Information Operations and the Conduct of Land Warfare

by Robert J. Bunker

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Foreword

Information operations (IO) represent a core Army XXI capability. They will allow for unprecedented battlespace awareness, increased speed and tempo in land warfare and, ultimately, for Army information superiority. These expectations must be tempered with the knowledge that they represent the institutional Army view of IO. Other views exist which challenge current Army warfighting assumptions.

The central argument developed in this article concerns whether IO will be an adjunct to current operational methods—a force multiplier—or a totally new operational mechanism which will provide warfighting capabilities which heretofore did not exist. Both schools of thought are analyzed along with a discussion of IO definitions and target sets and IO's land warfare implications.

This article's value is derived from its ability to generate debate on an issue of central importance to the Army. As the victors of the Cold and Gulf Wars, our approach to IO is inherently more conservative than that of many of our future opponents, some of whom will rely upon cyberterrorism and other asymmetric attempts to overcome our battlefield advantages. Thus, while IO will allow us to greatly advance our traditional warfighting capabilities, we must recognize that they may open up new warfighting venues which will need to be explored and debated to ensure that the Army retains its battlefield dominance into the early 21st century.

—General Gordon R. Sullivan, US Army, Retired, AUSA President, October 1998

THIS ARTICLE FOCUSES on the implications of IO on the US Army's conduct of land warfare over the next decade.[1] This transitional period—from the experimental Force XXI to the digitized Army XXI—offers many promises, potentials and even pitfalls for the world's predominant land power force. Army Brigadier General James M. Dubik has recognized this in an earlier ILW paper "Creating Combat Power for the 21st Century."[2]

The term "information operations" conjures up many images. To some the vision of Robert A. Heinlein's classic *Starship Troopers* comes to mind with its "mobile infantry" forces in high-tech body armor.[3] Armed with vast amounts of individual firepower and linked into information nets, these soldiers provide one future Army force archetype. Another vision is at odds with the high-tech warrior tradition. It is that of out-of-shape armchair soldiers sitting behind their computer terminals launching war-winning cyber-attacks at the stroke of a key. A third vision is derived from the cyber-punk genre. It is that of a "Johnny Mnemonic-type" individual, with hard-wires in his brain and enough downloaded information to make a modern supercomputer look like a kid's cheap toy.[4] Such enhanced individuals would give a whole new meaning to the concept of "special forces." While some truth probably exists in each of these visions, for now that is all they are—future visions.

This article will not consciously promote an underlying thesis or policy with regard to the Army's relationship to IO except for the self-evident fact that they are becoming increasingly critical to its continued battlefield dominance. This article has two goals: to focus on the important transitional period we are now facing and show the basis of IO thinking and the two competing schools of thought which have developed, outlining areas of potential synthesis between them; and to assess the potential impact of these operations on land warfare and analyze some of the issues associated with them.

Defining IO

"Information operations" is a relatively new term. In the current Army Field Manual (FM) 100-5, *Operations*, June 1993, the term is not even mentioned.[5] Early definitions of this term can be found in US Army Training and Doctrine Command (TRADOC) Pamphlet 525-5, *Force XXI Operations*, August 1994: "Continuous combined arms operations that enable, enhance, and protect the commander's decision cycle and execution while influencing an opponent's; operations are accomplished through effective intelligence, command and control, and command and control warfare operations, supported by all available friendly information systems; battle command IO are conducted across the full range of military operations."[6] FM 100-6, *Information Operations*, August 1996, defines IO as "Continuous military operations within the MIE [military information environment] that enable, enhance and protect the friendly force's ability to collect, process and act on information to achieve an advantage across the full range of military operations; IO include interacting with the GIE [global information environment] and exploiting or denying an adversary's information and decision capabilities."[7]

The best IO definition is currently provided by DOD. IO are defined as "actions taken to affect adversary information and information systems while defending one's own information and information systems.". . . IW, in turn, is conceptually subordinated to IO. It is defined as "information operations conducted during time of crisis or conflict to achieve or promote specific objectives over a specific adversary or adversaries."

The value of information to the conduct of land warfare has been commented on by Army Chief of Staff General Dennis J. Reimer—"The evolving military information environment will fundamentally change the way we, the Army, conduct operations in peace and conflict. IO includes all measures, both offensive and defensive, taken to achieve information dominance. The Army will integrate IO into every aspect of Army XXI."[8]

Yet two years later, some debate exists concerning the nature and value of IO to Army XXI. Early Army definitions are in variance with current joint force perceptions. Further, while IO are recognized as being potentially of great value, their actual value to date is disputed. One school of thought posits that they represent an adjunct to current

operations—the end result of which is to enhance current Army capabilities by making what it has traditionally done better by means of a force multiplier effect. Another school of thought suggests that IO will provide the Army with new capabilities. Instead of being a simple adjunct to current operations, according to this school, the influence of the "information revolution" on warfare will result in the redefinition of operations themselves. Both schools do agree that IO has become a dominant, albeit at times ambiguous, concept for Army professionals to wrestle with.

As can be seen even within the Army, one of the maddening aspects of IO is defining them. This is particularly troublesome for those who did not grow up with computers and who inherently do not feel comfortable working with them. An Internet-based attack, the use of propaganda and even terrorism can be labeled as forms of IO. Unless individuals can agree upon a broader definition, their examples have little in common with each other.

It is probably more useful to view two forms of information existing based upon message and processing considerations. The first form,* data, *is raw, disorganized and unfiltered in nature. . . . The second form,* information, *represents data which has been filtered and organized by human and electronic processors. Information represents a smaller, but more valuable, resource pool than data and is only as good as the validity of the data provided and the sophistication of the processor involved.

Joint force definition. The best IO definition is currently provided by DOD. IO are defined as "actions taken to affect adversary information and information systems while defending one's own information and information systems."[9] As previously discussed, early Army definitions were subordinated to more traditional commander and force needs. The joint force definition is much more abstract in nature.[10] It literally decouples the concept of operations from the physical environment in which the Army is used to campaigning. As an outcome, cyberspace takes on its own form of existence and becomes, in its own right, a form of battlespace where IO can be conducted. For those soldiers and leaders who think solely in terms of tanks, helicopters and artillery pieces, this conceptual leap is extremely difficult to grasp, much less accept.

Defend Our	Attack Their
Information	Information
Information Systems	Information Systems

Figure 1. Basic Information Operations.

Information warfare (IW), in turn, is conceptually subordinated to IO. It is defined as "information operations conducted during time of crisis or conflict to achieve or promote specific objectives over a specific adversary or adversaries."[11] The basic joint force IO concept is illustrated in Figure 1.

The next challenge is differentiating between "information" and "information systems." The definition of *information* used in *Concept for Future Joint Operations: Expanding Joint Vision 2010* is "data collected from the environment and processed into a usable form."[12] *Data* is then defined as "representation of facts, concepts, or instructions in a formalized manner suitable for communication, interpretation or processing by humans or by automated means. Any representations such as characters or analog quantities to which meaning is or might be assigned."[13] Based on these perceptions, an information attack upon an opposing force's (OPFOR's) systems result in the disruption of its cognitive hierarchy. This is done by targeting data—a processing function. This will directly affect higher-level functions such as cognition and judgment.[14]

War in the Information Age outlines four basic forms of information that form the core upon which America's information-age Army procedures and organizations will be built:

- Content information is the simple inventory of information about the quantity, location and types of items.
- Form information is the descriptions of the shape and composition of objects.

A soldier receives raw voice data and must "process it into a usable form" before retransmitting it by automated means to both higher and lower headquarters.

US Army

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• Behavior information is three-dimensional simulation that will predict behavior of at least physical objects, ultimately being able to "wargame" courses of action.

• Action information is the kind of information that allows operations cells to take appropriate action quickly.[15]

The attack and defense of each of these four forms of information could also fit into the IO mandate. More recently, three views of information prevail: "The first considers information in terms of the inherent message, the second in terms of the medium of production, storage, transmission and reception. The emerging third view transcends the former two; it speculates that information may be a physical property—as physical as mass and energy, and inherent in all matter."[16] The first view generally complements the *Joint Vision 2010* processing definition based upon IO directed against data. It also seems to include information which is viewed as "organized data"—as opposed to raw data, which is disjointed in nature because it has not been processed through some sort of filtering system. The second view, which is medium- or conduit-based, would appear to fall under the rubric of information systems rather than information.

The third view, based upon information as a physical property, a structuralist perspective, proposes that "Information is as basic to physical reality as matter and energy—all material objects are said to embody not only matter and energy, but also "information." The spectrum for this view runs from modestly regarding information as an output of matter and energy; to regarding information as equal in importance to matter and energy; to regarding information as even more fundamental than matter and energy. Information, then, is an embedded physical property of all objects that exhibit organization and structure. This applies to dirt clods as well as DNA strands."[17]

While this cutting-edge scientific view will have many implications for future IO, in tandem with the development of the new sciences of chaos and complexity theory and other post-mechanical and nonlinear disciplines, it will more heavily influence the Army After Next (AAN) than the more immediate Army XXI.[18]

Over the next decade, it is probably more useful to view two forms of information existing based upon message and processing considerations. The first form, *data,* is raw, disorganized and unfiltered in nature. The vast majority of battlespace information is gathered from human and electronic sensors. The second form, *information*, represents data which has been filtered and organized by human and electronic processors. Information represents a smaller, but more valuable, resource pool than data and is only as good as the validity of the data provided and the sophistication of the processor involved.[19] Many information-specific typologies can exist, including the previously mentioned one based upon content, form, behavior and action information.

The *Concept for Future Joint Operations* defines *information system* as: "Integrated systems of doctrine, procedures, organizational structures, personnel, equipment, facilities and communications designed to support a commander's exercise of command and control across the range of military operations, by collecting, processing, analyzing, archiving and disseminating information."[20]

The current special forces definition represents a variation on this theme: "The personnel and equipment to manage, display, transport and disseminate information needed for rapid decision making necessary for victory."[21] The medium view mentioned earlier suggests that such a system is composed of information production, storage, transmission and reception.

Probably the most useful way of defining a generic information system is to recognize that it requires seven basic components to minimally function.[22] These are sensors which provide data; processors who filter and organize it into information; receptors who utilize it; databases where data and information are stored; transmitters who disseminate data and information; rules which define system operation and structure; and synergy which allows a system to function better than the total sum of its parts. These components are not mutually exclusive. A receptor, for example, might be a decision maker or a trigger-puller or could just as well be a sensor which has been provided with new information concerning its sensing mission. What must also be recognized is that an individual soldier or a tank and its crew can be thought of as a miniature information system form even though the system which is being discussed in this article applies to Army XXI itself. An applied view of IO is expressed in Figure 2. It provides the conceptual basis from which the conduct of Army XXI IO can be discussed.

Defend Our	Attack Their
Information	*Information*
• Data	• Data
• Information	• Information
Information Systems	*Information Systems*
• Sensors	• Sensors
• Processors	• Processors
• Receptors	• Receptors
• Databases	• Databases
• Transmitters	• Transmitters
• Rules	• Rules
• Synergy	• Synergy

Figure 2. Applied Information Operations.

Army XXI IO

Derived from Figure 2, nine basic target sets exist in IO. These target sets can be applied against the popularized notion of the Clausewitzian trinity of a nation-state represented by its military, government and people. By necessity, Army XXI IO will focus upon the MIE. However, attributes of the informational environments belonging to the government and its people will impact the success of Army XXI on the battlefield. Increasing Army reliance on civilian Internet switches represents one example. If the Internet were disrupted by hackers, operating independently or in the employ of a foreign government or criminal organization while a military operation was in progress, information exchange between Army units could become severely disrupted. Another example can be derived from a recent incident. On 25 June 1998, the computerized reservation system belonging to American Airlines went down for 3 hours for unknown reasons. Flight delays resulted which ranged from 15 minutes to 2 hours.[23] Civilian carriers provide the Army with an additional surge capability to project its forces immediately. If the reservation systems of these carriers were targeted on an ongoing basis, the resulting chaos could disrupt such a surge capability, not to mention the massive problems it would generate for business professionals and other air travelers.[24]

When specifically applied to the MIE, these nine target sets can be broken down into two derived from information and seven derived from characteristics of information systems. Data obtained by sensors and information generated by processors can be attacked in three basic ways—destruction, degradation and alteration. The *destruction* of data and information is very straightforward—a string of "0s" and "1s" representing bits of information is eliminated. *Degradation* of data and information is the partial elimination of a string of "0s" and "1s" so that message gaps appear. Data and information *alteration* is the resequencing of a string of "0s" and "1s."[25]

Data alteration. Of these three forms of attack, alteration is the most threatening but also the most complicated to undertake. It can result in wrong decisions and actions being made, while also polluting the data and information belonging to a military force. This can produce ambiguity within a force concerning the validity and reliability of sections of its knowledge pool. For example, if the text of an on-line helicopter repair manual for the AH-64D Longbow Apache were altered, leading to a disaster for either the helicopter crewmen or the ground crew, all on-line repair manuals would become suspect. Unless proofed line-by-line or, far more likely, reloaded from secure backups protected by strong firewalls or physical air-gaps, their use would be denied to Army personnel. On the other hand, digital destruction results in the erasure of data and information which would be quite obvious, would not result in faulty helicopter repairs being made and is more easily solved. Possibly a more insidious example would be that of changing the dosage of medications for

A. Morkovkina, *Soldat Udachi*

An unescorted Russian TV crew interviews soldiers during the fighting in Chechnya.

Virtually all aspects of Army operations can be made more efficient via information technologies. In the case of nonstate war in urban environments, "One of the major insights gained from the Russian experience in Grozny concerns information dominance. The importance of being able to control broadcasting capabilities, suppress inflammatory information, influence attitudes and hamper or intercept information flow within hostile elements was abundantly clear. Russian forces were unable to do these things and suffered accordingly.

Army personnel or altering the information concerning the effects of prescribing two medications together so that fatal or near-fatal combinations could result.

Sensors, which range from close-in to stand-off forms, can be targeted by denying them data, altering the data provided, disrupting their sensing capabilities or destroying their capability to function. Data denial focuses on electromagnetic signature suppression and other techniques such as frequency-hopping broadcasts so that sensors are unable to gather data. Data alteration allows sensors to obtain data that the OPFOR wants to be obtained. This could allow a tank to broadcast a truck signature and vice versa or create the illusion that more forces exist than really do. Disruption of sensing capabilities can be undertaken by providing "noise" in the appropriate segment of the electromagnetic spectrum to achieve a masking effect or by the employment of obscurants which can be used to coat the surfaces of sensing devices, making them opaque to electromagnetic radiation. Sensor destruction can be achieved physically, by targeting them with conventional weaponry or by nonlethals such as destructive microbes, or nonphysically via electromagnetic pulse which would burn out their components.

The* Concept for Future Joint Operations *defines* information system *as:
"Integrated systems of doctrine, procedures, organizational structures, personnel, equipment, facilities and communications designed to support a commander's exercise of command and control across the range of military operations, by collecting, processing, analyzing, archiving and disseminating information."

Processors, both human and machine, can be attacked in order to degrade or influence analysis and decision-making functions. Providing processors altered data, via the sensors of their information net, would be the most basic form of such an attack because skewed data input results in skewed information output. Machine processors can also be targeted by corrupting their algorithms with a virus or providing them, as in the case of expert systems, with contradictory instructions which can result in the machine equivalent of a nervous breakdown. Humans, on the other hand, suffer greatly when faced with excessive ambiguity. If a human decision maker, such as a foreign military commander, can be purposefully targeted in this regard, his or her analytical process will suffer. Further, humans have a number of basic biological needs, such as sleep, and if such needs can be denied to them for extended periods of time, their decision-making capabilities will become severely degraded.

Receptors are vulnerable to sender deception and can be made to either believe that information being sent to them is false, as in the case of its appearing to come from an OPFOR when it is coming from their own force, or that information which is being sent to them is true, as in the case of its appearing to come from their own force when it is actually coming from the OPFOR (spoofing). In the first instance, information is not being accepted when it should be. In the second, information is

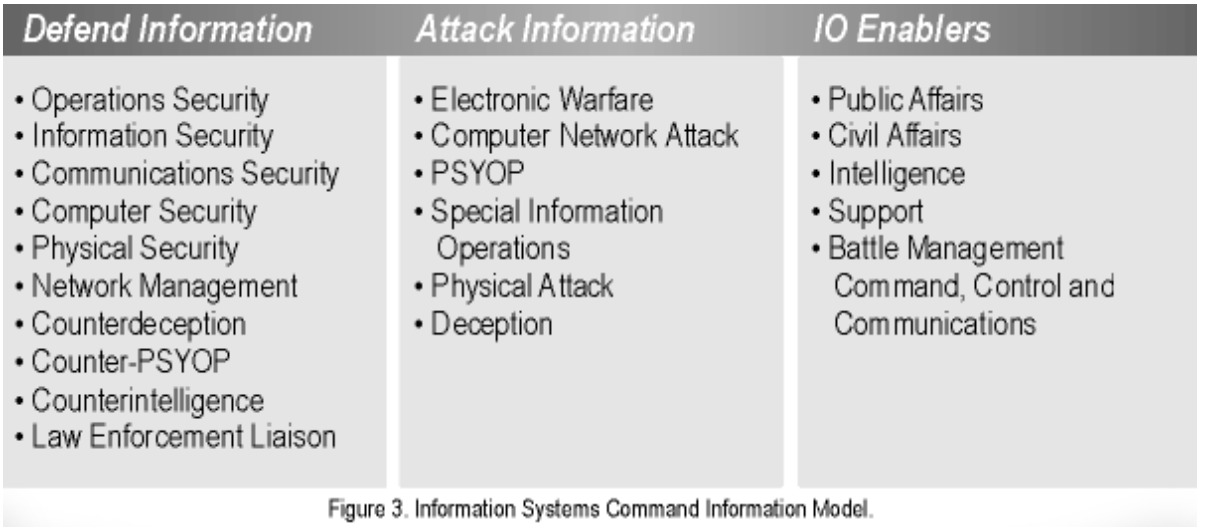


Figure 3. Information Systems Command Information Model.

being accepted when it should not. Both forms of sender deception can cause confusion and disruption to the OPFOR. Anything from e-mail messages to phone conversations to digital radio transmissions to videotapes can be affected in this manner.

Databases represent the physical hosts and mediums in which data and information are stored. This hardware is susceptible to physical and upper-tier nonlethal attack. While less sophisticated than targeting data and information itself via cyberspace, database targeting will result in either informational destruction or the denial of its use until database repairs are made or the surviving information they contain is salvaged and transferred to another database.

Transmitters are representative of communication devices and protocols and are highly susceptible to traditional forms of attack based upon electronic warfare, jamming measures and precision fires. As in conventional operations, this is one of the most desirable target sets to attack because it provides the informational linkages within and between military units.

Rules such as standing operating procedures, the laws of war and military ethics moderate and regulate warfare.[26] Rules help to establish warfare as a legitimate form of organized political violence—an extension of politics by other means—between sovereign states as opposed to mass murder, ethnic cleansing, terrorism and other forms of criminal activity waged by nonstate actors and illegitimate despots. Western rules of war are easy to attack because they represent artificial political conventions. By removing their uniforms and military insignia from their vehicles and mixing themselves in with civilian populations, many non-Western forces actively engage in applied IO against US forces.

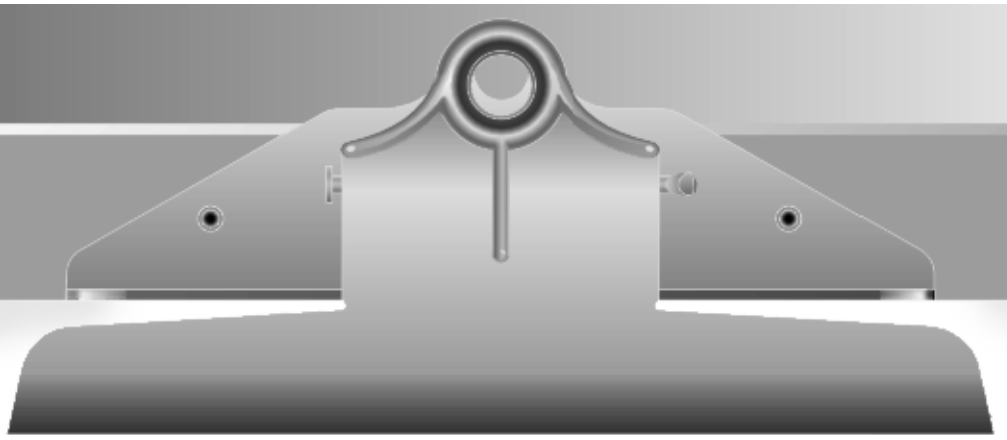
Synergy in an information system results in a military force gaining battlefield advantage by fusing together the individual contributions of its components into something greater than the sum of its parts. This synergy allows for faster OODA (Observe-Orient-Decide-Act) loops, reaction times and decision cycles to take place. By understanding an OPFOR information system process, this synergy can be attacked and degraded, disrupted or destroyed as an outcome of coordinated attacks upon the other IO target sets. As an example, the complete disruption of any one category of target sets, such as transmitters, will cripple an information system. Attacking the proper combinations of target sets may also achieve this desired effect by creating a cascading effect.

US Army Recruiting Command

The primary danger which exists with traditionalist-school thinking is that of being lulled into a false sense of security. Because Army XXI will be so far in advance of its nearest competitors, it may become fashionable to suggest that no one will ever be able to catch up to the Army in warfighting capacity. This would assume that IO will remain subordinate to conventional operations over the long term. As a result, land warfare forces would retain their current capabilities and continually refine them.

Based on the above typology, Army branches can attack specialized parts of an adversary's information and information system, and also help to protect their own assets. The tasking model used by US Army Intelligence and Security Command (INSCOM) breaks down IO into those units/functions which defend information, attack information and provide IO enablers as depicted in Figure 3.[27]

Such actions can be active or passive. A secure firewall between brigade networks would represent a passive form of defense, while installing *Blitzkrieg* software, which recognizes hacking attempts and repels them, would be an active form of defense.[28] The INSCOM model appears to be but one approach to undertaking IO. Because this



Army War College IW Tutorial Terms

Cryptology: A weapon of information warfare designed to encrypt and crack secure communications respectively. Despite significant advances in cryptography, cryptanalysis will continue to be an important weapon aided by equally significant advances in computing power.

Decision Support: As in any decision process, the more information available, the higher the probability of arriving at a useful solution. Likewise, computer decision support is also a key weapon in information warfare and especially in defensive information warfare. Decision support can be used to detect attacks, identify the type of attack, generate defensive options, evaluate options and perform damage assessments. In a similar manner, an adversary's decision support system can be delayed or disrupted with erroneous data.

Destructive Microbes: Researchers are also working on developing microbes which eat electronics components so that, in the event of conflict, these microbes could be introduced into an adversary's electronics equipment to cause failure.

Electromagnetic Pulse: Electromagnetic pulse weapons could be used to knock out enemy electronics equipment. Suitcase-size devices have been developed to do just that.

Infrastructure Attacks: Various possible operations with obvious effects include knocking out telephone switches, crashing stock markets, attacking electronic routers for rail systems, attacking bank accounts, disrupting air traffic control and denying service with, for instance, a ping attack. Note: The "ping" attack gets its name from old sonar techniques. Within a network, a computer can send systematic queries to all addresses and analyze the associated return time, very similar to sonar. Net groups with similar times of return can be associated into a hierarchical structure.

Malicious Software: includes the following:

Viruses: computer programs that can infect systems and cause damage. They are usually hidden within safe-looking programs (usually shareware or freeware).

Trojan Horse: a computer program that enables the disseminator of the program to access the system that interacts with the program. A Trojan horse is different from a virus in that a virus can be duplicated thousands of times and function according to a previous set of instructions, while a Trojan horse is designed to facilitate access and interaction between its creator and the system it infiltrates.

Worm: a computer program that infests network environments and copies itself over and over again. Worms can take up more and more memory and disk space until they stop the computer cold. The famous Internet worm of November 1988 replicated itself on more than 6,000 networks around the world.

Clipper: hardware that can automatically encrypt and decrypt data. It has a "trapdoor" which federal authorities could open with a key and monitor data.

PSYOP: PSYOP uses all available information means to form a desired public opinion. PSYOP benefits from the ability to conduct market research and analysis of regional data. As a result, customized messages can be generated for each target sector of society. PSYOP was very successful in the US reinstatement of Haiti's president.

Spoofing: An attempt to send a falsified message to someone. For example, I could dial up a university phone registration system, pretending to be someone I have a grudge against, and drop their classes. Since these systems are automated, all I would need to know in most cases is a person's social security number and birth date.

Stand-Off and Close-In Sensors: For military applications, the use of stand-off and close-in sensors to gather data could be considered an information warfare weapon.

Van Eck Radiation: The radiation which all electronic devices emit. Specialized receivers can pick up this radiation and tap a wealth of information. Fortunately, there are various safeguards against this type of attack.

Video Morphing: A weapon that could be used in a manner similar to that in the movie "Forrest Gump" to make an enemy leader appear to say things he or she didn't in fact say, undermining credibility.

Figure 4. Army War College IW Tutorial Terms.

concept is so new and dynamic, no general Army consensus exists in regards to which combat, support or service branch should undertake which IO mission.

IO's Competing Views

Two schools of thought exist in regard to IO's significance. The major perceptions of these schools of thought are discussed below.

The force multiplier school. The operational concepts developed in *Joint Vision 2010*—dominant maneuver, precision engagement, full-dimensional protection and focused logistics—are derived from information superiority and other joint warfighting capability objectives. Information superiority, however, is the only objective which is integral to all four operational concepts.[30] Such superiority is defined as "the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same."[31] This form of strategic guidance allows Army XXI to become better at what it already does, which is to seize terrain and destroy opposing conventional military forces belonging to other nation-states.

Such traditionalist concepts fully complement initiatives to take the current mechanized force of Bradley Fighting Vehicles, Abrams tanks, Apache helicopters and digitize them via *appliqués*. Wired fighting vehicles, artillery and helicopters benefit from IO by means of sensors which can better identify OPFOR, thus minimizing the "fog of war" and providing dominant battlespace awareness.

An interactive "picture" will yield much more accurate assessments of friendly and enemy operations within the area of interest. Although this will not eliminate the fog of war, dominant battlespace awareness will improve situational understanding, decrease response time and make the battlespace considerably more transparent to those who achieve it.[32] If an enemy can be sensed, he can then be fixed in time and space, and killed with precision munitions or neutralized with nonlethal force. These battlespace advantages will allow Army units to project current combat power levels with fewer personnel. Accordingly, the Army heavy division size is being reduced from more than 18,000 to just over 15,000 soldiers because of efficiencies realized through information technologies in logistics.[33] It should be noted that this personnel savings comes prior to a division digitization, slated to take place in 2000, and a corps digitization scheduled for 2004.[34]

Virtually all aspects of Army operations can be made more efficient via information technologies. In the case of nonstate war in urban environments, "One of the major insights gained from the Russian experience in Grozny concerns information dominance. The importance of being able to control broadcasting capabilities, suppress inflammatory information, influence attitudes and hamper or intercept information flow within hostile elements was abundantly clear. Russian forces were unable to do these things and suffered accordingly. Given the array of communications links—TV, radio, telephone, cellular phone, Internet . . . the challenge of achieving information dominance is formidable."[35]

Fortunately, in Bosnia, such mistakes were avoided by Army and allied forces in Operation *Joint Endeavor*. In fact, a well-coordinated information campaign based on public information (PI), psychological operations (PSYOP) and civil-military cooperation (CIMIC) was undertaken.[36]

[Data] alteration is the most threatening [form of attack] but also the most complicated to undertake. It can result in wrong decisions and actions being made, while also polluting the data and information belonging to a military force. This can produce ambiguity within a force concerning the validity and reliability of sections of its knowledge pool. . . . On the other hand, digital destruction results in the erasure of data and information which would be quite obvious, would not result in faulty helicopter repairs being made and is more easily solved.

Even with these many benefits, challenges exist in regard to IO as a whole. One concern is how to get information to tactical units and back to commanders. The older communications structure was built upon voice and low-speed data transmissions, while "the information component of future military operations will primarily be comprised of computer data, imagery, video and much less voice commo than in the past."[37] Another challenge may exist in regard to the potential for micromanagement by senior officers and junior officers becoming overloaded with too much information. Issues such as this will need to be explored and solved if problems do arise. As an outcome of digitization, hierarchical thinking will be replaced with a more networked approach to warfighting which will offer new opportunities in regard to fighting toward a common battlefield image but will also result in potential dilemmas in regard to

the current organizational structure, with some formations and possibly even rank structures no longer potentially needed as Army units get flatter.

What is known is that commercial technology will begin to provide an increasing segment of the hardware Army XXI will rely on. This exploitation of commercial technology will provide the Army with many advantages in regard to technical breakthroughs but must be tempered with the realization that such technology can be bought on the global market by anyone.[38] While the force multiplication effects of IO are fully recognized, the cost of digitization is becoming an increasing concern. The US Marine Corps commandant stated that his service cannot afford digitization and suggests that to a degree this may also be true for the Army because of the declining defense budget.[39] If this is the case, then Army XXI may ultimately comprise only selected divisions of the Army that will gain the full benefits IO will provide.[40]

Data denial focuses on electromagnetic signature suppression and other techniques such as frequency-hopping broadcasts so that sensors are unable to gather data. Data alteration allows sensors to obtain data that the OPFOR wants to be obtained. This could allow a tank to broadcast a truck signature and vice versa or create the illusion that more forces exist than really do. Disruption of sensing capabilities can be undertaken by providing "noise" in the appropriate segment of the electromagnetic spectrum . . . or by the employment of obscurants.

The new capabilities school. It has become an accepted fact that nonstate challengers and rogue nation-states have no hope of taking on and defeating the United States in conventional warfare. The Army is simply too good at what it does. The down side of ruling the battlefield is that our opponents have no choice but to replace symmetrical warfighting with asymmetrical counters. On a physical level, our opponents are exploring new combat capabilities based upon weapons of mass destruction. Nuclear, biological and chemical weapons offer many possibilities, especially when used by small terrorist cells which cannot be traced back to their employers.

Our focus, however, is in regard to the digital or cyber dimension. IO allow criminal, guerrilla and other rogue entities a new operational style which previously did not exist. A force multiplication effect is useless to such entities because they have no traditional combat power to multiply. Rather, IO in this regard are more visionary in nature and represent an asymmetric form of warfare based on what could be termed "weapons of mass disruption."[41] This potential has not gone unnoticed by government authorities with regard to the threat posed to our nation's infrastructure.[42] A National Defense University researcher observed that "The implications of warfare in the information arena are enormous. First, national homelands are not sanctuaries. They can be attacked directly, and potentially anonymously, by foreign powers, criminal organizations or nonnational actors such as ethnic groups, renegade corporations, or zealots of almost any persuasion. Traditional military weapons cannot be interposed between the information warfare threat and society.

"Second, even where traditional combat conditions exist (hostile military forces face one another in a terrain-defined battlespace), kinetic weapons are only part of the arsenal available to adversaries. Indeed, electronic espionage and sabotage, psychological warfare attacks delivered via mass media, digital deception and hacker attacks on the adversaries' command and control systems will be used to neutralize most traditional forces and allow concentration of fire and decisive force at the crucial time and place in the battlespace."[43]

Examples of this new operational style mentioned in another National Defense University paper include:

- A "trap door" hidden in the code controlling switching centers of the Public Switched Network could cause portions of it to fail on command.
- A mass dialing attack by personal computers might overwhelm a local phone system.
- A "logic bomb" or other intrusion into rail computer systems might cause trains to be misrouted and, perhaps, crash.
- A computer intruder might remotely alter the formulas of medication at pharmaceutical manufacturers, or personal medical information, such as blood type, in medical databases.
- A concentrated e-mail attack might overwhelm or paralyze a significant network.
- An "info blockade" could permit little or no electronic information to enter or leave a nation's borders.[44] For information concerning similar concepts, refer to Figure 4.

Conceptually, this form of warfighting can be considered a form of bond-relationship targeting—

A 51st Signal Battalion soldier adjusts his satellite dish before the VII Corps' offensive during Operation *Desert Storm*.

US Army

Transmitters are representative of communication devices and protocols and are highly susceptible to traditional forms of attack based upon electronic warfare, jamming measures and precision fires. As in conventional operations, this is one of the most desirable target sets to attack because it provides the informational linkages within and between military units.

the links between things—as opposed to precision strike, which targets things themselves. A proposed definition for this form of operation is: "Rather than gross physical destruction or injury, the desired end state is to create tailored disruption within a thing, between it and other things, or between it and its environment by degrading or severing the bonds and relationships which define its existence."[45]

Because Army special operations forces (SOF) do not rely upon forms of traditional combat power as do conventional Army forces, it would seem that they would be more apt to view IO as a new capability rather than as a force multiplier like nonstate groups. If this is the case, they may begin to rely upon offensive IO as a primary means of disruptive attack against an OPFOR. Within the next decade, lessons learned by Army SOF may offer little utility to conventional forces in this regard. However, what is now considered an unconventional form of IW could become the new norm.

In addition to Army SOF, the employment of IO by private security corporations is another trend which must be considered. The Army's recent decision to choose Internet Security Systems, Inc., to defend its cyber assets in over 400 US Army facilities worldwide suggests that the private sector may be more adept than traditional military institutions at waging war within higher-dimensional battlespace.[46] This is an ominous trend because cyberspace would ultimately help to undermine the warmaking monopoly held by the nation-state's public institutions, as it is already doing to concepts of national sovereignty.

Land Warfare Implications

Of the two schools of thought previously discussed, the perception of IO as a force multiplier will presumably dominate over the course of the next decade or so within Army circles—out to about 2010. Army XXI, by necessity, will exist in two worlds—partially mechanical and partially digital. First, it will draw its firepower largely from preexisting hardware that was designed for the Cold War security environment.[47] The hardware sunk costs and preexisting training and support base dictate no less in an era of declining defense expenditures.

At the same time, most of the Army's senior leadership will still be traditionalist in its view of the influence of technology, especially information

technology, on the conduct of land warfare. Bolted onto this hardware will be information devices which will multiply its combat power and effectiveness. Given such a near-term scenario, IO will be viewed as a means to an operational end, that is, as a force multiplier for conventional operations and probably not as a viable operational style in itself.

***Dominant maneuver, precision engagement, full-dimensional protection and focused logistics—are derived from information superiority and other joint warfighting capability objectives. Information superiority, however, is the only objective which is integral to all four operational concepts. . . . Such traditionalist concepts fully complement initiatives to take the current mechanized force of Bradley Fighting Vehicles, Abrams tanks, Apache helicopters and digitize them via* appliqués.**

The primary danger which exists with traditionalist-school thinking is that of being lulled into a false sense of security. Because Army XXI will be so far in advance of its nearest competitors, it may become fashionable to suggest that no one will ever be able to catch up to the Army in warfighting capacity. This would assume that IO will remain subordinate to conventional operations over the long term. As a result, land warfare forces would retain their current capabilities and continually refine them.[48] No basis exists to support such an assumption. Rather, it is suggested that IO may mature to the point of becoming an operational style in itself and/or fuse with conventional operations to become a dual-dimensional operational hybrid which is physically- and cyber-based. This maturation will develop primarily because of the development of asymmetric attempts of our opponents at undermining Army XXI combat power, Army SOF experimentation in these areas, growing private security IO capability and the recognition of these trends by senior Army leaders.[49] This would result in the development of a whole new battlefield upon which the AAN, rather than Army XXI, will be more suited to function.[50]

This perception brings up two land warfare issues which need to be studied further with regard to IO. The first concerns the impact of advanced technology and concepts on land warfare. Do such technologies and concepts tend to get designated as force multipliers by the dominant army of the era (the winners) to allow it to do what it does even better? This would be in contrast to such technologies and concepts being designated as a new form of operations by inferior armies or groups (the losers) who have no stake in the prevailing military status quo.

A historical example of this phenomenon is represented by the tank's development in the 1920s and 1930s. For the Allies in World War II, the tank was early on considered an infantry support weapon which provided mobile firepower, hence a force multiplier, rather than a key element of a new operational concept which was developed by the German army. Another example of this phenomenon would be the development and employment of functional field artillery, coupled with the *levee en masse* and other innovations by the French army during its revolutionary wars of the late 18th and early 19th centuries. This "loser" army of the late Absolutist Age went on to redefine warfare between the armies of nation-states because it saw the advanced technology and concepts which had developed as the basis of new operations and not as a force multiplier as did its competitors.

The issue of advanced technology and concepts either as a force multiplier or as the basis of new operations will heavily impact our future Army. It will likely result in the development of a second issue—when, and if, the Army should organize itself around qualitatively new operational styles. As previously mentioned, IO as a force multiplier will presumably dominate conventional Army force thinking to about 2010. From 2010 on, however, IO as a real operational style in itself and/or as part of the basis of a dual-dimensional operational hybrid will begin to make itself more pronounced. The time frame from 2010 to 2025 may thus become a critical period for Army planners. It will represent the last vestiges of Cold War-influenced combat hardware mated to digital *appliqués* and the introduction of qualitatively new systems which possess organic informational abilities and the new operational capabilities they will provide.[51]

In the short term, however, the future looks bright with regard to the transition from Force XXI to Army XXI and continued Army land warfare dominance with the addition of IO as a force multiplier. The Army is second to none as a land power force in a traditional battlefield setting with conventional arms and tactics. However, this recognized invulnerability is both a blessing and a bane because, as discussed earlier, America's opponents will ultimately attempt to turn IO into the Army's Achilles' heel. ***MR***

NOTES

1. For a complete listing of documents related to information operations (IO) on compact disc, see Land Information Warfare Activity at <http://www.sytexinc.com/cdrom/background/pubs.htm>. For an excellent set of annotated information warfare references compiled by Daniel E. Magsig, go to <http://carlisle-www.army.mil/usacsl/org/iw/tutorial/intro.htm> and click on "References."

2. James M. Dubik, *Creating Combat Power for the 21st Century*, Land Warfare Paper No. 25 (Arlington, VA: The Institute of Land Warfare, Association of the United States Army, October 1996).

3. Robert A. Heinlein, *Starship Troopers* (New York: G.P. Putnam's Sons, 1959).

4. William Gibson, *Johnny Mnemonic* (New York: Ace Books, 1995).

5. Headquarters, Department of the Army, US Army Field Manual (FM) 100-5, *Operations* (Washington, DC: US Government Printing Office [GPO], 14 June 1993).

6. TRADOC Pamphlet 525-5, *Force XXI Operations: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-First Century* (Fort Monroe, VA: US Army Training and Doctrine Command, 1 August 1994), Glossary-4.

7. FM 100-6, *Information Operations* (Washington, DC: GPO, 27 August 1996). Access via <http://www.atcs-army.org/cgi-bin/atdl.dll/query/download/fm/100-6/fm100-6.zip>.

8. Cited in MG John D. Thomas Jr., commander, US Army Intelligence and Security Command, "Impact of Information Operations for the Force XXI Army" (Fort Belvoir, VA: US Army Intelligence and Security Command), briefing slides presented at the Association of the United States Army Symposium and Exhibition, "The Role of Special Operations Forces in Information Operations" Pinehurst, NC, 7 April 1998.

9. US Department of Defense. Department of Defense Directive–Supplement (DODD-S) 3600.1, *Information Operations*, 9 Dec 96.

10. Later Army perceptions fall within the Joint Vision 2010 conceptual umbrella. See Army Vision 2010 at <http:www.army.mil/2010/>.

11. DODD-S 3600.1.

12. Joint Chiefs of Staff, *Concept for Future Joint Operations: Expanding Joint Vision 2010* (Fort Monroe, VA: Joint Warfighting Center, May 1997), 85. Derived from Joint Publication 6-0, *Doctrine for Command, Control, Communications and Computer Systems Support to Joint Operations*.

13. Ibid., 83. Approved DOD terminology.

14. Ibid., 85.

15. GEN Gordon R. Sullivan and COL James M. Dubik, *War in the Information Age* (Carlisle, PA: Strategic Studies Institute, US Army War College, 6 June 1994), 18. Derived from William H. Davidow and Michael S. Malone, *The Virtual Corporation* (New York: HarperCollins Publisher, 1992), 67-72.

16. John Arquilla and David Ronfeldt, Chapter Six, "Information, Power, and Grand Strategy: In Athena's Camp–Section 1," John Arquilla and David Ronfeldt, eds., *In Athena's Camp: Preparing for Conflict in the Information Age* (Santa Monica, CA: National Defense Research Institute, RAND, 1997), 144-45.

17. Ibid., 148.

18. For an overview of the challenges these sciences and disciplines may pose for the Army After Next, see Robert J. Bunker, *Five-Dimensional (Cyber) Warfighting: Can the Army After Next be Defeated Through Complex Concepts and Technologies?* (Carlisle, PA: Strategic Studies Institute, US Army War College, 10 March 1998).

19. This typology draws from "The 'Information Pyramid' from Two Views," John Arquilla and David Ronfeldt, Chapter Nineteen, "Looking Ahead: Preparing for Information-Age Conflict," *In Athena's Camp*, 448.

20. Joint Chiefs of Staff, *Concept for Future Joint Operations*, 86.

21. BG John R. Scales, deputy commander, US Army Special Forces Command (Airborne), "Information Operations" (Fort Bragg, NC: US Army Special Forces Command (Airborne), briefing slides presented at the Association of the United States Army Symposium and Exhibition, "The Role of Special Operations Forces in Information Operations" Pinehurst, NC, 8 April 1998.

22. This basic information system typology was created for use in this article. A weakness found in IO literature is the lack of a standard model. Another method of analysis uses information processing based on the OODA loop concept for offensive and defensive IO. See MAJ T. Eipp, *A Concept for Information Operations* (Concepts Division, Marine Corps Combat Development Command, 15 May 1998). Access at <http://138.156.107.3/concepts/home.htm>.

23. *Associated Press*, reporting from Fort Worth, Texas, Thursday, 25 June 1998.

24. On a daily basis, information attacks are becoming more common. In late May, hackers hit US Army computers and altered a command's Web site. Before that, India's national security computer network was raided for nuclear weapons secrets. The FBI has reported that from February to June, half a dozen substantial attacks have taken place in the United States. See "Hackers Hit U.S. Military Computers," *Associated Press*, 6 June 1998; and Patrick Connole, "FBI unit reports 'substantial' cyber attacks," *Reuters*, 11 June 1998.

25. This example is at the binary level. Other examples of data and information alteration include video morphing, voice cloning and e-mail spoofing.

26. With regard to some of the ethical and conceptual problems involved in IO, see Bradley Graham, "Authorities Struggle to Write the Rules of Cyberwar: Consequences of Using Computers as Weapons Are Largely Unexamined," *Washington Post*, 8 July 1998, A1.

27. Matrixing the information/information system typology used in this paper with the INSCOM model represents a future avenue of research which is beyond the scope of this paper.

28. George I. Seffers, "Inventor Spawns 'Electronic Ebola' for Info War," *Defense News*, 15-21 June 1998, 1, 27. See also *Army Times*, 28 June 1998, 27.

29. Reprinted from MG John D. Thomas Jr., commander, USAINSCOM, "Impact of Information Operations for the Force XXI Army," briefing slides (presented at AUSA Symposium, "The Role of Special Operations Forces in Information Operations," 7 April 1998).

30. Joint Chiefs of Staff, *Concept for Future Joint Operations*, 33.

31. Ibid., 35.

32. Joint Chiefs of Staff, *Joint Vision 2010* (Fort Monroe, VA: Joint Warfighting Center, July 1996).

33. Daniel M. Verton, "High-tech warriors, high-tech wars: the services extend IT from digital warriors to digital logistics," *Federal Computer Week*, 29 June 1998; and Jason Sherman, "Bulking Down," *Armed Forces Journal International*, July 1998, 32-34. A controversy concerning proper division size exists. See Richard J. Newman, "Renegades finish last: A colonel's innovative ideas don't sit well with the brass," *U.S. News & World Report*, 28 July 1997, 35.

34. "Washington Watch: Army will fix computer problems." *AUSA News*, June 1998, 21.

35. John E. Greenwood, "Editorial: Coping with Urban Crises," *Marine Corps Gazette*, June 1998, 2.

36. See Pascale Combelles Siegel, *Target Bosnia: Integrating Information Activities in Peace Operations* (Washington, DC: DOD Command and Control Research Program [CCRP], Institute for National Strategic Studies, National Defense University, January 1998).

37. Quote attributed to MG Michael W. Ackerman, USA, Chief of Signal. See Jim Tice, "Sending the Right Signal/Information as a Weapon," *Army Times*, 18 May 1998.

38. George Cahlink, "Army After Next Will Rely on More Commercial Technology," *Defense Daily*, 30 June 1998.

39. Editorial, "Two-War Strategy? Modernize, Expand or Give Up," *Aviation Week and Space Technology*, 29 June 1998, 70.

40. Besides cost concerns, technical considerations exist. As an example, the Force XXI Battle Command, Brigade and Below (FBCB2) system may not be operational in time for the fielding of the 4th Infantry Division as the First Digitized Division in Fiscal Year (FY) 2000. See Bryan Bender, "Tests May Delay Fielding of First US Digitised Force," *Jane's Defence Weekly*, 8 July 1998.

41. "Weapons of mass disruption" is an advanced battlespace term based upon bond-relationship targeting considerations. Traditionalists who see this threat view a potential cyber attack as a weapon of mass destruction, which is an inaccurate definition. See George I. Seffers, "NSA Chief Ups Info War Ante: Says Cyber Attack on U.S. is Weapon of Mass Destruction," *Defense News*, 29 June-5 July 1998, 1, 36.

42. *The Report of the President's Commission on Critical Infrastructure Protection, Critical Foundations: Protecting America's Infrastructures* (Washington, DC: GPO, October 1997).

43. David S. Alberts, *The Unintended Consequences of Information Age Technologies* (Washington, DC: The Center for Advanced Concepts and Technology, Institute for National Strategic Studies, National Defense University, April 1996), 27-28.

44. For the primary references to these examples, see Lawrence T. Greenberg, Seymour E. Goodman and Kevin J. Soo Hoo, *Information Warfare and International Law* (Washington, DC: The Center for Advanced Concepts and Technology, Institute for National Strategic Studies, National Defense University, January 1998), 3-5.

45. Robert J. Bunker, "Higher Dimensional Warfighting: Bond-Relationship Targeting and Cybershielding." *Parameters*. Draft under consideration.

46. Business Editors, "U.S. Army Selects Internet Security Systems' Intrusion Detection Technology to Protect Critical Networked Information," *Business Wire*, 7 July 1998.

47. It has been stated that the Longbow Apache has been designed and built for the digital age. The AH-64A fleet came into being in FY 1984. The AH-64D Modernization began delivery in 1997. The Apache attack helicopter is a transitional system which was conceived during the Cold War and has now been upgraded. See "News Call: The Longbow Apache Introduces the Army's Digital Age," *ARMY*, June 1998, 57; and McDonnell Douglas Helicopter Systems Pamphlet, *Team Apache Modernization: Lifting the Fog of War* (Mesa, AZ: Undated).

48. This would mean that speed and precision would be considered the dominant characteristics of future warfare. These mechanical perceptions are in variance with emergent nonlinear/post-mechanical sciences.

49. Part of this perceptional shift may include Army XXI warfighting doctrine focusing on who is the "right" enemy. See Dubik, *Creating Combat Power for the 21st Century*, 7.

50. A number of visions concerning this battlefield are discussed in the papers delivered at the US Army War College Ninth Annual Strategy Conference, "Challenging the United States Symmetrically and Asymmetrically: Can America be Defeated?" 31 March-2 April, 1998. Go to the Strategic Studies Institute (SSI) Homepage at <http://carlisle-www.army.mil/usassi/welcome.htm> for further information.

51. In regard to proposed small-arms capabilities, see Robert I. Widder, ed., *Report on the Results of the Future Small Arms Conclave* "Blue Sky"—2020, Contract No. DAAL03-91-C-0034 (Arlington, VA: Battelle Crystal City Operations 9-10 September 1997). This conference took place at Picatinny Arsenal, NJ, under the sponsorship of the Joint Service Small Arms Program (JSSAP).

52. Derived from "Module 6: IW Weapons" of the US Army War College Information Warfare Tutorial. Posted by the Knowledge Engineering Group, Center for Strategic Leadership. This module and the tutorial itself can be accessed at: <http://carlisle-www.army.mil/usacsl/org/iw/tutorial/intro.htm>. It is a condensation of material presented through an advanced course dedicated to information warfare taught by NSA Visiting Professor Robert J. Minehart Jr. The tutorial represents an unclassified version of the advanced course. (Notice: Due to the sensitive nature of this section, the terms presented are proposed by open-source [nongovernmental] authors. The examples offered should be considered only as concepts to stimulate your thoughts on "what-if" possibilities. This presentation neither confirms nor denies the existence of such weapons).

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