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United States General Accounting Office 131458

GAO

Briefing Report to  
the Honorable Bill Chappell,  
House of Representatives

April 1986  
*May*

# FIRE SUPPORT SYSTEM

## Army's Plans to Improve Its Fire Support Capabilities



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UNITED STATES GENERAL ACCOUNTING OFFICE  
WASHINGTON, D.C. 20548

NATIONAL SECURITY AND  
INTERNATIONAL AFFAIRS DIVISION

May 5, 1986

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The Honorable Bill Chappell, Jr.  
House of Representatives

Dear Mr. Chappell:

As requested in your September 6, 1985, letter, and in subsequent discussions with your Office, we evaluated the Army's plan to provide interim automated fire support capability to existing light divisions and increased capabilities for all divisions. This letter summarizes our observations. Appendix I is the briefing we provided to your staff and more fully discusses the issues in this letter. A final report which will address current tests of various fire support systems and equipment and the Army's preliminary response to fiscal year 1986 congressional guidance will be sent to you at a later time.

In the early 1980s, the Army provided most heavy divisions and one light division an automated artillery fire command and control (C2) system called TACFIRE. Because it was large and heavy, and becoming technically obsolete, the Army stopped buying it and began to develop a new system with improved mobility and capability called Advanced Field Artillery Tactical Data System (AFATDS).

Since most light divisions do not have an automated fire support C2 capability and AFATDS is not scheduled to be fielded before 1990, several congressional committees expressed a concern about the absence of this capability for light divisions. In fiscal year 1985, the House and Senate Appropriations Committees directed the Army to prepare a plan for providing interim capability to light divisions and increased capabilities to the total force.

The Army's plan, dated September 1985, identified two interim options for light divisions.

--The first was to provide two light divisions with increased quantities of Fire Support Team/Digital Message Devices (FIST/DMDs). These were initially bought for company level units and forward observers. The Army's plan now is to provide them to division and battalion fire direction centers.

--The second was to provide light divisions with a Tactical Computer Processor (TCP). The Army has subsequently abandoned plans to field the TCP due to cost and weight concerns.

The Army's September 1985 plan to provide automated fire support C2 is an implementation plan, and therefore, it did not include an evaluation of alternative systems such as the Light Field Artillery Tactical Data System (LFATDS). LFATDS, which is currently being tested by the 9th Infantry Division, was designed as a light division fire support C2 system. The Army had planned to provide LFATDS to light divisions but in June 1985, the Army abandoned this plan because it concluded that funding two different fire support C2 systems (LFATDS and AFATDS) was not justified.

According to the commanders of two light divisions, the FIST/DMD option, which would be a relatively low cost upgrade, does not meet their needs. These same commanders have requested LFATDS. They believe LFATDS has sufficient capability to meet light division needs. However, in determining the interim solution for light divisions, the Army must decide between low cost and risk equipment (FIST/DMD) that provides limited increased capability and a system which provides greater capability, but at increased cost and fielding time. This option involves some increased costs and fielding time over the FIST/DMD option.

The Army's September 1985 plan did not include any upgrade or replacement of the heavy division's TACFIRE capabilities until the AFATDS is fielded in the 1990s. However, the Army has funded an interim improvement program for the equipment of some elements of heavy divisions. But, another interim improvement program which could provide significant increased capabilities has not been approved.

The AFATDS program has already incurred cost and schedule growth and current testing deficiencies could cause further development problems. If these problems materialize, there is an alternative which, although it would not fully meet Army requirements, could enhance existing systems.

We have discussed a draft of this report with Army officials and have included their comments where appropriate. Unless you publicly announce its contents earlier, we plan no further distribution until 30 days from the date of the report. At that time we will send copies to interested parties and make copies available to others upon request. If you have questions or if we can be of further assistance, please contact Richard Davis, Associate Director, at 275-4841.

Sincerely yours,

A handwritten signature in cursive script that reads "Frank C. Conahan".

Frank C. Conahan  
Director

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## ABBREVIATIONS

ACCS	Army Command and Control System
AFATDS	Advanced Field Artillery Tactical Data System
BCS	Battery Computer System
BCT	Brief Case Terminal
C2	command and control
CEP	concept evaluation phase
DCT	Digital Communications Terminal
DMD	Digital Message Device
FDT&E	Force Development Test and Evaluation
FED	Forward Entry Device
FIST	Fire Support Team
GAO	General Accounting Office
IOC	initial operational capability
LFATDS	Light Field Artillery Tactical Data System
MCS	Maneuver Control System
MENS	Mission Elements Needs Statement
MIFASS	Marine Integrated Fire and Air Support System
OSD	Office of the Secretary of Defense
SHORAD	Short Range Air Defense
TACFIRE	Tactical Fire Direction System
TCP	Tactical Computer Processor

ARMY FIELD ARTILLERY TACTICAL DATA SYSTEMSCHART I.1OBJECTIVES, SCOPE, AND METHODOLOGYOBJECTIVES

- ASSESS ARMY'S FIRE SUPPORT PLANS AND PROGRAMS TO DETERMINE WHETHER:
  - PLANS ADDRESS ORDERLY TRANSITION FROM CURRENT TO PROJECTED CAPABILITIES THROUGH NEAR- TO MID-TERM IMPROVEMENTS OF EXISTING CAPABILITIES.
  - PRIORITY IS GIVEN TO PROVIDE A VIABLE CAPABILITY TO LIGHT DIVISIONS.
  - THE PROGRAMS ARE DEPENDENT ON HIGH RISK TECHNOLOGIES.

SCOPE AND METHODOLOGY

- WE REVIEWED DOCUMENTS AND INTERVIEWED OFFICIALS AT:
  - OFFICE OF SECRETARY OF DEFENSE;
  - ARMY HEADQUARTERS;
  - ARMY FORTS AT SILL, ORD, LEWIS, AND MONMOUTH; AND
  - CONTRACTOR PLANTS.

The objective of this review was to evaluate the Army's plan for providing near- and longer-term automated fire support capability to both light and heavy divisions. Specifically, our review addressed the following:

- The Army's overall fire support program as represented by its September 6, 1985, modified Advanced Field Artillery Tactical Data System (AFATDS) plan.
- Whether that plan provides for an orderly transition from current to projected capabilities.
- Whether the plan provides for near-term improvements in fielded systems.
- Whether the plan gives priority to providing a viable capability to light divisions.

In order to accomplish these tasks, we reviewed documents and interviewed key officials at:

- the Office of the Secretary of Defense (OSD);
- the Army's artillery school and the fire support C2 systems office at Fort Sill, Oklahoma;
- the 7th Infantry Division at Fort Ord, California;
- the 9th Infantry Division and Army Development and Employment Agency at Fort Lewis, Washington; and
- the AFATDS program office at Fort Monmouth, New Jersey.

In addition, we reviewed documents and interviewed contractor personnel responsible for the systems discussed in this report.

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



CHART I.2

CURRENT FIRE SUPPORT

C2 CAPABILITIES

- TACFIRE IS THE ARMY'S PRIMARY AUTOMATED FIRE SUPPORT C2 SYSTEM.
- TACFIRE FIELDING BEGAN IN LATE 1970s.
- 32 DIVISION SETS OF TACFIRE WERE PROCURED.
- CURRENT COMPLIMENTARY FIRE SUPPORT C2 SUBSYSTEMS INCLUDE:
  - o THE BATTERY COMPUTER SYSTEM.
  - o THE DIGITAL MESSAGE DEVICE.

The Tactical Fire Direction System (TACFIRE), fielded to most heavy divisions and one light division<sup>1</sup> beginning in the late 1970s, provides field artillery units with the means to automate tactical fire control, target analysis, fire planning, and target intelligence. Thirty-two TACFIRE sets have been procured. Within the division, TACFIRE sets are located at division, brigade, and battalion elements of fire support. Two fire support subsystems are in use below the battalion. The Battery Computer System (BCS) is being fielded at the battery level to process artillery fire missions. Also, the hand held Digital Message Device (DMD) is used at the company level and forward observer positions to relay targeting data and fire commands.

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<sup>1</sup>Heavy divisions are armored, mechanized and cavalry divisions. Light divisions, on the other hand, are infantry, airborne, and air assault divisions. Each type has authorized personnel ranging from 14,000 to 18,000.

CHART I.3FIRE SUPPORT C2 DEFICIENCIES

- MOST LIGHT DIVISIONS HAVE NO AUTOMATED FIRE SUPPORT C2.
- IN JUNE 1985, THE ARMY DECIDED NOT TO PROCURE LEATDS FOR LIGHT DIVISIONS.
- HEAVY DIVISIONS HAVE TACFIRE FOR FIRE SUPPORT C2, BUT IT IS CONSIDERED:
  - o LARGE,
  - o DIFFICULT TO OPERATE,
  - o CAPABILITY LIMITED, AND
  - o VULNERABLE.

Since TACFIRE's size and weight made its use impractical for light divisions, most light divisions have no automated fire support C2 capability. The Army had planned to procure the Light Field Artillery Tactical Data System (LFATDS)<sup>2</sup> to fill this void. However, in June 1985, the Army decided not to procure LFATDS for light divisions since it concluded funding two different systems concurrently (LFATDS and AFATDS) was not justified.

For several years light division commanders, specifically the 82nd Airborne Division commander and the 7th Infantry Division commander, have expressed a need and sought near-term capabilities to more effectively control and coordinate fire support. Further, the November 15, 1985, Near-Term Light Division Fire Support Operational and Organizational Plan identifies a need for an automated man-portable, low-powered artillery fire support system.

Heavy divisions currently have TACFIRE for fire support C2; however, its capabilities are considered inadequate. The Mission Element Needs Statement (MENS) for an advanced fire support system, states that TACFIRE does not meet current Army needs because it requires

- large vehicles, shelters, and power generation equipment;
- excessive operator training;
- upgrading to insure capability with all force level systems;
- upgrading communications capability;
- upgrading remote devices for distributive processing capability; and
- reduced vulnerability.

The MENS further states that in addition to correcting the above deficiencies, the advanced fire support C2 system must meet the following objectives.

- Enable the commander to control rapid sustained delivery of massed firepower by all fire support means.
- Automate the selection and processing of the most important targets for engagement and the optimum method to defeat those targets within available means.

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<sup>2</sup>LFATIDS is also known as Light TACFIRE.

CHART I.4ARMY'S PLAN FOR INTERIMAND NEW CAPABILITIES

--IN SEPTEMBER 1985, THE ARMY ISSUED A PLAN TO PROVIDE:

- LIMITED LIGHT DIVISION INTERIM CAPABILITY IN FISCAL YEAR 1986 WITH FIST/DMD.
- FULL LIGHT DIVISION CAPABILITY IN FISCAL YEAR 1989 WITH THE TCP.
- FULL HEAVY DIVISION CAPABILITY IN FISCAL YEAR 1990 WITH AFATDS.

--COST ESTIMATES FOR PROGRAMS OUTLINED IN THE SEPTEMBER PLAN:

- \$1.3 MILLION FOR FIST/DMD FOR 2 DIVISIONS.
- \$68 MILLION FOR TCP.
- \$2 BILLION FOR AFATDS.

--IN DECEMBER 1985 CONGRESSIONAL CONFEREES DIRECTED THE ARMY TO SUBMIT ADDITIONAL INFORMATION AND PLANS FOR FIRE SUPPORT C2:

- \$25.6 MILLION PROCUREMENT FUNDS APPROPRIATED BUT NOT AUTHORIZED.
- OBLIGATION OF FUNDS CONTINGENT ON CONGRESSIONAL REVIEW OF TEST RESULTS AND APPROVAL OF TRANSITION PLAN.
- ARMY RESPONSE DUE BY AUGUST 1, 1986.

The September 6, 1985, plan sets out the Army's latest approach to achieve progressive improvements to field fire support C2 systems, while continuing to evolve toward the longer term AFATDS program. Specifically, the plan called for the fielding of:

- Increased field artillery automation for two light divisions in fiscal year 1986 by procuring Fire Support Team/Digital Message Devices (FIST/DMDs), BCS, and Digital Communications Terminals (DCT) for the 7th and 82nd light divisions.
- AFATDS functional capability to all light divisions starting in first quarter fiscal year 1989, using existing peripheral equipment<sup>3</sup> and adding the Tactical Computer Processor (TCP). The TCP was the selected computer hardware for the Maneuver Control System (MCS).
- The AFATDS system starting in fiscal year 1990.

The cost estimates for the plan's three phases are

- \$1.3 million to procure the FIST/DMD for the 7th and 82nd light divisions (does not include peripheral equipment cost),
- \$68 million to develop and procure the TCP for all light divisions, and
- \$2 billion to develop and procure AFATDS for the total force.

In December 1985, the House and Senate Appropriation Conferees agreed to provide \$25,574,000 to maximize the near-term fire support C2 capabilities of light divisions in accordance with a congressionally approved plan which would culminate in the ultimate system for the 1990s. In addition, the conferees directed the Army to report on the test results of LFATDS currently undergoing Force Development Test and Evaluation. Furthermore, the Army must submit an overall transition plan for achieving interim improvements to the fielded systems of both light and heavy divisions. Army responses are due August 1, 1986, and no drafts are available at this time for our review.

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<sup>3</sup>BCS and DCT costs are not included because these or similar systems are required in all fire support C2 options reviewed.

CHART I.5ISSUES RELATIVE TO FIST/DMD OPTION

- FIST/DMD IS SCHEDULED FOR FIELDING IN FISCAL YEAR 1987 WITH FIRST ARTICLE TEST PLANNED FOR APRIL 1986.
- FIST/DMD EXPECTED TO BE A LOW-COST UPGRADE TO THE CURRENT MANUAL SYSTEM USED BY LIGHT DIVISIONS:
  - o \$4.7 MILLION FOR SEVEN LIGHT DIVISIONS.
  - o DEVELOPMENT COSTS ALREADY SUNK.

BUT

- FIST/DMD WAS NOT DESIGNED FOR LIGHT DIVISIONS AND ITS CAPABILITY TO MEET THEIR NEEDS IS LIMITED AND YET TO BE EVALUATED:
  - o FIST/DMD IS DESIGNED FOR COMPANY LEVEL USE IN THE HEAVY DIVISIONS.
  - o THE PLAN PROPOSES FIST/DMD USE IN THE LIGHT DIVISIONS AT BATTALION AND ABOVE WHERE ITS CAPABILITIES ARE LIMITED.

Fielding the FIST/DMD to light divisions in fiscal year 1987 is considered a low-risk option because final testing of production units is scheduled to start in May 1986. Procurement costs<sup>4</sup> are estimated at \$1.3 million for the 7th and 82nd divisions and \$4.7 million for all seven light divisions. Further, there are no incremental development costs since these costs are sunk within the Army's buy of FIST/DMDs for heavy divisions.

Since most light divisions do not have any automated fire support C2 capability, the FIST/DMD system could provide some improved effectiveness. However, the Army's plan calls for using the FIST/DMD in a much wider role than for which it was designed. The FIST/DMD was designed for the FIST company level position. Fielding FIST/DMDs for battalion level and above Fire Direction Centers and Fire Support Elements (which have much greater requirements than the FIST) would put the FIST/DMD in a role it was not designed to fulfill and it may not be sufficient. Functions required at Fire Direction Center and Fire Support Element which the FIST/DMD does not perform or compute are: ammunition and fire unit status, non-nuclear fire planning, support geometry, tactical fire control, commanders criteria, meteorological messages, and interface with all division artillery TACFIRE functions. The overall impact of these limitations on light division performance has not been studied. That is, the Army has proposed the FIST/DMD option without performing an analysis of how effective light divisions would be with it.

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<sup>4</sup>Contractor costs only, excludes government-furnished peripheral equipment.



CHART I.6

ISSUES RELATIVE TO TCP OPTION

--TCP OPTION CANCELED:

- o NOT AFFORDABLE.
- o EXCESSIVE WEIGHT.
- o HIGH RISK.
- o DOES NOT COMPLY WITH ACCS.

After fielding the FIST/DMD, the Army's plan called for providing light divisions with the TCP with some AFATDS software in fiscal year 1989. However, the TCP option was terminated in January 1986 because of funding constraints and diminished Army support. Specifically, the TCP phase was not considered viable because the

- development effort would increase total AFATDS development costs by \$18 million,
- TCP's 800 plus pound weight was considered excessive,
- projected fiscal year 1989 fielding date was considered by Army officials to be highly ambitious, and
- TCP was not considered compatible with Army Command and Control System (ACCS) hardware.

ACCS is the Army program to develop and procure common hardware and software for a variety of Army command and control systems, and to integrate these systems with Army tactical communications programs.

CHART I.7ISSUES RELATIVE TO LFATDS OPTION

- LFATDS OPTION NOT INCLUDED IN ARMY PLAN.
- LIGHT DIVISION COMMANDERS EXPRESS NEED FOR LFATDS.
- LFATDS COULD PROVIDE VIABLE CAPABILITY AT LOW TO MODERATE COST AND RISK:
  - o LFATDS PROVIDES SIGNIFICANT CAPABILITY OVER FIST/DMD OPTION.
  - o LFATDS DEVELOPMENT COST IS SUNK. A \$6.8 MILLION FIXED-PRICE CONTRACT INCLUDES DEVELOPMENT AND ONE DIVISION SET.
  - o ADDITIONAL LFATDS PROCUREMENTS PROJECTED TO COST \$3.3 MILLION PER DIVISION (EXCLUDING GOVERNMENT-FURNISHED EQUIPMENT).
  - o LFATDS CURRENTLY UNDERGOING FDT&E TO DETERMINE IF IT IS A GO TO WAR SYSTEM.
  - o ADDITIONAL LFATDS FIELDING COULD BEGIN IN AUGUST 1987 (CONTRACTOR ESTIMATE) OR FISCAL YEAR 1988 (ARMY ESTIMATE).

LFATDS has not been included as part of the Army's plan to field automated C2 field artillery support. Since 1984, light division commanders, specifically the 82nd Airborne and 7th Infantry Division commanders, have expressed a need to field LFATDS to effectively control and coordinate fire support. The 7th Infantry Division artillery commander, as recently as February 28, 1986, stated that the 7th needs LFATDS because the FIST/DMD does not meet its automated requirements.

A functional analysis of LFATDS as compared to the FIST/DMD shows that LFATDS is projected to perform or compute a number of additional mission essential fire support functions in

- non-nuclear fire planning;
- tactical fire control;
- ammunition and fire unit status;
- support geometry, that is, coordinate ground and air movements; and
- meteorological messages.

LFATDS development costs are included in a \$6.8 million, fixed-price contract for one light division set for the 9th Infantry Division. LFATDS does not have a light division artillery fire direction center capability. If this capability is required, the contractor estimates that full division capability would cost an additional \$1 million in development, and procurement would cost \$3.3 million<sup>5</sup> per division.

The ongoing Force Development Test and Evaluation (FDT&E) is scheduled to be completed in May 1986 to determine LFATDS acceptability for use by the 9th Infantry Division. If the tests demonstrate that the system is an acceptable go to war system and early commitments are made, the contractor estimates that fielding of additional sets could occur as early as August 1987. The Army believes that initial fielding would not begin until fiscal year 1988.

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<sup>5</sup>Excluding government-furnished equipment (such as vehicles, printers, and radios), which are required in all Army options.

CHART I.8COMPARISON OF LIGHT DIVISION INTERIM CAPABILITY OPTIONS

- FIELD FIST/DMD ONLY TO THE 7TH AND 82ND DIVISION, AS IDENTIFIED IN THE ARMY PLAN, AT AN INCREMENTAL COST OF \$1.3 MILLION.
- FIELD FIST/DMDs TO THE SEVEN LIGHT DIVISIONS AT AN INCREMENTAL COST OF \$4.7 MILLION.
- PROCURE LFATDS FOR THE 7TH AND 82ND DIVISIONS AT AN INCREMENTAL COST OF \$7.6 MILLION WITH FIELDING EXPECTED BY ARMY IN FISCAL YEAR 1988.
- BEGIN FIELDING LFATDS TO THE SEVEN LIGHT DIVISIONS STARTING IN FISCAL YEAR 1988 AT A PROJECTED INCREMENTAL COST OF \$24.1 MILLION (CONTRACTOR ESTIMATE).

FIST/DMD FOR LIGHT DIVISIONS

## --Advantages:

- o Low cost (about \$680,000 per division).
- o Low risk.
- o Fielding could begin fiscal year 1987.
- o No impact on ACCS.

## --Disadvantages:

- o Limited capability.

PROCURE LFATDS FOR LIGHT DIVISIONS

## --Advantages:

- o Low to moderate cost (about \$24 million for seven divisions or \$7.6 million for only 7th and 82nd per contractor estimates).
- o Capability significantly improved.
- o LFATDS computers can be used in other Army C2 systems when AFATDS is fielded to the light divisions in the 1990s.
- o Low to moderate development and schedule risk.

## --Disadvantages:

- o Does not conform with ACCS.

CHART I.9AFATDS PROGRAM COST AND GROWTH

- TOTAL AFATDS DEVELOPMENT AND PROCUREMENT COSTS ARE ESTIMATED AT OVER \$2 BILLION IN FISCAL YEAR 1986 DOLLARS:
- o \$277 MILLION FOR DEVELOPMENT.
  - o \$1.9 BILLION FOR PROCUREMENT, INCLUDING GOVERNMENT-FURNISHED EQUIPMENT AND SUPPORT.
- AFATDS COST GROWTH TO DATE:
- o CONCEPT EVALUATION PHASE CONTRACT HAS GROWN FROM \$34 MILLION TO \$46 MILLION.
  - o COST CEILING CAP ON CONTRACT REACHED.
  - o COSTS TO CONTRACTOR MAY ESCALATE.
  - o DEFICIENCIES IDENTIFIED IN TESTING COULD CAUSE FURTHER DEVELOPMENT PROBLEMS WITH ASSOCIATED COST GROWTH.

As of March 1986, AFATDS development effort is projected to cost \$277 million. Development funds spent through fiscal year 1985 were \$68 million. Procurement costs, according to the March 1986 base line estimate, are expected to be \$1.9 billion. The cost estimates may be understated in view of the potential development problems, risks related to the ACCS program, and the historical cost and schedule overruns of similar type programs.

The contract for the concept evaluation phase (CEP)<sup>6</sup> of the Fire Support System and Fire Support Terminal was awarded in May 1984. The contract specifically calls for system design, development, fabrication, integration of the software and hardware, and system test. Although the cost of this 33-month contract has grown from \$34 million to \$46 million, the Army has initiated efforts to contain further cost growth for this phase by placing a \$46 million cost ceiling on the contract and reducing the contractor's scope of work.

This CEP contract is a cost plus fixed-fee effort which is scheduled to be completed by February 1987. The contractor is contributing \$10 million of the original \$34 million. The Army has paid the full cost of the \$12 million increase to \$46 million. Additional contract cost will be borne by the contractor.

Although the Army has stabilized government costs for the AFATDS CEP with the cost ceiling cap, contractor costs as well as schedules may grow. An Army program analyst, using data through February 1986, has projected a \$48.7 million contract cost. This same analyst puts the contract 51 working days behind schedule.

In addition, the first of four required software packages was tested on February 28, 1986, by Magnavox, the prime contractor. This test was held even though Teledyne Brown Engineering, contractually responsible to advise the Army on product quality, recommended that the test plan be rejected. Teledyne reported that the test plan did not conform to contractual requirements and that the deletion of functions originally planned to be tested would result in an insufficient test.

In a March 13, 1986, test assessment report, Teledyne concluded that the test was not a full test. Further, the report states that 37 problems were identified that will impose additional tasks with associated risks on subsequent tests.

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<sup>6</sup>Software will be developed for use by both light and heavy divisions in this contract phase.



CHART I.10

AFATDS SCHEDULE COULD SLIP

--AFATDS PROGRAM INVOLVES SCHEDULE RISK BECAUSE:

- REQUIRED ADA TRANSPORTABILITY NOT DEMONSTRATED IN AFATDS CEP.
- ADA TRANSPORTABILITY DEMONSTRATIONS IN OTHER PROGRAMS HAVE BEEN LIMITED.
- ACCS DELAYS COULD CREATE SLIPPAGES IN AFATDS PROGRAM.

The AFATDS application system software is being coded in Ada<sup>7</sup> and is planned to operate on yet to be selected ACCS hardware. In order to maximize open competition, Ada must be usable (transportable) at minimum cost on any candidate ACCS hardware. Although software transportability is a major requirement of the AFATDS program, its demonstration is not included in the CEP contract. In addition, although a stated major benefit of Ada is ease of transportability, demonstrations of this have been limited with none at the projected magnitude of AFATDS. The Air Force World Wide Information System has demonstrated the most success by transporting up to 32,000 lines of Ada code. That effort, however, is significantly less than is envisioned with AFATDS--240,000 lines of code.

The ACCS concept was developed by the Army to guide the development of all automated C2 and communications systems for the battlefield of the future. It includes the eventual use of Ada and nondevelopmental equipment for the five components<sup>8</sup> of the ACCS, which includes AFATDS. Consequently, delays in the ACCS program could create slippages in the AFATDS program. For instance, the AFATDS plan projected a first quarter fiscal year 1990 IOC. This date was based on an earlier ACCS schedule that has already slipped. That schedule showed the ACCS proposal and demonstration phase starting in the fourth quarter fiscal year 1985 and ending in September 1986. However, as of April 1986, the ACCS request for proposal release date is now August 1986 with a March 1987 proposal and demonstration phase completion date.

In addition, the ACCS program does not yet have a budget line item or an approved charter.

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<sup>7</sup>Ada is the name given to the high order computer language developed as a standard language for use in military computers and computerized systems.

<sup>8</sup>The five components are fire support, air defense, intelligence, combat service support, and maneuver control.

CHART I.11AFATDS RISKS INDICATED BYOTHER C2 PROGRAMS

- THE ARMY HAS NOT FIELDDED A MAJOR TACTICAL C2 SYSTEM WITHIN ORIGINAL COST OR FIELDING PROJECTIONS:
  - o MCS DEVELOPMENT COST ESTIMATES INCREASED FROM \$182 MILLION IN DECEMBER 1984 TO \$217 MILLION IN JANUARY 1986; AND, THE PROGRAM SCHEDULE HAS SLIPPED MORE THAN 3 YEARS.
  - o SHORAD DEVELOPMENT COST ESCALATED FROM \$35 MILLION TO AN ESTIMATED \$245 MILLION WITH A 4-YEAR SCHEDULE SLIP.
- EXPERIENCE ON SIMILAR MILITARY C2 DEVELOPMENTS:
  - o MIFASS DEVELOPMENT COSTS HAVE ESCALATED FROM \$32 MILLION TO AN ESTIMATED \$112 MILLION WITH A 5-YEAR SCHEDULE SLIP.

There appear to be risks in achieving AFATDS cost and schedule goals since no major Army tactical C2 system has been developed without significant cost overruns and schedule slippages. Examples of cost and schedule experiences with automated C2 systems are illustrated in the development of the Army's MCS and the Short Range Air Defense (SHORAD) C2 system. In addition, the Marine Corps Fire Support C2 System development has experienced significant cost and schedule overruns.

During the 1970s, the Army began to develop a division level Tactical Operations System to provide automated tactical data assistance for battlefield commanders. Tests in 1977 revealed serious software and design problems with the system, and in 1979, the Congress terminated funding for the project. Since then, the Army has developed its MCS concept using several components from the Tactical Operations System. However, MCS has experienced several changes in design and capability. As a result, according to one set of estimates, development of MCS has fallen more than 3 years behind schedule and MCS development cost has also grown from \$182 million in December 1984 to \$217 million in January 1986. Also, acquisition cost has increased from \$.5 billion in 1982 to \$.9 billion in 1986.

The SHORAD C2 system was originally to be fielded in 1985, but disputes over the requirement for a sensor and changes to the acquisition strategy have delayed fielding until 1989 at the earliest. Like AFATDS, the SHORAD system is to be developed with Ada and will use nondevelopmental hardware and software to the extent possible. According to data presented during 1982 congressional hearings, fiscal year 1980 cost for system development was estimated at \$35.5 million. In 1983, the estimated cost was raised to \$245.4 million.

In developing the Marine Integrated Fire and Air Support System (MIFASS), the Marine Corps has experienced schedule and cost overruns. For example, MIFASS was initially scheduled to be developed for \$32 million over a 3-year period. According to a Navy program official, development problems have since increased the estimated cost to \$112 million (with the contractor contributing additional millions to ensure completion), and the schedule has been extended to more than 6 years. Furthermore, a Navy official told us that IOC is not expected until 1992. This is 5 years later than what the Marine Corps estimated in 1983.

CHART I.12IMPROVEMENTS FOR HEAVY DIVISIONS' SYSTEMS

--THE ARMY'S PLAN DOES NOT ADDRESS IMPROVEMENTS TO HEAVY DIVISIONS' FIRE SUPPORT SYSTEMS.

HOWEVER,

--SOME IMPROVEMENTS COULD BE EXPECTED FROM PROGRAMS NOT INCLUDED IN THE PLAN.

- o FIST/DMD PROCUREMENT FOR HEAVY DIVISIONS WILL UPGRADE FIRE SUPPORT C2 AT THE COMPANY LEVEL AND PROCUREMENT OF IMPROVED FORWARD ENTRY DEVICES WILL UPGRADE FORWARD OBSERVER CAPABILITY. (ACTIVE FUNDED PROGRAM.)
- o PROCUREMENT OF TACFIRE EMULATORS COULD PROVIDE COST SAVINGS AND SIGNIFICANTLY UPGRADE DIVISION TACFIRE. (UNFUNDED OPTION.)

The Army's plan does not address C2 interim improvements for heavy divisions. The plan focuses only on AFATDS replacing TACFIRE at division, brigade, and battalion echelons in fiscal year 1990. However, critical equipment below battalion are scheduled for near-term upgrades through programs not mentioned in the plan.

Although not included in the plan, the Army has funded the procurement of the FIST/DMD and improved forward entry devices for heavy divisions. The FIST/DMD, developed under a product improvement program contract, is scheduled for fielding in November 1986. The FIST/DMD is a man-portable or vehicle-mounted device intended to provide the FIST chief with an automated capability to plan and execute fire support at the company level. In addition, it provides the FIST chief with TACFIRE and forward entry device automated interface capability.

The planned fiscal year 1987 competitive procurement of a new forward entry device should significantly upgrade the forward observers automated input/output capability. This device is projected to give the forward observer an automated digital link to the BCS as well as TACFIRE.

The AFATDS program office, in September 1985, submitted a \$27.3 million improvement plan that could be cost recovering and significantly improve TACFIRE operations. A March 1986, economic analysis shows that fielding L3212 emulators to divisions with TACFIRE would result in a savings of \$3.5 million<sup>9</sup> in reduced parts and maintenance. This analysis assumes a September 1986 production contract award. It also assumes that AFATDS fielding will start in fiscal year 1992 and be completed by the end of fiscal year 1995. This improvement will significantly enhance operational benefits until AFATDS is fielded. Specifically, the L3212 emulator would increase reliability, operating speed, and needed memory while reducing vehicles, weight, personnel, and tear down and set up time.

Although substantial benefits could be realized from this interim improvement, the Army has not funded it because the Army has placed priority on funding AFATDS over interim capabilities. Delays in funding would result in the loss of its cost benefits and the capability to make significant interim upgrades to division TACFIRE.

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<sup>9</sup>Fiscal year 1986 current dollars.

CHART I.13POTENTIAL TOTAL FORCE CAPABILITY ALTERNATIVE

- IF SIGNIFICANT COST OR SCHEDULE GROWTH ARE ENCOUNTERED WITH AFATDS, THE LFATDS, COMBINED WITH THE TACFIRE EMULATOR COMPUTER, IS A POTENTIAL ALTERNATIVE FOR BOTH LIGHT AND HEAVY DIVISIONS:
- o LFATDS PLUS EMULATOR COST FOR 65 SETS IS ESTIMATED AT \$225 MILLION (EXCLUDING GOVERNMENT-FURNISHED EQUIPMENT), WITH A PROJECTED FISCAL YEAR 1988 IOC DATE.
  - o THIS OPTION WOULD NOT INTRODUCE UNIQUE EQUIPMENT INTO THE ARMY SYSTEM BECAUSE THE EMULATOR, WHICH HAS BEEN SUCCESSFULLY TESTED, IS BEING PROCURED FOR USE IN TACTICAL COMMUNICATION SWITCHES. ALSO LFATDS COMPUTERS ARE BEING PROCURED FOR THE ALL SOURCE ANALYSIS SYSTEM PROGRAM.
  - o LFATDS IS CURRENTLY UNDERGOING FDT&E TESTING WITH THE 9TH DIVISION.
  - o THIS OPTION WOULD PROVIDE SIGNIFICANT CAPABILITY OVER TACFIRE.
- HOWEVER, THIS OPTION WOULD NOT CONFORM TO THE ACCS ARCHITECTURE.

Contractor estimates to produce 65 sets of LFATDS plus emulator are about \$225 million, with an August 1988 IOC date. An Army AFATDS program official stated that over \$400 million more would be needed for government-furnished equipment and support. Development costs are projected at \$7 million since the majority of this effort was performed under the fixed-price LFATDS contract. Procurement is estimated at \$3.3 million per division set.

Fielding this configuration would not add unique hardware into the Army inventory, since the LFATDS computer and the L3212 series emulator are being procured for other Army programs--the All Source Analysis System and two Army tactical communications switch programs.

The development risks associated with this heavy division option would be low if the ongoing LFATDS field test at the 9th division is successful, since the emulator was already successfully tested in the TTC-39 tactical switch program.

The LFATDS plus emulator option would significantly upgrade current fire support C2 capabilities, and it largely complies with requirements of the MENS for AFATDS. Some of the major deficiencies of the TACFIRE system that would be corrected with this solution are mobility, trainability, decentralization, survivability, and responsiveness. Specifically:

- Division TACFIRE centers would use a single, smaller truck instead of four 5-ton trucks with shelters and generator sets. Also, the 15-minute set up time for TACFIRE would not be required. The resulting weight reduction would be from 108,000 pounds to 6,000 pounds.
- Operator training would be reduced from 7 weeks to 3 weeks with soldier friendly man-machine interface.
- Electronic signature would be reduced by replacing generator sets with vehicle battery power source. Also, reduced size, and increased maneuverability add to the systems survivability.
- The system is more responsive because the menu-driven system alleviates communication saturation.

The system's main deficiencies are that it does not automate C2 for naval gunfire and has limited intraservice, interservice, and allied interface capability.

The major disadvantage of this option is that it does not conform with the Army's ACCS plan for a single software language--Ada--and one 32-bit hardware architecture for the Army in the 1990s, without major software and hardware upgrades.



CHART I.14CONCLUSIONS

- THE ARMY'S PLAN WAS AN ACTION PLAN AND DID NOT INCLUDE AN EVALUATION OF ALTERNATIVES.
- THE FIST/DMD LOW COST OPTION FOR LIGHT DIVISIONS, INCLUDED IN THE ARMY'S PLAN, PROVIDES LIMITED INCREASED CAPABILITIES.
- THE LFATDS OPTION FOR LIGHT DIVISIONS, NOT INCLUDED IN THE ARMY'S PLAN, WOULD PROVIDE SIGNIFICANT INCREASED CAPABILITY AT MODERATE COSTS.
- AFATDS IS ONLY SOLUTION DESIGNED TO MEET ALL MENS AND ACCS OBJECTIVES. HOWEVER, FIELDING AFATDS TO HEAVY DIVISIONS IN FISCAL YEAR 1990 APPEARS TO BE OPTIMISTIC.
- THE ARMY HAS FUNDED AN INTERIM IMPROVEMENT PROGRAM FOR SOME ELEMENTS WITHIN HEAVY DIVISIONS.
- ANOTHER INTERIM PROGRAM WHICH COULD PROVIDE SIGNIFICANT INCREASED CAPABILITIES FOR HEAVY DIVISIONS HAS NOT BEEN FUNDED.
- AN ALTERNATIVE TO AFATDS EXISTS TO IMPROVE EXISTING SYSTEMS SHOULD AFATDS ENCOUNTER MAJOR DEVELOPMENT PROBLEMS.
- POTENTIAL CONGRESSIONAL ACTIONS:
  - o ASK ARMY TO FULLY EXPLAIN TRADEOFFS BETWEEN THE LOW COST FIST/DMD OPTION AND THE MODERATE COST LFATDS OPTION FOR LIGHT DIVISIONS.
  - o CONSIDER HAVING THE ARMY FUND THE TACFIRE EMULATOR OPTION FOR HEAVY DIVISIONS SINCE IT PROVIDES INCREASED CAPABILITY AT REDUCED COST.
  - o CONSIDER REDUCING AND/OR RESTRICTING USE OF FISCAL YEAR 1987 AFATDS FUNDS PENDING RESULTS OF AFATDS DEVELOPMENT TESTING.

The Army's September 1985 plan to provide automated fire support C2 is an implementation plan, and therefore, it did not include an evaluation of alternative interim or longer term systems such as the LFATDS.

According to light division commanders, the FIST/DMD option, which would be a relatively low cost upgrade, does not provide enough increased capability to meet their needs.

The LFATDS option was not included in the Army's plan, but light division commanders have requested it since they believe it would provide sufficient capability. This increased capability over the FIST/DMD option could be achieved at some increased cost and fielding time.

The AFATDS program outlined in the Army's September 6, 1985, plan is the only fire support C2 option that is projected to meet all MENS requirements. In addition, it is designed to comply with the ACCS program objectives of software development in Ada and nondevelopment common ACCS hardware procurement. However, the AFATDS program has significant cost and schedule risks.

The Army has funded the FIST/DMD as an interim improvement program for some units within the heavy divisions.

A proposed upgrade for heavy divisions (TACFIRE emulator) that could achieve savings as well as significantly upgrade capabilities, has not been funded. The TACFIRE emulator is the most cost and operational effective improvement option available to heavy divisions in the near term with projected net savings and significant operational upgrades.

Should AFATDS encounter major cost or schedule growth, fielding LFATDS plus emulator to the total force could be an alternative solution that would cost about one third as much as AFATDS and have nearly as much capability. This configuration, however, does not comply with the ACCS plan without major software and hardware changes.

Since the low cost FIST/DMD does not meet light division needs, according to artillery commanders, and the LFATDS costs about three times as much but meets their stated needs, perhaps the Army should be required by the Congress to explain the tradeoffs between the lower cost FIST/DMD and the more capable LFATDS solution for automated fire support capability for light divisions.

In view of the potential operational benefits and cost savings associated with the TACFIRE emulator for heavy divisions, the Congress could consider having the Army fund the TACFIRE emulator option for such divisions. Furthermore, in view of AFATDS cost and development risks, it might be advisable to either reduce the Army's fiscal year 1987 request for AFATDS and/or restrict the use of the funds until the results of the CEP have been fully evaluated.