GAO

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General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-249305.1

November 4, 1992

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

Dear Mr. Chairman:

The Army believes that battlefield commanders in the future will increasingly base critical decisions on information they receive from automated command and control systems. To facilitate the gathering, processing, and dissemination of timely battlefield information, the Army is integrating five command and control systems and three communications systems into a system of systems, the Army Tactical Command and Control System (ATCCS). As you requested, we reviewed the Army's efforts to ensure that the three communication systems will provide the appropriate communications capability for ATCCS.

Background

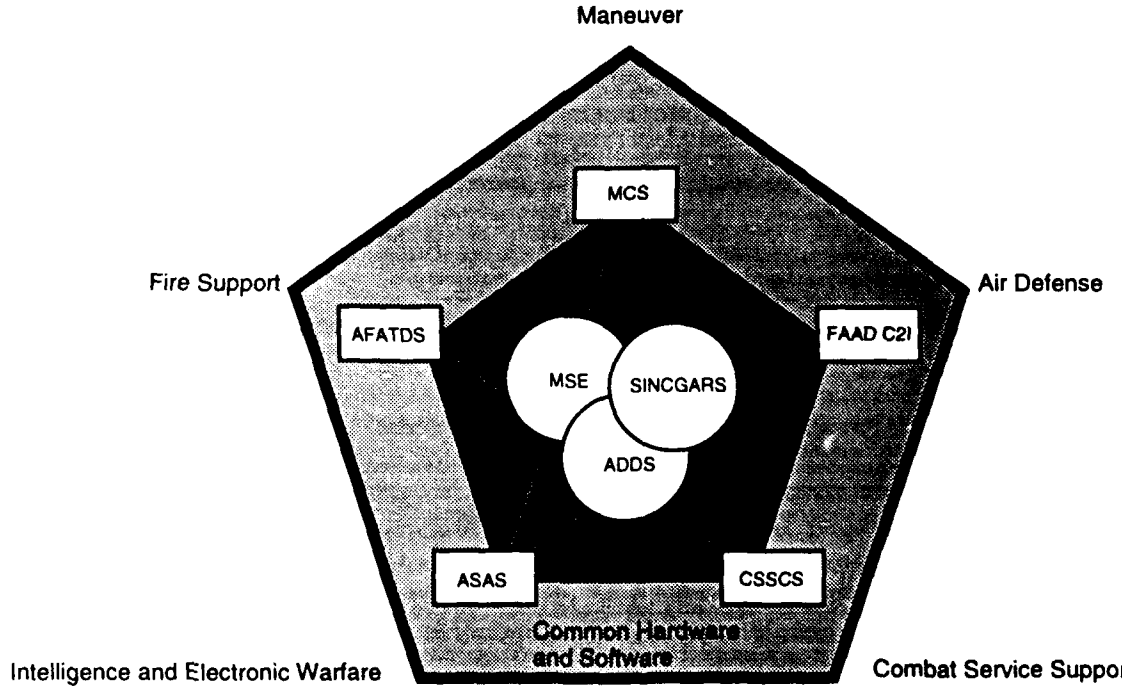
The five command and control systems (component systems) that are to be integrated under ATCCS are expected to provide information to control artillery; monitor troop movements and general battlefield conditions; control short-range air defense weapons; manage combat service support, such as supply, maintenance, transportation, medical, and personnel activities; and distribute intelligence information. The three communications systems are to provide voice and data communications capabilities linking the component systems and battlefield areas. These systems are

- the Army Data Distribution System, a data distribution network comprising the Enhanced Position Location Reporting System and the Joint Tactical Information Distribution System;[1]
- the Mobile Subscriber Equipment, the Army's battlefield telephone system; and
- the Single Channel Ground and Airborne Radio System, the Army's new generation of combat radios.

[1]The Joint Tactical Information Distribution System will be designed to support the communications needs of air defense units and will not interface with other component systems.

Figure 1 shows the ATCCS architecture. Appendix I provides further information on each of the three communication systems and on the communication links required for ATCCS.

Figure 1: Army Tactical Command and Control System Architecture



ADDS	Army Data Distribution System	FAAD C2I	Forward Area Air Defense Command, Control and Intelligence System
AFATDS	Advanced Field Artillery Tactical Data System	MCS	Maneuver Control System
ASAS	All Source Analysis System	MSE	Mobile Subscriber Equipment
CSSCS	Combat Service Support Control System	SINCGARS	Single Channel Ground and Airborne Radio System

Source: U.S. Army.

The three communications systems, like the component systems of ATCCS, were conceived as independent systems before the ATCCS program began in

1986 and are in different stages of development or deployment. About $11 billion of the $15.2 billion ATCCS estimated program cost is for communication systems.[2]

Department of Defense (DOD) acquisition policy and procedures base acquisition programs on identified mission requirements. These requirements are identified by assessments of current and projected capabilities considering changing military threats and defense policy. Accurate requirements are essential to determining procurement quantities and improvements needed to existing systems.

Results in Brief

In two analyses completed in 1991, the Army concluded that the three planned communications systems would meet the work load generated by the ATCCS component systems; the analyses, however, have deficiencies that prevent the Army from having reasonable assurances that the planned communications systems will provide adequate support for ATCCS. For example, the Army (1) did not use an appropriate threat scenario; (2) did not verify, validate, or accredit the model used to perform the analyses; (3) used dated information on users' communications requirements; and (4) included limitations that weaken the analyses. The Army is taking actions to correct some of these limitations.

In response to the reduction in threat, the downsizing of U.S. military forces, and the ongoing changes in war-fighting doctrine, the Army is reviewing ATCCS to determine whether its requirements for the system should be revised. Any revisions could have an impact on the communications support needed for ATCCS.

Army's Analyses Concluded That the Planned Communications Systems Were Adequately Sized

In April and December 1991, the Army Signal Center, Fort Gordon, Georgia, and the ATCCS systems engineer and integration contractor jointly completed two analyses of the communications work load to be generated by the ATCCS component systems in 1996. The conclusion reached in these analyses was that the three communications systems, with minor changes, would have the capabilities to transmit the amount of information generated by the ATCCS component systems.

[2]The estimate excludes the intelligence electronic warfare system—All Source Analysis System—acquisition cost estimate that is classified.

The first analysis addressed the Mobile Subscriber Equipment and the Single Channel Ground and Airborne Radio System, and the second analysis focused on the Enhanced Position Location Reporting System. These analyses are part of the Army's ongoing effort to assess the ATCCS communication requirements. They were performed using a computer model, called a network assessment model, developed under the sponsorship of the Army Signal Center (see app. II).

The primary purpose of these analyses was to determine whether the planned communications systems were adequately sized to handle the expected work load. This information is critical because without sufficient communications capability, battlefield commanders may not receive critical information when they need it. On the other hand, too much communications capability may not be affordable. Thus, the work load analyses can help determine what communications systems and improvements are needed.

The Army's Analyses Had Limitations

Our review showed that the Army's analyses contained significant limitations that raise questions about the results.

Analyses Did Not Use an Appropriate Threat Scenario

The Army's two analyses used a Soviet and Warsaw Pact threat scenario that did not include the electronic warfare threat component that ATCCS was designed to meet. However, the threat was changing at the time the analyses were performed and has now been reduced as a result of the events in East Europe and the former Soviet Union. According to Signal Center officials, the current threat has not yet been defined. They said using a new threat will likely alter the Army's information requirements. Thus, the type and amount of information that needs to be communicated could change.

The Soviet and Warsaw Pact electronic warfare component featured jammers attacking communications systems and causing outages; Army officials said they did not use this component because in their judgment it was obsolete. Instead, the Army judgmentally imposed network outages in the model. While we recognize that judgment was used in this case, it would have been better to use a current validated threat that addressed such issues as (1) quantity of expected jamming, (2) the location of that jamming, and (3) the speed with which the threat could be eliminated.

Model Was Not Verified, Validated, or Accredited

The Army did not comply with its own policies requiring that models such as the network assessment model be independently verified and either validated or accredited. "Verification" is the process of determining that a model accurately represents the developer's conceptual description and specifications—that is, that the software is performing as required. "Validation" is the process of determining that a model accurately represents the real world from the perspective of the model's intended use. "Accreditation" is an official determination that the model is acceptable for its intended purposes. The option of accrediting a model is based on the recognition that full validation may not be technically or economically feasible.

When using a model that is not verified and either validated or accredited, the Army cannot be reasonably certain that the model's results are accurate predictions. Thus, the network assessment model may not be a reliable tool for assessing whether the three communications systems will be capable of handling the work load generated by the ATCCS component systems or will provide too much capability. However, the Army has taken certain steps to correct the problem and increase its confidence in the model. The Army is now in the process of verifying and accrediting the total model. According to an Army official, the Army expects full accreditation by August 1993.

Communications Data Base Was Dated

The communications data base providing much of the data inputs into the network assessment model was dated when the Army performed its analyses. The data base represents the voice and data communications requirements of selected organizations.[3] The analyses stated that the data base had not kept up with developments in automated command and control systems and therefore no longer represented users' communications requirements. The last validation of the ATCCS needlines in the communications data base was in April 1990. The analyses also cited other factors that affected the accuracy of the data, such as the anticipated reduction in voice traffic due to increased confidence in automation.

The Army is integrating various data bases through a command, control, communications, and computers requirements definition process. This effort is crucial to maintaining a viable consistent baseline of users' communications requirements. Meanwhile, the verification and validation of all battlefield needlines is scheduled to be completed about mid-1993.

[3]Information in the data base is in the form of "needlines." A needline is a series of related data elements that together describe a requirement to communicate information between two or more users on the battlefield.

Other Limitations Weaken Analyses

The analyses identified several other limitations that affect the quality of the analyses. One limitation cited was that the analyses were based on existing models, simulations, data bases, analyses, and studies that did not reflect the configuration and operation of ATCCS. For example, the communications architecture of light divisions was not included. This is important because on the modern battlefield light divisions would have significantly different communications support requirements than heavy divisions. Another limitation was the assumption in the analyses that an automated communications management system will be in place and 100-percent effective. The analyses pointed out that ATCCS will be an extremely complex tactical information network requiring proper automated management to operate to its potential. However, the automated communications management system has yet to be developed.

The analyses stated that the results are optimistic. For example, potential operational problems, such as communications security and frequency mismatches, were not in the model but would likely occur. In addition, the analyses did not allow for human error or radio interference.

Changes in ATCCS Requirements Could Affect the Communications Systems

Several significant developments that have occurred outside the ATCCS program could have an impact on the Army's requirements for this system of systems. First, the Soviet and Warsaw Pact threat that ATCCS was being designed to meet has been reduced. Second, the Army is downsizing its forces as part of an overall reduction in forces in DOD. Third, the Army is revising its war-fighting doctrine on the basis of its having fewer forward-deployed combat forces.

The Commander of the Army Training and Doctrine Command requested in February 1992 that the Army Combined Arms Command review the ATCCS program in light of these developments. More specifically, the review will consider

- diminished radio electronic combat, electronic warfare, and air attack threats;
- the restructuring of the Army into a smaller, more versatile force capable of responding to a variety of conflicts;
- an emphasis on operational, as well as tactical, mobility;
- the expanded availability of satellite communications;
- the development of technology that was not part of the original ATCCS architecture, such as the global positioning system embedded in the Single Channel Ground and Airborne Radio System; and

- the needs of the commander on the future battlefield.

The results of this review have not been finalized; however, it appears the communications support needed for ATCCS will be impacted. For example, the study is recommending no additional procurement of Enhanced Position Location Reporting System units primarily on the basis of the reduction in the air attack threat. The study is also considering what improvements are needed to the communications capabilities of the existing systems to make greater use of satellite technology. In addition, the anticipated changes to ATCCS and its communications needs may affect the requirements for the automated communications management system.

Recommendation

We recommend that the Secretary of Defense direct the Secretary of the Army to perform a communications work load analysis using a verified and validated model with accurate inputs for threat, ATCCS architecture, and information requirements. This analysis could then be used to help determine requirements for communication systems, systems improvements, and management systems; the systems' capabilities; and subsequent funding requests.

Agency Comments and Our Evaluation

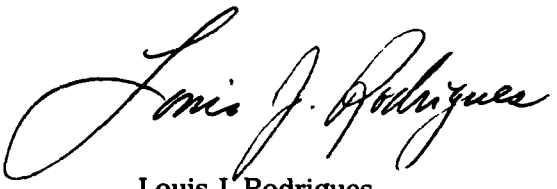
DOD concurred or partially concurred with the facts in this report. The agency did not agree with our recommendation that the Secretary of Defense direct the Secretary of the Army to perform a communication work load analysis because DOD believes that the Army has started this effort. However, DOD did concur that the results of the analysis we are recommending be used to help determine communications requirements.

Our draft report recognized that the Army was beginning efforts to correct the model, and we are encouraged by these initiatives. However, we believe our recommendation provides added emphasis to ensure that a fully usable model be developed and used to help determine requirements. DOD's comments on the draft of this report are included in their entirety in appendix IV.

Our scope and methodology are discussed in appendix III. As requested, unless you publicly announce its contents earlier, we plan no further distribution of this report until 10 days after its issue date. At that time, we will send copies to the Secretaries of Defense and the Army; appropriate congressional committees; and other interested parties on request.

Please contact me on (202) 275-4841 if you or your staff have any questions concerning this report. Other major contributors were William L. Wright, Assistant Director; Edwin B. Griffin, Evaluator-in-Charge; Robert J. Gentile, Evaluator; and Richard S. Felner, Engineer.

Sincerely yours,



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

Contents

Abbreviations

ATCCS	Army Tactical Command and Control System
DOD	Department of Defense
GAO	General Accounting Office

ATCCS Communications Systems and Links

According to the Army Field Manual on combat communications within the heavy and light divisions, communications is the dissemination of information through transmission, emission, or reception of signs, signals, writing, images, and sounds or data of any nature using audio, visual, electro-optical, or electromagnetic systems. The Army states that the vast majority of communications transmissions are data transmissions. Voice traffic includes user to user, conference and broadcast. Data distribution includes formal record traffic (joint message text), informal record traffic (facsimile and electronic mail), system-to-system data, and position/navigation data.

Primary Communication Segments

Communications is the means by which the commander and his staff distribute critical information between higher, lower, adjacent, combined, and joint forces. On the battlefield, critical information transfer requirements exist at each echelon. Voice traffic and data distribution are the primary methods of passing this information. The following is a brief description of the primary communications segments for the Army Tactical Command and Control System (ATCCS).

The Army Data Distribution System is a family of data communications and position location, reporting, navigation, and identification systems. These systems are to provide secure, jam-resistant communications in support of near-real-time data distribution requirements in the division and corps areas. The Army Data Distribution System consists of the Enhanced Position Location Reporting System and the Joint Tactical Information Distribution System. The Enhanced Position Location Reporting System is to provide a low- and medium-rate data communications capability for users at the division level and below. The system will support data communication requirements primarily in the areas of fire support, air defense, and intelligence, and electronic warfare. It also provides mutual position location and navigation information. The joint tactical information system is to support the unique data communications needs of air defense units.

The Mobile Subscriber Equipment is to provide areawide telephone-like communications for corps and division areas. It is designed to provide secure voice, data, and facsimile capability to fixed and mobile users. It is also to serve as a packet switch network that provides services similar to commercial telephone services for rapid data communications. The system is expected to be interoperable with communications systems of the other military services and North Atlantic Treaty Organization forces,

commercial systems, combat net radios, and multichannel satellite systems.

The Single Channel Ground and Airborne Radio System is the Army's new generation of lightweight, jam-resistant, secure, very high frequency combat radios that will be used by infantry, armored, artillery, and airborne forces. It is designed to be the primary mode of communications within the brigade and also provide command and control communications for combat support and combat service support units within division and corps areas. Although primarily for voice communications, the system is to have a data communications capability. It is expected to interoperate with the current family of Vietnam-era very high frequency radios; Army tactical data systems and equipment; and, in selected modes, North Atlantic Treaty Organization very high frequency single channel radio systems.

Communications Systems Interfaces

The Army stated that the ATCCS component systems are supposed to be capable of exchanging information using the three major communications systems and several other systems. Figure I.1 shows the required interface between the command and control systems and the specified communications systems.

Figure I.1: Communications Systems Interfaces

Communications Systems		Command and Control Systems				
Network	**System**	**MCS**	**FAADC2I**	**CSSCS**	**AFATDS**	**ASAS**
Area Common User System	MSE	●	●	●	●	●
	ATACS	●			●	●
Combat Radio	AN/VRC-12	●		●	●	●
	AN/PRC-77	●		●	●	●
	SINCGARS	●	●	●	●	●
	IHFR	●	●	●	●	●
Army Data Distribution System	EPLRS	●	●		●	●
Local Interconnection	802.3 LAN	●	●	●	●	●
	2W/4W	●	●	●	●	●

AFATDS	Advanced Field Artilery Tactical Data System	IHFR	Improved High Frequency Radio
ASAS	All Source Analysis System	LAN	Local Area Network
ATACS	Army Tactical Communicatons System	MCS	Maneuver Control System
CSSCS	Combat Service Support Control System	MSE	Mobile Suscriber Equipment
EPLRS	Enhanced Position Location and Reporting System	SINCGARS	Single Channel Ground and Airborne Radio System
FAAD C2I	Forward Area Air Defense Command, Control and Intelligence System	2W/4W	Two wires/four wires

Source: U.S. Army.

Both the Mobile Subscriber Equipment and the Single Channel Ground and Airborne Radio System are designed to be interfaced with all five command and control systems. The Enhanced Position Location Reporting System is to be used as the principal data distribution system for the Forward Area Air Defense Command, Control, and Intelligence System; Advanced Field Artillery Tactical Data System; and the All Source Analysis System. These three command and control systems have high volume data requirements. Data transmission rates for the ATCCS battlefield systems range from 1,200 to 16,000 bites per second. The data transmission rates vary depending on the requirements of the particular command and control system and the particular military echelon.

The ATCCS communications systems are separate development and acquisition programs under the Army Program Executive Office for Communications. The Army plans to test each system individually as it is being developed and later test the interfaces with the component systems during technical and operational testing.

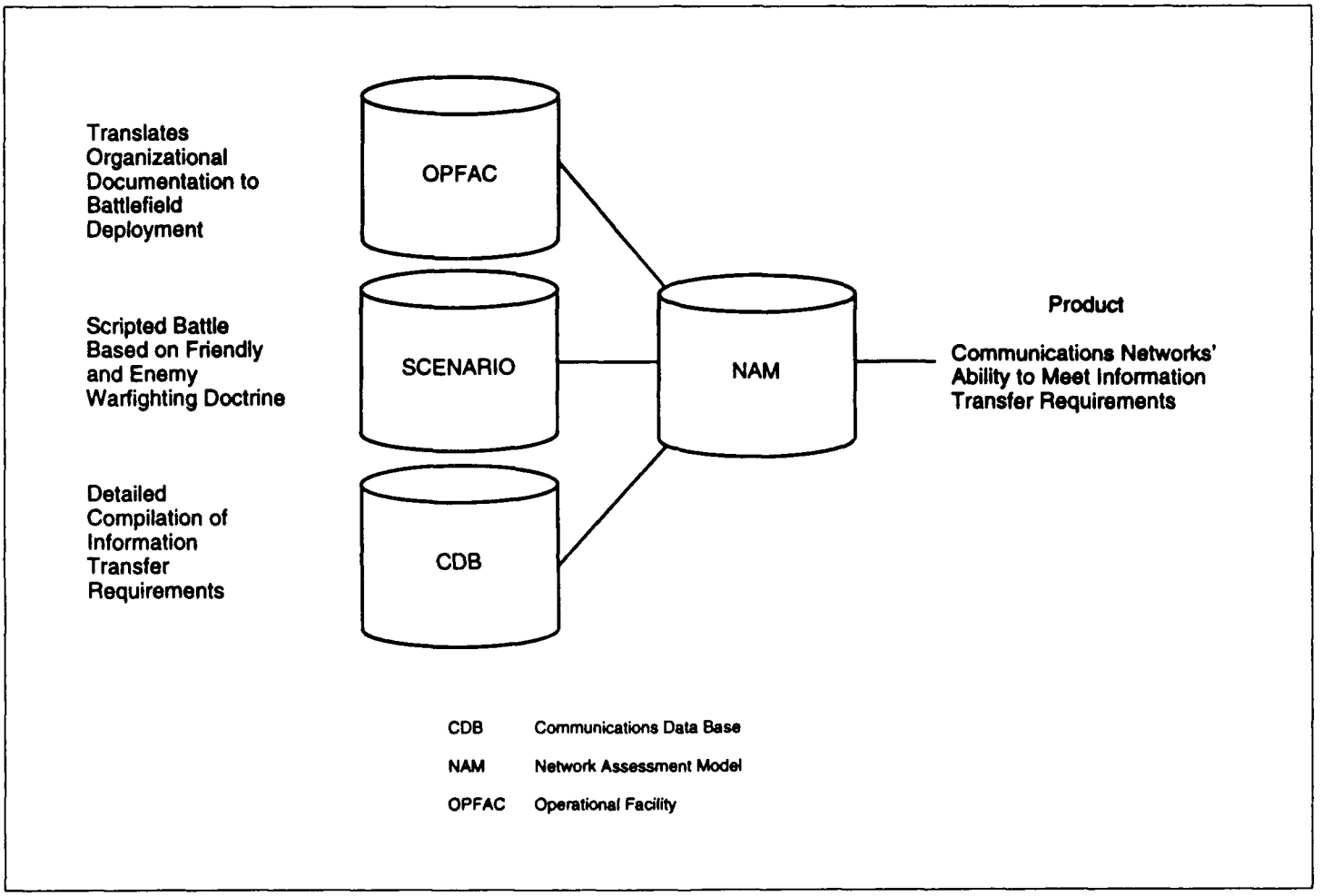
The ATCCS acquisition strategy is to maximize the use of off-the-shelf hardware and to acquire rugged commercial rather than militarized computers for use in more stringent operating conditions. Two of the computers are the Transportable Computer Unit and the Lightweight Computer Unit. The Army is using two interface units called the Adaptive Programmable Interface Unit and the Tactical Communications Interface Module. The communications systems are linked through an interface unit to the computers mentioned above. For example, a Single Channel Ground and Airborne Radio System radio is linked to the Transportable Computer Unit with the adaptive interface unit. The Army has procured several hundred adaptive interface units but does not plan to buy additional units. During the Maneuver Control System initial operational test and evaluation, the Army plans to use the adaptive interface units with the Transportable Computer Units and the tactical interface device with the Lightweight Computer Units. The Army's ultimate goal is to use only tactical interface devices for the interface with the communications equipment.

Network Assessment Model

The Army used a network assessment model in the two 1991 communication work load analyses. The model comprises a series of user-built models and a tactical communications network simulator. It is designed to simulate the activities of communications networks and to analyze their performance. The network assessment model measures the combined network's ability to support information transfer requirements.

The network assessment model uses inputs consisting of the communications data base, wartime scenario, and an operational facility such as a command post (see fig. II.1). The communications data base is the primary source of communications network loading information for the model. The data base represents the communications requirements of selected organizations. It contains the information transfer requirements in the form of needlines. According to the Army, there are currently 365,000 needlines (283,000 voice, 82,000 data). The scenario is the battle based on friendly and enemy war-fighting doctrine. Wartime scenarios are used to identify performance shortfalls. An operational facility is a person, section, or any group of people or sections that operate either individually or collectively on the battlefield. The operational facility data base identifies the equipment that is provided to each user or users to meet information exchange requirements.

Figure II.1: Inputs to the Network Assessment Model



Source: U.S. Army.

Objectives, Scope, and Methodology

We reviewed the Army's efforts to ensure that the three communication systems will provide the appropriate communications capability for ATCCS. We reviewed various Department of Defense and Army documents, including standards and regulations pertaining to modeling, communications need studies and plans, communication links materials, and modeling plans and methodology. We also reviewed system and segment requirements documents, ATCCS planning and review documentation, and program schedules. We discussed this information with officials at the following offices:

- Program Executive Office for Command and Control Systems and Program Executive Office for Communications Systems, Fort Monmouth, New Jersey.
- ATCCS program offices, McLean, Virginia; Redstone Arsenal, Alabama; and Fort Monmouth, New Jersey.
- Office of the Secretary of Defense for Command, Control, Communications, and Intelligence; Department of the Army's Office of the Director of Information Systems, Command, Control, Communications, and Computers, in Washington, D.C.
- Army Materiel Systems Analysis Activity, Aberdeen, Maryland.
- Army Operational Test and Evaluation Command, Alexandria, Virginia.
- Combined Arms Center, Fort Leavenworth, Kansas.
- Army Signal Center, Fort Gordon, Georgia.
- Army Training and Doctrine Command, Fort Monroe, Virginia.
- Institute for Defense Analysis, Alexandria, Virginia.
- Army Model and Simulation Management Office, Arlington, Virginia.
- System integration contractor office, Fort Monmouth, New Jersey, and Fort Washington, Pennsylvania.

We performed our review from July 1991 to July 1992 in accordance with generally accepted government auditing standards. The Department of Defense provided written comments on a draft of this report.

Comments From the Department of Defense

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

ASSISTANT SECRETARY OF DEFENSE

WASHINGTON, D.C. 20301-3040

COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE

September 21, 1992

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

Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "COMMUNICATIONS ACQUISITION: Army Still Needs to Determine Communications Capability for ATCCS", Dated July 31, 1992 (GAO Code 395173), OSD Case 9157.

The above draft report has two recommendations: (1) that the Secretary of Defense direct the Secretary of the Army to perform a communications work load analysis using a verified and validated model with accurate inputs for threat, Army Tactical Command and Control System(ATCCS) architecture, and information requirements, and (2) that the resulting analysis be used by the Army to help determine what communication systems, systems improvements, and management systems are needed, as well as determining their capabilities and subsequent funding requests. The DoD is actively addressing all the issues discussed in the GAO report through self-initiated and previous actions on the part of the Army

See comment 6.

The DoD concurs or partially concurs with all the report findings and agrees with one out of two of the recommendations. The DoD does not agree with the recommendation that it should task the Army to undertake efforts the Army has already begun. The Army, as are all the Services, is hard at work studying the effects of missing Soviet and Warsaw Pact threats which affect force structure, war fighting doctrine, and communications architecture for the battlefield. The Army's Post Cold War Command and Control Review is the analysis which will help to determine how the Army should be configured to accomplish its future mission. It is expected that the Army budget submission for FY1996 will support the results of this analysis.

Detailed DoD comments on the report findings and recommendations are provided in the enclosure. The DoD appreciates the opportunity to comment on the report.

Sincerely,

Duane P. Andrews

Enclosure

Enclosure

GAO DRAFT REPORT - DATED JULY 31, 1992
(GAO CODE 395173) OSD CASE 9157

"COMMUNICATIONS ACQUISITION: ARMY STILL NEEDS TO DETERMINE COMMUNICATIONS CAPABILITY FOR ATCCS"

DEPARTMENT OF DEFENSE COMMENTS

* * * * *

FINDINGS

- FINDING A: Army Analyses Concluded That The Planned Communications Systems Were Sized Adequately. The GAO reported that, in April and December 1991, the Army Signal Center, Fort Gordon, Georgia, and the Army Tactical Command and Control Systems (ATCCS) systems engineer and integration contractor jointly completed two analyses of the communications work load to be generated by the Army Tactical Command and Control Systems component systems. The GAO explained that the analyses are part of the ongoing Army effort to assess the Army Tactical Command and Control System communications requirements. The GAO further explained that the analyses were performed using a computer model -- called a network assessment model -- developed under the sponsorship of the Army Signal Center.

  The GAO observed that the primary purpose of the analyses was to determine whether the planned communications systems were sized adequately to handle the expected workload. The GAO concluded that the information was critical because, without sufficient communications capability, battlefield commanders may not receive information when they need it. The GAO pointed out that, on the other hand, too much communications capability may not be affordable. The GAO further concluded that the work load analyses and improvements are needed. (pp. 5-6/GAO Draft Report)

Now on pp. 3, 4.

  DoD Response: Concur. The DoD recognizes the need for additional, accurate assessments of Army Tactical Command and Control System communications requirements.

- FINDING B: Limitations in the Army Analyses -- Did Not Use Appropriate Threat. The GAO reported that the Army analyses contained significant limitations, many of which were identified by the Army Tactical Command and Control System contractor, and raised questions about the results of the analyses. The GAO found the two Army analyses used a dated threat scenario and did not portray an electronic warfare threat that the Army Tactical Command and Control System could face in wartime. The GAO noted that the model simulated a

Soviet and Warsaw Pact threat, which was changing at the time of the analyses and has now disappeared as a result of events in Eastern Europe and the former Soviet Union. The GAO further stated that a new threat will likely alter the Army information requirements and the amount and type information that needs to be communicated.

The GAO also reported that, although the Soviet and Warsaw Pact threat was simulated, the electronic warfare component of the threat was not simulated. The GAO explained that Army officials indicated that they did not use the Soviet and Warsaw Pact electronic warfare threat because, in their judgment, it was not necessary. The GAO found that, instead, the Army judgmentally imposed network outages in the model. The GAO concluded that, while judgment was used in this case, it would have been better to use a current validated threat that addressed such issues as (1) quantity of expected jamming, (2) where the jamming would occur, and (3) how rapidly the threat would be eliminated. (pp. 7-8/GAO Draft Report)

Now on pp. 4, 5.

DoD Response: Partially concur. The DoD agrees that the original model did simulate a Soviet and Warsaw Pact threat. The DoD also agrees that new threats will likely alter Army information requirements, specifically, the amount and type of information to be communicated.

See comment 1.

The DoD does not agree, however, that the threat used in the study was inappropriate for a transitional Cold War to Post-Cold War scenario. As indicated by the GAO, a judgement was made by the Army to abandon the outdated European threat scenario and simulate portions of the electronic coutermeasures situation. Only in very recent times has the Army been able to define an acceptable, environmentally current threat scenario--i.e., South West Asia--which may now be incorporated into the communications network assessment model. The threat used in the cited Army analysis was not "dated" as claimed by the GAO; however, it was certainly undergoing change and is vastly different now than prior to the analysis. (Also see DoD comments in response to Finding D.)

- **FINDING C: Model Was Not Verified, Validated, or Accredited.** The GAO concluded that the Army did not comply with its own regulations requiring that model -- such as the network assessment model(NAM) -- be verified independently, and either validated or accredited. The GAO also concluded that, by using a model that had not been verified and either validated or accredited, the Army cannot be reasonably certain the model results are accurate predictions. The GAO further concluded, therefore, that the network assessment model may not be a reliable tool for assessing (1) whether the three communications systems will be capable of handling the work load generated by the Army Tactical Command and Control System

component systems or (2) whether it will provide too much capability. The GAO did acknowledge, however, that the Army had taken certain steps to correct the problem and increase its confidence in the model. The GAO observed that the Army is now in the process of verifying and accrediting the model, with full accreditation planned for the Army Early User Test and Experimentation in October 1992. (pp. 8-9/ GAO Draft Report)

Now on p. 5.

DoD Response: Partially concur. The DoD does disagree that the Army is not complying with its own regulations to verify and accredit the Network Assessment Model. The Army has accomplished independent verification and accreditation for the Packet Switch and Mobile Subscriber Equipment software modules. Individual accreditation of model modules have been accomplished for specific studies and, in particular, for the Army Tactical Command and Control System study.

See comment 2.

The DoD agrees that the Army is taking action to complete the administrative requirements for accreditation of the entire network assessment model and these actions are expected to be finished in the next 18-24 months. Recent verification tests on the total model have not indicated any problems and would seem to support the validity of the Army Tactical Command and Control System modeling conclusions.

- FINDING D: Communications Data Base Was Dated. The GAO concluded that the communications database, which provided much of the data inputs into the network assessment model, was dated when the Army performed its analyses. The GAO reported the Army Tactical Command and Control System integration contractor had indicated that the database had not kept up with developments in automated command and control systems and, therefore, no longer represented user communications requirements. The GAO further found that the last validation of the communications database was in April 1990. The GAO pointed out the contractor also cited other factors that affected the currency of the data such as the anticipated reduction in voice traffic due to increased confidence in data communications.

  The GAO observed that the Army is integrating various databases through a command, control, communications, and computer requirements definition process. The GAO concluded that effort is crucial to maintaining a consistent baseline of user communication requirements. The GAO noted that the verification and validation of all battlefield needlines is scheduled to be completed about mid-1993. (pp. 9-10/ GAO Draft Report)

Now on p. 5.

DoD Response: Partially concur. The DoD does not concur that the database misrepresents user communications requirements. The GAO criticism is levied for the use of a "dated" communications database --i.e., one that was validated in

See comment 3.

April 1990. Since the analyses were completed in 1991, the data were relatively up-to-date at the time they were done. It is true, however, that since the April 1990 validation, many changes affecting the database have occurred.

The DoD agrees that the Army is well into the process of verifying and validating all battlefield communications needlines. That process will be completed by mid-FY1993, after incorporating the results of the Army directed Army Tactical Command and Control System mini-functional area assessment and the Post Cold War Command and Control Review. In the meantime, efforts are always made to ensure database accuracy for that portion of the model used in any study. As doctrinal changes occur, and recently there have been many such changes, incorporation of the changes to the database are planned. Database changes and updates are a continuous process. The Army is confident that the database reflected command and control needs based upon the most recent information available at the time of the two cited studies. The Army recognizes the problem of database information fragility and is actively updating the database as decisions are made at the national level about the defense strategy and its accompanying force structures.

- FINDING E: Other Limitations Weaken Analysis. The GAO reported that the Army Tactical Command and Control System contractor identified several other limitations that affect the quality of the analyses. The GAO explained one of the limitations cited was that the analyses were based on existing models, simulations, databases, analyses, and studies, which did not reflect the configuration and operation of the Army Tactical Command and Control System. The GAO pointed out, for example, that the analyses did not include the communications architecture of light divisions. The GAO further pointed out that, on the the modern battlefield, light divisions would have significantly different communications support requirements than would heavy divisions. In addition, the GAO reported that another limitation was the assumption in the analyses that an automated communications management system will be in place and 100 percent effective. The GAO also noted the contractor pointed out that the Army Tactical Command and Control System will be an extremely complex information network requiring proper automated management to operate to its potential. The GAO asserted, however, that an automated communications management system has yet to be developed.

  The GAO further reported that, according to the contractor, the results of the analysis are optimistic. The GAO observed, for example, that potential problems -- such as communications security and frequency mismatches -- were not in the model, but would likely occur. The GAO also pointed out the analyses

Now on p. 6.

did not allow for human error or radio interference. (pp. 10-11/GAO Draft Report)

DoD Response: Partially concur. The DoD agrees the number of possible variables that can be incorporated into the Network Analysis Model to reflect the Army Tactical Command and Control System are large, but only those which were considered to be germane and most significant to the study objectives were incorporated by the Army. In any model there are computational constraints and difficulties in establishing variable specificity. The current efforts to revise the Network Analysis Model will encompass additional data to assist the Army in considering a wider array of variables--e.g.,light and heavy division configurations, the effects of an automated communication management, communications security and frequency issues, and human error, as the GAO proposes. A myriad of improvements are planned and will be implemented as funds permit. In addition, a comprehensive analysis cannot be successfully accomplished until variables, which represent the threats in a new world order, are known and can be modeled.

See comment 4.

The DoD does not agree that the Army is not funding efforts to evolve automated communications management systems. The Army Theater Network Planning System is an existing network planning aide used by Army communications planners. The Mobile Subscriber Equipment has its own embedded network planning aide, which was not mentioned in the GAO report. The Army is planning to field in January 1993 a sophisticated automated network management tool, the Frequency, Utilization, Resource Integration and Engineering System, which was derived from the Theater Network Planning System and other planning aides.

See comment 5.

The GAO report references negative comments solicited from, "the ATCCS contractor." Such statements, which also occurred in other parts of the report, leaves the impression that there is only one Army Tactical Command and Control contractor and it is critical of the Army analysis. There are, in fact, several contractors contributing to the Army Tactical Command and Control development.

- FINDING F: Changes In Army Tactical Command and Control System Requirements Could Affect The Communications Systems. The GAO concluded that the following significant developments, which have occurred outside the program, could have an impact on the Army requirements for the system of systems:

  - the Soviet and Warsaw Pact threat that the Army Tactical Command and Control System was being designed to meet has disappeared;

  - the Army is downsizing its forces as part of an overall reduction in forces in the DoD; and

- the Army is revising its war-fighting doctrine based on having fewer forward-deployed combat forces.

The GAO reported that, in February 1992, the Commander of the Army Training and Doctrine Command requested that the Army Combined Arms Command review the Army Tactical Command and Control System program in light of the cited developments. The GAO asserted that the results of the review could have an impact on the communications support needed for the Army Tactical Command and Control System. The GAO noted, for example, that the Army is considering deep cuts in the number of Enhanced Position Location Reporting System units, primarily on the basis of the reduction in the air attack threat. The GAO also observed that the Army is considering what improvements are needed to the communications capabilities of the existing systems to make greater use of satellite technology. In summary, the GAO concluded that the anticipated changes to the Army Tactical Command and Control System and its communications needs may affect the requirements for the automated communications management system. (pp. 11-13/ GAO Draft Report)

Now on pp. 6, 7.

DoD Response: Concur. The effects of the changed Soviet and Warsaw Pact threats, downsized Army forces, and revised war-fighting doctrine may, indeed, change the communications architecture for the Army Tactical Command and Control System. Those and other changes need to be studied. Efforts such as the Post Cold War Command and Control Review are well underway to accomplish that end. Validation of the Army Tactical Command and Control System battlefield functional area needs and the resultant requirement for communications support is expected as the Army proceeds with development of its next Long Range Army Material Requirements Plan, Long Range Research, Development and Acquisition Plan, and submission of it's Program Objective Memorandum.

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RECOMMENDATIONS

- RECOMMENDATION 1: The GAO recommended that the Secretary of Defense direct the Secretary of the Army to perform a communications work load analysis using a verified and validated model with (1) accurate inputs for threat, (2) Army Tactical Command and Control System(ATCCS) architecture, and (3) information requirements.

See comment 6.

DoD Response: Non-Concur. The Army has already begun efforts the GAO recommends be done. The Post Cold War Command and Control Review is the current analysis plan to accomplish a detailed look at how the Army should be configured to accomplish it's future mission. A relook at the Army Tactical Command and Control System architecture utilizing a validated

Now on p. 7.

communications Network Assessment Model with updated threat inputs and informational requirements is part of that plan.

- **RECOMMENDATION 2:** The GAO further recommended that the resulting analysis be used (by the Army) to help determine what communication systems, systems improvements, and management systems are needed, as well as determining their capabilities and subsequent funding requests. (p. 13/ GAO Draft Report)

  DoD Response: Concur. The results of the Post-Cold War Command and Control Review will be realized upon submission of: the Long Range Army Material Requirements Plan scheduled for August, 1993; the Long Range Research, Development and Acquisition Plan scheduled for November, 1993; and the Program Objective Memorandum scheduled for April, 1994. These documents will outline quantities and resources needed to accomplish a viable Army Tactical Command and Control System communication architecture.

The following are GAO's comments on the Department of Defense's (DOD) letter dated September 21, 1992.

GAO Comments

1. Our point is that the model did not use a current validated threat. Therefore, the model results would not be representative. However, we did change the text of this report to reflect agency comments.

2. Our point is that the total model used was not a current, verified, validated or accredited version. According to Army officials, the packet switch and Mobile Subscriber Equipment modules were not accredited. Previous versions of these modules have been evaluated and deficiencies found; some of which have been corrected. We continue to believe that the model and its component modules must be current, free of deficiencies, and accredited to be useful.

3. DOD acknowledges that since the last validation of the data base in April 1990 many changes affecting the data base have occurred. Our point is that the changes that occurred between April 1990 and the first analysis in April 1991 could have made the data base inaccurate. In addition, by the time of the second analysis in December 1991, it is likely that the data base had more inaccuracies. Also, the analyses stated that the data base had not kept pace with changes in automation requirements. However, the most important point is that the data base needs to be updated if analyses that use it are going to be accurate.

4. We did not comment on Army funding for the automated communications management system. We did state that the automated communications management system for ATCCS (the Integrated System Control) has yet to be developed. The Army's April and December 1991 analyses stated that the Army is developing automated capabilities to support communications system management. For example, the analyses pointed out that in the 1995 time frame, the Integrated System Control program will address crucial communications areas such as battlefield spectrum management, communications security, signal command and control, and other areas. The analyses cautioned that until these functional areas are fully implemented, operational problems will occur and command, control, and communications performance will suffer. We recognize that the Army is working toward resolving these problems. Our point is that until communications and data management problems are sufficiently resolved and worked into the model, assumptions that

communications management is 100-percent effective seriously impacts the reliability of the results from the model.

5. We have changed the report to clarify that the statements were from the Army's analyses.

6. Our draft report recognized that the Army was beginning efforts to correct the model. We are encouraged by these initiatives. However, we will continue with our recommendation which we believe provides added emphasis to ensure that a fully usable model is developed and employed to help determine requirements.