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Report to the Under Secretary of the Army

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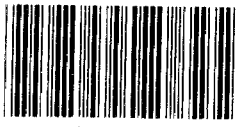
WEAPON SYSTEMS

Observations on Army's Efforts to Improve Its Requirements Process



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National Security and
International Affairs Division

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October 29, 1986

The Honorable James R. Ambrose
The Under Secretary of the Army

Dear Mr. Secretary:

Several Army weapon system programs, such as the LAV-25 light armored vehicle, were canceled after they were started because the requirement for the weapon was questionable. Others, like the Aquila remotely piloted vehicle, were cut back because it would have been too expensive to procure the total quantity originally planned. The Rattler medium antiarmor weapon system was canceled partly because of its high cost. These actions suggested that the Army's process for determining its weapon system requirements might be deficient in its ability to identify weapons that would best meet the Army's needs and that could be acquired at an affordable cost.

We reviewed the Army's requirements process as it was applied to the planned acquisition of five weapon systems to determine how the process could be made more efficient. Our findings are summarized below and discussed in more detail in appendix I.

Army's Requirements Determined From Limited Battlefield Perspective

We found that requirements for weapon systems were being developed by the Army's Training and Doctrine Command's (TRADOC's) requirements development centers who viewed the Army's needs from the confines of their individual mission areas rather than from a total force perspective. Personnel responsible for determining requirements for weapon systems were not adequately trained to make total force analyses since they did not possess the broad military experience this entailed, nor were they on the job long enough to perform this function effectively.

To reduce the influence of the individual centers in identifying weapon system deficiencies from their limited mission area perspectives, the Army has initiated plans to have a combined mission area analysis done by TRADOC's Combined Arms Center with the assistance of the TRADOC centers. Under the proposed procedures, the individual TRADOC centers will also assist the Combined Arms Center in identifying solutions to the significant deficiencies identified in the combined mission area analysis.

The Combined Arms Center is intended to provide the integrating mechanism that would ensure that the contributions to the battle of all the Army branches are considered. We found, however, that the reviewers at the Combined Arms Center had the same limited expertise and parochial point of view as the developers of requirements at the individual centers.

System's Affordability Must Be Considered Earlier

Affordability of systems proposed for development was seldom considered early enough in the acquisition process to avoid committing substantial resources to a weapon that could prove too expensive. An exception was the experimental light helicopter (LHX) program, and even there the emphasis on affordability emanated mainly from the headquarters level. The TRADOC centers generally adhered to the view that the urgency of the need should override cost considerations so that the technical performance sought in the weapon system would not be constrained by cost.

The TRADOC centers are not required to assess affordability when they propose a weapon system for development. This omission increases the system's vulnerability to subsequent cost growth.

Conclusions

The Army's decision to have TRADOC's Combined Arms Center assisted by the individual TRADOC centers prepare a combined mission area analysis and to have them collaborate on identifying solutions to the deficiencies disclosed in the analysis should help overcome a major criticism of the concept based requirements system. For instance, the tendency of the requirements centers to individually determine mission area deficiencies and solutions only within their own combat specialties has sometimes fostered the development of weapon systems which did not best meet the Army's needs.

For the Army to achieve the maximum benefit from the change it has proposed, the Combined Arms Center should be staffed not only with personnel who are sufficiently trained to make the Army-wide mission area analysis but also to evaluate the solutions and to pass along to higher headquarters for approval only those solutions that it determines will best meet the Army's needs from a total force perspective.

Affordability should receive early attention so that unnecessary or marginal operational requirements can be avoided. Particularly when so many systems are competing for funds, those proposing a new system

for development have to consider the cost implications of the performance capabilities they demand and be amenable to lowering them if they will cost too much. In assessing affordability, the Army should consider the cost of meeting the system's operational requirements in relation to the benefits they would provide, the total quantities required, and the funding likely to be available to acquire and support the system. In our opinion, these considerations can best be addressed by a group high enough in the Army organization to have knowledge of the Army's overall system needs and of its available funds. This group might include representatives from the Army's materiel developer, materiel user, and comptroller organizations, who could evaluate the potential cost of the new system and compare it with the amount of funds that could be made available for it.

Agency Comments and GAO's Evaluation

Army officials generally agreed with the contents of our report but felt we had not given the Army sufficient credit for the extent it had considered the affordability of new weapon systems. They said affordability had been studied in a number of systems other than the LHX. The Army also believed that placing responsibility for early consideration of a proposed weapon system's affordability in the hands of a permanent organization, e.g., TRADOC, was a preferable alternative to placing it in the hands of an ad hoc group.

Affordability is doubtless commanding the attention of the highest levels of the Army. However, in our assessment of the various weapon systems we selected for review we found no evidence, other than in the LHX program, where affordability initially played a role in the development centers' determining their requirements. The dominant interest at the centers was in obtaining the best system regardless of cost.

Concerning the merits of having an organization such as TRADOC bear ultimate responsibility for weighing a proposed system's affordability, we believe that a more objective assessment would be given to the issue of affordability by an organization other than the user (TRADOC) organization which by its nature is inclined towards being a strong system advocate. Further, the controller organization at the Department of the Army level has access to information on funding available on an Army-wide basis to enable it to recommend a more realistic and affordable cost level for weapon systems. Representatives of the materiel developer in the group making the affordability assessment should also assist in developing realistic cost estimates of the technical performance needed by the user. However, we believe no organization involved in

developing requirements should be relieved of the responsibility to constantly assess the system's affordability.

We would appreciate your keeping us informed on the actions the Army plans to take on the matters discussed in this report, particularly, those concerning the staffing of trained personnel at the Combined Arms Center and on the formation or designation of a group to address the issue of affordability before systems are approved for development.

We will continue to monitor the status of the proposed changes to the concept based requirements system to determine how effectively they are implemented.

Sincerely yours,

Henry W. Connor
Senior Associate Director

Observations on Army's Efforts to Improve Its Requirements Process

Introduction

In past years, the formulation of Army fighting doctrine, the establishment of the force structure, and the training of troops were constrained by the capabilities of weapon systems. Often this resulted in a fighting force that did not match in effectiveness the capabilities envisioned for it by the Army's military strategists. In an attempt to remedy this situation, the Army introduced the concept based requirements system in 1980. This is a system by which the operational concepts—the basic ideas of how the Army plans to fight—are developed first. Organizational, training, and weapon system needs evolve from these ideas.

How the Concept Based Requirements System Has Been Operating

The U.S. Army Training and Doctrine Command (TRADOC), whose headquarters is located at Fort Monroe, Virginia, is responsible for developing the broad operational concepts and preparing the Army's battlefield doctrine as shown in its Airland Battle plan. TRADOC operates through various schools and centers scattered throughout the country. Each has cognizance over a specific branch of the service, e.g., infantry, field artillery, air defense, and armor. Once the Airland Battle plan is approved, TRADOC provides it to the centers. Prior to 1986, each center was responsible for periodically analyzing its mission covering the specific branch under its cognizance. The battle plan served as guidance to the centers for preparing their individual mission area analyses. The Combat Developments Directorate within each center was responsible for preparing the analysis.

The mission area analysis translated elements of the overall battlefield concept into requirements. Each center analyzed the essential tasks to be performed within its mission considering the threat and the battlefield environment expected to be encountered. The shortfalls in the ability to execute the mission tasks were identified as mission area deficiencies.

Upon completion of the analysis, each center ranked its deficiencies in order of priority. The centers then provided their prioritized lists to a higher command level, the Army Combined Arms Center at Fort Leavenworth, Kansas. The deficiencies on these lists were further ranked by the Combined Arms Center and other Army organizations to produce the Battlefield Development Plan, a consolidation of the deficiencies identified in 13 mission area analyses. The plan, prepared annually, described the battlefield environment forecast for the Army and the doctrine used in the analyses and assessed the Army's capability to survive and win on the battlefield.

Objectives, Scope, and Methodology

In the past, some Army weapon systems such as the LAV-25 light armored vehicle, were canceled because of questionable need after they had begun development. The Aquila remotely piloted vehicle was cut back because it would have been too expensive to procure the total quantities originally planned. Its high cost was also a factor in the Rattler medium antiarmor weapon system cancellation. This raised questions about whether the requirements process was deficient in establishing which systems were needed and whether the process was focusing sufficient attention on the weapon systems' affordability.

Our objectives were to determine whether the concept based requirements system

- was effective in identifying for development weapon systems that were the most needed and
- considered a weapon system's affordability before it was approved for development.

To review the Army's requirements process in operation, we selected the following five weapon systems:

- the experimental light helicopter (LHX), which is in advance development and is being designed to replace the Army's present fleet of light helicopters;
- the remotely piloted vehicle, presently completing full-scale engineering development and nearing production, a small aircraft piloted by remote control being developed to collect combat information and locate targets in enemy territory;
- the future armored combat system, a proposed follow-on to the current Abrams tank;
- the armored gun system, a lightweight, armored air deployable system intended to provide antitank capability to the light divisions; and
- the medium advanced antiarmor weapon system, a hand-held infantry weapon expected to replace the Dragon antitank weapon system.

We discussed these and other Army weapon systems with Army officials and examined related documents at the Department of the Army Headquarters, Washington, D.C.; the Army Materiel Command, Alexandria, Virginia; the Training and Doctrine Command, Fort Monroe, Virginia; the Army Infantry Center, Fort Benning, Georgia; the Army Armor Center, Fort Knox, Kentucky; the Army Field Artillery Center, Fort Sill, Oklahoma; the Army Aviation Center, Fort Rucker, Alabama; the Army Combined Arms Center, Fort Leavenworth, Kansas; the Army

Missile Command, Huntsville, Alabama; and the Army Aviation Systems Command, St. Louis, Missouri.

Our review was made in accordance with generally accepted government auditing standards.

Parochialism Unduly Influenced TRADOC's Requirements Developers

Military officers, whose specialties coincided with the type of system they were analyzing, were responsible for performing most of the mission area analyses and preparing the requirements documents. For example, Army aviators developed requirements for the experimental light helicopter and armor officers did the same for the future armored combat system.

We found that these analyses were not made from a combined arms perspective and that a bias was evident in each TRADOC center's favoring the type of system over which it had cognizance. The advocacy for its particular combat specialties led each of the centers to consider only solutions that were within its mission area and to downplay the contribution of weapons available in the other Army branches. In our discussions, for example, Armor Center personnel characterized the infantry's medium advanced antiarmor weapon system as ineffective while the Infantry Center personnel minimized the tank's contribution to defeating armored vehicles.

Because each deficiency and its solution were both within the mission area of the proponent with little or no input from other requirements development centers, the process devoted insufficient attention to alternative solutions other centers could offer. Studies existed which supported the type of weapon system desired. For example, an Infantry Center's study favorably viewed the need for a medium range manportable antiarmor system. However, when another study of infantry antitank weapons by TRADOC's Systems Analysis Activity did not support the requirement for this system, the Infantry Center made a second study using different assumptions more favorable to it. The new study was accepted as supporting the requirement for what is now the medium advanced antiarmor weapon system. While the solutions adopted appear to be sufficient to overcome the mission deficiencies identified, there is no assurance that these are the best solutions since all the reasonable alternatives were not explored.

Since the proponents of a particular mission area were determining mission needs and operational requirements, their solutions were usually

conceived within the narrow limits of their mission capabilities, and the contributions of assets belonging to other missions, whether equipment or personnel, generally were not considered. This limited focus at the centers was reinforced, not moderated, at the Combined Arms Center.

In its March 1985 report, an Army special study team cited the fact that the Combined Arms Center was not coping with the intense parochialism at the TRADOC centers. While it found that parochialism was to be anticipated at the individual centers, the study concluded that TRADOC as a whole had not been able to exert any countervailing force to put this narrow view into a more useful perspective. The team reported that this had led to a process where the requirements passed up the line for approval were encountering little review or challenge. The study found that the Combined Arms Center was overwhelmed by the stature of the development centers and had become an agency that staffed and coordinated the flow of paperwork rather than one which critically scrutinized the mission needs and deficiencies identified by the individual centers. The study also noted that TRADOC Headquarters went along with virtually all requirements identified by the centers, believing that challenging requirements should be minimized.

In our case studies, the Combined Arms Center's staff officers did not perform the role of objective questioners of the Army's requirements and rarely challenged them. It appeared to us that they performed an editorial function, suggesting word changes in the requirements documents rather than determining how well the requirements responded to the total Army mission needs. Because the Battlefield Development Plan is a compendium of 13 separate analyses, it became difficult to determine which battlefield deficiencies were most urgent from a combined arms perspective or which improvements could provide the biggest payoff to the total battle outcome. Such a determination requires an analysis from a total force perspective.

The Combined Arms Center is intended to provide the integrating mechanism that would ensure that the contributions of all the mission areas are considered. We found, however, that the reviewers at the Combined Arms Center had the same limited expertise and parochial point of view as the developers of requirements at the individual centers. For example, the reviewer of the LHX requirements was an Army aviator, and the reviewer of the armored gun system and the future tank requirements was a former company commander in a tank battalion. While these officers brought with them extensive knowledge of operational issues from their field assignments, they lacked the analytical

skills needed to critically evaluate the center's proposals and were not inclined to force their views on the centers.

Army Aware of Need to Improve Requirements Process

A number of studies, including two by the Defense Science Board made in 1979 and 1985 and the previously mentioned Army special study in March 1985, identified opportunities to improve the Army's concept based requirements system.

In its assessment of the concept based requirements system, the study team concluded that the TRADOC centers lacked objectivity in proposing weapon systems for development and were inclined to favor their own type of weapon systems. The team felt that the Combined Arms Center frequently entered the process too late, with too little capability.

The study team recommended that the Combined Arms Center perform a combined mission area analysis to integrate the Army's mission areas, which it suggested be defined strategically or tactically and not functionally. The Combined Arms Center would analyze an extensive mission scenario, e.g., Europe or the Middle East, rather than analyze a narrow area, as each development center had been doing. The deficiencies identified in the analysis would be prioritized and provided to the development centers for them to propose solutions. These would then be sent back to the Combined Arms Center where the solutions would be evaluated.

The benefits which the team saw in this approach would include the following:

- The battlefield threat would be handled more consistently.
- The integration of the various mission areas would provide a larger view of the battlefield.
- Battlefield deficiencies would be identified more objectively.
- Each development center would be released from the burden of preparing a mission area analysis.

In response, the Army initiated its plan to improve the process by assigning the responsibility for preparing the combined mission area analysis to the Combined Arms Center, which is to be assisted by the TRADOC centers. A draft proposal implementing the change is now in preparation. Under the proposed procedures, the TRADOC centers will also work with the Combined Arms Center in identifying solutions to the significant deficiencies identified in the combined mission area analysis.

Affordability Is Not Considered Early Enough in Requirements Process

The TRADOC centers were not required to assess affordability when they proposed a weapon system for development. This omission increased the system's vulnerability to subsequent cost growth.

Occasionally, as in the LHX program, a system's cost receives top level Army attention early in the program. In most instances, by the time a system's affordability is scrutinized or questioned, the system has been accepted as a valid solution to the mission area deficiency, and its operational requirements have been defined. At this stage, it is difficult to economize by scaling down the system's operational characteristics.

There are two interrelated aspects to the affordability issue. One is the degree of sophistication built into a system. A second is the effect of a system's cost growth on quantities to be procured. The degree of sophistication in a weapon system can be a strong determinant of its cost and, thus, the quantity that can be bought. The trade-offs between high performance and quantities often appear to favor the former and lead to acquiring fewer units of very sophisticated systems, because the unit cost usually ends up being higher than anticipated.

The weapon systems covered in our study, for the most part, are examples of the application of advanced technology. Center personnel involved in developing the requirements for the systems were inclined toward the view that the urgency of the need overrode cost considerations and that the technical configuration of the weapon system should not be constrained by cost. The centers concentrated on performance requirements and typically regarded cost as an unfortunate roadblock to be overcome.

Although an earlier version of the medium advanced antiarmor weapon system was canceled in part because of its high cost, we were told by program officials that the restraints of affordability had not been considered by the center in the development of the most recent version of the system, in order that various potential technical solutions might be explored. The remotely piloted vehicle's numerous technical problems are attributable to stringent size and weight requirements coupled with requirements for advanced capability, especially in software and in the communications data link.

Extensive use of sophisticated technology to meet performance requirements was also involved in the Army's development of the future armored combat system. Here the Armor Center was directed to develop a system which, when fielded, will be at least 5 years ahead of the

threat. While an impressive goal, the complexity and immaturity of the various technologies involved pose substantial risks.

In the case of the LHX, after careful scrutiny by high ranking Army officials, an attempt was made to address affordability issues by establishing goals for its unit acquisition cost and operational and support costs. This is the only one among the five cases we examined where the Army recognized that affordability issues should be addressed early in the development program. Here too, however, the emphasis on affordability emanated mainly from the Army Headquarters level.

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