon, Arlington, VA. 28 JUL 1999

¹⁸ The army National Guard and the US Army reserve were invited to an initial meeting at the Land Information Warfare Activity (LIWA) by BG Lawlor to investigate how the reserve components could help fill this need.

¹⁹ Curry, Lynn, Jon F Wergin and Associates, "Educating Professionals – Responding to New Expectations for Competence and Accountability, Jossey-Bass, San Fransisco, 1993 , p. 216

²⁰ Meister, Jeanne C, "Corporate Universities: Lessons in Building a World Class Workforce", McGraw-Hill, Inc, 1998, p. 9

²¹ *ibid.* p. 132 (was based on the Annual Survey of Corporate University Future Directions 1997 by Corporate University Xchange, Inc.)

²² www.smartforce.com/corp/articles/elearn.htm

²³ David S. Sewell, *New Tools for New Minds: A Cognitive Perspective on the Use of Computers with Young Children*, St Martins Press, New York, 1990, p. 87

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