USAWC STRATEGY RESEARCH PROJECT

SOLDIER AS A SYSTEM

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
15 MAR 2006		**00-00-2005 to 00-00-2006**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Soldier as a System	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
Chris Lockhart	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
U.S. Army War College,Carlisle Barracks,Carlisle,PA,17013-5050	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
See attached.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**		**24**	

ABSTRACT

AUTHOR: Colonel Christopher E. Lockhart

TITLE: Soldier as a System

FORMAT: Strategy Research Project

DATE: 13 March 2006 WORD COUNT: 5195 PAGES: 24

KEY TERMS: Future Combat System, Capability Development Document, Integrated Concept Team, Program Executive Office-Soldier

CLASSIFICATION: Unclassified

Since the Soldier will remain the centerpiece of Army formations, it is essential that Army Transformation efforts ensure the Soldier possesses assured connectivity within the Future Combat System. In order to achieve this goal, TRADOC has reorganized various Soldier-specific research, development, and acquisition processes into a single concept known as Soldier as a System (SaaS). This research paper looks at the creation of SaaS, what SaaS means, current SaaS initiatives, and what SaaS actions still need to be completed.

SOLDIER AS A SYSTEM

"The future dismounted Soldier/Marine team will achieve decisive victory through a ten-fold (10X) improvement in effectiveness."[1] The 2001 Army Science Board (ASB) made this statement with confident assurance and urged the Army to "get on with it."[2] However, before this vision of a "10X" Soldier can become a reality, changes still have to be made in the way the Soldier is conceptualized and equipped.

The ASB study was accomplished in the summer of 2001 and its results published only weeks after the September 11th attacks which launched this Nation into a global war against international terrorism. Prophetically, the Assistant Secretary of the Army for Acquisition, Logistics, and Technology, who requested the study, stated in a memorandum to the ASB (dated December 2000) that "future adversaries are expected to use urban and complex terrain, state-of-the-art commercial technology, human shields and asymmetric means to mitigate U.S. military strengths."[3] Today, our Soldiers find themselves fighting such an asymmetric enemy in the mountains of Afghanistan and the cities of Iraq.

The Army's near-term priority is to fight and win the global war on terrorism. Its long-term focus is to remain the world's preeminent landpower that is both ready to meet and relevant to the challenges of the dangerous and complex 21st century security environment.[4] In its *2006 Posture Statement*, the Army re-emphasized that the Soldier is the centerpiece of its formations.[5] This is in recognition that the Army must deploy a force more responsive and dominant across the full spectrum of today's possible conflicts. The *2005 Army Modernization Plan* reiterates that the Soldier is indispensable to the Joint Force and is the focus of Army transformation efforts.[6] It states the foundation of the Army's Future Force (formerly, the Objective Force) is the Future Combat System (FCS) and that the 18 systems comprising the FCS are centered on the Soldier.[7]

Today's Joint Operations Concepts (JOpsC) are major combat operations, stability operations, homeland security, and strategic deterrence.[8] These concepts provide broad transformational guidance taking a Joint outlook. The overall goal of Joint Vision (JV) 2020 is "…the creation of a force that is dominant across the full spectrum of military operations—persuasive in peace, decisive in war, preeminent in any form of conflict."[9] The purpose of JV 2020 is to describe in broad terms the personnel and operational capabilities that will be required for the Joint Force to succeed across the full range of military operations in 2020 and beyond. The overarching focus of this vision is full spectrum dominance—achieved through the interdependent Joint application of the following eight functional concepts: battlespace

awareness, Joint command and control, force application, protection, focused logistics, net-centric environment, Joint training, and force management.[10]

Attaining that goal requires the steady infusion of new technology and modernization, as well as, replacing equipment. However, materiel superiority alone is not sufficient. Of equal importance is the development of doctrine, organizations, training, leadership and education, personnel, and facilities who effectively take advantage of the technology. This requires a systems approach to research, development, and acquisition of Soldier capabilities.

To correct the past tendency of fielding a myriad of separate systems for the Soldier, the Army recognized in the late 1990s that it must approach equipping Soldiers within a single integrated methodology. This process became known as the Soldier as a System (SaaS) concept. Its purpose is to provide the Soldier with modular integrated equipment, instead of fielding various pieces of equipment and requiring the Soldier to become the integrator. For example, at its current stage of development, the Land Warrior (LW) ensemble of electronics and batteries would add more than 30 pounds to a Soldier's load (already exceeding 100 pounds for certain missions).[11] Obviously, weight severely limits the combat Soldier's mobility. Given this prospect, it is important that new approaches are sought to integrate recommended technologies that will support the rapid development of effective systems for the Soldier.

The Executive Agent for transformation within the Army is the Training and Doctrine Command (TRADOC). As stated earlier, much of the U.S. Army's effort to transform is represented in development of the FCS. The cornerstone of the FCS program is creating network centric formations able to capitalize on information sharing. This systems approach links not only platforms, but Soldiers as well. "It is a Joint networked system of systems connected via an advanced network architecture that will enable levels of Joint connectivity, situational awareness and understanding, and synchronized operations heretofore unachievable."[12]

Networked access to multiple systems will provide the Soldier with support from organic and external assets at a much greater decentralized level than the current force allows. The Soldier will maintain situational awareness via a shared network while conducting MOS-related operations. The Unit Defined Operating Picture (UDOP) provided in both mounted and dismounted operations will be nested, and the transition from Future Combat System (FCS) platform supplied UDOP and the Soldier generated UDOP will be transparent.

Since the Soldier will remain the centerpiece of Army formations, it is essential that Army Transformation efforts ensure the Soldier possesses assured connectivity within the Future Combat System. The FCS program has been restructured to consist of four "spirals" (infusion

of new technologies) slated for 2008, 2010, 2012, and 2014. The Army plans to field two FCS equipped brigade combat teams (BCTs) by 2015, and two more each year after 2015, up to a total of 15 FCS equipped BCTs.[13] In order to ensure Soldier development keeps pace with this process, TRADOC has reorganized various Soldier-specific research, development, and acquisition processes into a single concept known as SaaS. This research paper looks at the creation of SaaS, what SaaS means, current SaaS initiatives, and what SaaS actions still need to be completed.

Background

Modern history provides multiple examples of the need for addressing the SaaS. S.L.A. Marshall's, The Soldier's Load, recognized the need to envision the Soldier as a complete system in order to increase the Soldier's efficiency and effectiveness. Marshall pointed out that more thought and care was needed in the overall design of what Soldiers were expected to carry into battle.[14] In World War II, the American Soldier went to war carrying the same load-bearing and personal equipment carried by his World War I predecessor twenty years earlier. The American Soldier in Vietnam carried load-bearing equipment that had only gradually evolved since World War I (the only significant change was that load-bearing equipment was made of lighter weight nylon). Since Vietnam, Research, Development, and Acquisition (RDA) has since given us even more lightweight clothing and equipment, but the total weight carried by each individual Soldier continues to grow—often exceeding 100 pounds—as more equipment is provided to the Soldier. This trend has continued despite numerous recent studies indicating that the Soldier's fighting load should not exceed approximately 50 pounds and the approach march load should not exceed approximately 70 pounds.[15] That 100-pound burden has been placed on the Soldier by the absence of an integrated, systematic approach to Soldier equipment requirements.[16]

Just as Desert Storm ended, the 1991 Army Science Board (ASB) conducted a summer study regarding how much Soldiers should carry and, most important, who should decide what and how much. This study, entitled "Soldier as a System" (SaaS), came to the following five conclusions: (1) The requirement to properly equip the Solder for combat is as complex as those of other programs such as the Abrams tank, Bradley fighting vehicle, Patriot missile system, and Black Hawk helicopter programs; (2) Existing Soldier equipment mismatches due to lack of integration are reducing combat efficiency and endangering Soldiers; (3) The planned "Block Change" concept of equipping the force (no new equipment is fielded until enough is procured for the entire Army) is an outdated concept; (4) Promising new technological

capabilities should be exploited to ensure battlefield overmatch for the American Soldier; (5) The Army should develop and employ experimentation (wargaming and simulations) with emphasis on future Solder system threats.[17]

The 1991 ASB Summer Study also identified a need for the Army to manage the SaaS. It stated Soldier requirements should be derived from the functions Soldiers must perform in the face of the threat on the future battlefield. It further recommended that TRADOC provide a list of prioritized capability needs in the form of requirements to guide the Doctrine, Organizations, Training, Materiel, Leadership and Education, Personnel, and Facilities (DOTMLPF) development process for future Soldier systems. The study found that the TRADOC System Manager (TSM) for the Soldier had much broader responsibilities than other TSMs and questioned the TSM-Soldier's ability to effectively perform all functions with existing manpower resources. The study went on to recommend a general officer manager of the Soldier system due to multiple program requirements and the complexity of achieving required capabilities.[18]

Although the findings and recommendations were supported in various Army circles, they lacked an authoritative sponsoring force to guide the recommendations into practice Army-wide. Shortly thereafter, the Soldier Integrated Protective Ensemble Advanced Technology Demonstration[19] verified the need to manage the SaaS, as well as, the increased Soldier capability achieved when developing the SaaS. In 1997, the United States Army Infantry Center conducted a holistic study of the future requirements for dismounted Soldiers; this study concluded that through the beginning decades of the 21st Century, U.S. forces will be engaged in smaller scale wars against asymmetric threats and that this would increase the need for dismounted ground forces.[20] Also in 1997, the Land Warrior Early Operational Experiment Report confirmed that a systems approach to Soldier requirements would provide greater payoffs in lethality, survivability, mobility, and situational awareness, for both the individual and the unit.[21] The Army created the Soldier System Command (SSCOM) to meet requirements for the SaaS. The SSCOM Project Manager-Soldier, at Fort Belvoir, was charged with coordinating the engineering/manufacturing development of the Land Warrior system with a program to insert new technology, under the direction of the Natick Research, Development, and Engineering Center in Natick, Massachusetts. The Land Warrior system included a computer/radio subsystem, an integrated helmet assembly subsystem, and a weapons subsystem to increase the effectiveness of the dismounted Soldier on the battlefield. The first Land Warrior units were scheduled to be fielded in the late 1990's; however, the Army temporarily divested this program after tactical training experiments revealed serious deficiencies. Thus, more than ever, it became clear the Army needed a systemic approach to equipping the Soldier.[22] Furthermore,

the Army had yet to appoint a general officer Program Executive Officer to integrate the various programs dealing with Soldier material solutions.[23]

Another Army Science Board study was conducted in the summer of 2001. This time, the purpose of the study was to determine ways to enhance the Objective Force Soldier and to recommend roadmaps to guide Soldier integration as part of the Future Combat System. The 2001 ASB study produced three important messages: 1) Our country has a critical need for a Soldier/Marine Team that can be deployed in time of crisis and can accomplish assigned missions with minimal casualties; 2) If a systems approach were taken which was oriented toward qualitative advances in six synergistic dimensions (lethality, survivability, C4ISR, mobility, sustainability, and people) a vision of a Soldier/Marine 10 times as effective could be achieved; 3) The study identified priority programs which would achieve desired gains and produced a series of roadmaps for implementation.[24]

The 2001 ASB study further concluded that the phrase “Soldier system" was a misnomer. It stated that Soldier’s systems were still being designed and developed as a series of programmatic and technical stovepipes. There was still no overall systems architect to resolve the performance, weight, power, and sustainability objectives for the Soldier. The study recommended a top level systems engineering approach to the Soldier system. It also recommended assigning a Chief Engineer with overall system design responsibility. The Chief Engineer must be empowered to ensure the necessary trade-offs are carried out and that the resulting system design is technically feasible, affordable, and can be manufactured.[25]

The terror attacks of September 2001 and the subsequent military operations in Afghanistan created a new sense of urgency. Acknowledging the long, evolving Soldier-equipping process needed to be transformed, Army Vice Chief General John M. Keane directed the Army Staff to institutionalize the SaaS and to take concrete actions to implement this philosophy. Past practices of individual and incremental additions to the Soldier kit would be replaced with holistic solutions. Under the SaaS concept, there would be one central developer and coordinator of requirements for Soldier equipment. Having one overall point of responsibility for current and future Soldier modernizations initiatives would improve material development by eliminating redundancy and waste. At last the Soldier would be viewed as the central system in current and future Army organizations. But achieving that central focus on the Soldier would not be a simple undertaking.

Multiple requirements fragmented equipping policies and incremental funding mechanisms had frustrated innovative thought when it came to putting the best in the hands of the troops. To provide direction and management structure for the SaaS, an Integrated

Concept Team (ICT) was formed to meet regularly and to represent those branches of the Army with special requirements. TRADOC designated the Commanding General of the U.S. Army Infantry Center (CG, USAIC) as proponent of the ICT and charged him with developing concepts in accordance with the DOTMLPF framework (discussed in further detail later is this paper). Soon after, Program Executive Office (PEO) Soldier was established at Fort Belvoir to oversee the material acquisition process. The PEO Soldier was responsible for developing, producing, fielding and sustaining everything the Soldier wears and carries (also, discussed in greater detail later in this paper).[26]

What Is Soldier as a System

In the years since World War II, the United States Army has succeeded in maximizing technological advancement in weapons but has failed to capture the potential value of treating our most important resource—the Soldier—as a system. The Army is now correcting this oversight. The vision of the Army Strategic Planning Guidance (ASPG) calls for providing two core competencies: (1) Train and equip Soldiers and grow leaders; and (2) Provide relevant and ready land power to the combatant commanders as part of the Joint Force.[27] In support of the ASPG, the Army's Future Force (FF) concept will provide a strategically responsive, flexible maneuver force, dominant across the range of military operations. The current key enabler to the FF concept is the establishment of full spectrum tactical combat units based on modular Brigade Combat Teams (BCTs). The SaaS concept is necessary to link Soldiers with the FF requirements and transformation efforts. The Future Force Warrior (FFW) is an Advance Technology Demonstration (ATD), a science and technology effort of the Natick Soldier Center, designed to accomplish this linkage. The FFW ATD identifies technology that industry can mature to the point it can be injected into the RDA process for future fielding. The SaaS concept also provides source documents for the development and integration of Soldier systems with desired capabilities. These documents facilitate funding of the SaaS, compared to past practices of funding individual Soldier equipment. Finally, as the cornerstone of combat developments, the SaaS concept will provide a common reference for all Soldier systems/subsystems integration across the DOTMLPF domains.

A conceptual framework for managing the SaaS is to determine desired characteristics of the current and future Soldier. Such characteristics become the foundation for related concepts. These concepts are researched and developed into specific capabilities. Subsequently, prototypes are produced exhibiting such capabilities. Finally, experiments are conducted to test results prior to acquisition and fielding. This is a top down planning, bottom up refinement

process. Determining desired characteristics is crucial to achieve Joint interdependence. The initial step is to consider the characteristics of the Joint Force: Knowledge Empowered; Networked; Interoperable; Expeditionary; Adaptable/Tailorable; Precise; Fast; Resilient; Agile; Lethal.[28] These characteristics are the foundation for the development of the SaaS Operational Concept, as well as, Soldier capabilities and individual tasks.

The SaaS concept focuses on providing capabilities to Soldiers involved in both war and military operations other than war, and may be in conjunction with other air, land, sea, space, and special operations forces. The SaaS concept will provide a model for the other services that ensures Sailors, Airmen, Marines, National Guardsmen, Army Reservists, and U.S. Coast Guardsmen are central to the transformation of their proponent service. This focus is critical as the Department of Defense advances technologically across the full spectrum of military operations, on all types of terrain, and under all types of climatic conditions. Increased capability in survivability, lethality, mobility, sustainability, and command and control (C2)/situational awareness are immediate results gained from this concept. The SaaS concept will address the Soldier's role in the Army's Current and Future Force (FF). It will assist in the transformation of today's Soldier into a FF Soldier, thereby, enhancing the Army's capability to provide the Joint Force Commander a dominant land force capability by directly supporting the accomplishment of the tactical-level collective tasks listed in the Army Universal Task List (AUTL).[29]

The SaaS process also provides a chance to fundamentally change ground Soldier training in the Army. Soldier's training must replicate the realities of modern combat as closely as practical. While constant training in weaponry and field craft is crucial, that alone is not sufficient. Soldiers and leaders must possess higher levels of proficiency on a wider array of skills and knowledge than the current force because of their 96-hour deployment requirement. FF Soldiers need a resident capability to acquire a greater number and variety of complex skills faster to reduce the "learning curve." They need a readily available training capability conveniently integrated into their system to sustain proficiency in complex tasks and perishable skills. The Army is developing an equipping system that quickly adapts training devices to reflect changes in requirements generated by low-technology asymmetrical threats. Embedded Training (ET) systems will provide leaders and Soldiers a readily available system for planning, executing and assessing Top Level and Second Level tasks.[30] The user goal is to train anywhere, any time, which means the Army will take training with them. Technology has matured to a level that supports these requirements. ET is the user's primary option for SaaS training in all training domains—institution, home station, Combat Training Centers, and

deployed. Separate training devices will be built only for those tasks that are unaffordable, unreasonable, or unsafe in an ET environment. The SaaS process will ensure ET development as an integral part of the SaaS architecture, not as a set of add-ons and software applications.[31]

From the equipping perspective, the SaaS consists of the Soldier and all those items of equipment worn, carried (to include man-portable radios and crew-served weapons) or consumed. The SaaS is becoming the foundation for current and future research, development, and procurement efforts. Soldier missions range from home station training, to peacekeeping, to support and stability operations, to full-scale war. For all Soldiers to achieve mission success as part of the Joint team, the Army must continue to improve acquisition of equipment which helps achieve the following Soldier characteristics (these are nested with the Joint Force characteristics previously listed): Lethality, Survivability, Mobility, Sustainability, and Battle Command Capabilities.[32] The creation of PEO Soldier was a major step to improve SaaS material acquisition.

Consolidating Soldier as a System Material Solutions

As stated earlier, the Army established the PEO Soldier under a general officer at Fort Belvoir to develop, produce, field and sustain everything the soldier wears and carries.

> PEO Soldier was created by the Army with one primary purpose: to develop the best equipment and field it as quickly as possible so that our soldiers remain second to none in missions that span the full spectrum of military operations. By viewing the soldier as part of an integrated system, PEO Soldier ensures that the soldier and everything he or she wears or carries works together as an integrated system. The result is an overall systematic design that benefits soldiers by enhancing their ability to accomplish individual and collective tasks, improving quality of life, building confidence, and saving lives. In this respect, PEO Soldier is at the vanguard of Army transformation.[33]
>
> - PEO Soldier Homepage

PEO Soldier is organized into three subordinate organizations lead by project managers: Project Manager Soldier Warrior; Project Manager Soldier Weapons; Project Manager Soldier Sensors and Equipment.

Project Manager (PM) Warrior supports the SaaS through the acquisition of all Soldier systems. PM Warrior is subdivided into two areas: Product Manager Air Warrior[34] and Product Manager Land Warrior.[35] Air Warrior and Land Warrior programs implement improvements in Soldier lethality, survivability, mobility, and sustainment.

Program Executive Office – Soldier Organization

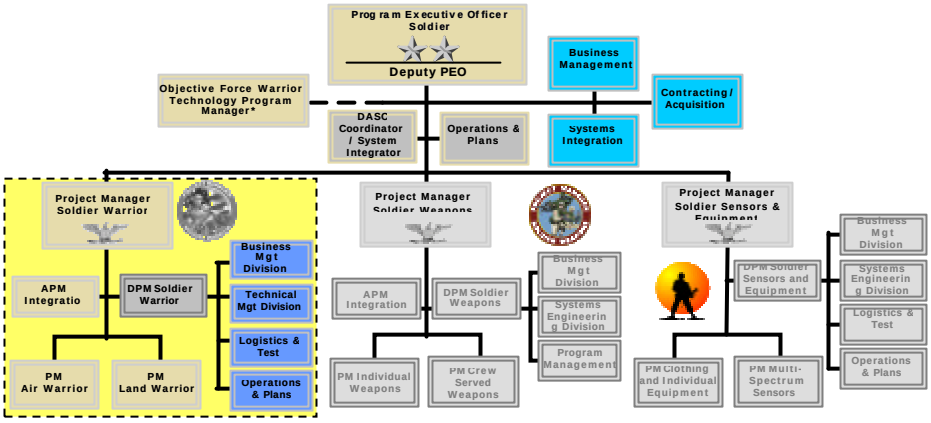

FIGURE 1: PROGRAM EXECUTIVE OFFICE SOLDIER ORGANIZATION

Project Manager Soldier Weapons (PM SW) supports Soldiers through the development, production, and procurement of future and current individual/crew served weapons systems, ammunition, and associated target acquisition/fire control systems. In addition to weapons and ammunition, PM SW manages development and procurement of suppressors, weapons accessory kits, optics, tripods, mounts, and binoculars. Their goal is to equip Soldiers with the best products industry has to offer, resulting in technological overmatch though increased lethality and range, as well as decreased weight. Two Product Managers under PM SW implement the program: Product Manager Individual Weapons [36] and Product Manager Crew Served Weapons.[37]

Project Manager Soldier Sensors and Equipment develops, fields, and sustains Soldier equipment to advance Soldiers' warfighting capabilities by procuring, modifying, or developing state-of-the-art sensors, lasers, clothing, and other individual equipment. This program includes: man-portable laser technologies for pointing and illumination, range-finding, and target designation; night vision capabilities; ballistic and fragmentation protection; technologically advanced tactical and environmental protective clothing; individual chemical protective gear; personnel airdrop equipment. PM Solider Sensors and Equipment consists of two functional product managers: Product Manager Clothing and Individual Equipment (CIE) [38] and Product Manager Sensors and Lasers (PM-SSL).[39]

Consolidating Soldier as a System Management Solutions

SaaS, however, is much more than transforming desired capabilities into material solutions. The Army addresses Soldier issues as they relate to Doctrine, Organization, Training, Material, Leadership and Education, Personnel, and Facilities (DOTMLPF). How SaaS relates to each of these imperatives is articulated in a key strategic document called the SaaS Initial Capabilities Document (ICD). The SaaS ICD describes revolutionary and evolutionary Future Force modernization requirements. It describes the efforts to achieve Army Transformation objectives of improving the responsiveness, agility, versatility, lethality, survivability, sustainability and interoperability of the future Soldier assigned to the FCS. The SaaS ICD also articulates the need for a chartered Integrated Concept Team (ICT) and process to optimize Solder effectiveness by fully integrating the Solder with his equipment.

The SaaS ICT (fig 2) is a formal organization chartered by HQ, TRADOC to oversee the development and establishment of SaaS Concepts and requirements. The CG, USAIC is the TRADOC Executive Agent for the ICT and is charged with developing a SaaS plan and vision within the Soldier community to monitor, leverage, and integrate common Soldier requirements. Each TRADOC proponent is represented on the SaaS ICT; it provides continuous monitoring and integration of new and developing Soldier DOTMLPF requirements with a holistic view. The SaaS ICT is the overall keeper of the SaaS concept, metrics, organizational framework, and capabilities. It is also the body that determines and produces Capability Development Documents (CDDs) for Soldier systems. The ICT coordinates these efforts directly with HQ TRADOC.

The ICT consists of active and reserve component representatives from major commands, TRADOC proponent installations, PEO Soldier, the Army Staff and the U.S. Air Force, Navy, and Marine Corps. Both the Army National Guard and the Army Reserve have individual permanent representatives on the ICT to ensure their specific concerns are heard. This decision making body, chaired by the CG, USAIC, reviews and validates all Soldier requirements to ensure integration and compatibility within the Army, with other services and, to the extent possible, with U.S. allies.

The SaaS ICT also reviews and updates all Soldier requirements (as required) to ensure requirements are compatible and fully integrated with SaaS concepts. Once the SaaS ICT reviews these requirements, they are forwarded through the ICT Executive Agent to CG, TRADOC for approval.[40] The diagram below illustrates how the ICT manages Soldier requirements development.

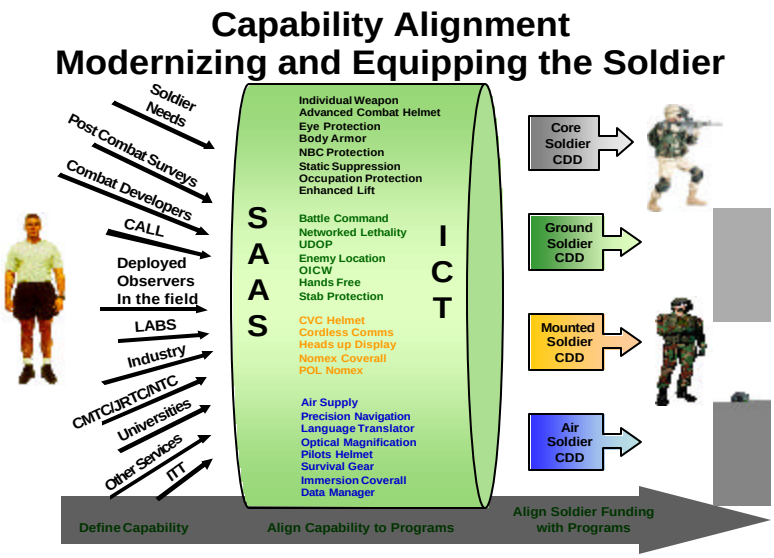

FIGURE 2: SaaS CAPABILITY DEVELOPMENT METHODOLOGY

Current Iniatives

Consolidation of Capabilities Documents

The responsibility for the modernization of Soldiers is spread among the 19 individual TRADOC centers and schools. This has made it difficult for the combat development community to identify and manage Soldier system requirements in a holistic fashion. In addition, individual pieces of equipment needed by Soldiers are defined in a collection of several hundred independent official requirements documents. This has resulted in hundreds of discrete development, procurement, and fielding actions. Previously, the items of equipment in this uncoordinated effort were not integrated with one another where necessary, not engineered for interoperable use, and not compliant with Army efforts to lower the total Soldier combat load. While the United States is still leading the world at using technological superiority to support Soldiers, uncoordinated application keeps Soldiers from becoming 10X Warriors as envisioned by the 2001 ASB.

Until recently, more than 300 separate requirements documents have driven the acquisition process for Soldier equipment. This is in sharp contrast to other major acquisition programs which are usually controlled by one requirements document.[41] Individual requirements documents established for each item worn, carried or consumed by the Soldier

have mismanaged the separate and uncoordinated acquisition of multiple items. Consolidation of all requirements documents into an interrelated system is essential to managing the SaaS. The system now consists of one Initial Capabilities Document (ICD) and four Capability Development Documents (CDDs). In October 2005, the Joint Requirements Oversight Council (JROC) approved the SaaS ICD,[42] setting conditions for future approval of the four CDDs.[43] The Core Soldier CDD establishes those tasks common to all Soldiers.[44] The Ground, Air, and Mounted Soldier build upon the capabilities of Core Soldier to achieve the unique specific capabilities required. The Ground Soldier System (GSS) CDD identifies capabilities for dismounted Soldiers (all those Soldier MOSs that require Soldiers to do their mission on the ground).[45] The Mounted Soldier System (MSS) CDD will improve fighting capabilities of Soldiers who fight from their ground platform (crews in combat vehicles comprising 12 separate subsystems).[46] The Air Soldier CDD will address the unique operational needs of Soldiers who fight from their air platform (crews in aircraft) to enhance effectiveness and stamina.[47]

Consolidation of Funding Lines

Funding lines are also in the process of being consolidated to support SaaS. Previously, more than 30 funding lines supported development and procurement of Soldier equipment (other Army systems are normally funded with one).[48] Managing so many different budget programs to support the Soldier was neither effective nor timely. Before the Soldier was managed and funded as a system, Soldier programs struggled for adequate funding. Today, funding is being consolidated and aligned with the four SaaS CDDs. This will provide the visibility for Soldier equipment to compete for resources with other major weapons systems in the DoD budget process. Following funding consolidation, PEO Soldier should consider establishing a Lead System Integrator (LSI) to manage acquisition of Soldier equipment. LSI's are used with several other major weapon systems to ensure CDDs are adhered to and they can also integrate new technology into programs as it matures.

The Rapid Fielding Initiative

The Rapid Fielding Initiative (RFI) was based on lessons learned during 2002's Operation Enduring Freedom, and was intended to supplement unit and Soldier equipment with essential capabilities required for success in the GWOT. This initiative has been tremendously successful because it has provided millions of articles of mission-essential equipment to deploying Soldiers and units in a matter of weeks and months (instead of the months and years characteristic of the traditional long acquisitions process). Central to the RFI is the concept of spiral development, whereby rapidly developing technologies are selected for additional focus to

improve maturity for Soldier use today instead of years in the future. Spiral development (especially in optics, weapons, and fabric technology) has enabled quantum advancement in Soldier lethality, force protection, and comfort in both Afghanistan and Iraq. However, the RFI is not simply a wartime effort. It has become the foundation for a systematic and cyclical approach to funding, assessing, adjusting, and sustaining Soldier equipment.[49]

The Soldier Enhancement Program

The Soldier Enhancement Program (SEP) solicits suggestions annually world-wide from individual Soldiers, commanders, industry, and combat and material developers. PEO Soldier, in coordination with TSM Soldier, takes these ideas through a series of steps to buy or produce an item, evaluate, conduct field testing, standardize, and issue to the field.[50]

The goal of SEP is to improve the lethality, survivability, command and control, mobility, and sustainability of all Soldiers. The mission of SEP is to identify and evaluate commercially available individual weapons, munitions, optics, combat clothing, individual equipment, water supply, shelters, communication, and navigational aids which can be adopted and provided to Soldiers in three years or less. The nature of the item determines the acquisition strategy, scale of testing, and fielding process.[51]

Recommendations

Much progress has been made, but what remains to be done is to fully implement SaaS as the Army's management process for determining required Soldier capabilities and linking funding to such capabilities. The four SaaS CDDs have been completed for each of the SaaS subsystems (Core, Ground, Air, and Mounted Soldier systems). Most of these CDDs have been vetted and validated by the Army Requirements Oversight Council (AROC). In accordance with the Joint Capabilities Integration and Development System (JCIDS), many are now being staffed in preparation for Joint Requirements Oversight Council (JROC) review.

However, CDD validation does not necessarily result in funding. Funding occurs during the Planning, Programming, Budgeting, and Execution (PPBE) process, which is currently in the programming and budgeting phase for FY 08-13. Much has been written recently criticizing JCIDS as overly complex and bureaucratic;[52] therefore it is imperative that CDD validation by the JROC is timed with Army Program Objective Memorandum (POM) development. Failure of such synchronization could lead to inadequate SaaS funding in the FY 08-13 budget. There can be no delay of funding if Soldier technology development is going to occur in parallel with FCS development. This point is so critical that Army leaders should fund AROC validated SaaS CDDs in the FY 08-13 Army POM, if necessary before JROC validation (in anticipation that

JROC validation will occur later this year), rather than delay SaaS funding to the next POM cycle. Army leaders should not allow the sometimes slow and overly bureaucratic JCIDS process to delay SaaS funding, or FF Soldier integration with the FCS will be in jeopardy.

Finally, as the Army transforms to the FCS, the SaaS concept can enable the Army to develop and field a 10X Soldier as the centerpiece of this formation. While FCS is an overall system consisting of 18 individual networked systems (vehicles, munitions, and sensors) it states the Soldier is still of primary importance.[53] In light of the current global security environment, the Army must not lose sight of this priority. As the Army develops and acquires FCS systems, it must maintain its current philosophy of equipping the man (or woman), rather than manning the equipment. However, this equipping philosophy will not translate into desired FF Soldier capabilities unless adequate dollars are allocated in a timely manner during the PPBE progress to make SaaS a reality.

Endnotes

[1] U.S. Department of the Army, *2001 Army Science Board Summer Study, Final Report, The Objective Force Soldier/Soldier Team* (Washington, D.C.: U.S. Department of the Army, November 2001), 3.

[2] Ibid., 49.

[3] Ibid., 61.

[4] U.S. Department of the Army, *Army 2006 Posture Statement* (Washington, D.C.: U.S. Department of the Army), ii.

[5] Ibid., i.

[6] U.S. Department of the Army, *2005 Army Modernization Plan* (Washington, D.C.: U.S. Department of the Army), 3.

[7] Ibid., 31-32

[8] U.S. Department of Defense, Director, Department of Defense Research and Engineering, *Joint Warfighting Science and Technology Plan*, (Washington, D.C.: U.S. Department of Defense, February 2005), 12.

[9] U.S. Department of Defense, *Joint Vision 2020,* (Washington, D.C.: U.S. Department of Defense, February 2005), 1

[10] U.S. Department of Defense, Director, Department of Defense Research and Engineering, *Joint Warfighting Science and Technology Plan* , (Washington, D.C.: U.S. Department of Defense, February 2005), 25.

[11] National Research Council, 2004, *Meeting the Energy Needs of Future Warriors*, (Washington, D.C.: National Academy Press), 1.

[12] Program Manager, Unit of Action, *Future Combat Systems White Paper*, September 2005, 3.

[13] Congressional Research Service (CRS) Report for Congress, *The Army's Future Combat System (FCS): Background and Issues for Congress*, 28 April 2005, 11.

[14] S.L.A. Marshall, *The Soldiers Load and Mobility of a Nation* (Washington D.C.: Combat Forces Press, 1951).

[15] FM 21-18, *Foot Marches*, 1 June 1990, states: that the fighting load should not exceed 30% of a Soldier's body weight and the approach march load should not exceed 45%. The 1998 *Study of Soldier Loads* at the Joint Readiness Training Center (JRTC) further validates this conclusion that the fighting load should not exceed 30% of a Soldier's body weight. Conclusions of the U.S. Army Institute of Environmental Medicine (USARIEM) Soldier Load Study, 2003, *Physical Performance Benefits of Offloading the Soldier* support a "30-33% of bodyweight recommend maximal load." Analytical studies, doctrine and command guidance consistently point toward a 40-50 lb metric. According to the 1988 *Anthropometric Survey* of U.S. Army Personnel, the 50th percentile male weighs 171.27 pounds, consequently, his fighting load should not exceed 51.4 pounds (.30 x 171.27 = 51.4 pounds). A 35 lb load, by this 30% standard, accommodates over 90% of all Soldiers. A 35 lb load better accommodates other Soldier roles in the small unit that require special weapons and equipment. The analytical community continues working to refine the ideal Soldier's load weights. Based on the 50th percentile body weight, the maximum approach march load (45% of a Soldier's body weight) would be 77.0715 pounds. A 65 pound load accommodates over 90% of all Soldiers. Excessive loads degrade Soldier operational performance. The 2000 Supporting Science and Technology Directorate U.S. Army Natick Soldier Center. "Effects of Load on Weight" study confirms that "Carrying of heavy loads can result in a substantial negative impact on Soldiers' mission performance and physical endurance…for every 1 Newton increase in weight carried, there was approximately a 3% increase in the time to complete an outdoor course and a 2% increase in metabolic cost." Preliminary findings of the 2003 "Modern Warrior's Combat Load: Dismounted Operations in Afghanistan" from the U.S. Army Center for Lessons Learned indicate that fighting loads of 55 pounds render exhaustion in well conditioned Soldiers during operations in difficult environments that can include significant changes in altitude and weather. FM 21-18, *Foot Marches*, 1990, states the approach march load includes "items of environmental protection, threat protection, and mission load selected according to METT-TC for approach marches where contact with the enemy is unlikely. The average weight of approach march loads in a squad should not exceed 72 lb, but individual loads should consider each man's physical capability." The approach march load consists of the fighting load plus additional items to sustain the dismounted ground Soldier for 24 hours.

[16] The Association of the United States Army (AUSA), *The Soldier: Centerpiece of the United States Army*, Torchbearer Issue, October 2004, 9.

[17] Ibid.

[18] U.S. Department of the Army, *1991 Army Science Board Summer Study, Final Report, Soldier as a System* , December 1991, 3

[19] U.S. Army Infantry Center, *Advanced Technology Demonstration Report for Soldier Integrated Protective Ensemble Tactical Field Demonstration*, Infantry School, Fort Benning, GA, 16 March 1993.

[20] United States Army Infantry Center, *Recapitulation of Infantry Squad and Platoon Organization Studies and Articles*, 25 July 1997. The report asserted this type of conflict would require a shift in strategy and equipment from high-intensity to low-intensity warfare, which would place a greater burden on the Soldier on the ground. The report foresaw US forces pitted against elusive bands operating in mountainous terrain or built-up areas (urban areas). It predicted unmanned air vehicles, reconnaissance aircraft, and standoff surveillance aircraft, such as JSTARS, would provide information, but the resulting intelligence would likely lead to some type of ground operation. The report concluded it was essential to increase the numbers of Infantry, Special Forces and Military Police.

[21] PM-Soldier, *Land Warrior Early Operational Experimentation Report*, 27 March 1997.

[22] National Research Council, *Energy-Efficient Technologies for the Dismounted Soldier*, (Washington, D.C.: National Academy Press, 1997), 1.

[23] AUSA, *The Soldier: Centerpiece of the United States Army*, Torchbearer Issue, October 2004. 10.

[24] U.S. Department of the Army, *2001 Army Science Board Summer Study*, 49.

[25] Ibid., 40.

[26] AUSA, *The Soldier: Centerpiece of the United States Army*, Torchbearer Issue, October 2004. 11.

[27] U.S. Department of the Army, *Army Strategic Planning Guidance* and *2004 Army Posture Statement* (Washington, D.C.: U.S. Department of the Army), 1. Both documents describe these two core competencies. The *2006 Army Posture Statement* expands the Army core competencies to four; it retains the two core competencies cited here and adds, “sustain the all-volunteer force” and “provide infrastructure and support to enable the force.”

[28] U.S. Department of Defense, *Capstone Concept for Joint Operations* (Version 2.0) (Washington D.C.: Department of Defense, August 2005), 124.

[29] U.S. Department of the Army, *The Army Universal Task List*, Field Manual 7-15, (Washington, D.C.: U.S. Department of the Army, August 2003).

[30] Top Level ET Tasks are identified as tasks that are directly related to the GSS system ensemble itself and how to operate special weapon systems, access to software menus, etc. Second Level ET Tasks are those tasks identified as perishable but not system (GSS) related, such as how to execute the 9-Line MEDEVAC procedure, how to write a 5 paragraph operations order, how to prepare range cards for individual as well as crew served fighting positions in a defense, etc.

[31] The Soldier System will have an embedded individual and collective training capability that supports the requirements of live, virtual, and constructive training environments.

Designing ET at the start of the program will ensure it is developed in conjunction with the FCS's System of Systems components. To do otherwise would lead to needless duplication of software development and additional space/weight/power claims for training. Training simulations can provide an infinite number of scenarios that the Soldier can use for training and rehearsal prior to deployment. This capability also allows for putting modified exercises back into the overall database of exercises, updating scenarios with the most recent combat experiences. Soldiers will be able to accomplish simulation at home station, in garrison, and in deployed assembly areas.

[32] AUSA, *The Soldier: Centerpiece of the United States Army*, Torchbearer Issue, October 2004. 13.

[33] *Program Executive Office Soldier Home Page* , PEO Soldier Soldier Enhancement Program, available from http://peosoldier.army.mil/sep.asp; Internet; accessed 17 December 2005.

[34] Product Manager Air Warrior develops and fields integrated Soldier systems for Army helicopter crews. Air Warrior development leverages several Joint service technology efforts to create a total, modular system that increases freedom of movement at flight controls, increases mobility to safely operate aircraft systems, enables enhanced ingress/egress from the aircraft, and through enhanced comfort, increases mission duration time in full mission-oriented protective posture ensemble.

[35] Product Manager Land Warrior is the Soldier system integrator for ground Soldiers. The system provides significant improvements in Soldier tactical awareness, lethality, survivability, mobility, and sustainment. Land Warrior's improved battle command and tactical awareness will improve individual and small unit combat effectiveness. It will also reduce fratricide incidents among individual Soldiers. Development is underway on the Mounted Warrior Soldier System. Mounted Warrior Soldier System is an integrated approach to equipping the mounted crewman and select maneuver support/sustainment Soldiers to fight, survive, and win across the full spectrum of operations. The complete system links mounted crewmen to their platform sensors and available command, control, communications, computers, information, surveillance and reconnaissance equipment integral to their individual units and provides enhanced Soldier protection.

[36] Product Manager Individual Weapons (PM IW) manages and is responsible for research and development of rifles, carbines, pistols, shotguns, grenade launchers, small arms ammunition, and related target acquisition/fire control products. These future weapons will increase lethality and enhance reliability.

[37] Product Manager Crew Served Weapons (PM CSW) manages light to heavy machine guns, grenade launchers, sniper systems, research and development of small arms ammunition, and related fire control/acquisition products. PM CSW is responsible for the development of all future crew served weapons systems.

[38] Product Manager Clothing and Individual Equipment (CIE) supports Soldiers in operational environments and improves their survivability, situational awareness, health, safety, mobility, lethality, and sustainability by providing state-of-the-art ballistic protection. It also produces safe, durable, and operationally effective individual and unit equipment. CIE

enhances survivability through technologically advanced protective clothing and individual chemical protective gear.

[39] Product Manager Sensors and Lasers (PM-SSL) enables Soldiers on the ground or in the air to "own the night" by providing them technologies that enhance the lethality of individual and crew-served weapon systems. These systems improve situational awareness through three core technologies: image intensification, forward looking infrared, and lasers.

[40] U.S. Department of the Army, *TRADOC System Management*, TRADOC Regulation 71-12 (Washington, D.C.: U.S. Department of the Army, 1 March 2002), 14-15.

[41] AUSA, *The Soldier: Centerpiece of the United States Army*, Torchbearer Issue, October 2004, 14-15. For example, the M1 Tank and the Apache Helicopter programs are managed by one requirements document apiece.

[42] Email message to author received on 15 January 2006 from David Libersat, SaaS Manager, Directorate of Combat Developments (DCD), U.S. Army Infantry Center (USAIC), Fort Benning, Georgia. USAIC's DCD SaaS Cell has been the focal point for coordinating the development of the various SaaS capability documents.

[43] Email message to author received from Patrick Berger, *TRADOC System Manager – Soldier Weekly SITREP*, U.S. Army Infantry Training Center, Fort Benning, Georgia, 30 January - 3 February 2006.

[44] The Core Soldier CDD identifies specific capabilities needed by all Soldiers. The Core Soldier CDD captures the basic modernization and overarching requirements for providing all Soldiers with fully integrated capabilities as a family of systems (maneuver, maneuver support, and maneuver service support Soldier programs). Supporting the requirement for a fully integrated Soldier system, the CDD will facilitate development of interoperable equipment common to all Army components. The Army Requirements Oversight Council (AROC) validated the Core Soldier CDD in Nov 05; it is currently undergoing Joint staffing prior to Joint Requirements Oversight Council (JROC) review.

[45] The Ground Soldier System (GSS) CDD identifies capabilities for dismounted Soldiers. This document was validated by the AROC on 1 February 2006 and is awaiting submission to the JROC. These capabilities include increased command and control (C2), situational awareness (SA), embedded training (ET), lethality, mobility, survivability, and sustainability. These capabilities include those currently being developed as part of the Land Warrior (LW) program. In addition, this document includes future net-centric requirements of individual Soldiers as part of the Future Force Warrior (FFW). GSS capabilities will be interoperable within the Future Combat Systems (FCS) and employ a system-of-systems approach, optimizing and integrating components while reducing the Soldier's combat load and logistical footprint. The system will include head-to-toe individual protection, networked communications for increased situational awareness and lethality, extended duration Soldier-worn power sources, physiological monitoring, embedded training capability, and significantly enhanced individual performance and combat team effectiveness. Soldiers will be connected to other Soldiers and to sensors, weapon systems, and C2 nodes. The Common Operating Picture (COP) produced by the network will provide Soldiers the information they need to plan and execute as a team. Networking of Soldiers, weapons/munitions, sensors and vehicles (a variety

of manned/unmanned air/ground vehicles) will enable dispersed small units to collaboratively influence larger areas with greater precision, speed, and a broader variety of lethal effects.

[46] The Mounted Soldier System (MSS) CDD will improve fighting capabilities of the crews in combat vehicles (comprising 12 separate subsystems). The MSS CDD connects crewman to other weapon systems, to sensors, and to mounted and dismounted crew and infantry. Combat vehicle crewmen will require integrated, modular, adaptable uniforms and equipment to protect against laser, NBC, environmental, flame, and ballistic threats. The MSS program will meet this need as it integrates current and future equipment. Additional operational capabilities of the MSS will be developed from the current Land and Air Warrior programs using spiral technology insertion when applicable. Possible examples of these advances are: hands-free, tether-less communication of tactical information, remote viewing of platform battle command displays and sensors, maximum individual protection from chemical and biological (CB) contamination, and protection from shrapnel, flame, and heat. The MSS CDD will provide for improved performance of crew tasks without reducing individual dexterity, tactility, and agility. At the time of this writing, the MSS CDD is in final HQDA Principle Staffing with an anticipated AROC validation NLT 17 March 2006.

[47] The Air Soldier CDD will address the unique operational needs of aircrew Soldiers to enhance effectiveness and stamina. It will consist of items worn by aircrew Soldiers and items mounted on aircraft platforms to include flight uniforms, CB protective equipment, microclimate cooling garments (MCG), ASE, night vision devices, and body armor. It includes non-removable items such as mounting brackets, tubing and wiring, as well as, removable items such as microclimate cooling units that are installed for particular missions. It will also address aircrew capabilities for protection from NBC contamination and from flame, heat, munitions, and small arms. This CDD will emphasize the requirement for material to reduce complexity while minimizing fatigue, stress, weight, and bulk associated with previous Aviation Life Support Equipment (ALSE). Air Soldier items, designed as an integrated system, will replace previous equipment that was issued piecemeal. Additionally, the CDD will address the need for the materiel solution to be modular and tailorable based on the mission. The Air Soldier CDD is presently being staffed at TRADOC.

[48] AUSA, *The Soldier: Centerpiece of the United States Army*, Torchbearer Issue, October 2004. 14.

[49] The RFI program began in 2003 when the Army Chief of Staff directed that all deploying Soldiers be equipped with enhanced capabilities for the Global War on Terrorism (GWOT). This initiated the U.S. Army's largest equipment fielding effort since World War II. The program enhances the capabilities of Active and Reserve Component fighting forces while supporting Soldier modernization in a systematic and integrated manner that is commensurate with the principles of the SaaS philosophy. The first step in expanding the program was to establish a standard list of capabilities that would provide predictable requirements for HQDA and the industrial base. TRADOC's SaaS Integrated Concept Team identified emerging requirements for the GWOT, and a list of 49 individual and unit equipment items was forwarded to HQDA for action. These items consisted of a combination of government off-the-shelf military equipment and commercial off-the-shelf items which were packaged in unit sets and delivered to Soldiers as they deployed to operational theaters. The items ranged from mission-essential equipment such as improved boots, socks, and "wick-away" T-shirts, to key force-protection items such as the advanced combat helmet and knee/elbow pads. Also included were critical lethality items such as improved ammunition packs, team radios, and advanced weapon optics. The G3

validated these unfunded requirements and forwarded the list to G8 for supplemental funding and implementation. PEO Soldier stood up an RFI Operations Cell in the CENTCOM Area of Responsibility for fielding. Expanded in 2004 to the entire Operating (MTOE) Army, the Program equipped over 450,000 soldiers by 30 September 2005. The PEO Soldier Project Managers for Soldier Equipment, Soldier Weapons, and Soldier Warrior have accelerated procurement of supplies, driving production rate increases by ten-fold on selected items. The RFI's current mission is to equip all Soldiers of the Operating Army by the end of FY07 with over 864,000 sets of equipment.

[50] *Program Executive Office Soldier Home Page* , PEO Soldier Soldier Enhancement Program, available from http://peosoldier.army.mil/sep.asp; Internet; accessed 17 December 2005.

[51] PEO Soldier and TSM-Soldier are charged with responsibility for managing the SEP program for the Army. TSM-Soldier has user management responsibility and represents all Soldiers in the field. PEO Soldier is responsible for material development and fielding oversight of SEP items. Execution is performed according to commodity responsibility by Product Manager Clothing and Individual Equipment; PM Sensors and Lasers; PM Small Arms; PM Mines, Countermine and Demolitions; PM Night Vision/Reconnaissance, Surveillance and Target Acquisition; PM Nuclear, Biological Chemical Defense Systems; and other PMs and R&D centers. Each year nearly 125 proposals are received and reviewed for suitable solutions to keep up with ever-changing technologies and new and improved ways to equip and maintain forces. Proposals that meet user deficiencies are presented at the Annual PEO / TRADOC SEP Review and compete for funding in the upcoming fiscal year.

[52] Keith J. Costa, *Inside the Pentagon*, "Rumsfeld Advisers Call JCIDS 'Ineffective,' Recommend Restructuring." The Defense Science Board states in a recent report that JCIDS fails to fully incorporate warfighters (COCOMs) into the capability producing process. The report also contends JCIDS is unwieldy and duplicates other DOD processes.

[53] Program Manager, Unit of Action, *Future Combat Systems White Paper*, September 2005, 3.