

FCS: WHY THE ARMY IS CHALLENGED TO SHOW ITS VALUE

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USAWC STRATEGY RESEARCH PROJECT

FCS: WHY THE ARMY IS CHALLENGED TO SHOW ITS VALUE

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ABSTRACT

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In Joint Force 2020, written in 2003, the chairman of the Joint Chief of staff warned that advances in technology and process may be moving so fast that it may challenge the Department of Defense's ability to assess, mature, and communicate the advantages and disadvantages of a networked force. This 2003 premonition may be eerily impacting the Army's efforts to mature the Future Combat Systems (FCS) program. While the Army has aggressively pursued General Shinseki's vision for the FCS force, the program continues to be challenged to successfully describe the "bang-for-the-buck" value that it will bring to the nation. While there are many potential reasons for the Army's less than optimal performance, I believe that there are six major areas that may be having the most significant impact: 1.) the system focus of current acquisition processes, 2.) the art and qualitative nature of information, 3.) the challenge of separating intelligence from information, 4.) current developmental tasking processes, 5.) Department of Defense's (DoD) limited expertise with networked operations and 6.) the use of inappropriate analytic tools.

FCS: WHY THE ARMY IS CHALLENGED TO SHOW ITS VALUE

When General Eric Shinseki presented the Objective Force concept in 2001,¹ he presented a vision of the revolutionary potential that an information-based force could have on the battlefields of the future. He cited unique attributes that would be enabled by the situational awareness created within a networked force, and presented some resulting effects that would be imposed upon the enemies of the future. The premise of General Shinseki's information-based or network-centric force was that information would be available at every tactical echelon within the formation that would allow Soldiers and leaders to "see first, understand first, act first, and finish decisively." The vision spoke of a Common Operating Picture (COP) that would further allow Soldiers and leaders to collaborate and thereby leverage intellect, experience, and intuition to act within the decision cycle of the threat. General Shinseki's vision was clear; the difference between future force capability and current force capability would be attributable to the future force's ability to collect, disseminate, synchronize, and collaborate information in ways that had been unattainable in the past.

Although the concept has been received with cautious optimism and has undergone nearly seven years of rigorous analytic evaluation, the Future Combat Systems (FCS)² program continues to be challenged to address its "bang-for-the-buck" value, its dependency on immature or risky technology, and its relevance for future long-wars.³ To some extent, this should be expected and is, in fact, a normal and required part of the evolutionary process associated with most Department of Defense (DoD) acquisition programs. However, the construct of the FCS program and the

environment in which this program is being assessed makes this program far different from most acquisition programs.

Unlike most programs to date, the FCS program is grounded in a system-of-systems construct that relies on the collective synergy of several systems vice a single system or technological enhancement. Secondly, the premise for the revolutionary potential is largely underpinned by the qualitative capabilities associated with the amount and fidelity of information as opposed to the largely quantitative capabilities of lethality and survivability associated with programs of the past. Thirdly, many of the key technologies are revolutionary, both in capability and in their distribution throughout the force. Finally, the challenge of developing and funding this large program has been significantly affected by competing demands required to support military operations in Iraq and Afghanistan. Indeed these factors have made the program much different from previous programs. However, these factors may only partially explain the questionable support that the Army's concept has received. In truth, evaluation processes, techniques, tools, and the cultural and experience base of its personnel tasked with evaluating and maturing the FCS program, may be having a greater impact on the success of the program to date.

To truly evaluate and assess General Shinseki's concept, it is important that the underlying premise for the revolutionary capabilities is understood and is the focus of the experimental and analytical work which is conducted. While past military programs have required force developers and program managers to focus on the capabilities of a single platform, munition, or organizational design, developers of the FCS force were not given this same luxury. Although similar evaluation of the systems is arguably an

important aspect of the required work, the true focus of the analysis of the FCS force should have been more focused on determining the impact that increases in quantity and quality of information have on force success. Work should have focused on the amounts and types of information that will be required and available at each echelon to underpin the premise of the concept. Furthermore, focused analysis should have been conducted on the information-based options created for friendly forces and options (challenges, dilemmas) that are imposed on the enemy force. In short, the premise behind the networked force concept is largely underpinned by a conditional if-then statement: **If** the force can achieve information dominance, **then** revolutionary capabilities can be achieved; or in the negative, if the information is not available, then the premise for the revolutionary changes will not be achieved. For, it is information that General Shinseki believed would have the potential to change the way future battles are fought, not the technical capabilities of the weapon systems themselves.⁴

While the above statements may appear bold and presumptuous, and are without a doubt somewhat based on personal experience with the program,⁵ similar warnings and concerns were communicated very early in the development of network-centric concepts that forewarned of this potential shortcoming.

In the Chairman of the Joint Chiefs of Staff's "Joint Vision 2020", subtle mention of this concern appears prophetically accurate: "... advances in information capabilities are proceeding so rapidly that there is a risk of outstripping our ability to capture ideas, formulate operational concepts, and develop the capacity to assess results...".⁶ This concern has also been expressed by several of the visionaries who articulated early understanding of the potential impacts of network-centric operations. An example of a

similar foreboding concern captured in an early National Defense University press book, expressed similar caution towards the challenges associated with analyzing and assessing a network concept:

The problem is hard to conceptualize...perhaps a testament to its ultimate importance. No analyst in history immediately comprehends the logic of their own situation, in periods of transition; a long epoch of disorientation and confusion is usually necessary to learn the necessary rules of the new era. Observers of the contemporary period of military transformation are no exception. Perspectives and theories have to be broken in by the harsh reality of critical analysis in order to discipline them.⁷

While the Army and other organizations within DoD may have a long and storied history of success developing and fielding new systems, munitions, and organizational structure,⁸ most if not all of these enhancements lack the revolutionary nature of a network-centric force. Arguably, it may be these revolutionary aspects of a network-centric force that most challenge the “business as usual” approach which has historically been used to underpin the acquisition process. It is, therefore, important to identify where these changes in process or approach are required to more credibly assess the unique attributes of the FCS enabled forces. Once identified, the Army may then need to develop and implement creative and innovative assessment methodologies to better capture and fully realize the capabilities envisioned by General Shinseki in 2001.

As an Operations Research and Systems Analyst (ORSA) who has had the unique opportunity to be directly involved with the program from its inception through the summer of 2007, I have had a front-row seat to the evolution and maturation of the Army’s FCS concept. Through analysis of more than 10,000 hours of FCS-focused simulation; interviews/discussions with thousands of Soldiers, engineers, and contractors associated with the program; and direct involvement in the requirements

aspects of the program, my experience has led me to believe that most of the Army's challenges can be directly linked to six key areas. While the six areas will be discussed individually, they are without doubt, inextricably interrelated and linked to each other. The linkage can be viewed through the ends, ways, and means strategic model as shown in figure 1. Using this methodology, Issue 1 relates to the "ends" (acquisition of the FCS), Issues 2 and 3 relate to the "ways" (Information vs Intelligence, and Quantitative (science) versus Qualitative (art)) and the means are issues 4 (Tasking Process), 5(Personnel), and 6(models and simulations).

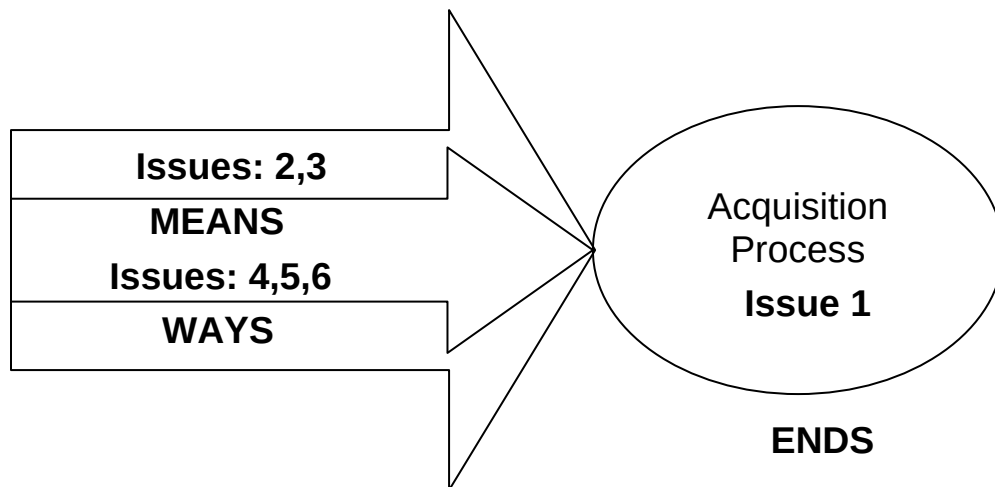


Figure 1:

The six key areas will be briefly described below and will then be examined in detail throughout the body of the report.

1. Current acquisition processes are underpinned by the quantitative capabilities of the evolving technology (Systems) and may lack the mechanisms to account for the qualitative derivatives of the technology. By definition, the current acquisition system (Defense Acquisition system, DAS) is a management process by which DoD acquires weapon systems and automated information systems.⁹ The requirements to assess the

qualitative aspects of information dominance are not discussed within the current acquisition directives or processes.¹⁰

2. The premise for the FCS concept is based upon increases in information, not necessarily intelligence. This may seem trivial; however, current lessons learned continue to indicate that information flow on both current and future battlefields is from the bottom up.¹¹ That is, information that is acquired at the point of the spear of the fighting force is driving the success of the force. As this information is typically raw, real-time, and, in many cases, a result of the dynamics of the battlefield, it is therefore more appropriately aligned with information than true intelligence. This is largely a result of fighting enemies that know and understand our desire to engage out of contact and who will achieve increasingly effective means of remaining hidden from our sensors.¹² Therefore, analysis of the FCS force may be more appropriately focused on the art...the cunning and devious real-time qualitative uses and impacts of information, rather than the current focus which is more aligned with the intelligence processes associated with today's operational forces.

3. Evaluation of the impact of information and intelligence crosses the line from the "science" of war to the "art" of war and from quantitative to qualitative in nature. The science associated with new technology can be readily explained and evaluated by quantitative metrics that have been historically accepted and relied upon to underpin current acquisition processes. On the other hand, information and the application of information on force success are arguably more art than science, largely qualitative in nature and inherently more difficult to definitively present in ways which support current acquisition processes.

4. Developmental tasking responsibilities may be limiting the Army's ability to accurately account for the system-of-systems impacts or the impact that information has on the success of a networked force. The current process based upon proponent development of systems may be limiting the realization of the system-of-systems impacts envisioned by General Shinseki. Without a system-of-systems, network-centric approach that forces proponent developers to account for, and leverage the generated information and enabling systems, developers are simply designing independent future fighting systems.

5. Soldiers, leaders and analysts' limited experience with networked operations theory may be limiting the assessment and development of the FCS force. The simple truth is that the Army and DoD are in the early stages of attaining understanding and comprehension of the capabilities of a networked force. Understanding is literally evolving across-DoD in near real-time. This, coupled with the aggressive speed at which the FCS program is being matured, and the continual rotation of its personnel in and out of the program may be limiting the Army's ability to apply the in-depth knowledge which is required to effectively assess and refine the networked capabilities of the FCS force.¹³

6. The current family of analytic tools are principally designed to compare quantitative differences in force capabilities and may not be well suited to conduct qualitative analysis of the largely cognitive applications of information.¹⁴ Many of the current models and simulations do not generate, account for, or analyze the impact that information has on force success. Current models lack the mechanisms to realistically

capture the information gathering capability of the force, its ability to filter and refine the information or the impact that information presentation has on decision making.

Issue 1: Ends-Current Acquisition Processes

Current Department of Defense acquisition processes are being challenged by the large number of interdependent systems as well as the unique qualitative capabilities of the FCS force. While current acquisition directives are written to provide detailed procedural guidance for the development of a single system, the 14 +1+1 systems associated with the FCS program stress these procedural guidelines to the limits. Even with some creative modifications to the existing procedures, these methodologies still remain somewhat fixed on the independent systems themselves. There have been no modifications to the accepted procedures to better account for the qualitative aspects of the force, nor has there been any adjustment that enables or requires system-of-system evaluations to be conducted. In short, the modifications to the existing processes have helped tailor the FCS program to make it better fit existing directive guidance rather than to develop a unique acquisition process that recognizes the importance of the qualitative aspects of the FCS force. By doing this, the FCS program may be inadvertently and indirectly forced to prove its effectiveness through component system effectiveness, rather than through the informational and system of systems premise envisioned by General Shinseki.

Current DoD acquisition processes are guided by Department of Defense Directives 5000.1 and 5000.2.¹⁵ These directives go into great detail on the requirements for the development of a particular system, whether it is a combat system or an information system. While this methodology works well for the systems

themselves, it does not allow or even account for the qualitative aspects associated with information superiority and dominance. In essence the current directives provide the requirements to build the system but does not account for the interaction between the systems—or for the real strength of the FCS force—its ability to collect, disseminate and apply the information. This may be resulting in a loop-hole in which there is no mechanism to identify or measure the collective strength of the formation associated with the information processing capabilities themselves.

While sections of the aforementioned directives focus on the system development process, there are likewise sections which specifically focus on implementing the DoD Net-Centric Data strategy.¹⁶ Unfortunately, even these more applicable sections expose the same loop-hole from a different direction. The guidance associated with network centric development is more in terms of compliance than it is real quantitative or qualitative capabilities which are enabled. That is, this section of the directive will make sure that the FCS network works with both existing networks and future networks, but does not demand metrics to demonstrate the effects of situational dominance.

In the end, the accepted guidance within DoD provides guidance for the FCS system designs and ensures that the network within the force meets interoperability guidelines, but has no requirement that specifically addresses the cumulative effects of the systems and the network. Because these directives are guiding the program timelines and developmental processes, the requirement documents for the FCS program have been correspondingly tailored to meet the directive guidelines and have themselves masked the requirement to account for the informational premise of the concept.

Recommendation

Refine the current “ends” to better account for the qualitative aspects of the information dominant FCS force. The issue of limitations within the current acquisition process is perhaps the most difficult to solve within the timelines associated with the program. The refinements to the existing processes have, in fact, facilitated and enabled the rapid acquisition cycles associated with the unique FCS program. While it is important to maintain these accepted guidelines for acquisition of the component systems, it is equally important to develop DoD level guidance which more effectively addresses the qualitative aspects associated with information superiority and the system-of-systems paradigm. Without these modifications, there is no mechanism which forces assessment of the unique attributes of the FCS force. While it may initially seem to make sense to align these assessments to the testing phase of the program, this would risk delaying the program, and may result in the fielding of systems that do not support the initial premise of the force.

Accounting for the qualitative and cumulative effects of the component systems may be best suited for think-tank developmental processes. Unlike current think-tanks composed of organizations not directly involved in the FCS program, the composition of this think-tank body should include organizations familiar with the qualitative capabilities of a networked force and organizations associated with the enforcement of the existing DoD acquisition directives. The purpose or end state of this work should be to provide initial guidance, recommendations, and evaluation criteria to the FCS developers that are better suited to assess the capabilities of a networked force. This work should serve to complement the acquisition processes associated with the systems themselves and

ultimately enable a more holistic understanding of the unique capabilities of the FCS force.

Issue 2: Ways-Science versus Art; Quantitative versus Qualitative¹⁷

To understand the evaluation of situational awareness, it is important to first understand the variety of complex factors which must be considered. Mica Endsley's work "Theoretical Underpinnings of Situation Awareness: A Critical Review"¹⁸ provides and discusses several keys to understanding the evaluation of situational awareness:

1. Technological systems do not provide situational awareness, it takes a human to perceive information and make it useful.
2. System designers tend to focus on the information provided through a system, in military applications, information will also come from the environment itself.
3. How people direct their attention has a fundamental impact on what portions of the environment are incorporated into their SA.
4. SA is not a process of receiving displayed information, but one in which the operator may be very actively involved.

Endsley's key ideas were used by the Army and have been captured within the definition of situational awareness found in the FCS Operational & Organizational Plan (TRADOC PAM 525-3-90) where situational awareness is defined as; "the perception of the elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the future."¹⁹ This definition is subjective in nature, but clearly focuses on the cognitive processes, not the technical acquisition capabilities of the systems. To evaluate the situational awareness of the

FCS formation it is apparent that analysis and evaluation must account for the cognitive development of the information that is acquired and enabled by its technical systems.

The underlying strength and conceptual premise of the FCS force is the situational awareness that is synergistically created and applied throughout the FCS formation.²⁰ Therefore, to credibly evaluate the force capability of the FCS force it is essential to account for these effects as they relate to battle outcomes. This is complex in nature, and potentially consists of the information and cognitive processes involved at a particular place in time and may also include the use of previously collected and documented information/experience. The information itself may come from the real world, system world, system knowledge, interface knowledge, team members, and/or from visual, aural, tactile and olfactory sensors.²¹ As if more complexity is needed, when evaluating situational awareness within military applications, personal traits such as experience, initiative, and aversion to risk must also be considered.

The potential variety of input sources which are uniquely applied based on personal traits and experience make the evaluation of true situational awareness very difficult indeed. Within the netted FCS force, once personal traits have been accounted for, analysts and evaluators have only accounted for a portion of the capability. Analysts must also account for the synergy that is created within the local environment due to the collaboration between key players within the decision making process. The wide variety of variables and the corresponding interactions of these variables quickly become extremely complex and unmanageable using existing quantitative tools and assessment processes. While the impact of these variables in terms of linkages to battle outcomes is

complex, the art associated with the application of information may be even more difficult to assess using existing quantitative assessment processes.

While current quantitative assessments are limited in their capability to evaluate the largely cognitive processes associated with situational awareness, qualitative assessment methodologies may be better suited for the task. In fact, qualitative methodologies have been used successfully within the FCS program to gain initial understanding of information presentation, limits of information-processing capability, and work-load assessments on robotics operators. However, they have not been routinely used to link changes in force effectiveness attributable to situational awareness.

Although qualitative approaches have not been used to directly assess the FCS concept, they have received a great deal of emphasis through academia, and peripheral studies associated with networked force concepts. The Defense Advanced Research Projects Agency (DARPA) has conducted a series of experiments. DARPA's work on Future Combat Systems Command and Control (FCS C2), and the Multi-cell and Dismounted Command and Control (MDC2) may more closely approach the methodology needed to credibly assess the force. However, these experiments were limited in scope due to exercise and simulation limitations and lacked the inclusion of much of the evolving knowledge and force composition that was being refined and generated within the program.²² Unfortunately, this work was not integrated into the annual assessments of the program.

If the premise laid out by General Shinseki is to be accurately evaluated, it is important to account for the human dimension of both the acquisition and application of

information. This challenge is, by its very nature, an evaluation more dealing with art than science, and while much work has been conducted to better understand the flow of information (i.e. network analysis), no significant work has been performed to specifically understand how the human decision making process is impacted by the technology available within the FCS force. The continual failure to underpin the qualitative aspects of SA which are generated within a networked force may be resulting in an incomplete and inaccurate assessment of FCS force capabilities, and may, in fact, be negatively impacting the program decisions that are being made.

Recommendations

In order to refine the “ways,” qualitative methodologies must be developed to better capture the impact that information has on force success and to account for the human interaction throughout the entire information process. That is to say that the work should not only focus on the human operator requirements needed to sift through informational data at the end of the process, but rather, through all phases of the information acquisition and application process. How human operators determine what information is acquired, how the information is to be acquired, how the information is displayed, how the information is disseminated, and how the information is used, are but a few of the related links requiring human cognitive interactions, and corresponding analytic and operational understanding. The developed qualitative processes must also have mechanisms to account for the synergy that is created by the Common Operational Picture (COP) that is shared across the networked FCS force.

Finally, this work must be evaluated using a family of realistic scenarios and tools that account for the art portion associated with gaining information in conditions

imposed by the Volatile, Uncertain, Complex, and Ambiguous (VUCA) environment. The work should be focused on the FCS force's ability to collect and understand information on a threat that has shown increasing capability to hide from current sensing capabilities through Camouflage, Concealment and Deception (CCD) and one who operates within complex urban environments.²³ The methodology should also include an evaluation of the force's ability to collect and apply information in support of counterinsurgency operations and host nation security forces.

Issue 3: Ways-Intelligence versus Information

Joint Publication 1-02 defines intelligence as the product resulting from the collection, processing, integration, evaluation, analysis, and interpretation of available information. Information on the other hand is defined as facts, data, or instructions in any medium or form.²⁴ From a military perspective, intelligence is most commonly associated with those skilled in this discipline (i.e. military intelligence personnel). Information, on the other hand, is the raw facts that apply to all Soldiers within the formation.

For the FCS force, the distinction between intelligence and information is important to differentiate. Based on the netted capability of the FCS force, intelligence should be available to more personnel, faster, and from more sources than today. However, as intelligence is a product, it therefore requires time to synthesize in order to be actionable. Information on the other hand, is raw in nature, aligned with the entire force's collection capability and, therefore, can be acquired and acted upon faster than true intelligence. From a situational awareness perspective, both intelligence and information are key components. However, based upon the echelon and unique

environment, intelligence or information may take on a greater degree of importance. For example, at the lower echelons of the formation, the speed of the battle is greater than that at the higher echelons. In these cases, to gain situational awareness of the immediate environment, the unit may be more dependent upon information than intelligence.

This distinction between intelligence and information is an important conceptual requirement in order to understand the capabilities of the netted FCS force. While current intelligence processes may be empowered by the FCS force, its capability to become skilled and efficient in the exploitation of information may be more critical to force success. Within the FCS force, the cumulative combination of intelligence and information should drive a synergistic chain of information gathering capability and synthesis applied against and in support of initial intelligence. General Shinseki believed that it is this synergy that would provide revolutionary capabilities for the FCS force.

Coincidental with understanding the differences between intelligence and information is an appreciation for the contextual time-lines associated with how each form enables operational capability. Within current operations, the intelligence typically provides the context for the operational missions. With the intelligence, the unit then uses its organic assets to gain information needed to develop its plan (this information may consist of map reconnaissance, cultural implications, traffic flow, and other pertinent data needed to develop the plan). During the execution phase, the unit may refine its actions through environmental cues and information developed during the mission. This process will then continue through mission completion. Following mission

completion, the unit may then use information gained during execution to re-energize the intelligence process.

For the FCS force, the process will be similar to that listed above. The difference will be both the speed at which this formation completes this intelligence-mission loop and the effectiveness at which this loop is completed.²⁵ The increase in speed will be attributable to the exponential growth in available intelligence, the larger amounts of information available for the planning process, the increases in organic ISR capability at every echelon, the ability to collaborate, and the corresponding time associated with each phase of the process. While this process should have a positive impact on mission success and effectiveness, it will also have an impact on the threat's ability to control and influence the tempo of the operations.

Understanding the difference between intelligence and information is key to understanding the capabilities of the FCS force. Program developers and analysts must consciously think in terms of information and intelligence in order to insure that both components are assessed—both independently as well as synergistically within the FCS force. While the value of intelligence is understood, the value of information is often below the noise of the metrics associated with current force evaluation and acquisition processes. However, for the FCS force, it is information that truly enables the revolutionary capabilities envisioned by General Shinseki.

Recommendation

In order to refine the “ways,” Soldiers and analysts must be trained to think in terms of intelligence and information to truly understand the capabilities of the network-enabled force. The evaluation of the force must include metrics and methods which

demonstrate the technological impact on both intelligence and information processes associated with this force and should then be compared to current force capabilities.

While intelligence personnel are familiar with intelligence processes, operators may be more familiar with the informational requirements needed to enable mission success. As noted in “The Functional Concept for Battlespace Awareness”, the success of future networked forces is dependent upon both communities.²⁶ It is this direction which may provide the greatest benefit. Future efforts require a teaming of personnel with expertise in both areas in order to qualitatively assess the capabilities of the FCS force. This work should not only focus on the capabilities that would impact and enable friendly forces, but should also include work to determine the impact that these capabilities would have on the threat’s ability to operate within the COE.

Issue 4: Means-Developmental Tasking Process

Developing and fielding a force with the capabilities envisioned by General Shinseki is by all accounts, the most aggressive and complex initiative ever undertaken by the Army. The complexity of this task has required aggressive, innovative, and adaptive leaders, Soldiers, and analysts in order to establish and maintain the momentum of this program. The developers have had to define system-of-systems approaches, synthesize developmental experience, and integrate evolving skills and lessons from current operations applicable to the FCS force. They have had to understand and objectively embrace the largely conceptual technologies while mitigating generations of cultural experience and processes which have historically been focused on a single piece of equipment. Adding to the complexity of this task, the Soldiers and leaders have had to conduct this aggressive transformation while the force

is at war. Certainly, this has been no small task, but one in which the Army has undertaken in impressive fashion. It has, however, been challenged to fully capture and communicate the implications of a networked, information based force as envisioned by General Shinseki in 1999.

To attack this complex problem, the Army has tasked the development of the FCS concept to its subordinate proponent organizations. While this methodology leverages the strengths of proponent experience, it may have also created disadvantages that far surpass the advantages. The clear advantage of the chosen process is that the organizational structure and experience base, resident within the proponent schools and centers, are well suited and equipped to define and develop unique system requirements. This process has resulted in the Infantry Center designing the Infantry Carrier Vehicle (ICV), the Armor Center developing the Reconnaissance & Surveillance Vehicle (R&SV) and the Intelligence Center developing key Intelligence, Surveillance and Reconnaissance (ISR) platforms.

The pursued methodology has also provided other unique advantages. On-going operations in both Afghanistan and Iraq have given the proponents unique opportunities to gain vision into the requirements of the future through the litany of collected lessons learned. The transformation to Brigade Combat Teams (BCTs) has similarly provided invaluable insight into the system design parameters. Unfortunately, a key source of information which has largely gone untapped is the lessons being collected from the interim or Stryker force. General Shinseki believed that this force would offer significant insight into the design of the FCS force as the Stryker Brigade Combat Team (SBCT) formation offers many conceptual similarities to the FCS force.²⁷ The SBCT's ability to

leverage information from external and internal sources, key personnel enhancements (Tactical Human Intelligence Teams, etc.), and the initial use of UAVs in support of maneuver formations are those most notably linked to the FCS force.²⁸

While the current tasking process has resulted in impressive evolution in system designs, it may lack the mechanism to evolve the premise for the concept itself—**information**. That is, within current tasking, there is no proponent directed to specifically develop, mature, and comprehensively understand the information gathering, disseminating, and application requirements of the FCS force. In large part, this task has been assumed in the tasking to the Intelligence Center at Fort Huachuca. Unfortunately, Fort Huachuca, like others, has focused on the technical aspects of the ISR systems (UAVs, sensors etc.) and has not served as a true lead for the qualitative aspects of the information premise under which the force was designed. The end result is that all proponents have become engulfed in the development of systems, but have not necessarily developed an integrated approach which facilitates a holistic understanding of the informational requirements and capabilities needed to enable the informational premise of the vision. Although this problem may appear simple to solve, it is really quite complex due to the unique roles, missions, organizational construct, and distribution of the technology within the FCS formation. For example, while Fort Huachuca may indeed be suited to inform or identify the roles of the family of Unmanned Aerial Vehicles (UAVs) in ISR operations, it may be challenged to understand, develop, and evaluate the roles and mission for the UAV when used within the maneuver echelons of the formation.

As the overall TRADOC proponent for FCS from 2003-2007, The Unit of Action Maneuver Battle Lab (UAMBL) in Fort Knox developed and documented initial understanding of the impact that information will have on operational success. Unfortunately, the understanding that has been documented to date is mostly in the form of Tactics, Techniques, and Procedures (TTP) which are unique to an echelon within the formation, but does not transcend across all echelons within the FCS Brigade Combat Team (FBCT). From a Tactics, Techniques and Procedures (TTP) perspective this organization melded the pieces of the informational concept together into a cognizant organization. However, it did not lead focused work to assess the underlying premise of the concept—information dominance. There may be many contributing reasons to the shortfall. Among them are the model limitations (discussed later); adequate time and resources to develop and retain Soldiers, leaders, and analysts who can approach the problem from an information dominance perspective (discussed later); and a cultural inability to communicate Soldier-driven qualitative results to credibly support the acquisition process.

In the end, the current tasking methodology has resulted in driving the focus of the FCS program towards system design and may not be providing the process or mechanisms required to develop the knowledge needed to underpin the impact that information dominance has on the force success.

Recommendation

To refine the “ways,” a responsible agent must be tasked to specifically focus on the impact that situational dominance has on force success. This will be difficult as it will necessarily include the meshing of intelligence and operational perspectives and may

exceed the expertise currently residing within a single organization. Options which may prove valuable include the Evaluation Brigade Combat Team (EBCT), or potentially an appointed information dominance team within the FCS program itself. The methodology pursued should include the ability to fully examine situations or scenarios that have taken place in operations in theater, work to understand the key informational requirements, and of course, identify the impact that this information would have had on the outcome of the battle. An excellent example of this type of work is the “Black Sunday” work that TRADOC conducted in 2006.²⁹

Issue 5: Means-Training to Analyze and Develop a Networked Force

The Soldiers and leaders tasked with maturing and evolving the FCS force concept do not receive any unique training designed to stimulate or facilitate the evolution of the fundamentals of military networked operations.³⁰ This may be due to the revolutionary nature of the concept, the distribution of the technology, or the lack of networked force expertise that exists within the Army (and DoD). These factors have resulted in a force charged with the evaluation and maturation of the FCS concept that itself is just beginning to become familiar with networked force fundamentals. To make matters worse, the tools that have been available to train this force are mostly limited to the models and simulations used for the evaluation (discussed later). While this process has been effective in terms of discovery learning, it may be artificially limiting the Army’s ability to evolve and communicate the advantages and disadvantages of the networked FCS force.

Educating Soldiers, leaders, and analysts to understand the unique differences between today’s force capabilities and the capabilities of the networked FCS force may

require a monumental change in how training is conducted. The differences are not only affected by the enhancements in technology, but will also be impacted by evolving threat Tactics, Techniques and Procedures (TTP), and the environments in which friendly forces are expected to operate in the future. The “Functional Concept for Battlespace Awareness (BA)” produced by the Joint Chiefs of Staff in December of 2003 speaks specifically of the need to “Recruit, Retain, and Train World-Class BA personnel.”³¹ Although this document was largely written for the higher levels of the intelligence organizations, its ideas clearly communicate the need to treat the requirements of the personnel of networked force as unique in nature. The document stresses the importance of “recruiting high quality, retaining high quality, training high quality, and increasing the diversity skill base of Battlespace Awareness personnel.”³² While this appreciation has been noted and implemented into the evolving training doctrine for the FCS force, it has not been recognized as a requirement for the Soldiers and leaders charged with evaluating and maturing the FCS concept. This oversight may be impacting the Army’s ability to credibly understand, evaluate, and communicate the impact and value of the FCS concept.

This is not an easy problem to solve within the Army’s existing personnel system. While the Army has grown a force capable of evaluating and maturing the FCS concept at Fort Knox and other proponent and analytical agencies within TRADOC, the continual rotation of military, contractor, and analytic personnel from the program may be negatively impacting the Army’s ability to effectively mature the FCS concept. The rotation of key personnel within the tasked units has resulted in short-term growth in the concept that is subsequently stagnated until replacement personnel gain the needed

knowledge to once again evolve the concept. While this process may be acceptable for most programs, the unique and revolutionary capabilities of the FCS force, and the speed at which the FCS program is evolving may require greater levels of training and continuity of personnel to credibly and effectively develop the force.

While rotation of personnel impacts the evaluation of the FCS force, identifying the right personnel to develop and mature the force may have an even greater impact. The current process of rotating military personnel from operational assignments into UAMBL and now the Evaluation Brigade Combat Team (EBCT) has the advantage of infusing recent experiences into the design, however, may not be the best method for assigning the “right” kinds of Soldiers and leaders needed to mature the FCS concept. As stated earlier, the networked force will require unique skills in its people if the full potential of a networked force is to be realized. With neither a process in place to determine the required skill sets for Soldiers entering the program, nor an accepted method of the training needed for this developmental work, the Army has simply resorted to using current force Soldiers to develop the FCS force. While the current concept may be the only option that is realistically feasible, the Army may need to consider more disciplined methodologies in order to legitimately expedite the maturation of the FCS program. Furthermore, once the Army finds a more effective way to assign the right Soldiers to this program, it may also need to institute creative reassignment strategies that keep acquired knowledge and understanding within the boundaries of the program.

While the Soldiers are the centerpiece of the maturation of the FCS force, the analysts and contractors supporting the effort have experienced similar short-term stints in the maturation of the FCS program. Most analysts and contractors assigned to

evaluate and mature the FCS program are rotated into other programs within 2-3 years. As mentioned previously, while this may be an acceptable way to do business with most other programs, it may not allow either the FCS program or the Army to fully leverage the unique skills and levels of understanding of networked operations which have been acquired.

In the end, the skill sets and lack of continuity for Soldiers, leaders, analysts, and contractors to remain engaged in the FCS program may be artificially limiting the growth of knowledge, and maturation of the FCS program.

Recommendation

To adjust the “means,” Army leadership must truly understand that the maturation of the FCS program is dependent upon the personnel assigned to the program. As such, selection of the personnel, the training that they receive, and the duration of assignments are crucial to the effective maturation of the FCS program. The standing up of the EBCT at Fort Bliss, Texas offers a unique opportunity to implement strategies that identify personnel traits and training requirements which are needed to expedite understanding of network enabled operations. Once identified, key personnel may need to be managed within the program to more efficiently ensure the continuous and credible growth of the program. The Army may also consider using the identified critical and key traits needed to develop the program to provide valuable insight into the unique skill sets that are needed for the Soldiers who fill positions within the FCS force.

Issue 6: Means-Assessment Tools

Throughout the preceding paragraphs, the importance of situational awareness on the fighting capabilities of the force has been highlighted as key to understanding the

capabilities and more importantly, the “bang for the buck” value of FCS and the network concept itself. How has the Army performed its evaluation of the largely qualitative network-centric concept? In short, the Army has turned to its family of quantitative models and analysts whose foundation and expertise reside in quantitative analysis. While these tools remain effective when analyzing the impact of enhancements in lethality, survivability, and mobility, they may offer only limited capability to gain qualitative insight into an information based force. Models such as TRAC’s Combined Arms & Support Task Force Evaluation Model (CASTFOREM) and Vector-in-Command (VIC) have historically proven to be remarkably useful closed-loop tools in the assessment of system enhancements, however have provided limited insight into the qualitative aspects of a networked force. Man-in-the-loop models such as TRADOC Analysis Center (TRAC’s) Janus and UAMBLs One-SAF (OS) have proven useful in gaining insight into the human interactions of an information based force. However, these models are limited in their ability to fully represent the network. These models also typically lack the number of trial runs needed to credibly support the acquisition process. While all of the tools offer capability to evaluate components of the FCS concept, none of the models accurately account for all of the forms of intelligence and information that are proving so valuable within current operations. While all of these simulations have undergone dramatic and impressive modifications and enhancements in an attempt to provide better analytic venues from which to assess FCS capabilities, at the end of the day, these simulations have failed to produce meaningful insight into the qualitative aspects of the FCS force.

There are several key reasons why these tools have been used. First and foremost, the speed at which the program is evolving and being evaluated has limited the Army's ability to develop and use appropriate qualitative assessment tools. Secondly, the base of analytic knowledge and experience which has typically supported the acquisition processes resides within these largely quantitative models. Although the Army has a great deal of knowledge with certain aspects of the required qualitative methodologies,³³ the personnel typically associated with these types of analysis are not normally associated with concept evaluation in support of the acquisition processes. Finally, the existing cultures within the DoD organizations responsible for the acquisition process are more comfortable and dependent on quantitative types of results and are, by default and by acceptance, limiting the requirement for qualitative analytic results.

To understand the impact of the limitations of these models, one only needs to examine the metrics that have routinely been shown in support of the FCS acquisition process. Metrics which have consistently been used to describe the capabilities of the force include those that show the netted FCS force seeing earlier, killing from longer ranges, and surviving better than the current force.³⁴ While these quantitative metrics certainly encapsulate key conceptual ideas, they are more attributable to the system capabilities than they are to the qualitative measurements associated with the impact that information plays on force success. What is clearly missing is an assessment of how much more information is available, how this information advantage translates to mission success, and how the FCS force leverages this information to change the way that it fights. Without this foundation, many of the metrics currently used to assess the

force capabilities are likely showing only a limited picture, and one that does not appear to support the context set forth through General Shinseki's original vision.

When examining the metrics that do specifically address the information that is produced and processed by the FCS force, the limitations may be more problematic. In short, the only metric consistently reported in the annual FCS assessments is the enemy which is actually seen. There are limited cases in which what is heard—Signals Intelligence (SIGINT)—is added to the generated and available information, despite the exponential growth in the number of systems available within the FCS formation. Similar limitations are noted across the remaining intelligence systems (Electronic Signals Intelligence (ELINT), Communications Intelligence (COMINT), Measurement and Signatures Intelligence (MASINT), Human Intelligence (HUMINT) and Open Source Intelligence (OSINT)) as well as weather and terrain. To truly understand the magnitude of this shortfall, one only needs to compare the existing simulation results with lessons learned from current operations in Iraq and Afghanistan. While FCS simulation reports show the enemy being found (first acquisition) nearly 100% of the time by actually seeing him,³⁵ interviews with Soldiers and leaders coming from current operations consistently report that HUMINT, SIGINT, and information from the local population is driving the intelligence and information processes.³⁶ In other words, the simulation output is nearly 180 degrees out from what is happening in current operations! If one assumes that current operations are indicative of future operations, the significance of this shortfall can not be understated.

While the current shortfall in simulation capability required to accurately assess the information processing capability of the FCS force is significant, it may only be the tip of

the proverbial iceberg. Failure to accurately represent the informational collection and processing capability of the force may also be producing other simulation-induced tactical behavioral inconsistencies when compared to operational results from both Iraq and Afghanistan. By only allowing the FCS force to know about an enemy by actually seeing him, commanders within simulation are more often than not forced to conduct “action on contact” drills when conducting actions within urban environments. While this certainly will happen from time to time, it happens as a rule within simulation. Again, this is not what is happening in theater. Intelligence and information provided beforehand, battlefield cues and information provided through the eyes and ears of the soldiers as the action unfolds, helps commanders bring awareness to the situation. Without this information, the force within simulation literally maneuvers until threat forces take action. This causes more close fighting, more losses, and may be negatively impacting an accurate assessment in other areas of lethality and survivability of the FCS force.

In the end, failure of the models and simulations to account for true SA may be presenting a false or incomplete assessment of force capabilities. This shortfall may be resulting in programmatic, organizational, and doctrinal refinements that are explainable within the models and simulations, but may not be consistent or intuitive when compared to real-world operational results. This is not only dangerous, but is having a dramatic impact on “bang for the buck” rationale used to describe this multi-billion dollar program.

Recommendation

To refine the “means,” analysts and force developers must realize that the premise for the analysis of the FCS force is far different than any analysis which has been

conducted in the past. More importantly, they must understand the limitations of the models and simulations in areas which are unique to the FCS force. While model and simulation enhancements must continue, force developers must concurrently develop complementary tools which better assess the qualitative impacts that increases in information will have on force success. A similar information campaign which highlights the importance of the qualitative aspects of the FCS force should be initiated and directed to DoD and acquisition leadership who have an historic affinity for quantitative types of analytic results. Concurrent with this training and information campaign, is a requirement to conduct “think-tank” events which leverage the skills and experiences of Soldiers (operators), system designers, and threat subject matter experts in order to gain an appreciation of the impact that information has on military operations. Operators should be used to provide the informational (and intelligence) requirements of the given scenario. System designers (and engineers) should evaluate how these requirements can be technically achieved. Threat subject matter experts should then evaluate mitigation strategies, and also be used to provide initial forecasting estimates of the impact that gains in information will have on threat success. This work must consider second and third order effects. The purpose or end-state of the think-tanks should be to develop initial estimates of the value that the qualitative aspects of information dominance has on force success. This work should be conducted in an analytically credible way so that it can be added to the quantitative assessments already being used to evaluate the FCS concept.

Conclusion

The vision for the FCS force set by General Shinseki in late 1999 has matured into one of the Army's most complex acquisitions in its history. However, the premise for the success of this force—information dominance—has not been the focus of the analysis and concept maturation to date. This shortcoming is without doubt, negatively impacting the Army's ability to mature and communicate the capabilities of a netted force. Based on experience gained working the program since its inception through the summer of 2007,³⁷ I believe that there are six factors which are key to contributing to this shortcoming;

- the system focus of current acquisition processes
- the art and qualitative nature of information
- the challenge of separating intelligence from information
- current developmental tasking processes
- Department of Defense's (DoD) limited expertise with networked operations
- the use of inappropriate analytic tools

Joint Vision 2020, the document which ultimately drove General Shinseki's vision for the Army, warned "...advances in information capabilities are proceeding so rapidly that there is a risk of outstripping our ability to capture ideas, formulate operational concepts, and develop the capacity to assess results."³⁸ While the Chairmen of the Joint Chiefs of Staffs and several others realized the potential difficulty of credibly assessing the information dominant FCS force, the warnings and concerns may have been inadvertently dismissed by the Army. Arguably, tools, processes, Soldiers, and analytic methods should have been developed to evaluate the unique attributes of this force. In

large part, they were not. In place of a unique approach, the Army has more or less attempted to develop this concept in the same way, using the same tools, and many of the same people and processes that it has used to develop the systems of today's force. The end result has been a greater focus on the systems within the FCS force rather than a focus on the underlying enabler for the force—information. This inappropriate focus may be having a dramatic impact on the Army's ability to credibly understand and communicate the value of the FCS force and could be resulting in misinformed program adjustments and cuts.

To re-set the azimuth that General Shinseki communicated in his initial strategic vision, the Army must refine the ends, ways and means used to assess and mature the FCS concept. As recommended throughout the previous paragraphs, it must find effective and credible methods to assess the impact of the FCS force's capability to generate, analyze and apply information. To do this, the Army should aggressively pursue unique FCS think-tanks, and other innovative approaches, to better account for the qualitative factors associated with an information-based networked force. For the Army to truly underpin the qualitative aspects of an information based force, it must refine its analytic techniques, train all personnel involved in the program to think and act more like a netted force, and set the stage within the acquisition process to allow the qualitative aspects of the netted FCS force to carry the appropriate weight within the annual assessments of the program. If it fails to do this, the force design may continue to be questioned on its "bang-for-the-buck" value, and may ultimately result in a force full of advanced technologies that fails to achieve the capabilities envisioned by General Shinseki.

Endnotes

¹ U.S. Department of the Army, *Concepts for the Objective Force*, White Paper (Washington, D.C.: U.S. Department of the Army, 2000), 1-8.

² Andrew Feickert, *The Army's Future Combat System (FCS): Background and Issues for Congress* (Washington, D.C.: Library of Congress, Congressional Research Service, January 2007), 1. The Future Combat System (FCS) is the U.S. Army's multiyear, multibillion-dollar program at the heart of the Army's Transformation efforts. It is to be the Army's major research, development, and acquisition program consisting of 18 manned and unmanned systems tied together by an extensive communications and information network. FCS is intended to replace such current systems as the M-1 Abrams tank and the M-2 Bradley infantry fighting vehicle with advanced, networked combat systems. The FCS has been characterized by the Army and others as a high-risk venture due to the advanced technologies involved as well as the challenge of networking all of the FCS subsystems together so that FCS-equipped units can function as intended.

³ Ibid., 6-12,14-15.

⁴ U.S. Department of the Army, *Concepts for the Objective Force*, Concept Summary, IV.

⁵ Based on author's personal experience. Nearly 7 years of experience as a military analyst involved with the FCS program; work included analysis of over 10,000 hours of simulation time and interactions with over 5,000 Soldiers, system engineers and contractors involved in the FCS program.

⁶ U.S. Joint Chiefs Staff, *Joint Vision 2020* (Washington D.C.: U.S. Joint Chiefs Staff, 2000), 8.

⁷ Paul Bracken, "Significance of Dominant Battlefield Awareness," in *Dominant Battlespace Knowledge*, eds. Stuart Johnson and Martin Libicki (Washington, D.C.: National Defense University Press, 1995), 1.

⁸ Office of Technology Assessment, *A History of the Department of Defense Federally Funded Research and Development Centers*, (Washington, D.C.: Office of Technology Assessment, June 1995), 8.

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¹⁰ U.S. Defense Acquisition University, "Systems Engineering," and "Human Systems Integration (HSI)," and "Acquiring Information Technology and National Security Systems," in *Defense Acquisition Guidebook* (Fort Belvoir, V.A.:U.S. Defense Acquisition University, n.d.); available from <https://akss.dau.mil/dag/DoD5000.asp?view=document&doc=1>; Internet; accessed 6 February 2008.

¹¹ Captain Gregory Moore, "Ten Principles of Intelligence on the Battlefield," *CALL Newsletter*, No.07-0191 (October 2006): 3-4 ; available from <http://call.army.mil>; Internet; accessed 15 February 2008.

¹² Major General Robert H. Scales, Jr., "From Korea to Kosovo: How America's Army Has Learned to Fight Limited Wars in the Precision Age," *Armed Forces Journal* (December 1999): 23.

¹³ Author's personal experience. Author's experience with over 5,000 personnel involved in the maturation of the FCS concept. See endnote number 5. Ibid.

¹⁴ Author's personal experience. Author's experience with over 5,000 personnel involved in the maturation of the FCS concept. See endnote number 5.

¹⁵ U.S. Department of Defense, *The Defense Acquisition System*.; and U.S. Department of Defense, *Operation of the Defense Acquisition System*, Directive 5000.2 (Washington D.C.: U.S. Department of Defense, 12 May 2003).

¹⁶ U.S. Defense Acquisition University, "Human Systems Integration (HSI)," and "Acquiring Information Technology and National Security Systems".

¹⁷ Quantitative Analysis is the process of presenting and interpreting numerical data, examples would include number of kills, range of kills etc. Analysis of Qualitative data is more of a process of noticing, collecting and thinking about an area of focus. Source : John V. Seidel, *Qualitative Data Analysis* (Colorado Springs, CO.: Qualis Research, 1998), 1 ; available from <ftp://ftp.qualisresearch.com/pub/qda.pdf>; Internet; accessed 19 March 2008. Examples of this would include analysis of how situational awareness is achieved and how it is unique to each individual.

¹⁸ M.R. Endsley, and D.J., Garland, eds., *Situation Awareness Analysis and Measurement*, (Mahwah, NJ: Lawrence Erlbaum Associates, 2000), 2-9

¹⁹ U.S. Department of the Army, *FCS Operational & Organizational Plan*, TRADOC Pamphlet 525-3-90 (Washington, D.C.: U.S. Department of the Army, 16 December 2005), A-39.

²⁰ U.S. Department of the Army, *Concepts for the Objective Force*, 7.

²¹ Endsley and Garland, 9-14.

²² Alexander Kott, *Battle of Cognition: The Future Information-Rich Warfare and the Mind of the Commander* (Westport, CT : Praeger Security International, 2007); available from <http://www.psi.praeger.com/doc.aspx?d=/books/gpg/C34995/C34995-425.xml>; Internet; accessed 19 March 2008.

²³ U.S. Joint Chiefs of Staff, *Functional Concept for Battlespace Awareness*, V 2.1 (Washington, D.C.: U.S. Joint Chiefs of Staff, 2003), 17-18.

²⁴ U.S. Joint Chiefs of Staff, *Department of Defense Dictionary of Military and Associated Terms*, Joint Publication 1-02 (Washington, D.C.: U.S. Joint Chiefs of Staff, 12 April 2001). As amended through 17 October 2007.

²⁵ U.S. Department of the Army, *Concepts for the Objective Force*, 8.

²⁶ U.S. Joint Chiefs of Staff, *Functional Concept for Battlespace Awareness*, 2.

²⁷ U.S. Department of the Army, "Vision Statement: The Army Vision: People, Readiness, Transformation," in *U.S. Army Posture Statement 2002* (Washington, D.C.: U.S. Department of the Army, 2002); available from <http://www.army.mil/aps/02/html/vision.html>; Internet; accessed 19 March 2008.

²⁸ Daniel Gonzales, et al., *Network-Centric Operations Case Study: The Stryker Brigade Combat Team* (Santa Monica, CA.: RAND, 2005), 13-16.

²⁹ Fawzia Sheikh, "Black Sunday," *Inside the Army* 19 (18 February 2007).

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³¹ U.S. Joint Chiefs of Staff, *Functional Concept for Battlespace Awareness*, 40.

³² Ibid.

³³ Dr. Kaleb McDowell, et al., "Addressing Human Factors Issues for Future Manned Ground Vehicles (MGVs)," *Army AL&T* (January-March 2007): 1-4.

³⁴ TRADOC Analysis Center, "Future Combat Systems, FY07: Office Secretary of Defense Spring Review," briefing slides, Fort Leavenworth, KS, 8 May 2007, Slide 10.

³⁵ Ibid., Slide 22.

³⁶ Author's personal experience. See endnote number 5. Based upon author's interviews/discussions with more than 100 senior leaders and military intelligence officers who served in OIF/OEF. This has been substantiated in growth and enhancement of these types of collection assets across the force.

³⁷ Ibid.

³⁸ U.S. Joint Chiefs Staff, *Joint Vision 2020* (Washington D.C.: U.S. Joint Chiefs Staff, 2000), 8.

