



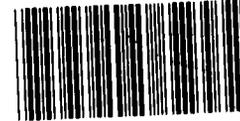
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WASHINGTON D.C. 20548

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SEPTEMBER 15, 1981

The Honorable Joseph P. Addabbo
Chairman, Subcommittee on Defense
Committee on Appropriations
House of Representatives



116378

Dear Mr. Chairman:

Subject: Evaluation of the Army's Advanced Field Artillery
Tactical Data System (MASAD-81-44)

Your December 12, 1980, letter asked us to evaluate (1) the progress of the Army's Advanced Field Artillery Tactical Data System (AFATDS) program and (2) the Army's plan for adopting components of the Marine Integrated Fire and Air Support System (MIFASS) for use in the AFATDS program. You were concerned whether the Army would make the proper choice for the AFATDS approach in terms of total cost, operational suitability, and timeliness. Also, you wanted assurance that the Army's development and acquisition procedures allowed for maximum competition.

The specific objectives of our evaluation were to (1) identify and assess the Army's decision to acquire AFATDS, (2) assess the extent of competition planned for the AFATDS program, and (3) analyze the MIFASS architecture and identify those components and features that could be candidates for incorporation into AFATDS. Information on the scope, methodology, and limitations of our evaluation is in the enclosure.

Our evaluation showed:

- The Army has decided to modularly improve the existing Tactical Fire Direction System (TACFIRE) to provide for a future field artillery command and control system. Although this approach, in our opinion, is the proper choice in terms of operational suitability and timeliness, the Army needs to establish a sound basis to assure that the most cost-effective system is being acquired to meet user needs.
- The Army's plans provide for ample equipment competition. Software, however, will be developed in-house.
- MIFASS was rejected as a follow-on system candidate, but a reconfigured MIFASS architecture or components may be usable in AFATDS.

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The results of our evaluation are described in more detail below.

AFATDS WILL BE DEVELOPED
MODULARLY

The Army has selected a modular approach to develop AFATDS, an automated command and control system intended to replace TACFIRE, which is now in the process of deployment. The modular approach was selected over a number of alternatives, including a new system development. The Army believes the selected approach will allow them to (1) build on the experience of TACFIRE, (2) maximize their fielded capability for command and control at any given time, and (3) save significant research and development dollars over the new systems approach.

The AFATDS program has three primary objectives to be accomplished in three phases. The first objective is to eliminate the communications bottleneck in TACFIRE and to provide greater flexibility to interoperate with emerging communication and sensor systems. This objective is to be achieved through the introduction of a new front-end communications processor into TACFIRE as the first phase of the program. The second objective, to be achieved in the program's second phase, is to improve system responsiveness and survivability through the use of intelligent remote terminals with a distributed data base. The third objective is to upgrade the equipment in TACFIRE's Fire Direction Center to improve system reliability and operational flexibility. With the introduction of this equipment in 1990 as the third phase of the program, AFATDS will replace TACFIRE as the Army's automated fire support command and control system.

Although little has been spent on the program to date, the Army is planning to commit major investment dollars to AFATDS. Through 1990 the Army estimates it will spend \$187 million in research and development funds. Estimated procurement costs range from \$763 million to equip the active Army force to over \$1.6 billion to equip the total Army force.

Because of the importance and dollar investment planned for the AFATDS program, it is imperative that the system be developed from a sound base to ensure that the most cost-effective system is being acquired to meet user needs. We found that the Army has yet to establish that base. For example, although the AFATDS and TACFIRE functional capabilities are to be the same, the Army has not yet determined how to best carry out those functions within a battlefield scenario. Until these requirements are defined and an overall system design is completed, the Army can neither effectively acquire AFATDS equipment nor develop software to best meet user needs. To assist in these tasks, the Army is contracting for a systems engineer and is planning to employ a user test bed to provide data regarding operational use and

serve as a basis for further development and production decisions.

ARMY APPROACH ALLOWS FOR AMPLE
COMPETITION

The Army's plan for acquiring AFATDS does provide for competition in the acquisition of equipment and selection of a systems engineer. Competitive acquisitions include the communications control subsystem, remote terminals, display panels, printers, and power supplies. The computer to be used is the Army's standard militarized computer, now under competitive development in the Military Computer Family program. Software development, however, will be performed by the Army's TACFIRE Software Support Group. The Army plans to program AFATDS software in Ada, the Department of Defense's (DOD's) new standard programming language. TACFIRE programs are presently written in the Tactical Procedure Oriented Language (TACPOL) and will continue to be maintained for the life of TACFIRE, estimated to be 1996. It should be noted that an Army study ^{1/} listed the estimated cost per instruction of TACPOL as higher than any language used for other military computers. For example, the study showed the cost to be more than double the cost per instruction of the language used for the AN/GYQ-21 computer. Thus, TACPOL is a very costly language to use.

MIFASS--IS IT USABLE IN AFATDS?

Although the Army rejected MIFASS as a follow-on system candidate in favor of the modular approach, MIFASS may offer the Army opportunities in developing AFATDS. The Army's rejection of MIFASS was based on using the system in total, as configured for Marine Corps use. The Army has not considered a reconfiguration of MIFASS or seriously evaluated its components or features to satisfy their future requirements. However, our evaluation showed that MIFASS could play a prominent role in the AFATDS program if given serious consideration. MIFASS, although it is currently in the engineering development stage, has several key features such as modularity, newer technology, and flexibility which make it attractive as a command and control system. Further, our discussions with Marine Corps officials produced counterviews to the Army's arguments for rejecting MIFASS, thereby raising questions as to the system's applicability for Army use.

As AFATDS progresses, the Army states they plan to monitor the development of MIFASS. However, Army officials informed us

^{1/}"Final Report Life Cycle Cost Analysis of Instruction--Set Architecture Standardization for Military Computer-Based Systems," January 1978.

they are more likely to make use of the technology in MIFASS equipment rather than the equipment itself.

CONCLUSIONS

In our opinion, the Army has made the proper choice in deciding to modularly acquire AFATDS. The modular approach is generally less risky, is oriented to addressing priority needs, and has a greater probability of success than an overall new system development. However, the Army must establish a sound basis for the system if it is to be the most cost-effective system that can be acquired to meet user needs in a timely manner. In this regard, the Army's highest short-term priority should be to clearly define and validate its requirements. Until this task is completed, the Army cannot determine whether alternate system components could be used effectively to meet user needs in lieu of developing new equipment. Regarding competition, the Army's phased approach and decision to individually acquire major subsystem components provides for ample equipment competition. Software development, however, will not be competed but will instead be performed in-house. This appears to be justified given the TACFIRE software base and experience already established. In our opinion, before any commitments are made to developing new equipment, MIFASS must be seriously evaluated to determine the opportunities it affords DOD in reducing development and acquisition costs and furthering interoperability between the services and the systems. The Army has not seriously evaluated MIFASS to date, and those efforts to examine MIFASS have been confined to MIFASS as configured for Marine Corps use.

RECOMMENDATIONS

We recommend that the Secretary of Defense:

- Limit Army funding for AFATDS to those program elements necessary to continue system planning and defining of detailed requirements before any expenditures are made for system component developments.
- Direct the Secretary of the Army to prepare a well-documented cost-benefit study of alternate system components which could have applicability to AFATDS. This study should pay particular attention to the possible use of a reconfigured MIFASS in AFATDS.

These actions would assist DOD in creating a sound base for AFATDS and increase the probability of success for acquiring a cost-effective system in line with user needs. With the completion of these tasks, there could be a basis for a joint Army-Marine Corps program rather than two separate but similar programs. A joint program could be more cost effective than two separate programs and could result in fielding an improved capability earlier than is presently planned.

A more detailed description of these issues is contained in the enclosure.

At your request, we have not solicited agency comments. As arranged with your office, we are sending copies of this report to interested parties and making additional copies available to others upon request.

Sincerely yours,

A handwritten signature in black ink that reads "Milton J. Fowler". The signature is written in a cursive style with a large, prominent initial "M".

Acting Comptroller General
of the United States

Enclosure

THE ARMY'S ADVANCED FIELD ARTILLERYTACTICAL DATA SYSTEM

The Advanced Field Artillery Tactical Data System (AFATDS) is the Army's planned successor system for the Tactical Fire Direction System (TACFIRE). TACFIRE, which is now being deployed, was designed to increase the effectiveness of field artillery support through the application of automatic data processing to field artillery command and control functions. By using the system, maneuver commanders are able to employ their assets more effectively. TACFIRE, for example, provides the means to receive targeting information, allocate firepower, compute firing data, and send orders to field artillery weapons.

TACFIRE MODERNIZATION
IS A NECESSITY

TACFIRE has had a long and troubled history. Even though system development began in 1967, it was not until 1979 that the initial system was deployed. During that time frame, TACFIRE was beset with numerous problems. In a 1978 report 1/, we identified serious communication, equipment, and software deficiencies associated with TACFIRE development. We further noted that TACFIRE was a technologically outdated system and that new equipment developments offered the Army an opportunity to improve TACFIRE before it entered full-scale production. As a result, we recommended that further production be delayed until the program could be reassessed.

In December 1979, because of action taken by the Joint Conference Committee of the Senate and House Appropriations Committees, TACFIRE fiscal year 1980 funding was terminated. However, the Army was successful in restoring the program through a later reprogramming action.

Although the Army states that TACFIRE is increasing the effectiveness of today's field artillery, TACFIRE will not be able to meet the needs of the field artillery for the 1990s and beyond. Because of the age of the technology used in the system, the Army recognizes that a successor system is needed for the 1990 time frame. The Army, in its Mission Element Needs Statement dated March 16, 1981, cites the following deficiencies in TACFIRE capabilities which prevent it from meeting future field artillery needs.

--Responsiveness: The current communications control system devices are operating at maximum capability and cannot accommodate additional message traffic without severe degradation in responsiveness.

1/Letter report on TACFIRE (LCD-78-116, June 2, 1978).

- Selectivity: The remote devices are not capable of distributive processing. The central computer requires state-of-the-art upgrade in man-machine interfaces, hardware, memory storage, and software.
- Mobility: TACFIRE is vehicle and shelter dependent. It requires large power generation equipment.
- Survivability: TACFIRE is highly vulnerable to enemy electronic warfare activities. It has a unique electronic signature, is overcentralized and too inflexible, and is vulnerable to disruption.
- Trainability: TACFIRE demands excessive operator training and retention capability to accomplish the man-machine interface.
- Interoperability: System components require upgrading to ensure compatibility with all force level systems.

ALTERNATIVES CONSIDERED AS
A SUCCESSOR TO TACFIRE

On November 13, 1978, the Under Secretary of Defense for Research and Engineering directed that the Army develop a plan for a successor system to TACFIRE based on a state-of-the-art microprocessor and packaging technologies with objectives of optimizing operational efficiency, simplifying training, easing maintenance requirements, reducing life-cycle costs, and improving battlefield survivability. A number of alternatives were considered to meet these objectives, including

- coproduction with a foreign system,
- follow-on production with the Marine Corps' Marine Integrated Fire and Air Support System (MIFASS),
- selective subsystem upgrade of TACFIRE,
- new total system development,
- evolutionary system development, and
- extending the life of TACFIRE indefinitely.

In November 1979, a concept plan was issued which outlined the Army's acquisition plan to develop a successor system. The plan emphasized that the new system would be introduced into the field in a modular manner, replacing TACFIRE by major subsystems in accordance with priorities established by the user. The user has specified that (1) better communications management, (2) availability of data processing capabilities remote from the Fire Direction Centers, and (3) a reduction in the size and weight of the Fire Direction Centers are the primary needs in

order of priority. Initially, this phased replacement of TACFIRE subsystems was labeled the TACFIRE Modular Improvement Program. Later its name was changed to AFATDS; however, the philosophy remains the same.

The House Appropriations Committee subsequently directed the Army in late 1980 to reexamine the alternatives of an entirely new system versus the proposed approach, leaving the selection of the programmatic approach to the Army. The Army was further directed to employ competition to the maximum extent possible in whichever alternative was selected. The Army's November 1980 reexamination results continued to support the AFATDS acquisition strategy. The Army noted that both new system development and the AFATDS approach provided for significant levels of competition. However, the Army concluded that AFATDS enjoys the following advantages over the new system development approach:

- Significant research and development cost savings.
- Technology decisions could be made in a phased subsystem sequence instead of at the beginning of a total system development.
- Development costs could be spread over a number of years instead of incurring significant unprogramed research and development investments in the near term.

As a result, the Army considers no other alternatives as viable options for a successor system to TACFIRE. They did state, however, that they would continue to monitor the development of similar systems, such as MIFASS, to determine whether any components could be used with AFATDS.

AFATDS--A MODULAR APPROACH

Through a phased replacement of TACFIRE subsystems, AFATDS will ultimately result in a new artillery command and control system to replace TACFIRE. The Army plans to redevelop at the subsystem level by expanding or changing the subsystem capability to meet the user's needs for the 1990 time frame. AFATDS equipment will be acquired competitively. Software, however, will evolve from the TACFIRE system and any new developments or modifications will be accomplished with organic capabilities.

The program has three primary phases. The first phase is expected to eliminate the current communications management bottleneck at the Fire Direction Centers by developing and deploying a new front-end communications processor. The second phase is expected to improve the responsiveness and survivability of the artillery system by introducing small, intelligent terminals at remote battlefield locations. The third and final phase will be to replace the current Fire Direction Centers using the emerging technologies of the Military Computer Family and

information displays. The Army expects that advanced technology will permit a significant reduction in size, weight, and power requirements and permit a greater degree of hardening against both conventional and nuclear weapons. In each of the phases, the Army intends to test subsystem components through the use of a user test bed located at Fort Sill, Oklahoma. The test bed will be used to provide data regarding operational use and will serve as a major basis for future development, production and fielding decisions.

Phase I--Communication Control System

The Army's examination of present TACFIRE capabilities led to the conclusion that communications and information flow are the areas where improvement will yield the greatest benefit. Communications management equipment has proven to be a limiting factor of TACFIRE. This equipment links the computer output to the tactical communications and allows wire or radio net selection. A problem exists in effectively using the limited wire and radio communications channels available. Current TACFIRE implementation limits the number of simultaneous communications to one per net on a maximum of seven nets. As the number of systems with which TACFIRE must communicate expands, this communications bottleneck will grow. Also, the communications equipment will not allow it to take advantage of the improved capability of emerging communications systems. Without improved communications efficiency, improvements in other areas would be largely ineffective.

During this phase, the Army intends to acquire a new communication control system which would expand net capability, provide message memory and message buffering capabilities, and be able to be retrofitted into the current TACFIRE until the remaining phases are complete. In March 1981, preliminary specifications for the system were released to industry for comment. The AFATDS manager expects that a development contract for this subsystem will be let on a competitive basis in fiscal year 1982.

Phase II--Remote Devices

The development of remote processing capability represents the second major phase of the AFATDS program. Army users have indicated that TACFIRE remote devices have neither the data base nor the processing capability needed to best support their artillery operations. Development is already underway on the Battery Computer System which is intended to replace the Battery Display Unit in TACFIRE. The Battery Computer System is a separate program from AFATDS but will be used in conjunction with

TACFIRE and AFATDS when it is fielded. Our previous report 1/ discusses test problems associated with the development of that system.

Further development is required to enhance the effectiveness of the maneuver commanders and fire support teams. For example, TACFIRE's Variable Format Message Entry Device, used by the Fire Support Officer, does not provide the required processing capability at that echelon. Multiple communications are required with the TACFIRE Fire Direction Center processor for each transaction, thereby burdening the communications network and slowing the mission response time. Through the introduction of a new remote device, the Fire Support Officer will be able to process certain missions at the remote location without burdening the entire system. The user has also identified a need for a remote device to support fire support team operations. This device will provide the Fire Support Team Chief with the capability of locally originating fire requests and executing fire missions while simultaneously monitoring the activities of forward observers. Through the combined introduction of these devices, the Army intends to increase fire processing survivability and reduce communications systems loading.

Phase III--Fire Direction Center

After the first two phases are underway, the Army plans to replace each device in the Fire Direction Centers, using the latest technology available. According to the Army, replacing current Fire Direction Center components with smaller, more rugged devices incorporating the latest technology will enhance system mobility, survivability, and flexibility, and will contribute to the ease of operation and training. Items to be replaced include the main computer (AN/GYK-12), a control console, printer, digital plotter map, tape units, and power converters. The AN/GYK-12 operates only over a limited temperature range, requires air-conditioning which necessitates the use of a generator, and is rapidly approaching obsolescence in terms of logistics support. It is to be replaced with a new militarized computer being developed in the Military Computer Family program. The current printer is also too slow to keep pace with target intelligence information under the European high intensity scenario, and the present tape units are low in reliability. Phase III efforts are expected to cost the most in terms of procurement, accounting for \$461 million of the estimated \$763 million procurement cost for AFATDS. With the introduction of phase II and phase III components into the field in 1990, AFATDS will begin to replace TACFIRE in its entirety as the Army's new field artillery command and control system.

1/"The Army's Battery Computer System" (MASAD-81-18, Mar. 6, 1981).

AFATDS COMPETITION

The Army has structured the program to provide for ample competition. All development efforts except for the software will be competitively solicited. The software effort will be accomplished by the TACFIRE Software Support Group at Fort Sill, Oklahoma. The Army further plans to competitively procure each subsystem for final production after validation of the final production specifications. Consequently, the contractor who developed the engineering development model and drafted the final production specifications may not be awarded the final production contract. The Army has identified several competitive opportunities, including the systems engineering and design effort, the communication control system, remote devices, displays, and printers. Further, the Army expects to use the Military Computer Family computer in AFATDS. This computer is now under competitive development.

Systems engineering contract

Because of the high probability of having multiple contractors developing various subsystems of AFATDS, the Army is competitively awarding a systems engineering contract to assist in the integration of all AFATDS subsystems. A solicitation was released in March 1981 to over 100 interested contractors with an award expected in late fiscal year 1981. It is anticipated that this contract will cost the Army about \$11 million spread over an 8-year period. Contractor duties include analyzing user needs, developing rationale for required functional and material changes to meet those needs, and defining subsystem electrical and software interface requirements. Also, the contractor is to prepare technical documentation for individual subsystems starting with the communication control system. The contractor will be excluded from any hardware developments.

Software support

The software effort for the AFATDS program will not be competed, and any software developments or modifications required will be performed by the Army's TACFIRE Software Support Group located at Fort Sill, Oklahoma. This group consists of both military and civilian software specialists augmented by contractual support. Included in their duties are all responsibilities for system level software; for example, they are to modify TACFIRE software to accommodate each new subsystem and modify software as necessary to allow use of the new computer. During our review, the Army conducted two studies to determine the final programming language to be used in both TACFIRE and AFATDS. TACFIRE is now programmed in the Tactical Procedure Oriented Language (TACPOL). The final decision was to maintain the current TACFIRE system in TACPOL through TACFIRE's expected life, which is estimated to be 1996. AFATDS is to be programmed in Ada, the Department of Defense's new standard programming language. Because it was determined that TACFIRE programs would not be readily transferable to AFATDS, the Army reasoned that it would be too

expensive and unnecessary to convert the existing programs in TACPOL to Ada.

AFATDS STATUS AND COST

AFATDS is still in the early planning stages, and no development contracts had been awarded at the time of our review. Staffing and budgetary constraints had delayed detailed planning efforts through February 1981, even though the Army had been directed in November 1978 to initiate planning for a successor system to TACFIRE, and the concept plan was released in November 1979. Major reasons for this delay include:

- Late release (February 1981) of fiscal year 1981 research and development funds to the AFATDS program manager.
- Approval of the Mission Element Needs Statement on March 16, 1981, even though it had been submitted for approval 1 year earlier.

These factors were instrumental in delaying the assignment of in-house staff to the program. This, in turn, delayed the start of detailed system planning. For example, the bid solicitation package for the systems engineering contract was not released until March 27, 1981, and contract award was not expected until late in fiscal year 1981. The original milestone in the concept plan was October 1980.

The systems engineering contract is to be the first of several contract awards. Following that award will be the initiation of the three-phased approach. Development of the communication control system, as phase I, is expected to begin in early fiscal year 1982 with the first system to be retrofitted into TACFIRE in fiscal year 1987. Phase II development is scheduled to start in late fiscal year 1982 with the remote devices being introduced into the field in 1990. Phase III development is to start in fiscal year 1985 with new Fire Direction Center components being deployed starting in 1990 in conjunction with phase II deployments.

Cost estimates

The total estimated research and development cost for the AFATDS program is \$187 million spread over 8 years. Fiscal year 1981 was the 1st year of funding with an approved program of \$3.56 million. The AFATDS program manager expected to use these funds as follows:

<u>Program area</u>	<u>Amount</u>
Systems engineering contract	\$ 690,000
Communication control systems contract	1,700,000
Systems software	700,000
Internal	<u>470,000</u>
Total	<u>\$3,560,000</u>

However, due to the late receipt of the funds and the program slippage, it is doubtful that the entire amount will be spent. For example, the money earmarked for the communication control systems contract will not be spent because of the contract award delay until early fiscal year 1982.

The Army procurement cost estimates for AFATDS for the active Army force is \$763 million and \$1,672 million for the total Army force.

MIFASS MAY OFFER OPPORTUNITIES FOR AFATDS DEVELOPMENT

MIFASS is the Marine Corps' command and control system being developed to optimize the use of fire and air support assets within a Marine Air Ground Task Force. Its objective is to achieve superior firepower during force buildup in an amphibious assault and thereafter during operations ashore. To achieve this objective, MIFASS provides a command, control, and coordination capability for mortars, artillery, naval gunfire, and direct air support aircraft.

MIFASS computer centers are to be situated at the maneuver battalion, regiment, and division level. MIFASS equipment need not be sheltered; for example, the battalion computer center is unsheltered. However, the other echelon centers are to be placed in van-type shelters, primarily for transportability purposes. Major components within the system are the central computer with memory (the Navy's AN/UYK-14 standard airborne computer), visual display equipment, printers, and digital communications equipment. The main visual display, the Dynamic Situation Display, appears to have direct application to AFATDS. The unit is a real-time graphic display of the battlefield with the operator having the capability to interact with the unit by touching the screen.

Schedule and costs

MIFASS is not an operational system, being only in the engineering development phase of the program. An engineering development contract was awarded to Norden Systems in September 1979 with an engineering model scheduled for delivery in March 1983. Development and operational testing is to follow in 1983 and 1984 with a production decision scheduled for April 1984. The Marine Corps subsequently expects to field the first units in late 1986. Costs for the program are expected to be

\$60.6 million in research, development, test and evaluation, and \$168.6 million in procurement.

System features

MIFASS incorporates several key features which make it attractive as an automated command and control system. These features include equipment modularity and flexibility and structured software, thereby allowing the system to be changed more easily to adapt to user needs and improved technology. With respect to modularity, each MIFASS unit is identical to every other MIFASS unit of the same type wherever it is located in the system. Thus, MIFASS units are completely interchangeable within and between centers. Also, items of equipment are capable of being put together in groups at any center to perform functions requiring more than one unit. MIFASS is further flexible in that varying quantities of equipment within a center's configuration is expandable through the use of a standard data bus, a cabling system which allows various components to be added or deleted without making overall system changes. This permits MIFASS to be maintained more easily and allows for future growth and technology infusion. Like the standard data bus, MIFASS's structured software architecture gives it flexibility when changes need to be made. The structured design separates functions to be performed into groups, which are separately written and coded. As a result, required changes affect a portion of the software as opposed to widespread system changes.

Arguments and rebuttals for MIFASS use in AFATDS

The Army, in its alternative system analysis, rejected MIFASS as a follow-on system to TACFIRE. Its arguments against MIFASS were predicated on using MIFASS in total, as configured for Marine Corps use. Because of the modularity and flexibility being built into MIFASS, the system can be configured in various ways to function in many command and control situations. However, the Army did not consider using such a MIFASS reconfiguration or components to satisfy its future field artillery requirements.

The Army presented several arguments against using MIFASS, pointing out that MIFASS could not meet their needs in terms of logistics support and performance factors. Marine Corps and contractor personnel, however, presented information which countered many of these arguments. Following are examples of the Army's arguments and countering views.

The Army argued that they could not logistically support MIFASS because (1) incorporating a new system would burden the Army's logistics, maintenance, and training, (2) MIFASS requires intermediate level maintenance, while TACFIRE maintenance can be done by the operator, and (3) MIFASS's complete redundancy is not required by the Army. Marine Corps officials disagreed with these points. They believed that introducing MIFASS should provide

no greater burden on Army logistics than introducing AFATDS as now planned, which is also a new system. Further, the Marine Corps argued, the decision of where maintenance is done is one of preference. The Marine Corps elected to remove the operator from the maintenance cycle; however, it could be performed at that level if desired. Also, MIFASS need not be configured to be completely redundant. This too is a matter of preference and could be readily changed if the Army wished.

The Army also cited performance factors as objections to MIFASS. Because MIFASS is not completely automated and fire requests are not prioritized, the Army argued that MIFASS could not support the Army's mission in a European scenario. However, it was pointed out that MIFASS, with its greater processing capability, could be adjusted by making software changes to function in this environment. The decision to automate to that degree again is a matter of preference.

The Army also argued that it could not use MIFASS because the system components were to be mounted in large, unarmored shelters, which restrict mobility and reduce survivability. However, Marine Corps officials explained that because MIFASS is modular, it could be reconfigured in many ways and be set up in the open, or other type shelters or vehicles.

Having different missions does not necessarily mean that MIFASS components, as a family or singly, cannot be shared between the two services. Although MIFASS, as configured for the Marine Corps, may not fulfill Army needs, we are not convinced that MIFASS could not play a prominent role in the AFATDS program. Certain MIFASS hardware components, such as the tactical display panels, offer new technology and could be used in AFATDS in lieu of developing new hardware. Further, MIFASS has certain key features which make it attractive as a command and control system. Those features are modularity and flexibility. MIFASS hardware is modular, thereby allowing various configurations to satisfy differing levels of capability. MIFASS flexibility, in the form of a standard data bus, allows for growth and change as demands and technology change. The standard data bus permits broken or outmoded components to be replaced very easily and readily without effecting systemwide changes.

Our evaluation did not address the extent of MIFASS incorporation into AFATDS because the Army has not sufficiently defined its requirements to date. However, the optimum MIFASS configuration for Army use could be one of many variations, including, for example, a reconfigured MIFASS hardware architecture coupled with software provided by the Army.

OBJECTIVES, SCOPE, AND METHODOLOGY

The objectives of our evaluation were to (1) identify and assess the Army's decision to acquire AFATDS, (2) assess the extent of competition planned for the AFATDS program, and (3)

analyze the MIFASS architecture and identify those components and features that could be candidates for incorporation into AFATDS.

During our evaluation, we visited the AFATDS program office at Fort Monmouth, New Jersey, to obtain and evaluate AFATDS programmatic data. We met with program officials to discuss TACFIRE deficiencies, future field artillery automation requirements, AFATDS objectives and funding, alternative follow-on system analyses, and the rationale for the current system design and acquisition strategy. We also reviewed pertinent documentation related to these issues.

To assure ourselves that field artillery user views were being adequately addressed in designing AFATDS, we visited Fort Sill, Oklahoma, where the Army's Training and Doctrine Command user representative for field artillery systems resides. We found them to be active in the AFATDS program and that their view was generally in consonance with those of the AFATDS program manager.

We also met with Marine Corps and contractor officials to obtain MIFASS programmatic data for comparative purposes. Early in the evaluation, we had documented reasons as to why the Army had discounted various alternative systems such as MIFASS for a TACFIRE follow-on system. Our review of documentation and discussions with Marine Corps and contractor personnel produced counterinterviews which indicated a more thorough evaluation of MIFASS by the Army was needed.

It should be noted that our evaluation spanned a period when AFATDS was in the early planning stages and subject to many changes. Because detailed system requirements were unavailable, we could not specify precisely whether and to what extent a MIFASS configuration could be incorporated into AFATDS. For example, Army system communication and performance requirements were not defined to the point where it was possible to determine whether MIFASS equipment could effectively be used in the program. Further, we are not endorsing the MIFASS program outright because MIFASS is not a proven system, being in the engineering development phase. However, once the Army finalizes its requirements, MIFASS components could be considered for inclusion in the AFATDS program, providing the Army an opportunity to field an improved capability earlier than presently planned.

We made our evaluation at the following locations:

--U.S. Army Communications and Electronics Command, Fort Monmouth, New Jersey.

--U.S. Army TACFIRE Software Support Group, Fort Sill, Oklahoma.

- 212th Field Artillery Brigade, Fort Sill, Oklahoma.
- U.S. Army Training and Doctrine Command System Manager-
Field Artillery Tactical Data Systems, Fort Sill, Okla-
homa.
- Headquarters, U.S. Marine Corps, Arlington, Virginia.
- U.S. Marine Corps Development and Education Command,
Quantico, Virginia.
- Norden Systems, Norwalk, Connecticut.