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Report to the Secretary of Defense

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MILITARY SATELLITE COMMUNICATIONS

Milstar Program Issues and Cost-Saving Opportunities

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GAO

United States
General Accounting Office
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National Security and
International Affairs Division

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June 26, 1992

The Honorable Richard B. Cheney
The Secretary of Defense

Dear Mr. Secretary:

This report discusses selected aspects of the Milstar communications satellite program—specifically (1) satellite issues that need to be resolved, (2) terminal cost-saving opportunities, (3) terminal program risks and production issues, and (4) annual program reports to the Congress.

This report was prepared pursuant to the General Accounting Office's basic legislative responsibilities to review federal programs and assess the extent to which such programs are achieving their intended purposes.

We are sending copies of this report to the Speaker of the House of Representatives; President of the Senate; selected congressional committee chairmen; Director, Office of Management and Budget; and Secretaries of the Air Force, the Army, and the Navy. Copies will also be made available to others upon request.

This report was prepared under the direction of Louis J. Rodrigues, Director, Command, Control, Communications, and Intelligence issues, who may be reached on 202-275-4841 if you or your staff have any questions. Major contributors to this report were Homer H. Thomson, Assistant Director and Eaton C. Clapp, Evaluator-in-Charge.

Sincerely yours,

Frank C. Conahan
Assistant Comptroller General

Executive Summary

Purpose

During the last 10 years, the Department of Defense (DOD) invested more than $5 billion in the multiservice Milstar program. In 1991, DOD restructured the program in response to congressional directions.

This report discusses (1) satellite issues that need to be resolved, (2) terminal cost-saving opportunities, (3) terminal program risks and production issues, and (4) annual program reports to the Congress.

Background

In 1981, DOD initiated the Milstar program to provide the President and military services with a survivable worldwide communications capability. The Milstar system consists of satellites, ground-based control stations, and various Army, Navy, and Air Force terminals.

In 1990, congressional concerns arose about Milstar's high costs, inadequate support to tactical forces, and unnecessary nuclear warfighting capabilities. DOD's restructuring plans include reducing the number of satellites and terminals, adding three new types of terminals, and increasing system communications capacity.

Results in Brief

DOD's plans to modify the Milstar satellite design are not the most cost and operationally effective alternative for satisfying tactical communication requirements. GAO believes that this matter and three technical issues—sufficient capacity, assured connectivity, and antennas capable of neutralizing the effects of electronic jammers—should be resolved before or in conjunction with the Defense Acquisition Board review of Milstar.

DOD can save up to $441 million by canceling planned procurement of one type of Army Milstar terminal (called SCOTT) and selecting one contractor to finish producing the Air Force's command post terminals.

DOD's oversight of the Air Force's so-called low cost terminal program is critical, considering the risks involved, and separate criteria for exiting the demonstration and validation phase and engineering and manufacturing development phase of the acquisition process is essential.

Caution is necessary regarding continued production of the Navy's Milstar terminals because of conflicting factors associated with reliability testing and production contract limitations.

Because Milstar is no longer a highly sensitive classified program, annual reports on the program must be submitted to the Congress.

Principal Findings

Satellite Issues

Uncertainty exists about the cost effectiveness of adding a medium data rate capability to Milstar, primarily to satisfy the Army's tactical communications requirements. A DOD study shows that there are less costly alternatives.

Formal agreement has not been reached within DOD regarding three issues that the Army claims would be important to its use of Milstar—sufficient capacity, assured connectivity, and special antennas capable of neutralizing the effects of electronic jammers.

Cost-Saving Opportunities

Planned quantities of the Army's SCOTT terminals and the Air Force's command post terminals have been substantially reduced because of Milstar program restructuring. Additional reductions in Army terminals are possible because of a reduced world threat, making future production questionable. Up to $308 million could be saved by canceling this Army program. Using one contractor, instead of two, to continue producing the relatively small quantity of Air Force terminals now planned could save up to $133 million.

Program Risks and Production Issues

The Air Force expects to face significant technical risks involving aircraft antennas and radomes (covers for protruding antennas) in its new low-cost terminal program. This will require continuous high-level oversight.

After two operational tests, the Navy's Milstar terminals are still experiencing reliability deficiencies. Conflicting factors regarding reliability testing and continued production contracting will have to be considered in making future production decisions.

Annual Selected Acquisition Reports

The Secretary of Defense recently determined that Milstar is no longer a highly sensitive classified program. Therefore, DOD is no longer exempt from the statutory requirement to submit selected acquisition reports on Milstar to the Congress.

Recommendations

Before DOD begins a major investment in modifying the Milstar satellite and developing new terminals, GAO recommends that the Secretary of Defense ensure that a cost and operational effectiveness analysis is performed to determine whether Milstar is the best alternative for satisfying tactical satellite communication requirements.

GAO is making other recommendations related to Army-stated satellite needs, cost-saving opportunities, program risks, production issues, and selected acquisition reports.

Matter for Congressional Consideration

Because of DOD's reluctance to reconsider the restructured Milstar plan, the congressional defense committees may wish to direct DOD to perform a cost and operational effectiveness analysis, or justify its intended course of action before providing additional Milstar funds.

Agency Comments

DOD provided written comments on a draft of this report and generally concurred with the contents. DOD disagreed with GAO's recommendation to perform a cost and operational effectiveness analysis, and GAO has therefore included a matter for consideration in this report raising the issue to the attention of the Congress. (See app. I.)

Contents

Introduction

In 1981, the Department of Defense (DOD) established the multi-service Milstar communications satellite program to provide the President, chief military commanders, and strategic and tactical forces with a worldwide, secure, voice and data communications capability that would be highly survivable through all levels of conflict—crises, theater war (conventional and tactical nuclear), general nuclear war, and postwar. During the last 10 years, DOD has invested more than $5 billion developing the space, mission control, and terminal segments of the Milstar program.

The space segment consists of a constellation of satellites. The mission control segment is a ground-based capability to provide overall control of the satellites and their payload. Both of these program segments are being developed by the Air Force. The terminal segment consists of various Army, Navy, and Air Force equipment for aircraft, ships, submarines, ground-mobile vehicles, and fixed ground locations to allow users to communicate using the satellites. Milstar is designed to operate in the extremely high frequency range of the electromagnetic spectrum, to be highly resistant to electronic jamming, and to withstand some effects of nuclear detonations.

Milstar Program Restructuring

The National Defense Authorization Act for fiscal year 1991, which was enacted on November 5, 1990, directed the Secretary of Defense to develop and carry out a plan for either a restructured Milstar or an alternative advanced communications satellite program. The objectives were to (1) substantially reduce program costs, (2) increase system utility for tactical forces, and (3) eliminate unnecessary capabilities for protracted nuclear warfighting missions and operations. Congressional leaders considered Milstar's cost to be too high, its support to tactical forces inadequate, and its nuclear warfighting capabilities unnecessary for deterrence.

In January 1991, DOD reported to the congressional defense committees its plans to restructure the Milstar program rather than develop an alternative advanced system. Key changes associated with lowering Milstar costs include reducing (1) the constellation size from 8 to 6 satellites, (2) the number of ground-based constellation control stations from 25 to 9, and (3) the total terminal quantity from 1,721 to 1,467, particularly the most costly and complex terminals. Also, several survivability features on satellites and ground equipment are to be eliminated.

Appendixes

Tables

Abbreviations

DOD	Department of Defense
LCT	Low Cost Terminal
SAR	Selected Acquisition Report
SCAMP	Single Channel, Anti-jam, Manportable
SCOTT	Single Channel Objective Tactical Terminal
SMART-T	Secure, Mobile, Anti-jam, Reliable, Tactical Terminal
OSD	Office of the Secretary of Defense

To provide greater system utility to tactical forces, DOD plans to (1) increase communications capacity by adding a medium data rate capability[1] to the satellite, (2) modify the number and types of antennas on the satellites, and (3) acquire three new, smaller types of terminals—two for the Army and one for the Air Force.

The plans indicate that the Army would be the predominant user of the satellites' new medium data rate capability, with one of the Army's two new terminals primarily designed for that purpose. The Air Force's new terminal will initially be designed to operate at Milstar's low data rate, but will subsequently be modified to include a medium data rate capability. Section 217 of the 1991 Authorization Act pertaining to Milstar specifically did not apply to the extremely high frequency terminal program of the Navy. DOD reported to the congressional defense committees that the Navy's terminal program, designed to transmit signals at low data rates, would remain the same. However, Navy program officials subsequently informed us that the Navy was requested to provide its medium data rate requirements to the Office of the Joint Chiefs of Staff. As a result, the Navy expects to modify its production terminals to also use this new medium data rate capability.

DOD estimated that the overall program risk would increase from low to medium as a result of the restructuring. This was primarily based on major modifications to the satellite design, the addition of the Army's new terminal designs, and a revised Air Force terminal design. DOD estimated that restructuring could save about 25 percent of the program's 20-year life cycle costs.

In May 1991, The Air Force Space Systems Division, which is responsible for managing the Milstar program, publicly announced its restructuring intentions by requesting information on the capabilities of interested contractors. The announcement envisioned major changes, including designing, fabricating, and testing a new medium data rate payload for the satellite; modifying the existing low data rate payload, crosslink payload, and satellite bus; building five complete satellites; and modifying mission control equipment. In June 1991, the Milstar Joint Program Office, within

[1]A medium data rate capability would significantly increase the volume of information that could be processed through the satellites. For example, the original Milstar design contained a low data rate capability that would allow terminals to transmit information at various speeds, ranging from 75 to 2,400 bits per second. Medium data rate is defined by DOD as allowing for speeds up to 1,544,000 bits per second.

the Space Systems Division, authorized the prime satellite Milstar contractor—Lockheed Missile and Space Corporation—to begin a 14-month Milstar architecture study during a demonstration and validation phase. This phase is to be followed by an engineering and manufacturing development phase to accomplish the satellite restructuring plans.

The Defense Acquisition Board plans to review the Milstar program in June 1992, prior to a development contract award for satellite modifications.

Objectives, Scope, and Methodology

DOD's plan to restructure the Milstar program is intended to comply with congressional concerns about high program costs, limited system utility for tactical forces, and unnecessary system capabilities associated with supporting a protracted nuclear war. This report discusses (1) satellite issues that need to be resolved before making additional Milstar program investment decisions, (2) terminal cost-saving opportunities, (3) terminal program risks and production issues, and (4) submission of annual program reports for congressional oversight. It also provides information on the status of the service's terminal programs. Information on the space and mission control segments is included to provide a broader system perspective; however, we did not examine these segments in depth.

We interviewed program officials and examined program management and budget documents, system requirements, test plans and results, acquisition plans and schedules, and other program documents. We performed work at the Air Force Electronic Systems Division, Hanscom Air Force Base, Massachusetts; Army Communications and Electronics Command, Fort Monmouth, New Jersey; and Navy Space and Naval Warfare Systems Command, Arlington, Virginia. We also contacted program representatives within the Joint Terminal Program Office, Arlington, Virginia; Office of the Secretary of Defense; Office of the Joint Chiefs of Staff; and Departments of the Air Force, Army, and Navy.

DOD provided written comments on a draft of this report. These comments are presented and evaluated in chapters 2 and 3, and in appendix I.

Our review was performed in accordance with generally accepted government auditing standards and includes information to March 1992.

Chapter 2

Army Terminal Requirements and Satellite Issues

The Army's Milstar terminal requirements have been substantially reduced because of DOD's plans to restructure the Milstar program. A declining world threat makes additional reductions possible. The benefits of procuring Army Single Channel Objective Tactical Terminals (SCOTT), which have been under development for several years, are now questionable. In addition, DOD should resolve several satellite issues before it makes a major investment in acquiring new terminals or modifying the satellite design.

Terminal Program Background and Status

In December 1985, the Army initiated full-scale development of SCOTT. This terminal is designed to be transported by a 5/4-ton truck and trailer and operated by a three-person crew. The terminal has an antenna 5.5 feet in diameter. During the early 1980s, the Army planned to procure several hundred SCOTTs for tactical users. However, by the late 1980s, the Army's interest in these terminals had declined.

In a May 1990 classified report, we questioned the importance of the Army's requirements for Milstar capabilities because of several attempts by the Army during the 3 previous years to cancel SCOTT development. DOD responded that the Army lowered the priority of the SCOTT program because it could not afford the three additional personnel required to operate and maintain each terminal. Army representatives told us that SCOTT became too heavy, too expensive, and too limited (in terms of communications capacity) to meet tactical user requirements. Although the Army chose not to procure any SCOTTs for its own tactical use, DOD directed it to procure several of the terminals for joint users, including non-strategic nuclear forces, chief military commanders, and other organizations under the control of the Joint Chiefs of Staff. The Air Force also planned to procure some SCOTTs. However, as a result of Milstar program restructuring in 1991, DOD reduced the total planned quantity of SCOTTs by 74 percent—from 330 to 85.

Because of Milstar program restructuring, as well as lessons learned from Operation Desert Storm (the 1991 Gulf War), the Army has taken a renewed interest in Milstar. It plans to develop two new terminals, which are to be lighter weight and less expensive, but less survivable than SCOTT. The terminals are referred to as the secure, mobile, anti-jam, reliable, tactical terminal (SMART-T) and the single channel anti-jam manportable (SCAMP) terminal. SMART-T is to be transported on Army 5/4-ton high mobility multipurpose wheeled vehicles, without a trailer, and operated by a one- to two-person crew. The antenna is to be 4.5 feet in diameter. This

terminal is to be designed primarily to meet the Army's medium data rate and multichannel requirements, although it is also to have a low data rate capability. SCAMP is to be a manportable terminal, initially weighing about 30 pounds, with a goal of 12 pounds, and operated by the user. The antenna is to be 2 feet in diameter. This terminal is to meet the Army's low data rate and single channel requirements. The Army plans to start development of the two terminals in fiscal year 1992.

The Army's renewed interest in Milstar is based on the belief that future air-land operations will be similar to the Gulf War, where forces were widely dispersed on a non-linear battlefield and advancing units outdistanced the range of existing tactical communications systems. Army representatives stated that this type of conflict will require highly mobile satellite communications systems that are more easily deployed than SCOTT and will extend the range of existing communication systems, such as mobile subscriber equipment,[1] beyond line-of-sight to allow for continuous communications.

In January 1991, DOD reported to the Congress that the following quantities of Army terminals were planned: 85 SCOTTs, 337 SMART-Ts, and 185 SCAMPs. Table 2.1 shows that procurement cost estimates for these three terminals would be slightly under $1 billion.

Table 2.1: Estimated Army Terminal Procurement Costs

Dollars in Millions

Terminal	Quantity of terminals	Unit cost	Unit cost with spares	Total cost with spares
SCOTT	70[a]	$1.876	$4.40	$308.00
SMART-T	337	0.822	1.65	556.05
SCAMP	185	0.204	0.48	88.80
Total	**592[b]**			**$952.85**

[a]The Army's SCOTT requirement includes 15 engineering development model terminals acquired with research, development, test and evaluation funds, for a total of 85.

[b]Includes 7 SCOTTs, 137 SMART-Ts, and 35 SCAMPs to be acquired by the Air Force.

[1]This is an area communications system that includes mobile radio telephone service and data capability for maintaining command and control over forces. It was designed as a pre-established terrestrial communications grid, primarily to operate in a European conflict where forces were dispersed on a relatively linear battlefield.

SCOTT Production Is Questionable and New Terminal Quantities Could Change

Although SCOTT quantities were significantly reduced because of program restructuring, a decline in the world threat makes additional reductions possible. For example, in November 1991, the Army's user representative (Training and Doctrine Command) questioned the need for the SCOTT because of DOD's plans to eliminate ground-based theater nuclear weapons. Also, in its report on the DOD appropriations bill for fiscal year 1992, the conference committee noted that the rapidly evolving world situation undercuts the requirement for command and control of theater nuclear weapons and the final inventory objective (quantity available for use) for SCOTT. The conferees directed the Army to thoroughly re-examine its acquisition strategy for the terminals.

Program and test representatives told us that (1) the demand for SCOTTs is not high, (2) several SCOTTs still planned for non-strategic (theater) nuclear forces could be eliminated, and (3) additional reductions in requirements may be possible, bringing the procurement quantity to as low as nine. This would result in a total of 24 terminals (including the Army's 15 engineering development models). According to the representatives, such a low production quantity would substantially increase unit production and logistic support costs. These conditions raise a question about the benefits of producing any SCOTTs. Up to $308 million could be saved if the planned SCOTT procurement of 70 terminals were canceled. DOD representatives stated, however, that if this were done, the requirement for SMART-Ts could increase, offsetting some of the cost savings. Current Army plans for SCOTT are to perform an operational assessment based on previous development testing, and possibly a limited operational test in 1992. Production is scheduled for fiscal year 1993.

SCAMP terminal quantities could also change. For example, an August 1991 draft Army operational requirements document stated that over 3,500 SCAMP terminals were required—compared to the 185 currently planned. In November 1991, user representatives estimated that total SCAMP requirements may be about 2,500. Although quantities of this magnitude would increase program cost estimates, program representatives told us that such quantities would only be acquired if terminal weight could be reduced from the initial 30 pounds to the 12-pound goal, or less, and unit costs did not exceed $50,000, compared with the current estimate of $204,000. Despite these planned Army requirements, DOD representatives stated that no quantities beyond the current 185 have been validated by the Office of the Joint Chiefs of Staff.

Satellite Issues to Resolve

Some satellite issues related to the Army's tactical use of Milstar have not been resolved. For example, some uncertainty exists about whether Milstar is the most cost and operationally effective means of satisfying, primarily, the Army's tactical communication requirements. In addition, formal agreement has not been reached on certain satellite capabilities the Army claims it needs—specifically, sufficient capacity, assured connectivity, and antennas capable of neutralizing the effects of electronic jammers.

Cost and Operational Effectiveness of New Satellite Capability Is Uncertain

In restructuring the Milstar program, DOD decided to add a medium data rate capability to satellite number four and beyond. It stated that this new capability would enhance the tactical utility of Milstar by extending the range and flexibility of existing Army communications and provide retargeting and intelligence data to land and naval forces. The Army is expected to be the predominant user of this new capability. Despite the existence of alternatives, DOD has not demonstrated through analysis that a medium data rate capability on Milstar would be the most cost and operationally effective means of satisfying tactical communication requirements.

In February 1991, after DOD had reported its Milstar restructuring plans to the congressional committees, an Army assessment team spent approximately 3 weeks analyzing Army communication requirements and studying lessons learned during the Gulf War. The team's objective was to identify capabilities that would make Milstar more supportive of Army tactical needs. According to Army representatives, the war demonstrated that the Army had insufficient satellite communication capacity and too few terminals to support its forces. The team saw the restructured Milstar program as an opportunity to meet outstanding jam-resistant communication requirements. It identified alternatives to Milstar, but gave them very limited consideration because the Army preferred not to take the risk of starting a new program in a tight budget environment. The alternatives included a medium data rate capability on the existing Defense Satellite Communication System and on light weight satellites that were being studied by Lincoln Laboratories and the Defense Advanced Research Projects Agency.

In late 1991, DOD representatives informed us that a cost and operational effectiveness analysis of a restructured Milstar system would be performed and be part of the documentation requirements for the Defense Acquisition Board's planned review of the program in May 1992. Subsequently, we were told that this analysis would not be performed. Instead, DOD officials

believed that a comprehensive military satellite communication architecture study, which was done at the direction of the conference committee on the fiscal year 1991 defense appropriations bill, would suffice.

The architecture study, a summary of which was published in October 1991, considered several alternatives to satisfying all of DOD's long-term and short-term satellite communication requirements, including alternatives with and without a restructured Milstar and with medium data rate capabilities on satellites other than a restructured Milstar. The study showed that there were less costly alternatives for providing medium data rate capabilities than with a restructured Milstar. It recommended that options for the planned Milstar medium data rate payload be defined in time for the Defense Acquisition Board review in early 1992.

We were informed by several DOD representatives that a separate analysis of the restructured Milstar was performed by the Office of the Assistant Secretary of Defense for Program Analysis and Evaluation. According to some representatives, the analysis showed that a modified Defense Satellite Communication System was a less costly alternative. However, other DOD representatives discounted the analysis stating that the alternative did not meet all requirements. We requested access to the documentation, but program analysis officials stated that it was for internal use only, and were unwilling to comply with our request. We disagree with their position, but did not wish to withhold the issuance of this report until the differing views were resolved.

Capacity, Assured Connectivity, and Nulling Capability Issues

Army representatives stated that they were working to resolve other system issues to ensure that the Army (1) is allocated sufficient satellite capacity on the new medium data rate payload to meet critical communication requirements for command and control, (2) can have assured connectivity, when needed, involving both dedicated access to the satellites and useful placement of satellites in orbit, and (3) is provided a special nulling capability[2] on satellite antennas to neutralize electronic jammers.

DOD expects the medium data rate payload on each Milstar satellite to allow about 40 million bits of information to be passed through the satellite each

[2]This nulling capability refers to a satellite antenna's ability to sense high-powered radio signals and adapt its behavior to minimize the interference effects of those signals.

second. Army representatives stated that to satisfy critical Army communication requirements for commanding and controlling forces, at least 34.4 million bits per second would be needed—about 86 percent of the total planned throughput capacity for each satellite. This is considered to be the amount necessary for one corps consisting of five divisions. However, for planning purposes in developing requirements, Army representatives consider a notional force size for most anticipated theater conflicts to consist of two corps (with five divisions each), which would require 68.8 million bits per second.

After considering the multiservice aspects of the Milstar program and the planned design of the medium data rate payload, the Army concluded that to justify its participation in the Milstar program, the minimum throughput capacity acceptable would be 30.7 million bits per second—about 77 percent of the total planned capacity for each satellite. The remaining capacity would be allocated among the Air Force, the Navy, and the Marine Corps. Army representatives stated that the remaining Army requirements of 38.1 million bits per second (68.8 minus 30.7) for two corps would still be unsatisfied. They also stated that formal approval for the minimum 30.7 million bits per second has not yet been received and that terminal development will not begin until such approval is granted.

Army representatives told us that access to this minimum capacity must be dedicated to Army operations—not based on a precedence protocol system whereby higher priority Milstar users could disrupt communications associated with commanding and controlling forces. This is not a new issue. In our May 1990 classified report, we stated that because validated Milstar requirements may exceed satellite capacity, DOD expected users to share the satellites on a demand basis, thus increasing Milstar's availability to more users. At that time, DOD planned to establish a priority protocol system, called precedence-based multiple access, designed to first assign communication service to high priority networks and then lower priority networks when capacity became available. In September 1990, DOD commented on our final report and stated that all networks would be accommodated based on the priority assigned by the unified commander. Currently, the Army has no plans to include such a protocol in its two new terminal designs, and there is no formal approval regarding such assured connectivity.

In addition, Army representatives told us that the Milstar satellites need to be placed in a geostationary or low-inclined orbit[3] to be useful for Army tactical missions. This is because the Army does not expect to be engaged in conflicts above 65 degrees north latitude or below 65 degrees south latitude. A high-inclined orbit, as has been planned for some of the Milstar satellites, is to gain polar coverage primarily for strategic users of the system's low data rate capabilities. The representatives maintain that satellites in these higher orbits would not contribute much to meeting Army tactical requirements. They further maintain that potential connectivity problems would be created when it became necessary to switch to a second satellite before the first satellite moved out of view—a procedure referred to as "handover." Formal agreement on this assured connectivity issue has also not been reached.

Finally, the Army has insisted that a nulling capability be placed on certain satellite antennas designed for Army use to neutralize electronic jammers and permit the use of smaller ground terminals—a desirable feature for mobile ground forces. Army representatives stated that without this feature (1) neither the SCAMP nor the SMART-T would meet Army requirements and (2) terminal weight, power levels, and antenna size would have to increase to provide the required jamming protection. They indicated that before Milstar restructuring, the lack of a nulling antenna on the satellite made the SCOTT design too large, too heavy, and too costly to provide more than limited tactical use.

Army representatives told us that the Office of the Joint Chiefs of Staff was drafting a requirement for a nulling capability, but that it has not yet been determined how this feature will be added to the satellite. The Air Force and the prime Milstar satellite contractor are considering nulling antennas, along with other satellite modifications, as part of the 14-month Milstar architecture study. However, the scope of work does not yet specifically require the contractor to include a nulling antenna.

How DOD resolves these issues—satellite capacity, assured connectivity, and nulling capability—is yet to be determined. Army representatives stated that if these issues are not resolved in a manner consistent with Army requirements, alternatives to Milstar may have to be pursued.

[3]A geostationary orbit refers to a circular orbit lying in the earth's equatorial plane at approximately 22,300 miles altitude where the orbital period is 24 hours, matching the rotation of the earth. Orbit inclination refers to the angle of the orbital plane relative to the earth's equatorial plane.

Conclusions

DOD's plans to restructure the Milstar program have significantly reduced the quantitative requirements for Army SCOTTs. The declining world threat has raised questions about the need for SCOTT. Considering the low procurement quantities anticipated, unit production and logistic support costs would likely increase. These factors make the benefits of procuring any of these terminals questionable. DOD may be able to substitute the lower cost SMART-T for any remaining SCOTT requirements.

DOD's plans to modify the Milstar satellite design have not been shown to be the most cost and operationally effective alternative toward satisfying tactical communication requirements. Instead, there are indications that less costly alternatives are available. A cost and operational effectiveness analysis specifically directed at a restructured Milstar would be preferable. Such an analysis could illuminate the relative advantages and disadvantages of each reasonable alternative on an equal-cost or equal-effectiveness basis. It could also better aid decisionmakers in judging whether Milstar modification would offer sufficient military benefit to be worth the cost. It should be done before DOD makes a major investment in medium data rate terminals or satellite modifications.

If Milstar is shown to be the most cost and operationally effective alternative to meeting tactical communication requirements, DOD then has three additional satellite issues to resolve which the Army states are important to its operations in using Milstar: (1) sufficient satellite capacity to meet communication requirements for commanding and controlling forces, (2) assured satellite connectivity (dedicated access to geostationary or low-inclined orbiting satellites) to preempt other users or preclude other users from disrupting communications, and (3) a capability to ensure communications in an electronic jamming environment.

Recommendations

We recommend that the Secretary of Defense consider canceling plans to procure Army SCOTTs, based on (1) the questionable need, (2) the likely higher unit costs associated with the anticipated low production quantities, and (3) the possibility that less costly SMART-Ts could be used as a substitute.

Before DOD begins a major investment in modifying the Milstar satellite and developing new medium data rate terminals, we recommend that the Secretary of Defense ensure that (1) a cost and operational effectiveness analysis is performed to determine whether Milstar is the best alternative for satisfying tactical satellite communication requirements and (2) the

issues associated with sufficient satellite capacity, assured satellite connectivity (access and orbit), and a capability for adequate communications in an electronic jamming environment are formally resolved if Milstar is determined to be the best alternative.

Agency Comments and Our Evaluation

DOD concurred with our recommendation to consider canceling the Army SCOTT program.

DOD did not concur with our recommendation regarding a cost and operational effectiveness analysis. Despite the existence of new evidence in a military satellite communications architecture study that less costly alternatives would also meet the requirements, DOD apparently has no incentive to reconsider the restructured Milstar, since the Congress approved DOD's approach in 1991. For this reason, we believe the congressional defense committees should obtain and review the new evidence.

Matter for Congressional Consideration

In view of DOD's apparent reluctance to reconsider the restructured Milstar plan, the congressional defense committees may wish to review the new evidence and direct DOD to perform a cost and operational effectiveness analysis, or justify its intended course of action, before providing additional Milstar funds.

Air Force Terminal Cost Savings and Program Risks

The Air Force has planned for several years to acquire two classes of Milstar terminals—command post and force element—both of which were to be used on various air and ground platforms. However, major changes, primarily as a result of restructuring the Milstar program, have occurred that have affected terminal quantities, costs, and schedules.

The total quantity of command post terminals to be procured has been significantly reduced and the Air Force may have an opportunity to save millions of dollars by selecting one contractor to finish production. The force element terminal is to be totally redesigned, and the Air Force expects to encounter significant risk in some areas during development of a new low cost terminal (LCT). Specifically, there are moderate to high technical risks associated with aircraft antennas and radomes.[1] This has also been an area of concern for several years with the airborne command post terminals.

Terminal Program, Background and Status

In September 1983, the Air Force initiated full-scale development of its Milstar terminals with two contractors under a leader-follower acquisition strategy. This strategy involved both contractors exchanging sufficient data to ensure that they would be equally capable of producing the terminals and could therefore compete for terminal production.

The Secretary of Defense, in a June 1989 acquisition decision memorandum for Milstar terminals, authorized the Air Force to proceed with low-rate initial production for 51 command post terminals during a 3-year period. In December 1989, the Air Force awarded initial production contracts to the two contractors for this first-generation terminal.

In June 1990, the Under Secretary of Defense for Acquisition approved an increase in the initial production quantity to 136 and extended the low-rate initial production period by 2 years. The Air Force planned to award a full-rate production contract in January 1994. However, in January 1991, as a result of Milstar program restructuring and a review of requirements, DOD reduced the total planned quantity of command post terminals by 66 percent, from 407 to 138.

The Air Force had also planned to acquire several hundred force element terminals. These terminals were characterized as second-generation

[1]These radomes refer to exterior covers mounted on the aircraft and designed to protect protruding antennas.

terminals with lower volume (physical size), weight, and cost than the command post terminals. They were to be used, for example, on B1-B aircraft and in ballistic missile launch control centers. However, as a result of program restructuring and a review of requirements, the Air Force decided to stop developing the original force element terminal, and instead, design the LCT to further reduce size, weight, and cost. The Air Force refers to the LCT as a third-generation terminal. During restructuring, DOD reduced the total planned quantity of this terminal class by 48 percent, from 541 to 279. Table 3.1 shows the changes in baseline cost estimates and quantities that have occurred to both classes of Air Force Milstar terminals during the past 2 years.

Table 3.1: Estimated Air Force Terminal Program Acquisition Costs and Quantities

Dollars in Billions

Appropriation account	June 1989	March 1991
Research, development, test, and evaluation	$2.327	$2.656
Procurement	5.697	2.369
Military construction	0.199	0.162
Total estimated costs	**$8.223**	**$5.187**
Terminal quantities	988[a]	444[b]

[a]Consists of 27 development terminals and 961 production terminals. Due to changing requirements between June 1989 and January 1991, the 961 production quantity decreased by 13 terminals, to 948 (407 command post and 541 force element).

[b]Consists of 27 development terminals and 417 production terminals (138 command post and 279 force element).

The Air Force released a request for proposal for the LCT in June 1991. The terminals are to be designed to operate at Milstar's low data rate, but are to be adaptable to the new medium data rate capability being planned for the Milstar system. In January 1992, the program office awarded demonstration and validation contracts, totaling about $39 million and extending through late 1993, to three contractors. After completing these contracts, an engineering and manufacturing development contract is to be awarded to a single contractor. According to Air Force documentation, this effort would require an estimated $780 million. A sole source production contract would then be awarded in 1997. The Air Force tentatively estimated total acquisition costs (development and production) at about $1.1 billion. Firmer cost estimates are being developed for the June 1992 system level Milstar program review by the Defense Acquisition Board.

Cost-Saving Opportunity

Millions of dollars could be saved by using a single contractor to complete Air Force command post terminal production. In 1989, upon entering low-rate initial production, the Air Force planned to eventually produce several hundred command post terminals for ground locations and airborne platforms. It split the initial quantities approximately in half and awarded two contracts—one to the leader and one to the follower. The purpose was to allow both contractors to demonstrate their capabilities to produce, test, integrate, and deliver production terminals. In 1991, upon restructuring the Milstar program, DOD reduced the quantity of command post terminals to 138. Additional reductions may be made as requirements undergo further review.

Using fiscal years 1989, 1990, and 1991 appropriations, the Air Force has thus far contracted for 43 command post terminals. It plans to award new contracts to produce the remaining 95 terminals. Program officials are considering two different approaches: (1) create competition between the leader and follower contractors and award a single contract for all 95 terminals to one contractor or (2) continue the earlier practice and split an additional year of production between the two contractors before creating competition the following year for the remaining quantity. They believe that by creating competition and selecting only one contractor, up to $133 million in command post terminal costs could be saved ($1.4 million savings per terminal times 95 terminals).

The continued use of two contractors is costly. For example, under the two basic low-rate initial production contracts, the average cost for each terminal was $5.2 million. In fiscal year 1991, when the options under the two basic contracts were exercised, the average cost for each terminal increased to $7.9 million. One reason was that with the available funds, neither contractor could be given sufficient quantities to achieve more economical production rates. By using one contractor to achieve greater efficiency, this additional cost could have been reduced.

The Air Force did not choose one contractor because a senior program official was concerned about (1) losing one of the original contractors before terminal field tests were performed with on-orbit Milstar satellites, (2) the fidelity of the cost models used to determine cost tradeoffs between a single and split contract, and (3) the potential of only one Air Force contractor remaining in the extremely high frequency satellite terminal business. Based on a program office assessment, the risk of selecting one contractor to finish command post terminal production is low. A decision on additional production is to be made after evaluating the contractors'

proposals. DOD officials stated that the source selection process is ongoing, and a contract decision is anticipated in June 1992.

Program Risks to Be Addressed

The Air Force states that there is moderate to high risk in portions of the LCT program, primarily because of technical challenges involving (1) limitations to aircraft antennas and (2) structural problems related to radomes for low-profile (stealth) aircraft. Schedules and costs are also placed at risk because of these technical challenges.

The Air Force plans to reduce the size and weight of the terminal to accommodate weight, power, and space limitations on specific aircraft platforms such as the B1-B and B-2 bombers. Terminal size (excluding antenna, radome, and input-output devices) is to be reduced from about 5,500 cubic inches—the size of the earlier force element terminal—to 717 cubic inches. The Air Force believes the risk of reducing the volume is low because the technology is mature, but the contractors must demonstrate their capabilities to achieve it.

According to Air Force documentation, developing special antennas for various stealth aircraft presents significant risk in terms of the type and size of antenna used and the antenna's location on the aircraft. For example, there are limits to how far the antenna can protrude outside and intrude inside the aircraft because of aircraft performance considerations. In addition, the antennas are required to operate under difficult environmental conditions such as vibration, noise, and shock. Considering these and other technical concerns, the Air Force characterized the antenna designs as being moderate to high risk.

Air Force documentation shows that LCT radome development is high risk and that multiple designs are probable. This is primarily because each platform type will require its own unique radome design and radome requirements are stringent and often conflicting. Thin radomes are desired because the materials that are available greatly weaken signal propagation at extremely high frequencies, which Milstar uses. However, the radomes must be sturdy enough to withstand aerodynamic loads and overpressure generated by possible weapon detonations—primarily nuclear.

The Air Force judges LCT program schedule risk to be moderate, in part, because of the development of antennas and radomes for unique applications. Schedule risk in these areas could result in contract delays for terminal-aircraft integration.

The Air Force judges LCT program cost risk to be moderate to high during the engineering and manufacturing phase because of unique technical challenges associated with new antenna designs. There is no cost data from similar efforts to use as a basis for the LCT program. The new radomes have even greater cost risk because the number of the design attempts that may be necessary cannot be predicted with confidence. In addition, reducing the size of the terminal may require multiple attempts at designing the necessary circuits. Finally, platform integration costs are risky because of the inherent uniqueness of each platform and the technical uncertainties that exist.

Radome Difficulties Are Not New

The high risk associated with LCT aircraft radome development deserves special attention because radome difficulties in the Milstar program are not new. Our May 1990 report stated that the radome material (a kevlar-polyester composite) for airborne command post aircraft (which uses command post terminals) lost strength from water absorption, fluttered in a supersonic airstream, and developed microcracks as it aged. Although program officials told us that these concerns were being resolved, additional concerns have developed. For example, the kevlar-polyester composite radome does not meet overpressure requirements, and the radome contractor has not produced quality radomes.

An alternate radome material was evaluated to solve overpressure requirements, but according to program officials, this effort will probably not continue because the declining strategic threat has resulted in plans to reduce the quantity of command post aircraft, and the estimated $80 million cost involved may not be justified. This means that the Air Force will continue installing kevlar-polyester composite radomes on command post aircraft. The program office and contractors are working to overcome the production quality problems.

DOD stated that the radome material for stealth aircraft, which will use the LCT, has not yet been selected.

Oversight and Exit Criteria Are Essential

Air Force documentation shows that the LCT is a totally new design effort. It also shows that there is (1) no physical connection between the work previously done on the program and the products to be supplied under the LCT contract and (2) no requirement for the hardware to be compatible with anything previously built or designed for the Milstar program. The

only constraint is that the LCT should be interoperable (capable of sending and receiving communications) with previously developed terminals.

The Air Force is not planning to have its contractors fabricate antennas or radomes—the most risky elements—during the demonstration and validation phase of the acquisition process. Instead, the contractors are only being asked to fabricate a brassboard processing unit for the terminal. The program office has initiated a separate effort to develop cost-effective antenna solutions for the demonstration contractors. In addition, it plans to use the results of the ongoing first-generation terminal development contract effort to enhance radomes as a basis for LCT radome development. The program office assessed the cost, schedule, and technical elements of this risk reduction project for antennas as moderate to high.

Program officials intend to brief the Defense Acquisition Board on the LCT in June 1992, when a total Milstar program review takes place. Subsequent to this review, the Air Force is not planning to obtain milestone approval from the Board before entering LCT engineering and manufacturing development. Air Force representatives stated that the original decision to proceed into this phase of the acquisition process was made in 1985 for the entire Milstar program. Although this may be acceptable, the important matter is that there be (1) sufficient high-level oversight of a risky, and potentially expensive terminal program and (2) the establishment of critical results (exit criteria) that must be attained during each phase of the acquisition process.

Conclusions

The Air Force has an opportunity to realize substantial cost savings at relatively low risk by selecting only one contractor to finish producing command post terminals. This could be done for the remaining necessary terminals after evaluating contractor bids on the next contract, which the Air Force plans to award in June 1992.

Considering the risks involved, DOD should maintain adequate oversight of the LCT program and establish separate criteria for exiting the LCT demonstration and validation phase and engineering and manufacturing development phase of the acquisition process.

Recommendations

Considering the relatively low risk, we recommend that the Secretary of the Air Force give primary consideration to achieving cost savings by selecting one contractor to finish producing the necessary command post terminals.

We recommend that the Secretary of Defense ensure that separate criteria is established for critical results that must be attained by the Air Force prior to entering LCT engineering and manufacturing development and prior to entering LCT production.

Agency Comments and Our Evaluation

DOD stated that it is premature to accept any recommendation to limit the command post terminal buy to one contractor based solely on estimated cost savings. It intends to weigh the estimated cost savings against program risk before making a decision. Program risk, according to the program office, is low. Therefore, we believe our recommendation has merit.

Regarding radome development, DOD stated that the key risk-reducing factor is to accomplish the design and fabrication in conjunction with the airframe contractor. Thus, DOD plans to defer radome development until the LCT program enters engineering and manufacturing development with a single contractor. Although we have no reason to question this approach, DOD's continuous program oversight will be very important, considering the stated high risk involved.

DOD concurred with our recommendation regarding establishment of exit criteria for the engineering and manufacturing development phase. We subsequently expanded this recommendation to include the demonstration and validation phase.

Navy Terminal Reliability and Production Issues

The Navy's Milstar terminal has been in low-rate initial production for about 2 years. After two operational tests, the terminal is still experiencing reliability deficiencies. The issue now is what level of production the Navy should pursue, considering terminal reliability and production contracting issues.

DOD reported to the congressional defense committees in January 1991 that under its Milstar restructuring plans, the Navy terminal program would remain the same. However, a Navy official told us that the Navy subsequently established some requirements for medium data rate capabilities on the satellites. The Navy plans to modify its production terminals to accommodate this capability instead of developing new terminals. It programmed $30 million in research, development, test, and evaluation funds for this effort, to begin in fiscal year 1994.

Terminal Program, Background and Status

In 1982, the Navy began full-scale terminal development for ships, submarines, and fixed shore locations. The primary differences among the three terminals are the size and weight of the antennas. The Navy's April 1989 decision coordinating paper established that a total of 397 terminals would be procured. However, the Navy's validated requirements are for 441 terminals.

In May 1989, the Defense Acquisition Board reviewed the Navy's terminal program. In his June 1989 acquisition decision memorandum, the Secretary of Defense authorized the Navy to proceed with low-rate initial production for 86 terminals in fiscal years 1990 and 1991. The memorandum required another milestone decision by the Board before the Navy could exercise additional contract options for full-rate production in fiscal year 1992. An operational evaluation was also scheduled to precede this decision.

The Navy's firm fixed price terminal development contract provides for 5 years of production during fiscal years 1990 through 1994. It also provides that procurement quantities may vary, plus or minus 50 percent, from contract targets in each of the 5 years. Program officials stated that if the minimum quantity is not procured each year, the contract would be subject to cancellation.

The Navy exercised the first low-rate production option in February 1990. Navy budget documents show that the average unit procurement cost for terminals under the current contract for fiscal years 1991 through 1993

options is about $1.6 million. Besides the terminal, this cost includes production support, trainers, peripheral equipment, and software support, but excludes installation and first-year nonrecurring costs such as tooling and production set-up.

Table 4.1 shows the Navy's original April 1989 planned procurements for fiscal years 1990 through 1994, compared with the minimum quantities allowable under the contract to avoid contract cancellation, and the quantities that have actually been procured or are currently planned to be procured. Because of funding reductions, the Navy has generally procured, and expects to continue procuring, quantities closer to the minimum levels. As a result, 235 terminals (441 less 206), or about 53 percent of the total requirement, will have to be procured after fiscal year 1994 under a new contract. According to program officials, terminal costs under a new contract would probably be substantially higher than the terminals now in production because the current contract was negotiated several years ago.

Table 4.1: Navy Terminal Planned Procurement Quantities for Fiscal Years 1990-1994

	Fiscal years						
Quantities	1990	1991	1992	1993	1994	Totals	Total requirement
Original plan	38	48	94	86	87	353	397
Minimum under contract	20	24	40	38	36	158	441
Actual or current plan	24	38	55	53	36	206	441

Reliability Deficiencies Not Fully Resolved

In May 1990, we reported that a 1988 operational test of the Navy's terminals, prior to beginning low-rate initial production, showed that the terminals did not meet the reliability criterion of 300 hours mean time between failure. The Navy test agency (Operational Test and Evaluation Force) concluded that the terminals had the potential to be reliable, and stated that the test results supported a recommendation for limited production. However, the test agency recommended the terminals not be introduced into the fleet until several corrective actions were accomplished and verified. Although program officials disputed some of the test agency's findings, some corrective measures were planned. Another operational test to verify the corrections was scheduled for 1990, prior to a decision on full-rate production.

During June to September 1990, the Navy's operational test agency performed another operational test of the terminals. The terminals again did not meet the reliability criterion of 300 hours mean time between failure. Although the test agency concluded that the terminals had the potential to be reliable, it stated that the test findings did not support a recommendation for a full production decision. It recommended that fleet introduction be limited to the low-rate initial production terminals and additional operational testing be scheduled to demonstrate terminal reliability. Table 4.2 compares the reliability results from the two operational tests.

Table 4.2: Navy Terminal Operational Reliability Results

	1988 Operational tests		1990 Operational tests	
Terminal type	Testing hours	Mean time between failure	Testing hours	Mean time between failure
Ship	1,338	61	1,921	96
Submarine	1,440	120	2,012	287[a]
Shore	1,440	289	2,008	183

[a]According to program officials, the operational test agency subsequently changed the submarine's terminal reliability to 335 mean hours between failure, thus exceeding the 300-hour criterion. However, one test limitation involved the submarine's inability to go to sea because of diesel generator problems. This prevented testing the terminal in an operational environment.

Subsequent to the 1990 operational test, the program office performed an analysis of each reliability failure and took exception to the operational test agency's unsatisfactory rating. It concluded that among the 38 failures reported by the test agency, only 7 were critical and should be counted. The remaining 31 reported failures were characterized as incorrect assessments, test misunderstandings, multiple reporting, and an installation error.

In re-computing the mean time between failure, the program office concluded that the three terminal types substantially exceeded the 300-hour criterion. It also determined that because the low-rate initial production terminals would not be fielded until fiscal year 1993, complying with the test agency's recommendation for additional testing would result in a major break in production and an estimated $168 million program cost increase.

In an effort to resolve the terminal reliability issue, different elements within the Navy proposed two different solutions—reliability growth testing by the developers and a follow-on operational test and evaluation by the operational test agency. Regarding reliability growth testing, specialists

within the Office of the Assistant Secretary of the Navy for Research, Development, and Acquisition performed a program review, focusing on terminal design, production, and test data, to determine relative inherent reliability of the hardware. The reported results were that the program design was sound, and that the terminal had the capability to meet the reliability requirement and the potential to exceed it after modifications and corrective actions. Terminal production, however, was characterized as needing improvements in selected areas, and the contractor was reportedly working to resolve the issues. The recommendation was to perform a 6-month reliability growth test on a production terminal, from February 1992 to August 1992, instead of performing a follow-on operational test and evaluation. It was expected that a production rate decision could be made in June 1992. The reliability growth test is estimated to cost about $500,000.

From a different perspective, the Director of Test and Evaluation and Technology Requirements, within the Office of the Chief of Naval Operations, stated that the proposed 6-month reliability growth test could not be used as a substitute for an operational test. His position was that testing at a contractor's site in a fully controlled environment with real-time analysis by highly qualified design/reliability engineers is not a fleet operating environment with sailors as operators. The Director proposed that a follow-on operational test and evaluation of approximately 30 days be performed in early 1992. However, the existing development terminals would have to be used for the test because the necessary quantity of production terminals would not be fielded until fiscal year 1993. The cost of this test was estimated to range from $1 million to $1.5 million.

Navy officials suggested that four possible options were available: (1) no further testing, (2) reliability growth testing, (3) follow-on operational testing, and (4) both reliability growth and follow-on operational testing. They stated that the first option of no further testing would probably not be acceptable.

Conflicting Factors to Consider in Continuing Production

Conflicting factors regarding reliability testing and production contracting should be considered when deciding how best to proceed with Navy terminal production. For example, performing reliability growth testing alone, even using a low-rate production terminal, would not satisfy all the decision criteria in DOD Instruction 5000.2 for entering full-rate production—specifically, the one regarding operational acceptability. These criteria require the milestone decision authority to confirm that test

results and low-rate initial production provide reasonable assurance that the design is stable, operationally acceptable, logistically supportable, and capable of being produced efficiently.

Performing follow-on operational testing alone would be more acceptable because of greater operational realism. However, program officials indicated that some risk would be involved because the same development model terminals that have already undergone considerable testing would have to be used, and these terminals would not contain all reliability improvements. Performing both tests, if practical, may be most desirable to gain sufficient knowledge on terminal reliability.

The reliability issue poses difficulties regarding how best to proceed with production. Generally, production should be performed at the most efficient rate possible to achieve the lowest unit cost. In this case, we believe the remaining annual terminal production quantities should be determined after considering additional reliability test results.

Navy program officials told us that for fiscal year 1992, the Congress provided procurement funding for 55 terminals. However, if reliability testing shows that the terminal is still not fully satisfactory, the Navy could procure as few as 40 terminals—the minimum allowable to avoid contract cancellation—or consider alternative actions. If testing shows the terminal to be sufficiently reliable, procuring larger quantities in fiscal years 1993 and 1994 than are now planned would be desirable. The purpose would be to avoid having to procure larger quantities under a new contract, starting in fiscal year 1995, probably at higher unit costs. The most prudent approach depends on the severity and resolution of the reliability problem.

Conclusions

Caution is necessary regarding continued production of the Navy's Milstar terminals because of the following conflicting factors: (1) the unresolved reliability issue, (2) the minimum contract production quantities to avoid contract cancellation, and (3) the potential for higher procurement costs under a new contract. DOD will have to reconcile these matters before the Navy proceeds with terminal production.

Recommendations

Before approving additional production of Navy Milstar terminals, we recommend that the Secretary of Defense (1) assess the results of the Navy's operational testing, particularly reliability, planned for completion in August 1992 and (2) determine the optimum annual full production quantities the Navy should procure under the existing production contract.

Agency Comments

DOD agreed with the recommendations.

Chapter 5

Comprehensive Annual Selected Acquisition Reports

Selected acquisition reports (SARs) are prepared by DOD on major defense acquisition programs for submission to the Congress. Comprehensive annual SARs are intended to provide the Senate and House Committees on Armed Services with program information, including summaries of program costs, schedules, performance characteristics, data on major contracts, and production rates, that is needed to perform oversight functions.

The submission of annual SARs for current major defense acquisition programs is required by public law—10 U.S.C. 2432. A major defense acquisition program is defined in 10 U.S.C. 2430 as one that is not a highly sensitive classified program as determined by the Secretary of Defense and is either (1) designated by the Secretary of Defense to be a major defense acquisition program or (2) estimated by the Secretary of Defense to require an eventual total expenditure of more than $200 million in research, development, test, and evaluation funds or more than $1 billion in procurement funds (both in fiscal year 1980 constant dollars).[1]

Although Milstar has always greatly exceeded the dollar criteria for a major defense program, DOD did not submit SARs annually because it considered Milstar to be a highly sensitive classified program. However, the National Defense Authorization Act for Fiscal Years 1990 and 1991 (Public Law 101-189), which was enacted on November 29, 1989, required that the Secretary of Defense submit a SAR on the total Milstar program to the congressional defense committees. DOD complied with this requirement by preparing separate SARs, as of December 1989, on each of the four subprograms—Air Force satellite and mission control and Army, Navy, and Air Force terminals. In November 1990, after discussions with the DOD Office of General Counsel, officials within the Office of the Secretary of Defense concluded that the December 1989 SARs fulfilled the requirement of the authorization act and that further submission of such Milstar reports to the Congress was unnecessary.

In its July 1991 report authorizing defense appropriations for fiscal years 1992 and 1993, the Senate Committee on Armed Services directed that a new SAR for Milstar be provided to the congressional defense committees by May 15, 1992. The new SAR was expected to show the changes that will be made in Milstar as a result of program restructuring. However, the

[1]DOD's current criteria in fiscal year 1990 constant dollars is approximately $300 million in research, development, test, and evaluation funds, or approximately $1.8 billion in procurement funds.

report language indicates that the SAR is being requested on a nonrecurring basis.

As a result of restructuring, DOD officials told us that in February 1992, the Secretary of Defense determined that Milstar was no longer a highly sensitive classified program. There is now a need for DOD to begin submitting annual SARs on the Milstar program.

There has been considerable congressional interest in Milstar during the past several years. As a result of the major changes planned for the program—satellite modifications, including a new satellite payload, and three new types of terminals—Milstar has essentially become a new development program. Considering these factors and DOD's characterization of overall program risk, several goals, including estimated costs, planned schedules, expected performance capabilities, and total quantities could change as development progresses.

Conclusions

The Secretary of Defense is required to submit SARs to the Congress for major defense acquisition programs that are not highly sensitive classified programs. Because Milstar is no longer a highly sensitive classified program, 10 U.S.C. 2432 requires that annual Milstar SARs be submitted. This could aid congressional oversight on the multibillion dollar program because restructuring plans are substantial and changes are likely to occur as system development progresses.

Recommendation

We recommend that the Secretary of Defense begin submitting comprehensive annual SARs to the Congress on the total Milstar program as required by 10 U.S.C. 2432.

Agency Comments

DOD agreed with the recommendation and plans to submit the first annual Milstar SAR in August 1992.

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

April 10, 1992

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

Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "MILITARY SATELLITE COMMUNICATIONS: Milstar Program Issues and Cost-Saving Opportunities," dated February 26, 1992 (GAO Code 395146), OSD Case 8967.

The Department generally concurs with the report. Detailed DoD comments on the report findings and recommendations are provided in the enclosure.

The Department appreciates the opportunity to comment on the draft report.

Sincerely,

Duane P. Andrews

Enclosure

GAO DRAFT REPORT - DATED FEBRUARY 26, 1992
(GAO CODE 395146) OSD CASE 8967-X

"MILITARY SATELLITE COMMUNICATIONS: MILSTAR PROGRAM ISSUES AND COST-SAVINGS OPPORTUNITIES"

DEPARTMENT OF DEFENSE COMMENTS

* * * * *

FINDINGS

FINDING A: Milstar Program Restructuring. The GAO reported that, during the last 10 years, the DoD has invested more than $5 billion developing the space, mission control, and terminal segments of the Milstar program. The GAO explained that the National Defense Authorization Act for FY 1991 directed the Secretary of Defense to develop and carry out a plan for either a restructured Milstar or an alternative advanced communications satellite program, in order to reduce program costs, increase utility for tactical forces, and eliminate unnecessary capabilities for protracted nuclear warfighting missions and operations.

The GAO noted that, in January 1991, the DoD reported to the congressional defense committees its plans to restructure the Milstar program and cut cost by reducing (1) the constellation size from eight to six satellites, (2) the number of ground-based control stations from 25 to nine, and (3) the total terminal quantity from 1,721 to 1467--eliminating the most costly and complex terminals. The GAO noted that several survivability features on satellites and ground equipment are also to be eliminated. The GAO observed that, in order to improve system utility to tactical forces, the DoD plans to increase communications capacity by adding a medium data rate capability to the satellite, modifying the number and types of antennas on the satellites, and acquiring three new and smaller types of terminals.

The GAO reported the DoD estimated that, as a result of the restructuring, the overall program risk would increase from low to medium due--primarily due to (1) required major modifications to the satellite design, (2) the addition of the new Army terminal designs, and (3) a revised Air Force terminal design. The GAO reported that the restructuring could save about 25 percent of the 20-year program life-cycle costs. (pp. 8-10/GAO Draft Report)

DOD Comments: Concur.

FINDING B: Single Channel Objective Tactical Terminal Production Is Questionable and New Terminal Quantities Could Change. The GAO reported that the Army Milstar terminal requirements have been reduced substantially because of DoD plans to restructure the Milstar program and the declining world threat. The GAO noted that the benefits of procuring the relatively large Army Milstar terminal, the Single Channel Objective Tactical Terminal, is now questionable. The GAO found the Single Channel Objective Tactical Terminal program terminals became too heavy, too expensive, and too limited in communications capacity to meet tactical user requirements. The GAO reported that, although the Army chose not to procure any Single Channel Objective Tactical Terminal program terminals for its own tactical use, the DoD directed it to procure several terminals for joint users. The GAO noted that the Air Force also planned to procure some Single Channel Objective Tactical Terminal program terminals. The GAO found, however, that as a result of 1991 Milstar restructuring, the DoD reduced the total planned quantity of Single Channel Objective Tactical Terminal program terminals by 70 percent, from 330 to 85.

The GAO also found that, because of program restructuring and lessons learned from Operation Desert Storm, the Army has taken a renewed interest in Milstar, and plans to develop two new terminals--which are to be lighter weight and less expensive, but less survivable than the Single Channel Objective Tactical Terminal.

In addition, the GAO found that, although Single Channel Objective Tactical Terminal quantities were reduced significantly because of program restructuring, a decline in the world threat makes additional reductions possible. The GAO observed that the Army Training and Doctrine Command questioned the need for the Single Channel Objective Tactical Terminal program terminals because of DoD plans to eliminate ground-based theater nuclear weapons. The GAO reported that the House and Senate Appropriations Committee Conference report on FY 1992 defense appropriations noted that a rapidly evolving world situation undercuts the requirement for command and control of theater nuclear weapons and the final inventory objective for the Single Channel Objective Tactical Terminal program terminals. The GAO concluded that the demand for the Single Channel Objective Tactical Terminal is not high--that several planned for non-strategic (theater) nuclear forces could be eliminated, and that additional reductions in requirements may be possible, bringing the procurement quantity as low as nine (along with 15 Army engineering development models).

The GAO further concluded that such a small quantity would increase unit production and logistics support costs substantially, raising a question about the need to produce any Single Channel Objective Tactical program terminals. The GAO also concluded that $308 million could be saved if the planned Single Channel Objective Tactical Terminal procurement of 70 terminals were canceled. The GAO did note that the savings would be offset somewhat by an increased need for other terminals. (pp. 11-14/GAO Draft Report)

DOD Comments: Concur. The Department is considering the termination of the Single Channel Objective Tactical Terminal program without entering production due to the evolving international security environment, force structure reductions, and the ability of other, cheaper terminals to satisfy remaining requirements. The procurement of alternative terminals to satisfy validated requirements will offset some of the savings from the termination. The Department will complete the analysis and make a final decision in conjunction with the June 1992 Defense Acquisition Board review of the program.

FINDING C: Cost and Operational Effectiveness of New Satellite Capability Is Uncertain. The GAO reported that some uncertainty exists about whether Milstar is the most cost and operationally effective means of satisfying primarily an Army tactical communication requirement. The GAO explained that the DoD decided to add a medium data rate capability to satellite number four and beyond to enhance the tactical utility of Milstar by extending the range and flexibility of existing Army communications and providing retargeting and intelligence data to land and naval forces. The GAO found that, despite the existence of alternatives, the DoD has not demonstrated through analysis that a medium data rate capability on Milstar would be the most cost and operationally effective means of satisfying tactical communications requirements.

The GAO found that an Army assessment team, which analyzed Army communication requirements and lessons learned from the Gulf War, indicated that the war demonstrated the Army had insufficient satellite communications capacity and too few terminals to support its forces. The GAO reported that a broad military satellite communication architecture study was performed at the direction of the House and Senate Conference on the FY 1991 Defense appropriations bill. The GAO explained that the study considered several alternatives for satisfying all of the DoD long and short-term satellite communication requirements, including alternatives with and without a restructured Milstar, and with medium data rate

capabilities on satellites other than a restructured Milstar. The GAO reported that the study showed less costly alternatives for providing medium data rate capabilities than with a restructured Milstar. The GAO also noted the study recommended that options for the planned Milstar medium data rate payload be defined in time for the Defense Acquisition Board review in early 1992.

The GAO reported that there was a separate analysis of the restructured Milstar, performed by the Office of the Assistant Secretary of Defense for Program Analysis and Evaluation, which showed that a modified Defense Satellite Communications System was a less costly alternative. The GAO noted, however, that DoD representatives discounted the analysis because the alternative did not meet all requirements. The GAO nonetheless concluded that there are indications that less costly alternatives are available for satisfying tactical communications requirements other than modifying the Milstar satellite design. (pp. 13-15/GAO Draft Report)

See comment 1.

DOD Comments: Partially concur. During the restructure in the Fall of 1990, the Services, the Joint Staff, and the staff of the Office of the Assistant Secretary of Defense (Command, Control, Communications and Intelligence) examined various Milstar constellation sizes, different Milstar payload options, and alternatives that terminated Milstar including common bus Super High Frequency approaches. Following the studies, the Department decided that the restructured Milstar program was the best overall approach. The Department briefed the Congress on its proposal in January 1991. The Congress approved the approach and authorized additional funds to implement the restructured program.

The Military Satellite Communications architecture study examined similar and additional alternatives. The study concluded that several alternatives did not satisfy requirements acceptably, but that there were a few alternatives, including the baseline architecture, that were acceptable--one potentially more expensive than the baseline, two potentially cheaper. The two potentially cheaper alternatives were judged to have high technical risk and larger cost uncertainties. The DoD plans to pursue the potentially cheaper alternatives by further developing the technologies involved, reducing risks, and reevaluating the architectures in FY 1996- FY 1997 in time for follow-on efforts to the initial block of Milstar medium data rate satellites.

FINDING D: Capacity, Assured Connectivity, and Nulling Capability Issues. The GAO reported that, if Milstar is shown to be the most cost and operationally effective alternative for meeting tactical communications requirements, the DoD needs to resolve three additional satellite matters of importance to Army operations (1) sufficient satellite capacity to meet critical and valid communication requirements for command and control, (2) assured satellite connectivity (dedicated access to geostationary or low-inclined orbiting satellites) to preempt other users or preclude other users from disrupting communications, and (3) a nulling capability on satellite antennas to neutralize the effects of electronic jammers.

The GAO reported that, after considering the multiservice aspects of the Milstar program and the planned design of the medium data rate payload, the Army concluded that to justify its participation in the Milstar program, the minimum throughput capacity acceptable would be 30.7 million bits per second--about 77 percent of the total planned capacity for each satellite. The GAO noted that would leave the remaining Army requirement of 38.1 million bits per second still unsatisfied. The GAO found that formal approval of the minimum 30.7 million bits per second has not yet been received by the Army and terminal development will not begin until such approval is granted. The GAO also explained that the Army access to this minimum capacity must be dedicated to Army operations, not based on a precedence protocol system whereby higher priority Milstar users could disrupt communications. The GAO noted that, currently, the Army has no plans to include a priority protocol system in its two new terminal designs, and there is no formal approval regarding the assured connectivity the Army desires.

The GAO also found that the Army needs Milstar satellites placed in a geostationary or low-inclined orbit to be useful for its tactical missions. The GAO noted that satellites in high-inclined orbits would not contribute much to meeting Army tactical requirements and could create potential connectivity problems, when it becomes necessary to switch to a second satellite before the first satellite moved out of view. The GAO reported that formal agreement on the assured connectivity issue also had not been reached.

In addition, the GAO found that the Army has insisted that a nulling capability be placed on certain satellite antennas designed for Army use to neutralize electronic jammers and permit the use of smaller ground terminals. The GAO reported that the Joint Chiefs of Staff was drafting a requirement for a nulling capability, but has not yet determined how such a feature will be added to the

satellite. The GAO noted that, according to Army representatives, if the cited issues are not resolved in a manner consistent with Army requirements, alternatives to Milstar may have to be pursued. (pp. 15-18/GAO Draft Report)

See comment 2.

DOD Comments: Partially concur. The Department is in the process of resolving each of the cited issues. The Department has informally resolved the issues related to capacity, assured connectivity, and nulling capability. Formal resolution will occur at the June 1992 Defense Acquisition Board review.

The constellation issue is being addressed via the overall Military Satellite Communications architecture process which includes key decision opportunities. The Department would like to resolve the constellation issue as soon as possible, but recognizes that formal resolution may not occur at the June 1992 Defense Acquisition Board.

In addition, the Department offers the following information to correct two points associated with this finding.

> First, the GAO has stated that the Army has "critical and valid" communication capacity requirements. The Department depends on the Joint Requirements Oversight Council to validate requirements and assess criticality. The Council will meet as part of the Defense Acquisition Board review. Until the Council validates the requirements, it may be premature to call them "critical and valid".
>
> Second, although the Army thinks a nulling antenna may be a good solution to its requirements, the actual requirement is to communicate at medium data rates in the threat environment.

FINDING E: Air Force Terminal Cost Savings Opportunity. The GAO reported that, primarily as a result of restructuring the Milstar program, major changes have occurred--which have affected the terminal quantities, costs, and schedules. The GAO found that, in January 1991, as a result of Milstar program restructuring and a review of requirements, the DoD reduced the total planned quantity of command post terminals by 66 percent--from 407 to 138. The GAO also noted that the program restructuring and review of requirements led the Air Force to stop developing the original force element terminal and, instead, design the new Low Cost Terminal to further reduce size, weight, and cost. The GAO reported that, during restructuring, the DoD reduced

the total planned quantity of the Low Cost Terminal class by 48 percent--from 541 to 279. The GAO explained that, in January 1992, the Air Force awarded demonstration and validation contracts to three contractors--(1) totaling almost $40 million and (2) extending through late 1993. The GAO noted that the Air Force then plans to award a single engineering and manufacturing development contract for an estimated $780 million.

The GAO found that millions could be saved if the Air Force used a single contractor to complete the command post terminal production. The GAO noted that the Air Force has thus far, contracted for 43 command post terminals, and plans to award new contracts to procure the remaining 95 terminals. The GAO explained it is the Air Force view that, by creating competition and selecting only one contractor, up to $133 million in command post terminal costs could be saved ($1.4 million savings per terminal times 95 terminals). The GAO found, however, that continuing to use two contractors is costly. The GAO reported that the average cost per terminal was $5.2 million under the two basic low-rate initial production contracts, which then rose to $7.9 million in FY 1991, when the options under the two basic contracts were exercised. The GAO concluded that one reason for the increase was that, with the limited available funds, neither contractor could be given sufficient quantities to achieve more economical production rates. The GAO further concluded that, by using one contractor to achieve greater efficiency, the additional cost could have been reduced.

The GAO reported that the Program Executive Officer concerns about using only one contractor included (1) losing one of the original contractors before terminal field tests were performed with on-orbit Milstar satellites, (2) the fidelity of the cost models used to determine cost tradeoffs between a single and split contractors, and (3) the potential of only one Air Force contractor remaining in the extremely high frequency satellite terminal business. The GAO noted, however, that the risk of selecting only one contractor to finish command post terminal production is considered low. (pp. 20-23/GAO Draft Report)

See comment 3.

DOD Comments: Partially concur. The GAO incorrectly implies that the Air Force has decided to maintain two Command Post terminal contractors. The GAO further implies that the split buy versus down select decision should be based solely on cost. It is premature to accept any recommendation to limit the final Command Post terminal buy to one contractor based solely on estimated cost savings. Instead, the Department is taking a more balanced approach

by weighing estimated cost savings against the program risk associated with down selecting to one contractor. Furthermore, the Department will use actual contractor bids, not internal estimates, to evaluate the benefits. That will allow the Department to make a well informed acquisition decision.

FINDING F: Low Cost Terminal Program Risks Moderate to High. The GAO reported that there is moderate to high risk in portions of the Low Cost Terminal program primarily because of technical challenges involving (1) limitations to aircraft antennas, and (2) structural problems related to radomes for low-profile (stealth) aircraft. The GAO noted that the schedules and costs are also placed at risk because of the technical challenges.

The GAO found the risk of reducing the terminal size, to meet volume limitations of platforms (like the B1-B and the B-2) is low because the technology is mature, but the contractors must demonstrate their capabilities to achieve the reduced size. The GAO concluded, however, that developing antenna designs for various stealth aircraft presents moderate to high risk in terms of the type and size of antenna used and the antenna location on the aircraft.

The GAO also found the Low Cost Terminal radome development is high risk and multiple designs are probable, primarily because each platform type will require its own unique radome design, and radome requirements are stringent and often conflicting. The GAO also reported that the kevlar-polyester composite radome does not meet overpressure requirements, and the contractor had not produced quality radomes. The GAO noted that, while an alternate radome material was evaluated to solve overpressure requirements, the effort will probably not continue because the declining strategic threat has resulted in plans to reduce the quantity of command post aircraft, and the estimated $80 million cost involved may not be justified.

The GAO reported the Low Cost Terminal program schedule risks are moderate, in part, because of (1) the potential for contractors to underestimate the number of iterations necessary to build integrated circuits within the time constraints, and (2) the development of antennas and radomes for unique applications. The GAO noted that schedule risk in these phases could result in contract delays for terminal-aircraft integration.

In addition, the GAO found that the Air Force judges the Low Cost Terminal program cost risk to be moderate to high

during the engineering and manufacturing phase, because of the unique technical challenges associated with new antenna designs. The GAO explained there is no cost data from similar efforts for comparison, and the new radomes have even greater cost risk because the number of the design attempts that may be necessary cannot be predicted with confidence. The GAO also pointed out that reducing the size of the terminal may require multiple attempts at designing the necessary circuits, and platform integration costs are risky because of the inherent uniqueness of each platform and the related technical uncertainties that exist. The GAO concluded that the Air Force may not be placing sufficient emphasis on reducing aircraft antenna and radome risks during the demonstration and validation phase of the Low Cost Terminal acquisition process. (pp. 23-24/GAO Draft Report)

See comment 4.

DOD Comments: Partially concur. The GAO implies that the Air Force is not addressing the risks associated with the Low Cost Terminal. To the contrary, the first part of a two-part acquisition strategy is focused on reducing risk prior to Engineering and Manufacturing Development. The first phase is a multiple contract award in which the contractors demonstrate their capability to meet the terminal performance requirements and prove their integrated product development process. Additionally, several risk reduction contracts will be awarded for antenna and power amplifier development. All of the efforts are structured to reduce risk before entry into the second phase of the acquisition strategy. The second phase, Engineering and Manufacturing Development, completes the design and fabrication of the Low Cost Terminal by a single contractor using the contractor's integrated product development process.

The kevlar-polyester radome issue is not an issue associated with the Low Cost Terminal, but with the Command Post terminal. The material for the Low Cost Terminal radome has not been selected. There are funds within the program for radome development, including material selection and radome fabrication.

The GAO also raised an issue with respect to risk in the development of multiple integrated circuits, based on the potential risk outlined in the Low Cost Terminal Acquisition Plan. Now that the Department has awarded the demonstration contracts, it has been determined that only one integrated circuit will be developed. Consequently, the risk has been dropped as an issue.

The Department disagrees that the Air Force may not be placing sufficient emphasis on reducing aircraft antenna and radome risk. The Air Force is addressing antenna issues through multiple risk reduction contracts. Those efforts will reduce risk during the Engineering and Manufacturing Development phase. The Department has determined that the key to reducing risk in radome development is to work closely with the airframe contractor during radome design and fabrication. Since radome development is unique to the host platform, Low Cost Terminal radome development will be deferred until the program enters Engineering and Manufacturing Development with a single contractor.

FINDING G: Milestone Approval Not Planned. The GAO reported that the Low Cost Terminal is a totally new design effort, with (1) no physical connection between the work done previously on the program and the products to be supplied under the Low Cost Terminal contract, and (2) no requirement for the hardware to be compatible with anything built previously or designed for the Milstar program (except that the terminal should be interoperable with previously developed terminals). The GAO found that, despite the new development effort and the significant risks involved in the program, the Air Force is not planning to have its contractors fabricate antennas or radomes during the demonstration and validation phase of the acquisition process--even though the antennas and radomes are the most risky elements

The GAO also found that, although program officials intend to brief the Defense Acquisition Board on the Low Cost Terminal in May 1992 (when a total Milstar program review takes place), they are not planning to obtain milestone approval from the Board before entering the engineering and manufacturing development phase of the acquisition process. The GAO reported that the reason for not doing so was that the original decision to proceed into this phase was made in 1985 for the entire Milstar program. The GAO concluded that this approach will not provide (1) sufficient high-level oversight of a risky, and potentially expensive terminal program, or (2) the opportunity to establish critical results (exit criteria) that must be attained during the engineering and manufacturing development phase. (pp. 24-25/GAO Draft Report)

See comment 4.

DOD Comments: Partially concur. First, the GAO has incorrectly stated Air Force plans for risk reduction associated with the antennas and radome. As stated in the DoD response to Finding F, the Air Force will award multiple contracts for antenna and power amplifier risk reduction.

Experience and economics requires us to attack radome risks after the decision to down select to one contractor.

The Milstar program is already in the Engineering and Manufacturing Development phase. It is unnecessary to re-validate that decision with a Milestone review of the Low Cost Terminal. On the other hand, the Defense Acquisition Board review of the program scheduled for May 1992 will review the Low Cost Terminal efforts. Although Milestone approval is not the goal, the Defense Acquisition Board review will be thorough. The Defense Acquisition Board will establish exit criteria, as appropriate, based on the review.

FINDING H: Navy Terminal Reliability Deficiencies Not Fully Resolved. The GAO reported that, after two operational tests, the Navy Milstar terminal, which has been in low-rate initial production for about two years, is still experiencing reliability deficiencies. The GAO reported that operational tests of the Navy terminals in 1988, prior to low-rate initial production, and, from June to September 1990, to verify corrections, concluded that the terminals did not meet the reliability criterion of 300 hours mean time between failure. The GAO noted that the Navy operational test agency concluded, as a result of the 1990 tests, that the terminals had the potential to be reliable, but the test findings did not support a recommendation for a full production decision.

The GAO reported that different elements within the Navy have proposed a number of solutions to resolve the terminal reliability issue, including (1) reliability growth testing by the developers, (2) follow-on operational test and evaluation by the operational test agency, or (3) both. The GAO observed that conflicting factors regarding reliability testing and production contracting need to be considered when deciding how best to proceed with Navy terminal production. The GAO pointed out that performing reliability growth testing alone, even using a low-rate production terminal, would not satisfy all the decision criteria in DoD Instruction 5000.2 for entering full-rate production, specifically the one regarding operational acceptability. The GAO reported that performing follow-on operational testing alone would be more acceptable because of greater operational realism--although some risk would be involved because the same development model terminals that have already undergone considerable testing would have to be used, and the terminals would not contain all reliability improvements. The GAO concluded that, if practical,

performing both tests may be most desirable to gain sufficient knowledge on terminal reliability.

The GAO reported that, generally, production should be performed at the most efficient rate possible to achieve the lowest unit cost. The GAO concluded, however, that, in case of the Navy, the remaining annual terminal production quantities should be determined after considering additional reliability test results. The GAO explained that, while Congress provided procurement funding for 55 terminals in FY 1992, the Navy could procure as few as 40 terminals, if reliability testing shows the terminal is still not fully satisfactory. The GAO observed that, if testing shows the terminal to be sufficiently reliable, procurement of larger quantities than is now planned in FY 1993 and FY 1994 would be desirable to avoid having to procure larger quantities under a new contract starting in FY 1995, which would probably be at a higher unit cost. The GAO noted that the most prudent approach depends on the severity and resolution of the reliability problem. The GAO concluded that caution is necessary regarding continued production of the Navy Milstar terminals because of (1) the unresolved reliability issue, (2) the minimum contract production quantities to avoid contract cancellation, and (3) the potential for higher procurement costs under a new contract. The GAO noted that the DoD needs to reconcile those issues before the Navy proceeds with terminal production. (pp. 26-30/GAO Draft Report)

DOD Comments: Concur. The Department agrees that caution is necessary regarding production of the Navy Extremely High Frequency Satellite Communication Program AN/USC-38(V) terminals because of (1) the unresolved reliability issue, (2) the minimum contract production quantities to avoid contract cancellation, and (3) the potential for higher procurement costs under a new contract. The Navy previously developed a well established approval process to reconcile all the issues before proceeding to terminal full production.

In January 1992, the Navy terminal program was designated by the Under Secretary of Defense for Acquisition as an Acquisition Category I Component program. In accordance with DOD Instruction 5000.2, major acquisition decisions for the program are made at the Service component Acquisition Executive level. For the Navy, that is the Assistant Secretary of the Navy (Research, Development and Acquisition). The Navy terminal has undergone extensive development testing and two major phases of operational at sea testing by the Navy independent testing activity (Commander, Operational Test and Evaluation Force). The

Navy terminal program is the most mature of all the Milstar related terminal programs and is the only terminal program to date to have undergone formal operational testing.

The GAO reported that different elements of the Navy proposed a number of solutions to resolve the terminal reliability issue that were noted in the Operational Evaluation in June - September 1990. The GAO further concluded that, if practical, performing both follow-on operational testing and reliability growth testing may be the most desirable to gain sufficient knowledge on terminal reliability.

In January 1992 (prior to receiving the GAO draft report), the Navy Acquisition Executive reviewed terminal program information provided by all involved elements of the Navy. Specifically addressing the conflicting test information, the Assistant Secretary determined that all of the Navy terminal operational effectiveness and suitability Critical Operational Issues, with the exception of reliability, were successfully demonstrated. In order to resolve the outstanding issue, the Assistant Secretary concurred with recommendations from the Director of Navy Test and Evaluation and Technology Requirements that an additional period of focused operation testing will be required. The testing is scheduled to be conducted by the Navy independent test activity during July - August 1992, with the requirement for test reports being available to the Assistant Secretary not later than November 1992--in order to support a full production decision under the provisions of the current terminal production contract.

An extremely important aspect of the additional testing is that production ship and shore antenna systems will be used to verify the correction of the ship reliability issue. In addition to the above decision, the Navy is proceeding with terminal reliability growth testing.

FINDING I: Need For Annual Selected Acquisition Reports. The GAO reported that, in its July 1991 report authorizing Defense appropriations for FY 1992, the Senate Committee on Armed Services directed that a new Selected Acquisition Report for Milstar be provided to the congressional Defense committees by May 15, 1992. The GAO noted, however, that the report language indicates the Selected Acquisition Report is being requested on a non-recurring basis. The GAO reported that the submission of annual Selected Acquisition Reports on current major defense acquisition programs is well established in law--10 USC 2432. The GAO observed that, in the past, because Milstar was a highly

sensitive classified program, the DoD did not prepare annual Selected Acquisition Reports. The GAO noted that, in 1991, the classification was removed as part of the DoD Milstar program restructuring. The GAO also pointed out that Milstar greatly exceeds the dollar criteria for a major defense acquisition program.

The GAO concluded that Milstar has, in essence, become a new development program--as a result of the major changes planned for the program--i.e., satellite modifications, including a new satellite payload, and three new types of terminals. The GAO explained that the precedent for submitting Selected Acquisition Reports to the Congress on the multibillion dollar Milstar program has been established, but not on an annual basis. The GAO concluded that submission of comprehensive annual Selected Acquisition Reports to the Congress would aid congressional oversight, given the fact that (1) the reason for not submitting Selected Acquisition Reports in the past has been removed, (2) there are substantial plans for Milstar program restructuring, (3) decisions are yet to be made, and (4) changes are likely as system development progresses. (pp. 31-32/ GAO Draft Report)

DOD Comments: Concur. The Department will submit the first annual Milstar Selected Acquisition Report on August 14, 1992.

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RECOMMENDATIONS

RECOMMENDATION 1: The GAO recommended that the Secretary of Defense consider canceling plans to procure Army Single Channel Objective Tactical Terminal program terminals based on (1) questionable need, (2) the likely higher unit costs associated with the anticipated low production quantities, and (3) possibly the less costly secure, mobile, anti-jam, reliable, tactical terminal could be used as a substitute. (p. 18/GAO Draft Report)

DOD Comments: Concur. The Department is considering the termination of the Single Channel Objective Tactical Terminal program without entering production. The Department is examining how residual requirements for the terminals might be satisfied by other Milstar terminals before making a final decision. The Department will complete the analysis and make a final decision in

conjunction with the June 1992 Defense Acquisition Board review of the Milstar program.

RECOMMENDATION 2: The GAO recommended that, before the DoD begin a major investment in modifying the Milstar satellite and developing new medium data rate terminals, the Secretary of Defense ensure that (1) a cost and operational effectiveness analysis is performed to determine whether Milstar is the best alternative to satisfy tactical requirements for satellite communications, and (2) if Milstar is determined to be the best alternative, the issues associated with satellite capacity, assured satellite connectivity (access and orbit), and satellite antennas capable of neutralizing electronic jammers are formally resolved. (pp. 18-19/GAO Draft Report)

DOD Comments: Nonconcur. It has already been determined not to do a cost and operational effectiveness analysis for the June 1992 Defense Acquisition Board review of Milstar.

RECOMMENDATION 3: The GAO recommended that the Secretary of Defense ensure that the Air Force is placing sufficient emphasis on aircraft antennas and radomes to minimize Low Cost Terminal program risks. (p. 25/GAO Draft Report)

DOD Comments: Partially concur. The Air Force is pursuing several terminal, antenna, and power amplifier risk reduction contracts. The key risk reducing factor in radome development is to accomplish the design and fabrication in conjunction with the airframe contractor. Therefore, since radome development is unique to the host platform, Low Cost Terminal radome development will be deferred until the down select to a single contractor.

RECOMMENDATION 4: The GAO recommended that the Secretary of Defense establish criteria, prior to the Air Force entering Low Cost Terminal engineering and manufacturing development, for attaining risk reduction results prior to entering Low Cost Terminal production. (p. 25/GAO Draft Report)

DOD Comments: Concur. In June 1992, the Defense Acquisition Board will review the program and consider appropriate exit criteria.

RECOMMENDATION 5: The GAO recommended that, before approving additional production of Navy Milstar terminals,

the Secretary of Defense (1) assess the adequacy and results of the Navy approach to resolving the terminal reliability issue, and (2) determine the optimum annual quantities the Navy should procure under the existing production contract. (p. 30/GAO Draft Report)

DOD Comments: Concur. The Department agrees that, before approving additional production of Navy terminals there must be (1) an assessment of the adequacy and results of the Navy approach to resolving terminal reliability issues, and (2) a determination of the optimum annual quantities procured under the existing production contract.

(U) The Navy Acquisition Executive is the decision authority and previously established procedures to ensure the proper execution of the terminal program. Concomitant to the 1992 review of the terminal testing issues and the direction to perform additional operational testing, the Assistant Secretary approved the production of the third year of Navy terminals. The decision concerning full production of the additional terminals will be made by the Navy Acquisition Executive after review of the independent testing agency operational test report in November 1992.

RECOMMENDATION 6: The GAO recommended that the Secretary of Defense begin submitting to the Congress comprehensive annual Selected Acquisition Reports on the total Milstar program. (p. 32/GAO Draft Report)

DOD Comments: Concur. The Department will submit the first annual Milstar Selected Acquisition Report to the Congress on August 14, 1992.

The following are GAO's comments on the Assistant Secretary of Defense for Command, Control, Communications, and Intelligence's letter dated April 10, 1992.

GAO Comments

1. Although DOD obtained congressional approval of its January 1991 proposal to implement the restructured Milstar program, subsequent information shows that Milstar may not be the most cost and operationally effective alternative to satisfy tactical satellite communication requirements. DOD's October 1991 military satellite communications architecture study contained 12 different alternatives, and identified two acceptable and potentially less expensive alternatives compared to the baseline alternative, which included the restructured Milstar. DOD stated that these two alternatives were judged to have high technical risk and larger cost uncertainties.

The study actually shows that one of the alternatives, referred to as the single common bus, which did not include the restructured Milstar, is moderate risk—the same as a restructured Milstar. This means that the technology is basically in hand, requiring development, but no research. Life cycle costs for this alternative over a 20-year period were estimated to be substantially less (by several billion dollars) than the architecture's baseline alternative. The other lower cost alternative, referred to as the dual common bus, which also did not include the restructured Milstar, was characterized as high risk, requiring both research and development in some critical technology areas. Twenty-year life cycle costs for this alternative were estimated to be substantially less (by several billion dollars) than the single common bus alternative.

The question now is whether the estimated lower costs of these two alternatives are sufficiently attractive to offset any factors against pursuing the alternatives. DOD has time to consider this question, and should do so, before continuing with what it characterizes as the initial block of Milstar medium data rate satellites. We believe that a cost and operational effectiveness analysis of alternatives for acquisitions the size of the restructured Milstar not only would be useful but also should be important to decisionmakers.

2. We agree with DOD that it is the responsibility of the Joint Requirements Oversight Council to "validate" military requirements. Regarding "critical" requirements, our use of the word conveyed what Army representatives told us—that from an Army viewpoint, the minimum satellite

communications capacity needed on Milstar was for commanding and controlling forces, rather than administrative communications, and was therefore critical. To ensure that our views are not misconstrued, we deleted reference to "critical and valid" in our conclusions.

We also agree with DOD that regarding electronic jamming, the requirement is to communicate in the threat environment, rather than to designate a specific anti-jamming capability. Accordingly, we modified our conclusion and recommendation related to this matter.

3. It was not our intention to imply that the Air Force had already decided to maintain two command post terminal contractors. In fact, we stated that a decision on additional production is to be made after evaluating the contractors' proposals. We did, however, imply that a decision to use one contractor instead of two could be based primarily on cost because of the low risk assessment made by the program office. To clarify our position on this matter, we modified our conclusion and recommendation.

4. We agree that the Air Force's efforts to address risks associated with the low cost terminal are reasonable. We therefore deleted reference to the risk in developing integrated circuits and modified our conclusion and recommendation. We revised the report to clarify the information regarding radomes for stealth versus command post aircraft to distinguish between the two types of aircraft.

Our primary concern, however, is with the establishment of exit criteria and the degree of terminal program oversight. Although it may be unnecessary for DOD to revalidate the engineering and manufacturing development decision, we believe it is important for DOD to establish criteria that the Air Force must attain for the LCT efforts before making the transition from one phase to another. First, it would be useful for DOD to establish such criteria during the June 1992 program review for exiting the demonstration/validation effort. Second, it is even more important to establish such criteria at the beginning of the engineering and manufacturing development effort for results that must be attained before entering production.