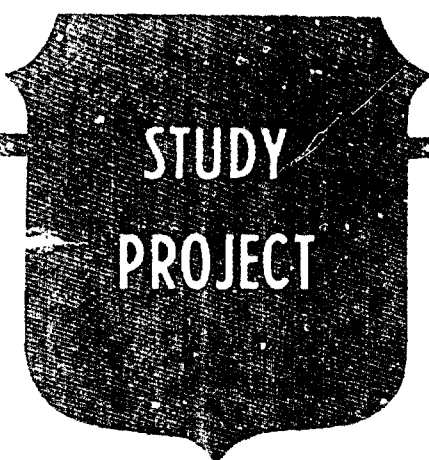


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**ANALYSIS REQUIREMENTS
TO SUPPORT THE
NEW ACQUISITION SYSTEM
IN THE DEPARTMENT OF DEFENSE**

BY

LIEUTENANT COLONEL WALTER L. SHARP
United States Army

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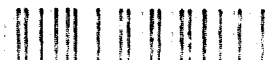
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ANALYSIS REQUIREMENTS
TO SUPPORT THE
NEW ACQUISITION SYSTEM
IN THE
DEPARTMENT OF DEFENSE

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ABSTRACT

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Today, the Department of Defense (DOD) is faced with many changes that will directly affect acquisition of new systems for years to come. Since the demise of the Soviet Union, the United States is no longer required to field new systems every six to eight years in order to counter Soviet modernization. This major change in world order has generated a new DOD acquisition philosophy which in turn prompted many changes in the DOD acquisition system. This article focuses on recent changes to the acquisition system and the combat effectiveness analysis required to identify and acquire future Army material needs. First, the effect of the new world order on the acquisition system includes changes in the threat, future defense budgets, the industrial base, and science and technology thrusts. Second, these underlying drivers of future defense needs have generated changes to the Acquisition Process as defined in the DOD Directive 5000 series. They have also changed the perspectives of key DOD and Army acquisition decision makers. Finally, all of these changes will require different combat effectiveness analysis than we have done in the past.

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Today, the Department of Defense (DOD) is faced with many changes that will directly affect acquisition of new systems for years to come. Since the demise of the Soviet Union, the United States is no longer required to field new systems every six to eight years in order to counter Soviet modernization. This major change in world order has generated a new DOD acquisition philosophy which in turn prompted many changes in the DOD acquisition system. In a recent interview, Mr. Keith Charles, Deputy Assistant Secretary for Plans, Programs and Policy stated there has been more change in the acquisition system in the last several years than over its entire history.¹

This article will focus on recent changes to the acquisition system and the combat effectiveness analysis required to identify and acquire future Army material needs. First, the effect of the new world order on the acquisition system includes changes in the threat, future defense budgets, the industrial base, and science and technology thrusts. Second, these underlying drivers of future defense needs have generated changes to the Acquisition Process as defined in the DOD Directive 5000 series. They have also changed the perspectives of key DOD and Army acquisition decision makers. Finally, all of these changes will require different combat effectiveness analysis than we have done in the past.

THE THREAT

To say that the world has changed in the last several years is an understatement. The effect the breakup of the Soviet Union had on the acquisition process and the analysis required to

support that process is tremendous. Several "givens" have emerged in today's new world order. First, there is little possibility of a large-scale war that will endanger our national survival. Additionally, we will have sufficient warning of any nation rearming to the point that such a war would be possible. These facts (perception or reality) eliminate the requirement to continuously field new systems every six to eight years in order to maintain significant technological advantage over potential enemies. This will result in more technology upgrades to existing systems and a greatly reduced number of new systems.

Second, reduced threats spell reduced defense budgets (the projected amount of these reductions are discussed later). Not only does this imply reduced production of new systems but it also means less force structure and fewer forward deployed forces. Therefore, there must be increased emphasis on power projection, rapid deployment, and increased firepower so early deploying forces can survive until reinforcements arrive.²

Third, based on conflicts such as Just Cause and Desert Storm, the American people and Congress expect quick wars with few friendly casualties and overwhelming victories. We can no longer measure success solely on a comparison of friendly to enemy lives lost and ground won or lost. Americans now expect few friendly casualties regardless of enemy losses.

Finally, we must expect to face Western equipment in future wars. Transfer of technology and outright selling of sophisticated hardware has increased the national income of many

countries. Unfortunately, it has also meant that many potential enemies now possess modern military equipment. Today, any nation with hard currency can buy outstanding military equipment.

In summary, the breakup of the Soviet Union has meant a less stable world that will require our smaller military to quickly deploy, fight against modern equipment, and quickly win with few friendly casualties. The acquisition implications of these requirements are far reaching.

FUTURE DEFENSE BUDGETS

The collapse of the Soviet Union has also brought about a cry for reduced defense spending. Congress and the President are responding to this demand by significantly cutting the defense budget. The Army and all Services must balance the cost of competing demands for these reduced dollars. Some of these demands include the costs of forward presence, reserve components, base closures, force structure, and finally modernization.³ Department of Defense budgets are shown in Table 1.⁴

It is evident that money for both procurement and research and development will continue to fall. Major Army programs that have been terminated or greatly reduced by recent year's budgets include the Apache Attack Helicopter, M-1 Tank, Tow Sight Improvement Program, Block III Tank (Armored System Modernization), and Line of Sight Anti-Tank Missile.⁵ One impact of these budget cuts will be to lengthen the time for new systems

Table I

	FY92	FY93	FY94	FY95	FY96	FY97	FY98
DOD	281.9	259.1	257.2	252.4	244.8	240.6	240.9
ARMY	73.6	63.6	62.0	60.8	58.2	55.4	55.2
D-PROC	63.0	53.8	49.6	52.7	53.9	52.5	54.5
A-PROC			8.4	8.0	8.5	7.5	6.8
D-RDTE	36.6	38.2	41.6	40.9	37.8	35.8	34.5
A-RDTE			5.6	5.0	4.2	3.8	3.7

to get to the troops. This could, in the long run, increase the cost. Some recent examples of this effect include the M1 Tank and the Blackhawk Helicopter. Between 1987 and 1988, production of these systems were reduced by 25% and 26% respectively from original orders. This resulted in a 13% and 25% increase in unit cost for each system.⁶ A very recent \$10 billion budget cut requested by President Clinton will greatly affect Army R&D. The Army's portion of the \$10 billion cut was \$2.5 billion; \$2.4 billion came from RDT&E.⁷ Complete programs must be agreed to and stop and go defense spending halted in order to get the most

out of our defense dollars.

INDUSTRIAL BASE

As the Army's budget falls, favorable production decisions will be harder to obtain. Industries are less likely to invest in research if they can not assume a reasonable assurance of production. Companies that produce warheads, munitions, and bombs are very dependant on defense funding as they have no commercial market.⁸ The current defense industrial base has far more capacity to produce than is needed for the foreseeable future. It is trying to adjust to lower production rates but has little incentive for capital investment. The Army must identify military-unique industries and determine which of these industries to keep alive.⁹ Research and development, upgrade capability, spare parts and production must be considered. The Army must also push industries to develop flexible production lines that can quickly and cheaply retool to produce different products. This would reduce production costs of small lots, thus increasing our ability to validate production techniques. The Army must also keep its foot in the door of industries that produce products for both commercial and military use. These industries will advance technologically quicker than defense-only industries. The Army must continually assess these advancements for military application.

Most importantly, the defense companies have no insight on the end state of the Army. As a result, they can no longer afford to invest in research and development.¹⁰ Defense

industries will fail and future production capacity will decrease. The Army must address this problem immediately through greater industry involvement and by identifying future defense critical production and research capabilities. Industries must be chosen now and restructured for success.

Reduced budgets mean several things to acquisition analysts. First, cost benefit tradeoffs become relatively more crucial to the decision whether to produce a new system. No longer can we only show that a greatly improved capability warrants its cost. The cost and benefit of the new system must now be weighed against other systems and mission areas. In times of reduced budgets, as will be the case for years to come, procurement of a new system to solve one mission area's deficiency will mean reduced funding for other mission areas. These trade-offs must be transparent and made early in the acquisition process. Second, certain parts of the U.S. military industrial base must be kept alive in order to maintain future production capability. We must continue to produce tanks or be willing to pay tremendous start up time and costs in both construction of facilities and personnel training to regain that capability.¹¹ Therefore, the effect on industries that we close must be a part of the decision of what to produce. Third, with reduced opportunities to produce, industry will be less willing to invest their capital in research and development.¹² This will result in an increased cost of research and development or a very narrowly focused research and development program.

In summary, the Army will face reduced budgets in both the procurement and research and development accounts. Trade offs among mission areas and the analysis of these trade offs will become critical to both future procurement and research.

SCIENCE AND TECHNOLOGY

The Department of Defense remains committed to equipping soldiers with the most effective equipment. Yet the approach DOD will pursue toward acquisition has greatly changed. Secretary Cheney defined this change before the House Armed Services Committee on February 7, 1991.

"My overall acquisition approach for the 1990's differs markedly from the past. This will be a decade of development, more than production. Scaling back production helps us to (1) preserve our technological superiority through ambitious research and development, (2) procure high priority systems at more efficient rates, and (3) lay the foundation for sustaining U.S. military strength through the year 2000 and beyond."¹³

One of the main goals of the new acquisition strategy is to provide more time to develop and test new technology prior to production in order to make that production less risky and more cost effective. To accomplish this goal, DOD has developed a new Defense Science and Technology Strategy. The strategy has three primary elements: taking advantage of the dramatic advances in information technology while sustaining their development, getting the user involved in the early stages of development, and showing that the technology works in realistic environments.¹⁴

DOD has identified seven capabilities that are required for future military operations. These capabilities define the seven

technology thrust areas in which DOD is focusing its energy: Global Surveillance and Communications, Precision Strike, Air Superiority and Defense, Sea Control and Undersea Superiority, Advanced Land Combat, Synthetic Environments, and Technology for Affordability.¹⁵

In order to "prove" technologies, DOD has established two types of demonstrations, Technology Demonstrations and Advanced Technology Transition Demonstrations (ATTDs). Technology Demonstrations attempt to demonstrate technology designed to correct specific deficiencies. They are conducted in a lab environment and are designed to reduce future development risks. On the other hand, Advanced Technology Transition Demonstrations (ATTDs) are focused on integrating technologies into full system demonstration or manufacturing development prototype systems. They are designed to coordinate the efforts and requirements of the technology developer, the program manager, the program executive officer, and the user. They are demonstrated at system level in a field environment. The Army currently has 13 approved ATTDs:¹⁶

APPROVED ATTDs

1. Advanced Air Defense Electro-optic system
2. Airland Battle Management
3. Component Advanced Technology Testbed
4. Multirole Survivable Radar
5. Multisensor Aided Targeting-Air
6. Radar Deception and Jamming
7. Soldier Integrated Protective Ensemble
8. Bistatic Radar for Weapons Location
9. Survivable Adaptive Systems Technology
10. Battlefield Distributes Simulation
11. Advanced Pilot's Aid
12. Remote Sentry
13. Rotorcraft Pilot's Associate

Research and technology development is cheap compared to production. Only ten percent of a system's total life cycle costs is spent prior to manufacturing development and production.¹⁷ The new strategy calls for more technology demonstrations early in the acquisition process. "These technologies will remain in the Science and Technology program until they are fully matured and ready for application to upgrades of existing systems or to a new system."¹⁸ Secretary of Defense Aspin has stated that he favors prototyping in order to assess risk and searching for "silver bullets" in order to dramatically change the battlefield and allow smaller production runs.¹⁹

The former Deputy Secretary of Defense, Donald Atwood, has strengthened Science and Technology efforts by centralizing control of S&T programs at DOD level. Funding for S&T programs must now be developed as a "joint effort with service participation under the guidance of the Defense Technology Board and under the leadership of the Director of Defense Research and Engineering (DDR&E)."²⁰ The Defense Technology Board is chaired by the DDR&E. Other members include the Secretaries of the Services, ASD(Command, Control, Communications, and Intelligence (C3I)), ASD(PA&E), ASD(Production and Logistics), Defense Advanced Research Projects Agency (DARPA), JCS, and Defense Test and Evaluation. Among its many missions, the Defense Science Board will develop the DOD S&T strategy, ensure service compliance with the DOD S&T strategy, develop Defense Planning

Guidance for S&T, coordinate capital investment strategies for S&T, and assess the Service's Program Objective Memorandum and Budget Estimate Submission for compliance with the DOD S&T strategy.²¹ The goal is integrated S&T priorities among all the services and obtaining the maximum benefit of the funds spent toward Science and Technology. The Army has translated the DOD strategy into a comprehensive plan called the Army Science and Technology Plan (ASTMP). This plan is published annually in three volumes. It lays out "the strategic vision of the Army leadership to provide tomorrow's warfighter with the winning technology edge".²²

In his May 1992 memorandum to the secretaries of the military departments, Mr Yockey, the Under Secretary of Defense for Acquisition stated, "the transition point from the demonstration of technology in one or more S&T projects to a formal acquisition program for a new system occurs when the program begins the demonstration and validation phase. This occurs after a validated need has been approved and the technologies critical to system performance have been proven."²³ In order to meet these requirements, the Army must first articulate clear mission area deficiencies, backed up by transparent combat effectiveness analysis, in order to focus science and technology towards future Army needs. Second, it must take leap ahead technologies that labs are discovering and analyze the possible military utility of these programs. And finally, it must conduct combat effectiveness analysis that

proves a new system is warranted. All analysis must be consistent in order to receive a favorable new system start decision. How the Army is restructuring to address these analysis requirements will be discussed later.

SUMMARY

In summary, the understanding of recent changes in the world is critical to the determination of future combat effectiveness requirements. First, we will have a smaller military that must deploy (rather than be forward deployed), fight against modern equipment, and quickly win with few friendly casualties. Second, the Army will face reduced budgets in both the procurement and research and development accounts. Decision makers will weigh cost effectiveness and affordability more than they have in the past. Trade-offs among mission areas and the analysis of these trade-offs will become critical to both future procurement and research. Third, survival of some defense industries is critical. Fourth, reduced production and research budgets will require a more focused research effort. And fifth, systems will stay in research and testing for longer periods in order to reduce risk while in production. We must structure our analysis efforts to reflect these realities.

THE DEFENSE ACQUISITION PROCESS

DOD 5000 SERIES

Not only has the basic acquisition philosophy changed but so has many components of the acquisition system. DOD Directive

5000.1 (dtd 23 Feb 91) defines three systems that govern acquisition. The Requirements Generation System identifies mission needs based on evaluation of current and future capabilities. The Acquisition Management System establishes a system to guide material solutions to deficiencies identified in the Requirement Generation System from early development to fielding. The Planning, Programming, and Budgeting System determines affordability of new systems and prioritizes defense acquisition programs.

REQUIREMENTS GENERATION SYSTEM

The purpose of the Requirements Generation System is to identify force deficiencies and required capabilities and to translate these mission needs into system-specific performance requirements.²⁴ Within the Army, the process of determining deficiencies and recommending solutions is the Concept Based Requirements System (CBRS). This system was first developed in 1980 and has evolved through several changes. Today the system is known as the Enhanced Concept Based Requirements System (ECBRS). The ECBRS is designed to provide an "audit trail from the National Military Strategy's (NMS) objectives to required military capabilities."²⁵ The objectives of the system are to (1) determine the Army tasks and functions on future battlefields to ensure land force dominance, (2) to identify capabilities required to execute these tasks and functions and to determine which of these capabilities provide the best return on investment, (3) to insure the correct systems are funded for

development, and (4) to establish some stability on our Research, Development, and Acquisition program.²⁶ The new process differs from previous CBRS processes in that it will take one year rather than two to complete, will be constrained by the current Program Objective Memorandum (POM), and will attempt to objectively prioritize requirements and solutions by determining the best return on investment across all mission areas. In other words, the ECBRS will provide the Army's initial analytical underpinning that define new requirements or mission needs and help build the Long Range Research, Development and Acquisition Plan (LRRDAP).

The LRRDAP is "a 15 year plan (the LRRDAP that DA is currently building is for FY 1996 - FY 2010) for the development and production of technologies and material to support Army modernization."²⁷ It is a 1 to N prioritized list of all the Army's RDTE and procurement programs and their associated funding lines for the 15 year period. The ECBRS process takes the current LRRDAP and assessments of what is required to execute each battlefield operating system from TRADOC schools and centers; determines the best battlefield return of investment at HQ TRADOC; adds current business, political, and budgetary requirements at HQDA; determines what we will do in the future; and funds it in the POM. Schools and centers determine requirements through a variety of analytical tools. The most recent addition to these tools is the "Battle Lab".

HQ TRADOC has identified five battlefield functions that

encompass future battles. These functions, known as "Battlefield Dynamics" include:

- (1) Early Entry, Lethality, and Survivability (Ft Monroe)
- (2) Depth and Simultaneous Attack (Ft Sill)
- (3) Battle Command (Ft Leavenworth)
- (4) Battlespace (mounted and dismounted) (Ft Knox and Ft Benning)
- (5) Combat Service Support (Ft Lee)

Battle Labs develop and refine requirements and permit examination of future doctrine, training, organizations, and material. They utilize state of the art simulations (such as SIMNET), maneuvers, and field exercises to explore new ideas and emerging technologies.²⁸ These ideas are based on solutions to known deficiencies and leap-ahead technologies being examined in labs and industry. Interface with the Army Science and Technology Plan is critical at this phase of the process. Battle Labs examine their functional area across all types of Army divisions (armor, infantry, airborne, etc) to determine the best return of investment (defined later) within their battle dynamic. The Battle Labs produce a prioritized assessment of material requirements within each of the battlefield dynamic areas that they examined across all division types.

HQ TRADOC takes the results from each battle dynamic, combines it with input from CINCs and joint planners, and based on budgetary restrictions and material developer's capabilities determines the best Battlefield Return on Investment (BROI). HQ TRADOC has named the methodology to accomplish BROI the Warfighting Lens Assessment (WFLA). WFLA is now in development.

When complete it will be an analytical methodology that is based on both subjective and objective analysis. It is designed to determine the synergistic value added to the battlefield with the introduction of new systems, tactics, or organizations and to determine the cost of the value added. Battlefield Return on Investment (BROI) is defined as the additional combat capability a system adds to a force divided by the system's cost. TRADOC has contracted Vector Research Institute (VRI) to develop the required combat simulations and American Power Jet (APJ) to develop the prioritization methodology to complete the WFLA. The first prototype of the WFLA was tested on 28-29 Jan 93 based on an airborne division (other types simulated) within the Early Entry, Lethality, and Survivability battlefield dynamic.²⁹

This year, the development of the LRRDAP and the working of the ECBRS to support that development are significantly different than in previous years. HQDA, TRADOC, and AMC are working together for the first time to directly build the next LRRDAF. The process begins with examination of the Army Modernization Plan (AMP) which was produced by ODCSOPS in Jan 1993. The AMP (which includes a summary volume and 16 functional area annexes) defines the "Army's vision of the future force and translates that vision into a strategy for the near to mid term force development and long term evolution."³⁰ Based upon the Army Modernization Plan, the FY94/95 President's Budget, and the current LRRDAP database, ODCSOPS is developing a database that consists of battlefield and infrastructure Management Decision

Package (MDEP) files. All currently funded RTDE and procurement programs are contained in these files. TRADOC will analyze all the battlefield MDEPs. AMC will examine the infrastructure MDEPs. If TRADOC or AMC feel there are any new MDEPs (new RDTE requirements), they may add them to their lists. The analysis of these MDEPs, the formation of any new MDEPs, and the resulting prioritization is the ECBRS for this year. During the process there are five two star reviews planned to insure that TRADOC and AMC are using up to date data bases and modernization and budgetary guidance. The LRRDAP is the interface between the Requirements Generation System and the Planning, Programming, and Budgeting System in that it provides the material acquisition needs to the POM for funding.

As discussed earlier, the purpose of the ECBRS is also to identify new mission needs and potential leap aheads. Based on the Warfighting Lens Assessment, the output of the Enhanced Concept Based Requirements System is a prioritized list of mission needs. Any new need that requires a material solution is documented in a Mission Needs Statement (MNS). Mission Needs Statements are couched in broad operational terms. Two examples from DOD 5000.1 are "the need to impede the advance of large armored formations 200 kilometers beyond the front lines; or the need to neutralize advances in submarine quieting made by potential adversaries."³¹ The format for a MNS is governed by DOD Manual 5000.2-M, 23 Feb 91, Defense Acquisition Management Documentation and Reports. In general a MNS must: (1) include a

nonsystem-specific statement of the operational capability needed; (2) identify the section of the Defense Planning Guidance (DPG) to which the Mission Needs Statement responds and reference the service's long range investment plan; (3) identify and describe the mission need or deficiency in terms of mission, objective, and capability; (4) discuss the DIA validated threat; (5) comment on the timing of the need; and (6) discuss the general priority of the need relative to others in the mission area.³²

Mission Needs Statement for Acquisition Category I (RDTE cost greater than \$300 million or Procurement cost greater than \$1.8 billion in FY 1990 constant dollars) systems are forwarded to a standing section of the Joint Staff, the Joint Requirements Oversight Council (JROC), for validation. In order to validate a MNS the JROC sends draft MNS to all CINCs, Services, Joint Staff directorates, and Defense Intelligence Agency (DIA) for review. Comments are returned to the MNS originator for possible (but not required) inclusion in the MNS. A JROC meeting is then scheduled and the sponsor prepares the JROC briefing. The JROC consists of five members; the Vice Chairman of the Joint Staff, the Army's and Air Force's Vice Chiefs of Staff, the Vice Chief of Naval Operations, and the Assistant Commandant of the Marine Corps. The Vice Chairman of the Joint Staff is the chairman and, although the purpose of the JROC is to build consensus, final validation authority rests with the Vice Chairman. This council validates the MNS by confirming that a nonmaterial solution is

not feasible and by determining joint service potential. In 1992 the JROC validated nine Mission Needs Statements. There are currently six MNS out for review.³³ Validated MNS do not automatically enter the acquisition process. This decision is the responsibility of the Under Secretary of Defense for Acquisition.

The Under Secretary of Defense for Acquisition determines whether the validated Mission Needs Statement warrants convening a Defense Acquisition Board. This board (called Milestone 0 - Concept Study Approval) is the initial interface between the Requirements Generation System and the Acquisition Management System.³⁴

ACQUISITION MANAGEMENT SYSTEM

Department of Defense Instruction 5000.2, Defense Acquisition Management Policies and Procedures, establishes "an integrated framework for translating broadly stated mission needs into stable, affordable acquisition programs ... and a rigorous, event-oriented management process for acquiring quality products..."³⁵ Four phases (Phase 0 - Phase III) define this process.

- Phase 0: Concept Exploration & Definition.
- Phase I: Demonstration & Validation.
- Phase II: Engineering & Manufacturing Development.
- Phase III: Production & Deployment.

To pass from one Phase to the next, the Army must receive approval from DOD at formal "Milestone" reviews (called Defense Acquisition Boards (DAB)). Milestones precede Phases of the same

number (Milestone 0 allows entry into Phase 0).

Milestone 0: Concept Studies Approval.
Milestone I: Concept Demonstration Approval.
Milestone II: Development Approval.
Milestone III: Production Approval.

Milestone 0 establishes that a deficiency in capability exists (based on a validated projected threat) by approving the Mission Needs Statement (MNS). It also determines whether this deficiency warrants further study (severe enough to possibly justify a new system) and that a nonmaterial solution will not correct the deficiency. The DAB is chaired by the Under Secretary of Defense for Acquisition. The Vice Chairman is the Vice Chairman of the Joint Chiefs of Staff (the validation authority for the MNS). Other members include the Deputy Under Secretary of Defense for Acquisition; Acquisition Executives of the Army, Navy, and Air Force; the Director of Defense Research and Engineering; the Assistant Secretary of Defense for Program Analysis and Evaluation; the Comptroller of the Department of Defense; and the Director of Operational Test and Evaluation.³⁶ The majority of Defense Acquisition Board members played no role in the development of the Mission Needs Statement; however, since Milestone 0 approval does nothing more than approve studies to find feasible solutions, it is usually granted. At the DAB for Milestone 0, members are asked to verify that a mission area deficiency warrants study but not to determine the priority of eliminating that deficiency nor commit to the elimination of that deficiency through the acquisition of a new system.

The decision of the DAB is documented in a memorandum called the Acquisition Decision Memorandum (ADM). The ADM identifies a minimum set of alternative concepts to be studied and the organizations to perform the studies, establishes what must be presented at the next Milestone DAB, and determines the permissible cost of the studies and the source of funding.³⁷ The documents and studies that must be prepared during Phase 0 include:

- (1) The Operational Requirements Document (identifies minimum acceptable performance requirements and objectives)
- (2) The System Threat Assessment Report (STAR) (threat assessment at the system level)
- (3) Defense Intelligence Agency Intelligence Report (validates the threat used in the MNS and the STAR)
- (4) JROC Assessment (verifies need still exists and that performance objectives and thresholds in the program baseline satisfy the operational need)
- (5) Integrated Program Summary (includes Program Structure, Life Cycle cost estimates, acquisition strategy, risk assessment, environmental analysis, affordability assessment, and Cooperative Opportunity Document)
- (6) Integrated Program Assessment (summarizes the independent assessment of the program)
- (7) Program Life Cycle Cost Estimate (documents the Program Manager's life cycle cost estimate)
- (8) Acquisition Program Baseline Agreement (documents the cost, schedule, and program baseline agreement)
- (9) Test and Evaluation Master Plan (lists the Developmental Test and Operational Test objectives, approach, and methodology)
- (10) Independent Cost Estimate
- (11) Cost and Operational Effectiveness Analysis (analyzes the comparative cost-effectiveness of alternatives).

The objectives of Phase 0, Concept Exploration and Definition are to "explore various material alternatives to satisfy the documented mission need; define the most promising system concepts; develop supporting analysis and information to include identifying high risk area and risk management approaches to support the Milestone I decision; and develop a proposed acquisition strategy and initial program objectives for cost, schedule, and performance."³⁸ From the example given in DOD 5000.1, the need to stop the advance of large armored formations 200 kilometers from the front, the "various material alternatives" may include cannon artillery, rockets, Air Force fighters, Army helicopters, and space based lasers. The purpose of this phase is to determine the "most promising" type of system. DOD 5000.1 specifies the "hierarchy of potential material alternatives that must be considered prior to a decision to commit to a new start acquisition program are:

- (1) Use or modification of an existing U.S. military system.
- (2) Use or modification of an existing commercially developed or Allied system that fosters a nondevelopmental acquisition strategy.
- (3) A cooperative research and development program with one or more Allied nations.
- (4) A new joint-Service development program.
- (5) A new Service-unique development program."³⁹

However; in reality, alternatives rarely consider other services' needs and capabilities. With reduced budgets, DOD will require this cross service analysis prior to Milestone I.

COMBAT EFFECTIVENESS ANALYSIS

The goal of analysis in the acquisition system is to identify and prioritize required capabilities then to determine what type of system will best fulfill those needs (considering warfighting contribution and cost). Logically the Joint Staff would determine the Armed Force's mission needs and prioritize force deficiencies across Services. Currently, no agency in JCS performs this function. Each service prioritizes their own material corrections to deficiencies. To compound the problem, each Service has developed its own set of models to analyze combat effectiveness.⁴⁰ These models generally portray that Service's systems to a higher resolution than other Service's equipment. This greatly inhibits the ability to analyze trade offs among different Service's equipment. Future DOD analysis requirements for Milestone I will demand this be corrected. Cross Service analysis requirements are a thing of the present not the future.

THE COST AND OPERATIONAL EFFECTIVENESS ANALYSIS (COEA)

The Milestone I COEA is one of the analysis tools used to determine the cost and operational effectiveness of possible corrective actions to material deficiencies. The Honorable David S.C. Chu, former Assistant Secretary of Defense, Program Analysis and Evaluation, recently stated its importance at a Program

Manager's graduation.

"The COEA ... is a tool to help understand what the effects of different technology solutions might be in terms of military capabilities. I should stress that the Department is making a determined effort to link all oversight documents in the acquisition process, including the Cost and Operational Effectiveness Analysis. This would give us a coherent view of what we are supposed to be doing and why. We need to line up the Cost and Operational Effectiveness Analysis, test documents, and the way you were charged to manage your program on the same scale and measure them with the same criteria. You should be interested in seeing the COEA play a helpful role in your understanding of different alternatives and their payoffs."⁴¹

This comment is interesting in that not only does it stress the importance of the COEA in defining cost and operational effectiveness trade-offs but it also requires the Army to link the COEA to other analysis and documents required by the acquisition system.

DOD Manual 5000.2-M, Defense Acquisition Management Documentation and Reports, defines the format and scope for the Milestone I Cost and Operational Effectiveness Analysis (COEA) required to support a new acquisition program. For Army systems, TRADOC Analysis Command (TRAC) performs this analysis with help from the schools and centers. The purpose of a COEA is to define the costs and associated operational benefits of several courses of action that meet recognized Army needs. COEAs are performed or updated during each phase of the acquisition cycle but the analysis that is critical to start a new program is performed during Phase 0.

A COEA takes approved mission needs statements and determines opportunities to eliminate these deficiencies. It

accomplishes this by analyzing the current system, in the context of the combined arms team defined by the Future Years Defense Budget (FYDP), to prove that a deficiency exists in a particular mission area. This base case represents the programmed systems and organizations that will exist if nothing new is done. It is examined across several scenarios defined in the Defense Planning Guidance and against a threat laid out in the System Threat Assessment Report (STAR) under varying operational environments (coalition vs unilateral warfare, NBC vs conventional environment, desert vs mountainous terrain, etc). If possible, the analysis also assesses the effect of a change in doctrine, organization, or training on the deficiency. Simply stated, the analysis must prove that a deficiency truly exists, that it can not be corrected by changing doctrine, organizations, or training and that the cause of the deficiency is the system being examined.⁴²

The COEA team then analyzes the alternatives agreed to at the Milestone 0 DAB. One of the alternatives must include a product improved version of the current system. Others will be new systems that potentially alleviate the deficiency. DOD Manual 5000.2-M recognizes that during Phase 0, the new system only exists on paper. Rounds have not been fired, production lines have not been developed, engines have not been tested for fuel consumption and reliability, and protective armor has not been subjected to enemy fire. Therefore, TRADOC must perform a parametric analysis to bound both the expected operational

benefits and costs of the new system. Additionally, the sensitivity of the results to threat variations must be examined. The COEA team then analyzes these alternatives in the scenarios, the environments, and against the threats described above.⁴³ Operational effectiveness is based on results of models that represent the system in the context of the combined arms team. When possible, the COEA uses several models to show that the results do not change based on the assumptions used to build each model. Results are measured both at the system and force level. Force levels vary from battalion (usually the smallest combined arms team) to corps (the largest element current combat simulation models can now handle with any degree of resolution).

Life cycle cost estimates are made for the base case and all alternatives. These costs include cumulative costs of developing, procuring, operating, and supporting a system. Again, since the alternatives are yet to be developed, parametric methods are used to bound cost estimates.⁴⁴

DOD Instruction 5000.2, Defense Acquisition Management Policies and Procedures, states that at Milestone I, decision authorities must "assess the affordability" of a proposed new

acquisition program.⁴⁵ The program will not get a favorable decision unless several criteria have been met:

- 1) the threat, environment, and performance objectives have been validated.
- 2) all analysis proves the need for a new system.
- 3) the environmental consequences have been analyzed and accepted.
- 4) the projected life-cycle costs and funding requirements are affordable.
- 5) adequate resources (people and funds) can be programmed.

DOD Instruction 5000.2 goes on to lay out the order of preference for new programs as first, use or modification of an existing system; second, a nondevelopmental system; thirdly, cooperative research with our allies; fourth, a joint service program; and lastly, a new service unique development program.⁴⁶

The role of the COEA in the Acquisition Management System continues to grow in the eyes of acquisition decision makers. DOD, DA, and TRADOC have devoted many hours in defining the COEA's role and how it will be conducted. In March 1992, a MORS COEA Symposium was held to address this issue. The symposium was sponsored by the Deputy Under Secretary of the Army (Operations Research); the Director of Program Resource Appraisal, Office of the Chief of Naval Operations; the Director, Directorate of Programs and Evaluation, HQ USAF; the Director of Force structure, Resource and Assessments, the Joint Staff; and the Assistant Secretary of Defense for Program Analysis and

Evaluation. The objectives of the symposium were to:

(1) Understand the role of the COEA in the DOD 5000 Series Acquisition Regulations

(2) Define the role of operations research in the COEA process

(3) Identify the challenges and issues associated with conducting COEAs and identify those challenges that could best be addressed by operations research

(4) Develop possible solutions or identify appropriate research areas

(5) Improve the collaborative framework for dealing with COEA requirements⁴⁷

At the symposium, Dr. William Lese of OSD(PA&E) presented his views of the analysis requirements for Milestone Reviews.

These requirements are summarized below.⁴⁸

MISSION NEED DETERMINATION (minimum requirements)

OBJECTIVE

Identify deficiencies and/or requirements.

ASSESSMENTS

Threat.

Mission need analysis.

Non-material solution.

Mods to current US/Allied systems.

MILESTONE 0 REVIEW

DAB DECISION ISSUE

Is the MNS acceptable based on:

A validated threat.

Confirmation of material solution requirement.

Mission need being important enough to fund Phase 0 studies.

ANALYSIS NEEDS

Theater level/campaign analysis.

MILESTONE I REVIEW

DAB DECISION ISSUES

Is a new program start warranted based on

A valid threat.

Confirmation of need by studies.

Program being affordable.

Is concept baseline acceptable based on specified

Cost, schedule & performance objectives.

ORD thresholds.

ANALYSIS REQUIREMENTS

COEA.

Theater level/campaign analysis.

Affordability analysis.

Dr. Lese goes on to define the theater level/campaign analysis to support the Milestone 0 decision as follows.

- (1) Evaluates cross service and within service alternative concepts to satisfy identified deficiencies or to capitalize on opportunities.
- (2) Conducted in context of joint operations in large scale scenarios.
- (3) Captures the synergistic effects of cross-service systems over an extended period of conflict.
- (4) Defines the characteristics required of a system to meet identified deficiencies.⁴⁹

These definitions of analysis requirements could force many changes in analysis the Army conducts and provides to DOD. In the past we rarely did any type of cross service evaluations or campaign analysis to support Milestone 0 decisions.

Affordability issues among mission areas have not been a part of the Milestone process, instead they have been addressed in the budget process. Dr. Lese is arguing for a combination of a DOD Joint Mission Area Analysis and a DOD COEA to determine affordability of the Mission Area Analysis results.

DA (ODCSOPS) recently held a meeting to define COEA concepts, procedures, and responsibilities and to define the COEA's role in the Acquisition Management and Requirements Generations Process. ODCSOPS reinforced the view that OSD believes that the COEA should cover all the parts of the acquisition system to include requirements generation, acquisition management, system design trade-offs, and affordability issues in the budget process. ODCSOPS view is that

the COEA is only one part of the entire system. Recommendations include:

(1) COEA is a stand alone document. COEA is structured to define costs, military capabilities and operational benefits associated with principal material alternatives that address validated mission needs.

(2) COEAs do not address mission area tradeoffs or roles and missions issues or affordability.

(3) Campaign analysis is not a habitual component of the COEA.

SUMMARY OF MILESTONE REQUIREMENTS

A summary of the analysis and decision points from identification of mission deficiency to new system start at Milestone I is as follows. TRADOC views its analytical role as a supporter of Army resourcers at the Department of the Army. Through the Warfighting Lens Assessment process, as a part of the Requirements Generation System, TRADOC determines Army mission deficiencies and prioritizes solutions across all Army mission areas. This prioritization is based on increased combat effectiveness of the combined arms teams and very early cost estimates. HQDA (primarily ODCSOPS) then refines the prioritization based on political and business realities and up to date budgetary considerations. They then determine which of the deficiencies and possible solutions should be brought before the DAB for additional study. At Milestone 0, the DAB considers the Mission Needs Statement and, if approved, funds studies to explore the concept and define the type and performance requirements of the system. Based on the results of the

Milestone I DAB and the WFLA, DOD decides whether to fund correction of the mission area deficiency in the POM. Many different analyses support the Milestone I decision. In the cost and combat effectiveness arena, the COEA carries the most weight and is the most comprehensive. At Milestone I, the Office of the Secretary of Defense determines whether a new system start should be granted. Funds for the entire life cycle of the new system must be programmed into the POM prior to this decision.

FUNDAMENTAL ANALYSIS PROBLEM

The Milestone I DAB is the critical event that determines if a new program will start. Successful negotiation of Milestone I authorizes prototyping, testing, and early operational assessment of critical systems, subsystems, and components. The new program is no longer a paper system. The dollars required to support Phase I are considerably larger than Phase 0. For this reason the DAB at Milestone I requires not only an examination of alternatives to fix a deficiency but also proof that fixing this deficiency provides the best utilization of production money across all mission areas. In the past DOD has only asked for analysis across Army mission areas to solve Army deficiencies. The COEA has taken the lead in fulfilling the combat effectiveness portion of this requirement. However, in the future, DOD will demand analysis that crosses Service mission areas. In most cases, the COEA conducted in support of the Milestone I does not answer the DAB's final question.

Additionally, since the COEA in Phase 0 is focused on correcting the deficiency identified in the Mission Needs Statement, it cannot answer why this mission area deficiency was chosen above all others to correct.

This leaves the Army (as well as other Services) in an extremely vulnerable position at the Milestone I DAB. DAB members can easily challenge the COEA results based on the introduction of other mission areas not modeled. For example, a Milestone 0 DAB may have agreed that our ability to penetrate enemy armor and survive an enemy attack is insufficient. The Phase 0 COEA would then focus on alternative improvements from more lethal tanks to more powerful missiles to small combat systems. At Milestone I, as a result of the Phase 0 COEA, the DAB could easily agree that the best way to correct that deficiency is to produce a new tank. However, they would also likely ask if a new tank would provide more overall force capability than additional artillery or air support. In other words, why would this Army mission area provide more return for the defense dollar than another Army mission area or even another Service mission area?

In the past, Department of the Army's response has been that the prioritization process among mission areas is done during the POM process. They argue that once the POM is approved, prioritization of new systems and DOD approval of that prioritization is complete. This reasoning is supported by DOD Directive 5000.1. It states that "the products of the planning,

programming, and budgeting system provide the basis for making informed affordability assessments and resource allocation decisions on defense acquisition programs."⁵⁰ Indeed the entire LRRDAP process, especially with recent changes, supports this contention. The rub is that the Assistant Secretary of Defense for Program Analysis and Evaluation is responsible for "assessing the adequacy of the cost and operational effectiveness analysis...submitted in support of DAB reviews."⁵¹ OSD(PA&E) requires much more analysis for a Milestone I decision than they do to support Program Budget Decisions in support of POM decisions. OSD's argument is that substantial dollars are not committed and analysis is not conducted until a system is within the Acquisition Management system. Furthermore they see the COEA as the "primary tool for resolving resource allocation issues ... of the DOD budget; and ... the analytical justification for selected courses of action."⁵² At best TRADOC is conducting the COEA at the same time DA is building the POM. The COEA is not approved (or even seen) until Milestone I - well after the OSD has approved the POM that DA will present to the DAB. Therefore the most comprehensive analysis to support budgetary decisions is not graded by OSD until Milestone I. If the COEA or other analysis does not answer why the deficiency being examined warrants funding before other deficiencies (both within the Army and across other Services), OSD is not likely to approve a Milestone I decision.

RECOMMENDED ANALYSIS CHANGES

Based on all the recent changes to the acquisition system and the state of DOD budgets; DOD, JCS, and the Army must make several changes to the analyses they conduct. First, and most importantly, the requirement for a "Joint MAA or COEA" must be addressed. The current study on roles and missions and the budget process are designed to partially alleviate its need. However, in reality, the Chairman of the Joint Chiefs of Staff February 1993 Report on the Roles, Missions, and Functions of the Armed Forces did little more than address specific Congressional issues of redundancy among Services.⁵³ It did not, nor was it really designed to, answer what our armed forces of the future should look like considering realistic budgets. Nor did it identify or prioritize deficiencies in the current or future force. To date, no study has provided the analytical underpinnings required to support the acquisition system as it is now defined. No study prioritizes deficiencies across the Services. Individual services are not capable of conducting this type of study. The Joint Staff must take the lead in any cross service analysis. The Joint Staff must determine force capabilities and force deficiencies. Only with such an examination can the Department of Defense hope to properly allocate the scarce budgetary resources of the future. All Services will then be able to build on this critical cornerstone. Services will be able to use this analysis at the Milestone 0 DAB to validate the importance of correcting a mission area

deficiency. It will satisfy OSD(PA&E) requirement for a cross service analysis. Services will then be able to address their mission area deficiencies. The Army's Warfighting Lens Assessment is specifically designed to accomplish this by prioritizing among Army mission areas. However, the Joint Staff must first conduct a realistic mission area analysis and prioritize deficiencies across the entire Armed Force.

Second, battle labs are a step in the right direction toward eliminating parochialism within the Army and providing tools for examining the overall effect of new ideas and technology. We must man and resource these labs to allow them to accomplish all we have asked them to do. Personnel and equipment must be dedicated to that task only. It cannot be an extra duty for Combat Development Directorate analysts at TRADOC Schools and Centers. Schools and centers who do not own Battle Labs will have to dedicate people to the labs that analyze their mission area. TRADOC must develop a consistent methodology that all Battle Labs can use. To a degree, Battle Labs must use consistent models and analytical techniques. It is important to remember that the preliminary goal of this methodology is to determine deficiencies, solutions, and leap ahead potentials. The primary goal must be to provide the analysis required to get those solutions and potentials through a JROC and Milestone 0 DAB. The analysis must also be able to directly feed the Phase 0 COEA. The LRRDAP is only one part of the ECBRS output; support of the Acquisition Management System must be the other. TRADOC

must gear the analysis and the way we package the results of the analysis to satisfy both requirements.

Third, TRADOC is working hard to develop the Battlefield Return On Investment methodology. Several factors are keys to this development. It must be consistent across all battle dynamics and as transparent as possible. Black boxes will not work. It must be clear and logical enough for nonmilitary decision makers to understand; they are its final and most important audience. The Army currently has at least three agencies working on Return on Investment methodologies. First, as a result of a 1988 tasking by the Chief of Staff of the Army to Army PA&E, the U.S. Army Concepts Analysis Agency (CAA) is developing a Value Added Analysis (VAA) that is designed to determine "the incremental return on investment as measured using explicit and implicit effectiveness values as compared to cost."⁵⁴ It was first demonstrated in September of 1991 and used to help build the 1992 LRRDAP. Second, the Office of the Secretary of the Army for Research, Development, and Acquisition (SARDA) is sponsoring the development of the Armor Antiarmor Advanced Technology Demonstration (ATD). This ATD is designed to determine system performance differentials and their contribution to force level effectiveness in order to support decision reviews.⁵⁵ TRADOC Analysis Center (TRAC) is developing the simulations and analytical tools to support the methodology. The third methodology is the WFLA described earlier. It should be noted that TRAC is not involved in the development of the WFLA

methodology. The Army is developing these different methodologies for different intermediate goals, but they all have the same final goal - to determine our material needs and prioritize them. HQDA must coordinate these and any other similar efforts. The Army must present to OSD one prioritization methodology that lays out the Army's singular view of future modernization.

Fourth, HQDA must continue to refine the process started this year to build the LRRDAP. It is vital that the link between DA, TRADOC, and AMC be strengthened. The goal to build this year's LRRDAP while developing the WFLA methodology is very ambitious. Even if it does not produce timely, analytically based results this year, we must continue its development. As stated earlier, it must be transparent and able to produce timely results based on changing budgets and technology developments. It is critical to the Army's ability to develop a singular modernization plan for the future.

Fifth, the Science and Technology Board must explicitly determine when a new technology warrants production versus "leaving it on the shelf". I do not believe this will be readily apparent to all. A methodology that defines acceptable cost to leap-ahead technology production must be defined. This must be linked to an overall industrial plan. DOD must subsidize certain industries (especially defense-only industries) and these industries must respond by devoting research and development towards stated modernization goals. Most importantly, DOD must

stabilize modernization. Industries cannot be expected to survive without a clear articulation of the vision of the future and the realistic budgetary restraint in that vision.

And sixth, combat effectiveness models and methodologies must more directly deal with realities of future battles. Measure of effectiveness such a length of the war and friendly battle losses (not loss exchange ratios) are now critical. OSD will require some type of campaign analysis to support Milestone 0 decisions. TRADOC must make this analysis part of the Battle Lab and WFLA structure. Additionally, combat development analysts must be trained in costing methodologies. Too often senior analysts can effectively argue combat effectiveness results but are not able to discuss costing methodology with the same degree of confidence. Analysts must be schooled in both disciplines as they will be closely linked in all future decisions.

CONCLUSION

The Department of Defense is currently on the verge of a new era of acquisition. Future acquisition will not require new equipment every six to eight years to counter an ever modernizing threat. Greatly reduced research, development, and procurement budgets will require the Army and all Services to focus their science and technology efforts; the Army Science and Technology Master Plan is a good start towards that end. The Army must insure certain industries survive by establishing a clear vision

of future research and production requirements.

The new DOD Acquisition Directives define the requirements for approval of new system starts. The Army is developing the tools and organizations to deal with this new era. TRADOC, HQDA, AMC, and to a degree OSD are working together as never before. TRADOC has made great strides towards these requirements by enhancing the Concept Based Requirements System. HQDA is closely coordinating with TRADOC to fund future Army needs through the LRRDAP process. Analysis accomplished to support the WFLA and Milestone I COEA's are starting to cut across Army mission areas.

Despite all these major accomplishments, they do not fulfill the cornerstone acquisition analysis requirement. The Joint Staff, in cooperation with all the Services, must routinely conduct analytically supported studies to validate missions for each Service. These studies must also identify doctrinal, organizational, training, and equipment deficiencies that cut across the Services. Finally, they must prioritize the requirement to correct these deficiencies. Services will then be able to produce consistent, well developed analysis to support future systems. The Department of Defense's final acquisition goal is to equip our soldiers with the best possible equipment. All our efforts must be directed toward that goal and toward providing the information required by the decision makers in OSD and Congress that allow us to accomplish it.

ENDNOTES

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