

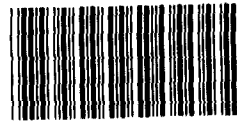
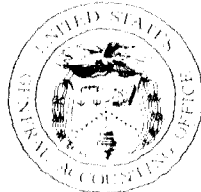
GAO

Report to the Chairman, Subcommittee
on Defense, House Committee on
Appropriations

May 1991

BATTLEFIELD
AUTOMATION

Army Needs to
Reevaluate Air
Defense Radar
Acquisition Programs



144022



United States
General Accounting Office
Washington, D.C. 20548

**National Security and
International Affairs Division**

B-242246

May 3, 1991

The Honorable John P. Murtha
Chairman, Subcommittee on Defense
Committee on Appropriations
House of Representatives

Dear Mr. Chairman:

As requested, we reviewed the Army's progress and strategy in acquiring an off-the-shelf radar for its Forward Area Air Defense System and concurrently developing advanced radar technology. The report also discusses the Army's plans to provide interim air defense radar capabilities.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after its issue date. At that time, we will send copies to appropriate congressional committees; the Secretaries of Defense and the Army; and the Director, Office of Management and Budget. We will make copies available to others on request.

Please contact me on (202) 275-4841 if you or your staff have any questions concerning this report. The major contributors to this report are listed in appendix III.

Sincerely yours,

A handwritten signature in cursive script that reads 'Louis J. Rodrigues'.

Louis J. Rodrigues
Director, Command, Control, Communications,
and Intelligence Issues

Executive Summary

Purpose

The Army is pursuing three air defense radar programs. It (1) plans to spend up to \$1 billion to acquire and modify an off-the-shelf radar system, (2) is developing advanced radar technology for potential multiple uses, and (3) is acquiring an interim lightweight radar for its mobile light divisions until the off-the-shelf radar is fielded in the late 1990s. The Chairman, Subcommittee on Defense, House Committee on Appropriations, asked GAO to review the Army's plans to concurrently pursue these three programs.

Background

The Army is acquiring an off-the-shelf Forward Area Air Defense System radar to detect and warn of approaching aircraft. It has delayed deployment of the radar until 1997 because of delays in purchasing a radar that meets its original requirements. The Army now plans to buy the radar with the best price and capabilities available and then modify it as needed. Also, the Army is developing multirole survivable advanced radar technology to demonstrate potential capabilities to satisfy future requirements of multiple air defense programs. The Army estimates that with approval and funding, production of this advanced radar could begin about 1997 and fielding could begin about 2 years later.

The Army is purchasing an interim lightweight radar for use by the rapid deployable light divisions. The Army retired most existing radars used for forward area air defense in fiscal year 1990 because of high operating and support costs. The heavy divisions, except the one initially deployed to Saudi Arabia, have retired their existing radar and will not get an interim radar.

Results in Brief

Currently, because of delays in acquiring the off-the-shelf Forward Area Air Defense radar, its deployment has moved much closer to the potential multirole survivable radar's projected availability date. As a result, major development efforts to pursue both radars may no longer be essential or justified. Estimated development costs of both programs exceed \$450 million. Although the Army has not compared the production costs of these two programs, preliminary Army estimates indicate that each advanced multirole radar could cost more than an off-the-shelf radar. However, the advanced radar system should provide superior survivability and performance and could require fewer units to perform the same functions as the off-the-shelf radar system. Ongoing and planned demonstrations of these radars should provide data needed to

determine whether a single one could meet Army needs and avoid continued development of both programs.

To fill the gap created by the retirement of the existing air defense radar and slippages in fielding the off-the-shelf radar, the Army decided to equip its mobile light divisions with a limited capability, lightweight radar. Heavy divisions, except the one initially deployed to Saudi Arabia, will not have a radar capability until the off-the-shelf radar is fielded in 1997.

Principal Findings

The Army Is Pursuing Dual Radar Programs

A single program could meet multiple Army requirements in the late 1990s. The advanced multirole survivable radar could meet the Forward Area Air Defense System's requirements and exceed the off-the-shelf radar's capabilities, but it may initially cost more and its size needs to be reduced for mobility.

The Army has not made a detailed cost comparison of the off-the-shelf radar and the multirole survivable radar technology programs. Based on preliminary estimates, the unit cost to acquire a radar using the multirole survivable radar could be 1-1/2 to 2 times the cost of the basic off-the-shelf radar. Although unit costs could be greater, fewer multirole survivable radars may be needed than off-the-shelf radars.

Continuing the two separate programs may result in unnecessary development costs. Based on Army estimates, the costs to modify the off-the-shelf radar and develop the multirole survivable radar are about \$323 million and \$129 million, respectively. Defense officials stated that the multirole survivable radar is not currently funded or approved to proceed beyond the advanced development phase.

To determine if fewer new radar programs could meet the Army's requirements, more adequate cost, schedule, and performance data on the off-the-shelf and multirole radars is needed. Based on Army plans to evaluate and demonstrate these two radars during the next 2 years, more adequate data will be available to determine if one of the programs can be terminated or whether the technologies of the two programs should be merged before production of the off-the-shelf radar is scheduled to begin.

Division Radar Capability Gap

The Army retired its existing division air defense radar for most units at the end of calendar year 1990. However, the off-the-shelf radar, which is to replace the retired radar, has experienced program delays and is not scheduled to be deployed until fiscal year 1997.

An interim lightweight radar is being acquired for light divisions because they are more likely to be used to counter the predominant threat for the 1990s—low- to mid-intensity conflicts. Heavy divisions, except the one initially deployed to Saudi Arabia, did not retain their existing radar due to its operating cost. The heavy division initially deployed to Saudi Arabia is assigned to the airborne corps and is therefore more likely to be used for low- to mid-intensity conflicts than other heavy divisions. The remaining heavy divisions, including those deployed to Saudi Arabia, will not have a dedicated air defense radar capability until the late 1990s. This gap will exist whether the Army selects the off-the-shelf radar or advanced multirole survivable radar technology to meet future needs.

Experiences gained in Operation Desert Storm should help determine whether lightweight interim radars should be acquired for additional heavy divisions, while evaluating and selecting the best value radar to meet future requirements.

Recommendations

GAO recommends that the Secretary of the Army, before entering production of the off-the-shelf radar or full-scale development of the multirole radar, evaluate the cost-effectiveness of selecting one of these programs to meet both corps and division air defense requirements based on scheduled demonstrations and evaluations of these programs. As part of that evaluation, GAO recommends that the Secretary of the Army consider the availability of interim lightweight radars to meet any priority needs to allow time to select the most cost-effective candidate radar system, or to merge radar programs to satisfy both corps and division long-term requirements with one system.

Agency Comments and GAO's Evaluation

The Department of Defense (DOD) agreed or partially agreed with GAO's findings and partially concurred with the recommendations.

DOD stated that the multirole survivable radar program is a technology demonstration program rather than an acquisition program. Therefore, the Army has only one radar program that will continue as an acquisition program beyond the demonstrations and evaluations in fiscal year

1992. DOD stated that if the advanced technology radar yields advancements that can be used in existing or planned radars, the technology will be incorporated to the extent requirements dictate.

GAO believes that before the Army enters production of the off-the-shelf radar in 1994, the Army should evaluate whether the advanced technology of the multirole survivable radar can be used to produce one radar for corps and division requirements or whether the advanced technology program and the off-the-shelf radar program can be merged to produce one radar to meet Army requirements. Excluding consideration of the advanced survivable technology radar to meet multiple division and corps requirements before it is tested and evaluated appears premature. The Army should assess the capabilities of both radar programs over the next 2 years and experiences gained during Operation Desert Storm to determine (1) the potential for one program to serve multiple division and corps needs and (2) which radar program, or whether merging the radar programs, would provide the best value radar.

Contents

Executive Summary		2
Chapter 1		8
Introduction	Background	8
	Objectives, Scope, and Methodology	9
Chapter 2		10
Potential to Avoid Dual Air Defense Radar Programs	Off-the-Shelf Radar Acquisition Program	10
	Multirole Survivable Radar Technology Program	11
	Cost of Radar Programs	12
	Legislative Comments on Weapons Acquisition Strategy	13
	Conclusions	13
	Recommendations	14
Chapter 3		15
Interim Capability Plans and Options	Existing Radar Retirement and New Radar Program	15
	Slippage Create Capability Gap	
	Heavy Divisions Left Without Radar Capability	17
	Interim Capability Planned for Light Divisions	17
	Alternatives Available to Equip Heavy Divisions With Interim Radar	18
	Conclusions	18
	Recommendation	19
Appendixes	Appendix I: Organizations Visited	20
	Appendix II: Comments From the Department of Defense	21
	Appendix III: Major Contributors to This Report	29
Related GAO Products		32
Table	Table 3.1: FAADS GBS Program Cost Estimate	12

Abbreviations

DOD	Department of Defense
FAADS	Forward Area Air Defense System
FAADS GBS	Forward Area Air Defense System Ground-Based Sensor
FAAR	Forward Area Alerting Radar
GAO	General Accounting Office
MRSR	Multirole Survivable Radar

Introduction

The Army plans to acquire an air defense radar to support its division Forward Area Air Defense System (FAADS). The Army is also developing advanced radar technology to demonstrate technologies for multiple future requirements, primarily for future corps air defense weapons.

The Army plans to acquire 155 off-the-shelf radars, called FAADS ground-based sensors (FAADS GBS), and associated equipment. Total estimated acquisition costs range from \$759 million to over \$1 billion, depending on the extent to which the selected radar must be improved to meet requirements. Each radar could cost from \$4.9 million to \$7 million. The Army has no firm cost or schedule estimates for the advanced technology radar and still considers it a technology demonstration program for potential future uses and has not established requirements or funding for full-scale development.

Background

FAADS includes three air defense weapons and a command, control, and intelligence system to automate command and control of the weapons. The command, control, and intelligence system, which includes computers, FAADS GBS, and other devices, is to automatically detect and identify incoming enemy aircraft flying at low altitudes and provide targeting and tracking information to forward area air defense units. This information will enable the units to pivot their weapons more quickly towards enemy aircraft.

In 1986, the Department of Defense (DOD) approved fielding parts of the FAADS command, control, and intelligence system, including FAADS GBS, starting in 1990. The radar's fielding date has slipped several times and is now scheduled for late fiscal year 1997. In September 1990, the Army began considering proposals for the radar and plans to select a candidate during fiscal year 1991. The primary reason for the program slippage is the Army's inability to obtain an off-the-shelf radar that meets its original requirements.

The Army plans to acquire 8 preproduction and 147 production radars, for a total of 155, to replace the existing division air defense radars. Most of the existing radars were retired in 1990, because the radars were costly to operate and maintain. However, divisions initially deployed to Saudi Arabia for Operation Desert Storm continued to use these radars.

The Army is not requiring the off-the-shelf FAADS GBS candidate to meet all of its requirements. Instead, the Army plans to acquire the best value

off-the-shelf candidate and modify it as needed. Planned performance improvements include longer range, faster response, better performance in an electronic warfare environment, and greater accuracy.

Objectives, Scope, and Methodology

At the request of the Chairman, Subcommittee on Defense, House Committee on Appropriations, we evaluated the Army's plan to acquire an off-the-shelf radar that may necessitate a preplanned improvement program to meet the Army's requirements. Our specific objectives were to review the Army's plans to (1) purchase an off-the-shelf radar for its FAADS program and concurrently develop advanced radar technology and (2) provide interim air defense radar capabilities until the modified off-the-shelf radar is fielded in the late 1990s.

To assess the Army's FAADS GBS acquisition strategy and options to provide interim capabilities, we reviewed requirements documents, acquisition plans, and the status of other DOD radar development and acquisition programs. We obtained cost, schedule, technical, and acquisition information from (1) Army organizations managing the development, testing, and procurement of radar programs; (2) user representatives; and (3) private sector contractor representatives. Appendix I lists the organizations we visited.

The FAADS GBS quantity requirements are based on an Army force structure of 26 divisions; however, the Army plans to reduce its force structure by at least 8 divisions through 1995. Since force structure changes were not finalized, we did not examine the impact of planned Army force structure changes on planned quantities of radars.

We conducted our review from September 1989 through March 1991 in accordance with generally accepted government auditing standards. DOD provided written comments on a draft of this report. These comments are presented and evaluated in appendix II. DOD's specific comments and suggestions have been incorporated into the report where appropriate.

Potential to Avoid Dual Air Defense Radar Programs

The Army has two separate programs with potential to satisfy FAADS air defense radar requirements in the late 1990s.¹ The Army is acquiring an off-the-shelf FAADS GBS radar to meet minimum division air defense radar requirements and plans to modify this radar as necessary to fully meet its requirements. Also, the Army is developing advanced radar technology, under a technology demonstration² program called the multirole survivable radar (MRSR), to show the capabilities necessary to meet requirements of multiple future air defense programs.

The Army plans to start fielding FAADS GBS in 1997 and complete the modifications about 2 years later. MRSR program officials estimate that, with approval and funding, MRSR could be available for production about 1997 and fielded about 1999, or about the time the fully capable FAADS GBS is available. Army officials stated that the MRSR is not approved for full-scale development production and its schedule is less certain than the FAADS GBS schedule.

The Army has not made a comparative study of the cost and capability of FAADS GBS and MRSR to determine the potential to skip the generation of the off-the-shelf FAADS GBS radars to satisfy future division air defense requirements. However, acquiring one radar to satisfy both corps and division requirements could save development costs. The Army estimates the cost to develop the two separate programs at \$452 million, excluding costs to adapt the MRSR technology to specific programs. The Army did not have sufficient data available on MRSR for us to reliably estimate its total acquisition and life-cycle cost. However, preliminary Army estimates indicate that MRSR could cost more per unit but require fewer units than FAADS GBS.

Off-the-Shelf Radar Acquisition Program

Because of the need for a division air defense radar, the Army plans to acquire an off-the-shelf FAADS GBS. The Army is using what it terms "best value" strategy to select the FAADS GBS candidate that is based on a number of factors, including technical performance, cost, and potential for performance improvement. This strategy encourages competition by allowing more offerors to qualify by initially meeting a set of minimum

¹Division air defense requirements are aimed at low-altitude protection, while corps requirements call for mid- to high-altitude defense.

²A technology demonstration program does not have approved plans and requirements for proceeding into production. Rather, it is to advance the state of technology for potential follow-on acquisition programs.

requirements, rather than having to meet the Army's full set of requirements.

The Army has set three levels of requirements: minimum, objective, and future requirements. The off-the-shelf radar must meet all the minimum requirements, although the Army also plans to select the radar that meets the most objective and future requirements at the best price.

The Army adopted the best value radar approach after the previous single offeror's radar did not meet FAADS GBS requirements in 1988. The Army began evaluating proposals in September 1990 and is currently testing seven candidate radars. The Army plans to select the radar to acquire in July 1991, then start building eight prototype radars in fiscal year 1992 for operational testing. A low-rate initial production decision is scheduled for February 1994, and a full-rate production decision is scheduled for January 1995. Initial fielding is scheduled to start in fiscal year 1997.

Improvements to the FAADS GBS radar are to start when full-rate production begins. Initial, referred to as Block I, improvements are expected to be completed by August 1997. Block I improvements are primarily to meet the Army's objective FAADS GBS requirements. Block II modifications are scheduled to begin around August 1997 and are to be completed in 1999. These are to meet the Army's stated future FAADS GBS requirements, including downsizing for the light divisions.

Multirole Survivable Radar Technology Program

The objective of the MRSR program is to develop technologies for potential use in a corps air defense radar for the late 1990s and beyond as a replacement for the HAWK radar and the radar for the next generation corps high-to-medium altitude air defense missile. The Army also envisions this radar technology as a possible update to the FAADS GBS.³ Based on the Army's 1990 Air Defense Modernization Plan and according to Army representatives, MRSR is expected to result in a leap in sensor technology.

The MRSR program is managed by the Army Missile Command's Research, Development, and Engineering Center and is currently in advanced development. An Army air defense representative stated that a preliminary prototype was successfully demonstrated in 1990 and a

³To use MRSR as a corps radar requires an added capability to track ballistic missiles; to use its technology for updating the FAADS GBS requires a reduction in size to increase mobility.

prototype is scheduled for delivery in December 1991 for advanced development testing. A center representative expects MRSR to be ready to enter full-scale engineering development in fiscal year 1993. With program approval and funding, he said the radar could be ready for initial production about 1997 and begin fielding about 1999.

Cost of Radar Programs

Based on an April 1990 Army estimate, the FAADS GBS could cost over \$1 billion with planned improvements, as shown in table 3.1.

Table 3.1: FAADS GBS Program Cost Estimate

Dollars in millions	
Program element	Cost
Base program	
Development	\$190.6
Procurement	525.1
Spares	43.6
Subtotal	\$759.3
Preplanned improvements	
Development	\$132.5
Procurement	173.8
Spares	15.5
Subtotal	\$321.8
Total cost	\$1,081.1

The Army has not developed an official cost estimate for MRSR. According to preliminary estimates from an Army study, MRSR's unit cost could be as much as 1-1/2 to 2 times the cost of a basic FAADS GBS without improvements. Based on current cost estimates, this would equate to \$7.3 million to \$9.8 million per MRSR as compared to \$7 million for a fully capable FAADS GBS. Army Missile Command officials stated that five MRSR units could replace six FAADS GBS units because of their longer range.

The Army has not made official estimates of MRSR production and life-cycle costs; therefore, we could not reliably compare acquisition costs for both programs. However, since fewer MRSRs than FAADS GBS are required to cover a division's airspace, the cost difference could be partially or entirely offset, especially when considering life-cycle costs. In addition, eliminating one of the two programs could reduce development

costs, which are projected to be over \$452 million for both programs. According to preliminary Army estimates, MRSR will cost \$129 million to develop, excluding potentially significant additional costs to adapt it to specific programs, and FAADS GBS could cost \$323 million to develop with planned improvements. The Army will have more complete and precise information on cost and capability of both sensors by the end of fiscal year 1992 when demonstration and evaluation of both radars will be completed. This is before MRSR would be ready to enter full-scale development in fiscal year 1993 and FAADS GBS enters low-rate initial production in fiscal year 1994.

Army representatives stated that because MRSR's cost estimates and schedules are less certain than those for FAADS GBS, they prefer to remain with the currently funded FAADS GBS program to meet division air defense requirements in the late 1990s.

Legislative Comments on Weapons Acquisition Strategy

In face of the new post-Cold War era, in which Soviet and Warsaw Pact threats of all-out attack against Western Europe have diminished, and in light of tighter defense budgets, the House and Senate Committees on Armed Services stated that emphasis should be placed on improving existing systems and starting fewer new systems. They advocated, however, that the nation's technological superiority should be maintained by supporting innovative and advanced technological concepts.

Conclusions

Both FAADS GBS and MRSR have potential to become a standard division and corps air defense sensor. The Army has time to reevaluate its strategy before it makes important decisions to enter initial FAADS GBS production in 1994 or MRSR full-scale development in 1993.

The Army plans to spend about \$452 million to develop two different radars to support corps and division air defense. The original rationale for separate programs was to acquire an off-the-shelf radar to meet an urgent need for a division radar by the early to mid-1990s, while developing more advanced radar technology for future corps and division needs.

Several events have occurred that affect the Army's justification for separate programs. For instance, the FAADS GBS schedule for initial fielding has slipped to late 1997, with improvements to fully meet requirements to be made by 1999. Meanwhile, the Army's advanced technology program for potential multiple uses, MRSR, will be evaluated

in fiscal year 1992. With approval and funding, it could be available for fielding about the same time as the FAADS GBS modifications are completed. Also, defense budgets are becoming tighter and fewer new weapons will be affordable.

Comparing FAADS GBS and MRSR cost and technical performance after more adequate information is available could allow the selection of the best value system to meet both corps and division radar requirements. Selecting one system, or merging the technologies of the two programs, for future corps and division requirements would avoid incurring unnecessary costs in developing and supporting separate programs.

Recommendation

We recommend that the Secretary of the Army, before entering FAADS GBS production or MRSR full-scale development, evaluate the cost-effectiveness of selecting one of these programs to meet both corps and division air defense requirements based on the demonstrations and evaluations of these systems scheduled to be completed by the end of fiscal year 1992.

Interim Capability Plans and Options

The Army's 1990 retirement of the Forward Area Alerting Radar (FAAR), coupled with slippage in the FAADS GBS program, created a 6-1/2-year gap in the Army's division air defense radar capability. The Army is acquiring a low-cost, lightweight interim radar for its more mobile light and special divisions and is not providing an interim radar for its heavy divisions. Until FAADS GBS is fielded in 1997, heavy divisions will rely primarily on forward observer teams using binoculars and radios to provide early warning of aircraft.

The Army does not consider the lightweight radar adequate for high-intensity conflicts where it expects to use heavy divisions. Its light divisions are more likely to be used in a low- to mid-intensity conflict, which is considered the predominant threat in the 1990s. However, representatives of the heavy division we visited did not consider forward observers to be adequate and stated that lightweight radars are more capable than forward observers. Based on Army cost estimates for an off-the-shelf lightweight radar being acquired for light and special divisions, we estimate that to equip all heavy divisions with the lightweight radar would cost about \$39 million.

Existing Radar Retirement and New Radar Program Slippage Create Capability Gap

From the original fielding date of 1990, the FAADS GBS schedule has slipped to 1997 because of difficulties in finding an acceptable off-the-shelf radar. The Army's decision to essentially retire FAAR at the end of 1990, with the exception of those radars that supported Operation Desert Storm, leaves a gap in air defense capability.

Program Slippage

An April 1988 request for proposals for an off-the-shelf FAADS GBS resulted in one proposal. During testing, the proposed radar did not meet the Army's requirements for limiting false targets, reaction time, detection range, or detecting slow-moving targets. In June 1989, the Army decided to cancel its acquisition plans, reassess requirements, and resolicit proposals.

As a result of the radar's failure to meet requirements, the Office of the Secretary of Defense withdrew the program's fiscal year 1991 development funding and its fiscal years 1992 and 1993 production funding. Additionally, the Army withdrew all FAADS GBS preplanned product improvement funding. The loss of fiscal years 1992 and 1993 production

funding precluded the program office from concurrently acquiring and testing production radars, delaying FAADS GBS fielding.

Due to the program restructuring and budget cuts, the Army does not plan to start fielding FAADS GBS until late 1997. Some heavy division air defense artillery battalions scheduled to receive radars last will not be equipped until about the year 2000.

Current Air Defense Radar Retired

Originally, the Army planned to operate FAAR until FAADS GBS was fielded. However, based on a December 1989 Defense Management Report, the Army decided to remove FAAR from the field by the end of fiscal year 1990,¹ even though FAADS GBS would not be fielded by then. This decision was prompted by the retirement of the GAMA Goat vehicle used to transport FAAR and the system's high operating and support costs.

In December 1989, the Army directed that the GAMA Goat be retired by the end of fiscal year 1990, leaving FAAR without a carrier vehicle. According to Army estimates, the annual cost to operate and support each combined FAAR and GAMA Goat unit was about \$541,000. This is a high-cost capability compared with a lightweight air defense radar that the Marine Corps is purchasing. The Marine Corps lightweight radar is estimated to provide capabilities comparable to FAAR at an annual operating and support cost of \$25,000 each. The Army considered retaining FAAR on a different vehicle, but, because of the high operating and support cost, even without the GAMA Goat, and its limited capabilities, the Army decided to retire FAAR along with the GAMA Goat.

In September 1990, the Army waived retirement of FAAR for units that initially deployed to Saudi Arabia, including one heavy division. This heavy division, assigned to the XVIII Airborne Corps, will use FAAR until it is replaced by the lightweight radar, because it is more likely to be used for low- to mid-intensity conflicts than other heavy divisions.

The heavy divisions subsequently deployed from Germany to Saudi Arabia had already retired their FAARS, and the Army does not currently plan to equip these divisions with the lightweight radar. They will rely primarily on binoculars and radios to detect and provide warning of approaching aircraft.

¹FAAR's retirement was delayed for most units until the end of 1990. Army National Guard and Training and Doctrine Command FAARs are to be retired by March 31, 1991.

Heavy Divisions Left Without Radar Capability

Based on the Army's FAADS radar acquisition strategy, heavy divisions, except the one initially deployed to Saudi Arabia, will not have an air defense radar for about 6-1/2 years. Until FAADS GBS is fielded beginning in 1997, the Army's strategy calls for heavy divisions to use forward observers with binoculars and radios to detect and warn of hostile aircraft.

The Army decided in 1990 that heavy divisions would await the availability of the planned FAADS GBS in the late 1990s because of improvements in U.S.-Soviet relations and the heavy divisions' need for an effective sensor in a high-intensity, heavy electronic warfare environment. Army representatives indicated that a low- to mid-intensity conflict was the greater threat, and light and special forces would generally be used for these types of conflicts. Heavy forces would generally be used for high-intensity conflicts, now considered less of a threat.

Heavy forces representatives are concerned about not having an air defense radar and consider the fielding of a new radar to be an urgent need. As far back as 1972, the Army's requirements document for FAAR states that forward observer teams were inadequate.

According to officials at the 24th Infantry Division (Mechanized), which was the heavy division initially deployed to Saudi Arabia, a radar is essential for the air defense artillery battalion to perform its mission of detecting hostile air attack and warning the division. The commander considered the interim radar planned for light and special forces much superior to forward observers for heavy divisions.

A representative of the U.S. Army Air Defense Artillery School, the organization which defines air defense radar requirements, stated that the interim radar planned for light divisions would provide some capability to the heavy divisions and would be acceptable, as long as it does not become the permanent solution to the heavy division FAADS GBS requirement.

Interim Capability Planned for Light Divisions

Recognizing the gap in air defense radar capabilities until the late 1990s, the Army decided to field an interim radar to its mobile light and special divisions starting in fiscal year 1992. The interim radar is expected to be used until the off-the-shelf FAADS GBS size is reduced for these divisions around the year 2000.

A market survey identified at least four viable candidate lightweight radars to meet the Army's requirements. The Army Missile Command issued a solicitation, dated July 31, 1990, for 4 lightweight radars, with options for an additional 56. The Army estimates these radars will cost about \$24.4 million, or \$407,000 each. The Army plans to award a contract in fiscal year 1991 for the initial four lightweight radars.

Alternatives Available to Equip Heavy Divisions With Interim Radar

The interim radar planned for the light and special divisions could provide heavy divisions many of FAAR's capabilities at significantly less cost and, according to users, would be better than forward observers.

According to a 1990 Army Missile Command comparison of performance capabilities, FAAR and lightweight radars have comparable characteristics. Both have ranges of approximately 20 kilometers, limited electronic counter-countermeasure capability, and only voice communications with the weapon systems to provide threat information. FAAR was considered better in identifying friendly from hostile aircraft and detecting smaller targets at low altitudes.

A study in November 1989 by the Army Communications-Electronics Command assessed the Marine Corps' lightweight radar versus FAAR and concluded that the lightweight radar met the majority of FAAR requirements and that the deficiencies noted were not critical if the system was appropriately deployed. It assessed the Marine Corps radar as highly reliable, lightweight, and low power. The study further observed that the radar was easily operated and maintained.

Conclusions

The Army's acquisition strategy to replace its division air defense radar 6-1/2 years after phasing out FAAR has created a radar capability gap for the heavy divisions.

Heavy division representatives from the 24th Infantry Division and the Air Defense Artillery Center have cited the limitations of the forward observer approach and expressed a need for an air defense radar. This Division's deployment of FAARS to Saudi Arabia appears to support those concerns.

The lightweight radars being acquired for light divisions offer a low-cost alternative with capability comparable to that of FAAR if

- additional time is needed for the Army to obtain the data necessary to evaluate the potential to select either FAADS GBS or MRSR to meet its corps and division air defense requirements and
- the Army determines that heavy divisions need an interim radar to fill the current capability gap until a more capable radar can be fielded.

We estimate that the additional lightweight radars required to equip all heavy divisions would cost about \$39 million.

Recommendation

We recommend that the Secretary of the Army consider the availability of interim lightweight radars should they be needed to fill the more critical needs and allow time to select and field one future radar, or merge the radar programs, to satisfy both corps and division long-term requirements. This assessment should consider experiences gained during Operation Desert Storm.

Organizations Visited

- Program Executive Office, Air Defense, U.S. Army Missile Command, Redstone Arsenal, Alabama;
- Program Executive Office, Command and Control Systems, U.S. Army Communications-Electronics Command, Fort Monmouth, New Jersey;
- Program Executive Office, Intelligence and Electronic Warfare, U.S. Army Communications-Electronics Command, Fort Monmouth, New Jersey;
- Research, Development, and Engineering Center, U.S. Army Missile Command, Redstone Arsenal, Alabama;
- Center for Research, Development, and Engineering, U.S. Army Communications-Electronics Command, Fort Monmouth, New Jersey;
- Headquarters, U.S. Army Air Defense Artillery Center and Fort Bliss, Fort Bliss, Texas;
- Headquarters, Office of the Secretary of Defense, Washington, D.C.;
- Headquarters, Department of the Army, Washington, D.C.;
- Headquarters, 24th Infantry Division (Mechanized) and Fort Stewart, Fort Stewart, Georgia;
- Headquarters, XVIII Airborne Corps and Fort Bragg, Fort Bragg, North Carolina;
- Raytheon Company, Bedford, Massachusetts;
- Lear Astronics Corporation, Santa Monica, California; and
- Hughes Aircraft Company, Fullerton, California.

Comments From the Department of Defense

Note: GAO comments supplementing those in the report text appear at the end of this appendix.



COMMAND, CONTROL,
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ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301-3040

March 1, 1991

Mr. Frank C. Conahan
Assistant Comptroller General
National Security & International
Affairs Division
U.S. General Accounting Office
Washington, DC 20548

Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report entitled -- "BATTLEFIELD AUTOMATION: Army Needs to Re-evaluate Air Defense Radar Acquisition Programs," dated January 14, 1991 (GAO Code 395126/OSD Case 8584). The DoD partially agrees with the report.

The DoD review of the draft report indicates that the distinction between a technology demonstration program and an acquisition program is not well defined. A technology demonstration is not an acquisition program that goes from the basic research and development on through full scale production. It is technology research--which, if proven to be effective, can be used in future developments. If no requirement exists, the product of the technology demonstration is put on the shelf for possible future use. The Multirole Survivable Radar System Technology demonstration is funded only through the evaluation stages and has no dollars for Full Scale Development or Production. Given the status of the program and its lack of future funding, the DoD made a selection of one radar system, the Ground Based Sensor, which will continue to be funded beyond the FY 1992 evaluations.

Detailed DoD comments on the report findings and recommendations are provided in the enclosure.

Sincerely,

Duane P. Andrews

Enclosure

See comment 1.

See comment 2.

GAO DRAFT REPORT - DATED JANUARY 14, 1991
(GAO CODE 395126) OSD CASE 8584

"BATTLEFIELD AUTOMATION: ARMY NEEDS TO RE-EVALUATE AIR DEFENSE
RADAR ACQUISITION PROGRAMS"

DEPARTMENT OF DEFENSE COMMENTS

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FINDINGS

- o FINDING A: The Forward Area Air Defense Ground-based Sensor. The GAO reported that the Army plans to acquire an air defense radar to support its division Forward Area Air Defense System. The GAO explained that the Army plans to acquire 155 off-the-shelf radars (called Forward Area Air Defense System Ground-based sensors) and associated equipment, at a total acquisition cost ranging from \$759 million to over \$1 billion--depending on the extent to which the selected radar must be improved to meet requirements. The GAO noted that each radar could cost from \$4.9 million to \$7 million. The GAO observed that the Army has no firm cost or schedule estimates for the advanced technology radar and still considers it a technology demonstration program for potential future uses.

The GAO found that deployment of the radar, now scheduled for late FY 1997, has slipped several times, primarily because of delays in purchasing a radar that meets the original Army requirements. The GAO reported that the Army plans to replace the existing division air defense radars, most of which were retired in 1990 because they were too costly to operate and maintain, by acquiring eight preproduction and 147 production radars--for a total of 155. The GAO noted that the Army is not requiring the off-the-shelf ground-based sensor candidate to meet all of its requirements--but, instead, plans to acquire the best value off-the-shelf candidate and modify it, as needed, for (1) longer range, (2) faster response, (3) better performance in an electronic warfare environment, and (4) greater accuracy. The GAO explained that the Army is using what it terms "best value" strategy to select the ground-based sensor candidate based on a number of factors, including technical performance, cost, and potential for performance improvement. The GAO reported that the

Army plans to start fielding the Forward Area Air Defense System ground based sensor in 1997, and complete the modification about 2 years later.

The GAO also reported that while the Army plans upgrades to meet stated future requirements, it no longer plans to upgrade the ground-based sensor to satisfy corps requirements because the recently approved corps air defense missile program is expected to be provided with a radar that will satisfy corps requirements. (pp. 2-3, pp. 12-14, and pp. 16-19/GAO Draft Report)

Now on pp. 2-3, 8, and 10-11.

- o **DOD RESPONSE:** Concur.

- o **FINDING B: The Multirole Survivable Radar Technology Program.** The GAO reported that the Army is developing the multirole survivable radar technology to satisfy future requirements of multiple air defense programs. The GAO observed that the program objective is to develop a corps air defense radar for the late 1990s and beyond as a replacement for the HAWK radar and for the next generation corps high-to-medium altitude air defense missile. The GAO noted that the Army also envisions that radar, which is expected to be a leap in sensor technology, as a possible update to the Forward Area Air Defense Ground-based Sensor. The GAO reported that the Army expects the multirole survivable radar to enter full-scale engineering development in FY 1993, with initial production about 1997 and fielding about 1999. (pp. 2-3 and pp. 19-20/GAO Draft Report)

- o **DOD RESPONSE:** Partially Concur. The DoD Multirole Survivable Radar is an Army technology demonstration laboratory project. It is not an acquisition program to fill any approved requirement for corps air defense radar and is not a replacement for the Hawk radar system. Concepts and technology advancements from this program may be used in future radars if feasible and if a requirement exists. The DoD does not have any plans, at this time, to bring the Multirole Survivable Radar project any further forward than advanced development. No funding has been allocated in the President's Budget for engineering development of the multirole radar and no funding is allocated in the DoD six year Future Defense Plan for production of a multirole survivable radar.

- o **FINDING C: The Army Is Pursuing Dual Radar Programs.** The GAO reported that, with the planned improvements, the Forward Area Air Defense Ground-based sensor program could cost over \$1 billion. The GAO also reported that the Army has not yet developed an official cost estimate for the multirole survivable radar. The GAO noted that

Now on pp. 2-3, 11-12.

See comment 3.

the multirole survivable radar unit cost may be as much as 1 1/2 to 2 times the cost of the Forward Area Air Defense Ground-based sensor. The GAO observed, however, that five multirole survivable radar units could replace six Forward Area Air Defense ground-based sensors.

The GAO found that, because of delays in acquiring the Forward Area Air Defense off-the-shelf radar, its deployment has moved closer to the projected availability date for the multirole survivable radar. The GAO concluded that, as a result, concurrent acquisition of both radars may no longer be essential. The GAO reported that elimination of one of the two programs could reduce development costs, which are projected to be \$129 million for the multirole survivable radar, and \$323 million for the Forward Area Air Defense Ground-based sensor (with the planned improvements). The GAO noted that the Army will have more complete and precise information on the cost and capability of both sensors by the end of FY 1992, when demonstration and evaluation of both radars will be completed. The GAO also observed that, according to Army representatives, because the cost estimates and schedules of the multirole survivable radar are less certain than those of the Forward Area Air Defense Ground-based sensor, they prefer to remain with the latter to meet division air defense requirements in the late 1990s.

The GAO reported that the Army rationale for two separate radar programs is that an urgent need exists to replace the existing division air defense radar and a future need exists for a more capable Army air defense radar. The GAO also reported that the House and Senate Armed Services Committees have indicated that emphasis should be placed on improving existing systems, not starting fewer newer systems--yet directing that the nation's technological superiority should be maintained by supporting innovative and advanced technological concepts. The GAO concluded that both the Forward Area Air Defense Ground-based radar and the multirole survivable radar have the potential to become a standard division and corps air defense sensor. The GAO further concluded that selecting one system, after more adequate information is available, would avoid the costs of developing and supporting separate systems. (pp. 4-7, pp. 20-24/GAO Draft Report)

Now on pp. 3, 12-14.

See comment 4.

- o **DOD RESPONSE:** Partially Concur. The DoD has one program (Ground Based Sensor) that is presently being developed to satisfy an approved requirement for an air defense radar. The multirole survivable radar system is strictly a technology demonstration program. If the technology proves to be of significant value, it may be used in future radar upgrades.

- o **FINDING D: Interim Capability Plans and Options.** The GAO reported that the 1990 retirement of the Forward Area Alerting Radar, coupled with slippage in the Forward Area Air Defense Ground-based sensor program, created a six and a half year gap in the Army division air defense radar capability. The GAO reported that, as a result, the Army is acquiring an interim lightweight radar for light divisions, because they are more likely to be used to counter the predominant threat for the 1990s--i.e., low to mid-intensity conflicts. The GAO reported that the Army plans to award a contract in January 1991 for the initial four lightweight radars, which are expected to cost \$407,000 each. The GAO noted that options exist for another 56 units, which would bring the total cost to about \$24.4 million.

The GAO noted that, aside from the heavy division initially deployed to Saudi Arabia, the remaining Army heavy divisions, including others in Saudi Arabia, do not have a dedicated air defense radar capability. The GAO reported that until the Forward Area Air Defense Ground-based sensor is fielded in 1997, heavy divisions will rely primarily on forward observer teams using binoculars and radios to provide early warning of aircraft. The GAO also observed that experiences gained in Operation Desert Shield will help determine whether lightweight interim radars should be acquired for additional heavy divisions, while evaluating and selecting the best value radar to meet future requirements. The GAO reported that the commander of the 24th Infantry Division, initially deployed in Operation Desert Shield, considered the interim radar planned for light and special forces much superior to forward observers for heavy divisions. The GAO further reported that a November 1989 Army Communications Electronics Command study concluded that the Marine Corps lightweight radar met the majority of the Forward Area Alerting Radar requirements, and that the deficiencies noted were not critical--if the system was deployed appropriately. The GAO estimated that, to equip all heavy divisions with an off-the-shelf lightweight radar being acquired for light and special divisions, would cost about \$39 million.

The GAO reported that the Army originally planned to operate the Forward Area Alerting Radar until the Forward Area Air Radar Ground-based sensor was fielded, but plans changed because of the high operating and support costs of the Alerting radar, and the retirement of the GAMA Goat vehicle, used to transport the Forward Area Alerting Radar. The GAO also noted that the annual operating and support cost for the Marine Corps lightweight radar is estimated at \$25,000, while similar costs for the Forward Area Alerting Radar and the GAMA

Now on pp. 4, 15-19.

Goat unit are about \$541,000. (pp. 7-9 and 25-32/GAO Draft Report)

- o **DOD RESPONSE:** Concur.

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RECOMMENDATIONS

- o **RECOMMENDATION 1:** The GAO recommended that the Secretary of the Army, before entering Forward Area Air Defense Ground-based sensor production or Multirole Survivable Radar full-scale development, evaluate the cost effectiveness of selecting one of those programs to meet both corps and division air defense requirements, based on the demonstrations and evaluations of the systems scheduled to be completed by the end of FY 1992. (pp. 23-24/GAO Draft Report)
- o **DOD RESPONSE:** Partially Concur. The DoD agrees that one radar system should be procured to meet air defense requirements. As stated in the responses to Findings B and C, the DoD presently has one Army program that will continue as an acquisition program beyond the demonstrations and evaluations in FY 1992. If the radar technology demonstration project yields advancements that can be incorporated in existing or planned radars, it will be done to the extent that requirements dictate.
- o **RECOMMENDATION 2:** The GAO recommended that the Secretary of the Army consider whether an interim lightweight radar is needed to fill the gap in radar capability for some heavy divisions while fully evaluating the cost effectiveness of selecting between the Forward Area Air Defense Ground-based sensor and the Multirole Survivable Radar, to meet future Army requirements. The GAO further recommended that such an assessment consider experiences gained during Operation Desert Shield/Storm. (p. 33/GAO Draft Report)
- o **DOD RESPONSE:** Partially Concur. The DoD considered putting an interim lightweight radar in the heavy divisions and determined that it will rely on observer teams in the heavy divisions for an interim period. The DoD weighed the costs and capabilities of the alternatives in the context of the perceived threat and determined that a lightweight radar was not necessary for the time being. The Department will assess experiences gained during Operation Desert Shield/Storm in planning for future air defense radar programs, as well as many other Defense programs.

Now on p. 14.

Now on p. 19.

See comment 5.

The following are GAO's comments on the Department of Defense's letter dated March 1, 1991.

GAO Comments

1. We have revised the report to more clearly recognize that the multirole survivable radar system is a technology demonstration program rather than an acquisition program. However, if the advanced radar development proves to be highly successful, it could become an acquisition program or the technology could be used in a competitive acquisition program. The multirole radar is scheduled to be demonstrated before production of the off-the-shelf radar is to begin. Therefore, the Army will have adequate data available to determine if one of the programs can be terminated or whether the technologies should be merged before beginning production.
2. Although the multirole survivable radar system is currently funded only through the evaluation stages, the decision whether to continue into full-scale development or to field the system should be made after the radar has been tested, demonstrated, and evaluated. We believe that until then, ruling out use of this radar or its technology for both division and corps requirements is premature and defeats the purpose of continuing advanced radar development.
3. We have incorporated DOD's position that the multirole survivable radar is an Army technology demonstration project. However, the purpose of this project is to develop advanced technology capable of satisfying multiple Army requirements and therefore has the potential to meet future requirements for both the corps and division levels.
4. We assumed this program is the FAADS Ground-Based Sensor off-the-shelf acquisition program. By excluding the multirole survivable radar system at this time, the Army is precluding consideration of the radar before it is demonstrated in the field and evaluated for potential to provide a single system to satisfy both corps and division requirements in the late 1990s and beyond. We believe that by the late 1990s advancing technologies could make today's off-the-shelf radar technologies virtually obsolete. Also, the Army has encountered difficulties in obtaining an off-the-shelf radar that meets its requirements and has modified its requirements to overcome those difficulties.
5. In light of the lack of urgency acknowledged by DOD in filling the radar capability gap for heavy divisions, we believe the Army has time to wait if necessary to field the best technology with potential to satisfy

both corps and division requirements. Meanwhile, if some interim equipment is needed for specific units, the lightweight radar offers a low-cost alternative to provide an interim solution.

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Related GAO Products

Major Acquisition Programs: Selected Aspects of the Army's Forward Area Air Defense System (GAO/NSIAD-90-191, June 25, 1990).

Battlefield Automation: Army's Air Defense Command and Control System Status and Program Issues (GAO/NSIAD-90-12BR, Dec. 20, 1989).

DOD Acquisition Programs: Status of Selected Systems (GAO/NSIAD-88-160, June 30, 1988).

Battlefield Automation: Better Justification and Testing Needed for Common Computer Acquisition (GAO/IMTEC-88-12, Dec. 31, 1987).

Battlefield Automation: Army Command and Control Systems Acquisition Cost and Schedule Changes (GAO/NSIAD-88-42FS, Dec. 9, 1987).

Battlefield Automation: Army Air Defense Command and Control System Acquisition and Budget Issues (GAO/NSIAD-87-208, Sept. 28, 1987).

DOD Acquisition Programs: Status of Selected Systems (GAO/NSIAD-87-128, Apr. 2, 1987).

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