

**LEVEL 1**

BY THE COMPTROLLER GENERAL

# Report To The Congress

OF THE UNITED STATES

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## Issues Identified In 21 Recently Published Major Weapon System Reports.

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Billions of dollars are requested each year by the Department of Defense to acquire and modernize its major weapon systems. GAO annually reviews selected weapon systems to advise the Congress on program issues and problems.

During January and February 1980, GAO issued 21 weapon system reports. This report consolidates the summaries and highlights the issues in those reports.

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To the President of the Senate and the  
Speaker of the House of Representatives

→ This report summarizes 21 major weapon system reports we issued during January and February 1980. Our purpose is to focus attention on the principal issues that we found to be common among several weapon programs. The report also serves as a quick reference to all our major acquisition work during the past 12 months. → cont on p 1

For the past several years, we have reported annually to the Congress on selected major weapon systems to provide information on programs for which funding is requested. We hope this consolidated report will be useful in your deliberations.

We are sending copies of this report to the Director, Office of Management and Budget, and the Secretary of Defense.

*Lester B. Atchley*  
Comptroller General  
of the United States

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## CHAPTER 1

### SYNOPSIS

The Department of Defense (DOD) plans to spend several hundred billion dollars during the next few years to acquire and modernize its major weapon systems, and the Congress must decide annually upon the necessary level of funding. The issues disclosed each year about these weapon programs may affect the amount of funds the Congress wishes to authorize and appropriate.

We conduct annual reviews of selected weapon systems to provide the Congress with information on program issues and problems. Our work during 1979 culminated in 21 reports issued to the Congress, committee chairmen, and the Secretary of Defense during January and February 1980. The issues identified in our reports are grouped into 17 categories. As shown in the chart on page 2, about 59 percent of these issues would have a direct impact upon the weapon system's mission effectiveness--that is, how well the weapon could be expected to accomplish its intended purpose when threatened by a major hostile force. The remaining 41 percent are program acquisition issues requiring management decisions or improvements.

Our 21 reviews were initiated independently of each other, so we did not have any preconceived notions as to what issues should be studied in depth. Therefore, the issues identified in the chart are not intended to represent all of the problems or questions associated with the weapon programs reviewed. Nor do we consider all the issue categories to be independent of each other because some of the categories are very closely related. The chart merely combines the issues we found and reported on and focuses on what we consider to be more important. Each issue may become more or less serious over time depending upon how DOD chooses to address it.

#### DESCRIPTION OF ISSUES

(cont on p A)

As shown in the chart, the majority of issues affecting the weapon systems' mission effectiveness are concerned with operational or performance limitations, survivability or vulnerability, availability, requirements, and reliability.

A weapon system's operational or performance limitations are inhibiting conditions based upon the threat environment in which the system is expected to operate and the capabilities designed into the system. In some cases, DOD testing

ISSUES ASSOCIATED WITH SELECTED MAJOR WEAPON SYSTEM PROGRAMS

	MISSION EFFECTIVENESS										PROGRAM ACQUISITION						
	PERFORMANCE LIMITATIONS	AVAILABILITY	OPERATIONAL REQUIREMENTS	RELIABILITY	FORCE MIX REQUIREMENTS	FORCE CAPABILITIES	OPERATIONAL UTILITY	AFFORDABILITY	DATA REPORTING INCOMPLETE	CONCURRENCY	AGENCY OR TESTING	COST EFFECTIVENESS	PROGRAM MANAGEMENT	DEPLOYMENT STRATEGY	SYSTEM URGENCY	TECHNICAL RISK/ PROBLEMS	
<b>ARMY PROGRAMS</b>																	
MAN TANK																	
MULTIPLE LAUNCH ROCKET SYSTEM		X															
DIVISION AIR DEFENSE GUN	X																
INFANTRY FIGHTING VEHICLE	X																
<b>NAVY PROGRAMS</b>																	
ASB(CG-47)	X	X															
LIGHT AIRBORNE MULTIPURPOSE SYSTEM	X			X													
PG-7 SHIP	X	X															
CAPTOR SHIP	X	X															
SHIPBOARD AIR LAUNCH AND REBLENDE	X			X													
PIA'S AIRCRAFT	X																
AV-8B AIRCRAFT						X	X										
<b>AIR FORCE PROGRAMS</b>																	
MAX WEAPON SYSTEM	X												X	X			
F-16 REGION LOCATION STRIKE SYSTEM	X	X		X													
ADVANCED TACTICAL AIR LAUNCH AND REBLENDE	X	X														X	
ES-111 AIRCRAFT	X	X		X									X				
STRATEGIC BOMBER FORCE	X	X		X	X												
<b>JOINT PROGRAMS</b>																	
CRUISE MISSILES				X	X									X	X		
JOINT TACTICAL INFO DISTRIBUTION SYSTEM	X			X													
MAVERICK MISSILE	X			X												X	
HIGH SPEED ANTI-RADIATION MISSILE	X																
NAVSTAR GLOBAL POSITIONING SYSTEM	X	X		X													
NUMBER OF ISSUES (70)	11	11	7	5	4	4	1	1	5	6	4	4	3	2	2	2	
PERCENT OF TOTAL ISSUES					44.7%-58%											31.7%-41%	

and analysis has shown that weapon systems or subsystems are not meeting their originally established performance goals. In other cases, threat information indicates that enemy capabilities have been or will be enhanced to a point that questions the ability of some U.S. weapons to conduct successful operations. Examples of weapon limitations we found include insufficient range, increased weight, limited space, inadequate armament, and lack of self-protection and adverse weather capabilities. We also found that enemy countermeasures would likely create limitations on some weapons.

The survivability or vulnerability issue refers to the questionable ability of a system or subsystem to avoid or reasonably withstand a hostile environment without suffering definite impairment or degradation in carrying out its assigned mission. It presumes an enemy could inflict damage and, therefore, reduce the system's fighting capability. Examples that cause this survivability or vulnerability condition include fragile equipment designed into the weapon, exposure in unsafe areas without adequate threat detection or resistance capabilities, lack of armament for self-defense, and inadequate concealment strategy.

A weapon system's availability is the degree in which it is in an operational state of readiness to perform its mission and, therefore, capable of being committed to battle at any time. Some of the weapon systems we reviewed were not expected to have adequate subsystems or related supporting systems in a timely manner to be able to operate with the primary system. Other systems showed potentially deficient readiness characteristics because the availability of basic delivery platforms or vehicles was questionable. One individual system was not expected to achieve its availability goal because the service was experiencing a broader problem--an inadequate logistic system.

Operational requirements for weapon systems are characteristics that are deemed necessary to fulfill a needed defense capability. They are usually specified well before initiating development work, but are frequently modified during development. In some cases, the precise role of the weapon system is an issue resulting in uncertainty as to the capabilities proposed for the weapons. In other cases, some of the requirements proposed for a few of the weapon systems where their roles were not an issue were questionable or not firmly established.

The reliability of a system and its component parts is usually expressed as a goal to achieve to ensure that the

system will perform its intended function for a specified period of time under certain stated conditions. In a few cases, the weapon systems we reviewed either failed to meet the reliability goals during testing or indicated a potential for reliability problems.

Force mix requirements refers to the appropriate combination of weapons needed to effectively achieve the mission or desired end purpose. We found examples of this force mix issue, wherein we questioned the basis of proposals, disclosed the lack of long-range plans, and reported on the uncertainties in establishing quantities.

We identified one issue concerned with force capabilities where the effectiveness of a combination of weapon systems is being debated within DOD. In another case, the operational utility of one uniquely designed system versus a conventional design was the subject of much controversy.

The chart on page 2 also shows that most of the issues affecting program acquisition fall into the categories of affordability, reporting incomplete data, program concurrency, adequacy of testing, cost effectiveness, and program management.

Affordability has become a major issue associated with all major weapon systems. It generally applies to exceedingly high-cost programs that tend to disrupt the procurement expectations for other programs and result in compromises between military requirements and the availability of funds. It leads to uneconomical rates of production and stress on the defense budget.

Regarding data reporting, we disclosed that on DOD's Selected Acquisition Reports the full costs of some programs were not being reported; performance data may be misleading; and in one case there was no Selected Acquisition Report at all, which limited the program's visibility.

Program concurrency has been a persistent issue for several years with various weapon programs. Concurrency refers to production before development is complete and the system is approved for service use. Experience has shown that this management approach can frequently increase the risk in a program to an unacceptable degree, often leads to higher costs and lower performance, and is generally undesirable in the absence of an overriding immediate military requirement. We emphasized this issue in 4 of our 21 reports.

During weapon system development, the adequacy of testing is critical to assess and reduce program acquisition risks and to evaluate operational effectiveness and suitability. The purpose of testing is to minimize uncertainties that could adversely affect system effectiveness, cost, or availability for deployment. We found examples of testing not being comprehensive, rigorous, and complete.

Cost-effectiveness analysis is an attempt to determine among alternatives which option will be the most effective for the least cost. We reported on three systems where cost-effectiveness issues were unresolved and inconclusive and where studies contained questionable assumptions:

We emphasized a need for better program management in three of our reports. The issues involved a lack of sufficient qualified personnel and the necessity for higher level and formal management attention.

Deployment strategy is an issue in two of our reports. Essentially, the questions involve the placement of ground-based missiles and the means of accomplishing it.

Because of DOD management actions or indecision, there appears to be a lack of system urgency in two of the programs we reviewed. We have recommended that the Secretary of Defense resolve these matters.

Most weapon systems encounter some technical risks or problems during their development phase. We emphasized this situation on two programs. As system development proceeds, it is necessary to periodically reassess the seriousness of these technical concerns.

The remainder of this report contains the summaries of our 21 reports issued earlier this year. Chapter 2 includes four report summaries on Army weapon programs. Chapter 3 contains seven summaries of Navy programs. Chapter 4 includes Air Force programs in five report summaries. Chapter 5 consists of five summaries on programs being jointly developed by the Navy and Air Force.

Appendix I lists all of the remaining reports issued on our civil and military acquisitions and related work during the past 12 months.

**CHAPTER 2**  
**ARMY PROGRAMS**

## XMI TANK'S RELIABILITY

### IS STILL UNCERTAIN

Although production of the Army's first increment of 110 XMI tanks has begun, the tank's reliability is still to be proven. Serious doubts remain about the performance of the XMI's turbine engine. Recent tests of the tank, which the Army has often called potentially the finest in the world, revealed many incidences of engine power losses and even some total aborts. The engine has yet to meet its reliability goals. A panel convened by the Secretary of Defense in 1979 to evaluate the engine's performance recommended additional engine testing. These tests are continuing.

Last February the tank was achieving only 145 mean miles between failures in operational and development testing. This compared unfavorably with the 272 mean mile goal the Army had hoped to reach in the short time remaining until the conclusion of those tests in September.

The most serious problems reported by the Army test agencies concerned the tank's reliability and durability. Included were the more prevalent mobility failures, those affecting the tank's movement. Nonmobility failures, such as the inability to fully rotate the tank's turret, were also cited as problems.

Additional mobility tests were conducted at Fort Knox from June to October 1979. According to the Army, modifications to the tank allowed it to achieve 299 mean miles between failures in those tests.

Although the score of 299 indicates that the XMI is overcoming many of its earlier problems, it may not be an accurate measure of the tank's progress. The Fort Knox tests were neither as comprehensive nor as rigorous as the operational and development ones, whose scores were either discarded or refined in the Army's latest evaluation.

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Also, to some extent, the improved performance at Fort Knox is attributable to extraordinary maintenance actions taken to keep the testing on schedule.

The Fort Knox tests provided the opportunity to assess contractor modifications made because of earlier failures in the XM1's mobility. The principal problems in those tests were the XM1's tendency to frequently throw its track in certain soil conditions, ingestion of dirt into the engine damaging its internal parts, clogged fuel filters, malfunctions in the fuel and water separator, and fuel pump failures which cut the supply of fuel to the engine causing it to stop. Few incidences of track throwing or damaging dirt ingestion occurred in the testing at Fort Knox.

Because of the uncertainty of the tank's performance with the turbine engine, members of the Congress have suggested on several occasions that the Army develop a backup diesel engine. If this were to be done, it would have to be tested in the same manner as the turbine. Switching to a diesel could possibly delay fielding the tank. However, if reliability and durability problems continue to plague the tank when operating with the turbine engine, the diesel would seem to offer the better alternative.

The Army, however, shows no enthusiasm for pursuing this alternative, maintaining that the turbine has proven its reliability. The Secretary of Defense is reconvening the panel early in 1980 to further assess the engine's performance and reliability.

Although recent tests indicate that the XM1 has made consistent progress, its performance should be tempered with the realization that the many corrective modifications made to the tank in the past year are still to be tested in a combat environment. The tank's potential performance on the battlefield cannot be judged until the XM1 has demonstrated its reliability

and maintainability in the next phase of operational and development testing. Until then it seems advisable for the tank's procurement to continue at a low rate.

#### RECOMMENDATIONS

The Congress should limit the further procurement of the XM1 to a low rate until the Army demonstrates conclusively that it has achieved acceptable levels of reliability, maintainability, and durability.

The Secretary of Defense should initiate a full-scale diesel engine development program for the XM1 if the panel's evaluation report expresses sufficient reservations about the turbine engine's test results to render the XM1's performance with that engine uncertain.

#### AGENCY COMMENTS

This report was discussed with Department of Defense officials responsible for the XM1 program. Representatives of the Department of the Army who were present were confident that the turbine engine would eventually achieve its reliability and durability goals and that a backup diesel engine program was unnecessary.

CURRENT DIFFICULTIES IN EFFECTIVELY  
DEPLOYING MULTIPLE LAUNCH ROCKET  
SYSTEM RENDER PROGRAM'S CONCURRENCY  
QUESTIONABLE

The Army's Multiple Launch Rocket System (MLRS) 1/ is being developed as an addition to the field artillery's weaponry used in the fire support mission. Its principal mission will be the counterfire role when it will be attacking the enemy's artillery positions, especially during surge periods 2/ when other fire support systems are heavily engaged.

MLRS will be mounted on a derivative of the new XM2 infantry fighting vehicle. Its principal feature will be its anticipated quick reaction once the target is located. MLRS has the growth potential to attack moving targets and to deliver scatterable mines and fire-guided munitions.

In our view, three issues of major importance should be considered in making future program decisions. First, the Army may seek approval for MLRS to enter limited production before it is fully tested. Second, several systems on which MLRS depends for target information will either not be available or will not have been tested with MLRS when MLRS is scheduled for deployment. Finally, the program will likely involve considerably more expenditures than its current \$4 billion cost estimate indicates because of MLRS' extensive support requirements.

CONCURRENCY

The Army began developing MLRS early in 1977 and is following a compressed schedule in an effort to meet the specified deployment date. To do so, the Army has built a considerable amount of concurrency into the program. A decision is to be made in May 1980 on whether to begin

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1/The weapon system's name was changed from General Support Rocket System to Multiple Launch Rocket System on Nov. 16, 1979.

2/Surge periods are defined as specific combat situations in which the number of critical targets acquired far exceeds the number that available cannon artillery are capable of attacking.

low-rate production (with development continuing concurrently) or to defer production and continue further full-scale engineering development. The decision will depend on how much progress MLRS will have made in its development as demonstrated in testing up to that point.

Because of the planned concurrency, results of several tests will not be available until after the May 1980 program decision. The most important of these is MLRS' integrated testing with some of its associated components and target information systems.

#### DEPENDENCE ON OTHER SYSTEMS

MLRS could dramatically increase the field artillery's firepower. However, MLRS will depend on other systems to provide it with target information. None of these has yet been tested with MLRS. Of several new target acquisition systems being considered, only one, Firefinder, is expected to be available when MLRS is to begin its deployment. This will limit MLRS' contribution in the counterfire role.

The Army's two automated fire direction systems will be used to assign target information to MLRS. One, the Tactical Fire Direction Center (TACFIRE), was terminated after about 50 percent of the programmed units were procured because the Congress opposed the Army's continuing to buy equipment employing obsolete technology. The second, the Battery Computer System, experienced serious problems during operational and development testing, and the unique software compatible with MLRS is still to be developed.

#### MLRS IS A COSTLY SYSTEM

MLRS will be an expensive addition to the Army's inventory of fire support weapons. Its acquisition comes at a time when the Army faces a vexing affordability problem because other important major weapon systems are beginning or approaching initial production. The Army plans to buy 173 rocket launcher systems and 362,832 rockets at a cost of \$4 billion. Costs could go considerably higher.

Some Army studies have projected considerably more than the programmed 362,832 rounds to be needed. Each rocket will cost an estimated \$4,500. If surge conditions develop as anticipated, this quantity may be totally expended within a very short period. The introduction of MLRS could result in a significant increase in support requirements, such as making available additional storage igloos in Europe and involving additional Army support personnel. The Army is

also developing plans which would increase the number of MLRSs to be acquired.

### CONCLUSIONS

Regardless of when MLRS is introduced into the inventory, the cost it will add to the Army's budget, in terms of procurement and support, is so formidable that ways should be found to lessen its cost impact. A partial solution might be to trade-off some less vital systems in the force structure that the Army plans to procure in order to offset the cost of adding MLRS. This would also reduce some of the burden MLRS will place on the Army's logistics system since it would permit diverting funds for procuring ammunition and support from those systems to MLRS.

Since it is scheduled to be deployed before the deployment of several target acquisition systems and command, control, and communications systems with which it will operate, we see no need for the concurrent development and production.

Taking all these together--the testing still to come, the likelihood that the system's full potential will not be realized in the early years of its deployment, and the fact that several major Army programs are vying for procurement funds simultaneously--it would appear to be in the Army's interest for the MLRS acquisition to follow the more conservative approach of further proving the system before production.

### RECOMMENDATIONS

The Secretary of Defense should

- require the Army to adequately demonstrate the satisfactory performance of MLRS with associated target acquisition and command, control, and communications systems before approving its production and
- direct the Army to identify other less vital systems in the force structure it plans to procure that might be deleted or deferred in order to lessen the impact on the Army's budget that will result from the introduction of MLRS into the inventory.

### AGENCY COMMENTS

In discussing this report with Army officials, they said that the contribution MLRS could make to the battle

in the counterfire role alone was so significant that they could see no reason for requiring further demonstration of MLRS' performance beyond what it now has scheduled prior to the production decision. They also believe Firefinder's testing with other artillery systems has created sufficient confidence that it will work effectively with MLRS.

Officials in the Office of the Secretary of Defense were more guarded in their assessment of the program. They are concerned about the concurrency and believe further testing may be needed before MLRS' reliability is sufficiently proven to support a production decision.

However, concerning our first recommendation, both Army and Defense officials contend that they should not delay MLRS' beginning production simply because it will not have been tested with any of the associated systems now in development. They point to the target acquisition systems that are already deployed which can be used with MLRS.

In our opinion, these systems, because of their limitations, fall short of meeting the sophisticated needs of MLRS. They depend almost totally on manual operation and consequently cannot be linked up with TACFIRE. Their target identification capability is imprecise, and their response time is slow. Therefore, the value to be gained from earlier deployment of MLRS with these target acquisition systems is questionable.

Army officials agreed with our second recommendation and said that force structure trade-offs involving equipment and other elements are in fact now being studied.

INHERENT RISK IN THE ARMY'S ACQUISITION

STRATEGY DEMANDS PARTICULAR CAUTION IN

EVALUATING THE DIVISION AIR DEFENSE GUN

SYSTEM'S PRODUCTION READINESS

The Army is developing the Division Air Defense Gun System (DIVAD) to fill a perceived air defense void in the forward area. DIVAD is intended to replace the Vulcan gun and some Chaparral missile systems in each divisional air defense battalion. It will be used to engage helicopters and high-performance, fixed-wing aircraft.

The Army estimates the program cost for the acquisition of 618 DIVADs at \$3.3 billion. For fiscal year 1981, the Army's budget included about \$383 million to continue research and development; procure 42 DIVADs, spare parts, and ammunition; and establish production facilities for DIVAD and associated ammunition.

UNIQUE ACQUISITION STRATEGY

DIVAD is being procured under a compressed schedule in the expectation that it will reduce the cost and time to field the new system. Two competing contractors, Ford Aerospace and Communications Corporation and General Dynamics Corporation, are each developing two prototype systems. Subsystems developed for already existing weapons systems, including some of European origin, are being integrated into the new system. An M48A5 tank chassis furnished by the Army is the carrier vehicle.

After completing 29 months of development, the competing prototypes are to undergo 90 days of combined development and operational testing in the summer of 1980. The results of the combined test, together with an evaluation of the contractors' proposals, will be used to select a DIVAD prototype and make the production decision in October 1980.

Engineering development of the winning prototype is to continue for about 2 years following the production decision. During this time the contractor will effect the technology transfer of the foreign gun and ammunition, looking towards their possible production in the United States. The Army anticipates no significant problems in transferring the technology since the European gun and ammunition have been in production for some time.

The Army's acquisition strategy, known as "skunk-works, hands-off," provides for very minimal Government management and surveillance over the contractors during the 29-month development period. The Army's monitoring of contractor progress is limited to 2-day quarterly meetings at each contractor's location and a review of their reports. The Army hopes that this limited surveillance, coupled with a short test program and concurrent initial production, will permit earlier fielding of the first DIVAD units.

A judgment at this time as to the correctness of the application of the hands-off policy to the DIVAD program would be premature. Any conclusions must await the completion of testing when the prototypes will have been demonstrated and a comparison can be made with the Army's requirements. The program does have the advantage of considerable reliance on existing components. In this sense, there is less uncertainty than in programs involving considerable new technology. At the same time the Army is aware of certain risks that remain, not the least of which is the high degree of concurrency.

#### LIMITED TESTING BEFORE PRODUCTION

Some important development testing, including durability tests, will not be addressed until after the production contract is awarded.

Several critical evaluations of DIVAD's operational performance and supportability, including its maintainability, will also be limited or not made at all.

The agencies responsible for testing and evaluating the DIVAD prototypes are concerned because limited testing time, the limited number of fire units on hand for the tests, and deferral of some engineering development until after the prototype is selected place constraints on their ability to fully test and evaluate the competing prototypes for production readiness.

The Army is providing 6 months for corrective action testing by the winning contractor starting immediately after the award of the production contract. Following this, the Army will perform a 2-month check test to make sure that the contractor has corrected whatever deficiencies were identified during the testing.

SOME DEGRADATION MAY OCCUR  
IN BATTLEFIELD ENVIRONMENT

While the Army anticipates a considerable improvement over Vulcan, DIVAD may experience some degradation in certain battlefield conditions, particularly when operating in its radar mode.

Although both contractors are using existing radar systems as the basis for their DIVAD prototypes, modifications to these systems and fabrication of new components are necessary in order for the radar to be compatible with the air defense role. The ability of DIVAD's acquisition and track radar to meet the required performance parameters is not yet known. The Army considers this critically important and a technical risk.

An Army cost and operational effectiveness study shows that in certain electronic countermeasure environments, the DIVAD acquisition radar's range will be reduced.

CONCLUSION

The Army's strategy provides for considerable concurrency. Only about half of the scheduled engineering development period will have expired when the Army plans to begin production. Information available at that time will not include critical data on either candidate's durability and maintainability. These are central to the successful deployment of any weapon system. We believe it would be consistent with the Army's concern for maintaining a highly competitive environment in this program to evaluate both competing candidates in these two very critical areas.

The Army also appears to be running a high risk in deferring other tests which its own test and evaluation agencies feel are critical to their assessments of DIVAD. We believe it would be appropriate that the Army review the current test plan to determine which of the deferred tests, in addition to the durability and maintainability tests, should be added before the production decision.

The Army is reluctant to make any changes in its plans which might delay the program. The Army believes this would interfere drastically with its carefully planned acquisition strategy and hamper its ability to evaluate the strategy for use in other selected programs. The Army also cites the additional cost that would arise from the need to maintain a second contractor longer than anticipated.

We believe, however, that the Army's concerns do not outweigh the benefits of obtaining more critical data about DIVAD through further testing and evaluation before its production begins. Without this additional effort, the Army would lack information which could be crucial to its decisionmaking. In turn, the Congress should have this information before it is required to make a decision on whether to begin funding what will ultimately be a multi-billion dollar program.

#### RECOMMENDATIONS

The Secretary of Defense should

- continue competition for DIVAD until both prototypes have undergone tests for durability and maintainability and
- approve production of DIVAD only after the selected prototype has demonstrated through adequate testing and evaluation its readiness to proceed into production.

The Congress should withhold procurement funds for DIVAD until the weapon has demonstrated its readiness for production.

#### AGENCY COMMENTS

A draft of this report was reviewed by agency officials associated with management of the program, and their comments have been incorporated as appropriate.

## CONCERNS ABOUT THE ARMY'S INFANTRY

### FIGHTING VEHICLE

As part of our annual examinations of selected major weapon system acquisitions, we have reviewed the Army's Fighting Vehicle Systems Program. Primarily, our review focused on the Infantry Fighting Vehicle's (IFV's) performance in operational and development testing. The test results were used as a basis for the Defense Systems Acquisition Review Council's recommending approval of the start of production in January 1980.

The Army is looking to IFV to provide the infantry with a vehicle to move rapidly in a hostile environment with better armor and greater firepower than is currently available in the M113. Unlike the M113 that is basically a transport vehicle, IFV will be a fighting vehicle that can carry troops into combat as a companion to the tank.

Operational testing was completed in November 1979, and development tests are scheduled for completion in July 1980. Test data available in December 1979 showed that IFV had met or exceeded virtually all its performance requirements, including its reliability goals.

#### IFV'S HIGH COST MAY WARRANT CONSIDERATION OF A HIGH-LOW MIX

A principal concern about IFV is its high cost. The September 1979 Selected Acquisition Report shows an estimated unit procurement cost of about \$600,000 for contemplated procurements through 1995. The report uses rather low inflation rates, generally about 5.5 percent. The armored personnel carrier it is replacing, the M113, can be purchased for about \$100,000.

IFV's estimated cost per vehicle has grown considerably and rapidly over the past several years. In 1972 it was, according to Army estimates, \$172,000. Just 1 year ago, the contractor submitted a proposal showing a unit cost of \$497,000, based on the fiscal year 1978 cost index.

We were informed by IFV program officials that despite the acquisition of the new fighting vehicle, the Army does not intend to reduce its inventory of M113s. It plans to use them as carriers for the TOW (tube-launched, optically tracked, wire-guided) missile; vehicles for the artillery's forward observer; and carriers for tactical signal intelligence systems.

We believe IFV's high cost also merits considering the use of the M113 as part of a high-low mix with IFV within the mechanized infantry battalion if the M113's firepower can be augmented. We understand the Army's Training and Doctrine Command is planning to retain some M113 vehicles in mechanized battalions for other purposes than transporting troops.

#### IFV's TEST SCORES EXCEED ARMY'S RELIABILITY GOALS

The mean miles between failures, as scored by the army, show steady growth in total system reliability. A reliability score as of December 6, 1979, showed that 260 mean miles between failures was achieved. This reliability measurement exceeds the operational and development testing goals of 195 and the initial production goal of 240 mean miles. Several problems surfaced during testing, but most have already been corrected. Further corrections to rectify problems will continue throughout development testing.

#### NEEDED TO MONITOR FUTURE VULNERABILITY TESTS

There is, however, one crucial development test still to be completed. It concerns the vehicle's vulnerability. One of the advantages of IFV over the M113 is its anticipated greater survivability on the battlefield because of its superior armor protection. Very limited testing of the vehicle's armor has been conducted to date. The initial testing showed the armor to be somewhat under the Army's stated ballistic protection requirements against both small arms fire and overhead airbursts.

The testing for small arms fire was accomplished by firing against armor plates, similar to those to be used on portions of the vehicle, as opposed to firing against the armored vehicle itself. In overhead airburst testing with armored plates, four different scenarios were used, and the vulnerability requirement was met in three of them. In the fourth scenario, the protection achieved was slightly less than the requirement.

Based on these limited tests, the Fighting Vehicle Systems program office is prepared to consider increasing the thickness of the armor plating of several areas on the vehicle and changing the obliqueness of others. The program office believes that a few of these changes will bring the protection level up to the requirements for the first production vehicles. However, the extent of any changes to the armor will depend on the results of the vulnerability tests on a fully armored vehicle scheduled for June and July 1980.

Since the tactical use of IFV would require its moving into areas where it could come under attack from machine guns and artillery weapons, the criticality of the vulnerability tests is self-evident.

IFV'S SPACE LIMITATIONS MAY IMPEDE MECHANIZED INFANTRY SQUAD'S EFFECTIVENESS

A 1978 study by the Army Training and Doctrine Command's Infantry School indicates that the proposed dismounting of six infantry men may be insufficient for accomplishing the mechanized infantry's mission. Consequently, the Army is considering either enlarging the infantry squad or increasing the number of vehicles in each mechanized infantry unit.

At one time, an 11-man squad was being considered for IFV, of which 9 would dismount and 2 remain inside. Partly because of configuration changes to the vehicle which reduced the interior space, the squad size was reduced to nine.

The Infantry School's study was used in a report on IFV prepared at your request to consider, among other matters, possible alternatives to IFV. This is the latest completed study on squad effectiveness. The study showed the following levels of enemy kills for a force of IFVs where seven or five men, instead of nine, are able to dismount.

Percent Killed Compared to Case  
Where 9 Men Can Dismount

	<u>7 men vs. 9 men</u>	<u>5 men vs. 9 men</u>
	------(percent)-----	
Enemy vehicle and weapons	74	19
Enemy personnel	55	14

The study assumed that only two men would remain with the vehicle. Since the study was made, the Infantry School has decided that in most situations three men, rather than two, would remain with the vehicle. Thus, the current IFV squad of nine men would result generally in six men, rather than seven, dismounting. Its effectiveness would fall between that of the five and seven men dismounting, as shown above.

If the close-in battle that was war gamed in this study is typical of situations that IFV will face, then an increase in dismounted capability is desirable, if not mandatory.

Due to the sensitivity of force effectiveness to the number of men able to dismount, the Army is considering ways to accommodate one or two additional men in each IFV. The Army found that with a few minor rearrangements of stowed equipment, adequate floor space exists for two additional men.

We viewed the interior of an IFV at Fort Carson, Colorado, and discussed the space problem with several squad members. It appeared that with the gear the additional men would bring aboard and the seats that would have to be installed for them, conditions inside the vehicle would be intolerably cramped.

In a meeting at the Infantry School, we were told the Army may consider a second alternative of increasing the number of IFVs per mechanized infantry unit. If the Army opts for adding vehicles to enhance the dismounted fighting capability, it would appear much more cost effective to consider adding M113s rather than more IFVs for this role, considering the great disparity in their cost.

#### SCOPE OF REVIEW

Most of our review was accomplished at the offices of the Program Manager, Fighting Vehicle Systems. We reviewed the test plan, procedures, and results with officials of the Army Test and Evaluation Command and the Army Operational Test and Evaluation Agency. We also discussed the IFV cost and operational effectiveness analysis results with officials of the Army Training and Doctrine Command's Infantry School.

We would appreciate receiving your comments on these matters within 30 days. Should you desire, we will be pleased to discuss this report with you or your staff.

We are sending copies of this letter to the Director, Office of Management and Budget, and to the Secretary of the Army. We are also sending copies to the chairmen of the Senate Committees on Appropriations, Armed Services, and Governmental Affairs and to the chairmen of the House Committees on Appropriations, Armed Services, and Government Operations.

**CHAPTER 3**  
**NAVY PROGRAMS**

## STATUS OF THE NAVY'S AEGIS WEAPON SYSTEM

### AND DDG-47 SHIPBUILDING PROGRAM

U.S. naval surface forces cannot presently counter the Soviet ability to launch high-intensity, antiship missile attacks. Because of continued advancements in technology, this threat is expected to become more difficult to counter in the future.

The Aegis weapon system is an advanced anti-air warfare system being developed to provide the Navy with an improved defense against the air threat in the 1980s. The system is composed of phased array radars, high-power illuminators to guide missiles, advanced missile guidance, high-firepower missile launchers, and a fast reaction command and control system. To accommodate Aegis, a new class of destroyers--DDG-47 1/--is being constructed.

The Aegis system will be more capable than current anti-air warfare systems. Although it is planned to use the Standard Missile (SM) (SM-1 and SM-2 missiles), Aegis is to have a superior capability during heavy jamming. It is also to have the ability to concurrently intercept multiple targets.

System improvements planned include replacing the current MK-26 launchers with a new vertical launcher. This will provide faster reaction time and also allow more missiles to be stored onboard. The Navy plans to increase the number of missiles and illuminators available to an Aegis ship by integrating it with other ships having anti-air warfare systems.

The Aegis weapon system has entered limited production, and the construction contract for the DDG-47 lead ship has been awarded and construction started.

The conventionally powered DDG-47s are currently the only ships designated as Aegis ships. According to the approved fiscal year 1980 plan, there will be 16 DDG-47s at an estimated cost of about \$15 billion. Some concerns and potential problems exist. Foremost are Aegis availability

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1/The Navy recently changed the designation of this ship to "CG-47."

problems, software reliability, ship weight, reduced antisubmarine warfare capability, and ship vulnerability.

#### FUTURE OPERATIONAL AVAILABILITY PROBLEM

The Navy considers the established 80-percent operational availability goal as unrealistic and invalid under its current logistics system. The Navy expects that the actual level of operational availability will be 43 percent or less, based on actual fleet logistic system experience. Different logistic practices now being evaluated by the Navy could increase operational availability to the 60- to 80-percent range.

#### SOFTWARE RELIABILITY PROBLEMS

Although software reliability problems were experienced during development and operational testing, these do not appear to be an issue at this time. The software was planned to operate continuously for 5 hours before failing, but less than 50 percent of this goal was achieved during operational tests conducted in May 1979. Navy officials, however, stated that at this stage in a development program the software is satisfactory.

#### DISPLACEMENT WEIGHT CONCERNS

Displacement weight has been and continues to be a concern for DDG-47. The displacement weight of the ship is currently over approved goals, and the addition of the planned vertical launcher, more missiles, and the Light Airborne Multipurpose System (LAMPS) III helicopter will increase weight by more than 100 tons.

#### REDUCED DDG-47 ANTISUBMARINE WARFARE CAPABILITY

The DDG-47 will not have its planned full antisubmarine warfare capability when it is deployed. Neither the Tactical Towed Array Sonar (TACTAS) nor the LAMPS III helicopter is yet in production and will not be available until the follow ships are built.

#### COMBAT INFORMATION CENTER VULNERABILITY

The ship's combat information center is located above deck within the ship's aluminum plate superstructure and is susceptible to partial damage or complete destruction. If the combat information center is damaged, the ship's fighting capability will be reduced. The Navy is studying ways to reduce the vulnerability of the center.

## RECOMMENDATIONS

We recommend that the Secretary of Defense:

--Direct the Navy to develop realistic Aegis weapon system operational availability goals. The Navy should also assess what effect new and more realistic goals will have on logistical planning and support.

--Closely monitor the Aegis software development to ensure that satisfactory progress is being made to field a reliable system that will meet established operational goals.

--Closely monitor planned and future DDG-47 ship changes and their effects on the ship's displacement weight and vulnerability.

## AGENCY COMMENTS

A draft of this report was reviewed by agency officials associated with the management of the program, and their comments have been incorporated as appropriate.

THE LIGHT AIRBORNE MULTI-PURPOSE SYSTEM,

LAMPS MK III, MAY NOT EFFECTIVELY

MEET NAVY REQUIREMENTS

The Navy's newest Light Airborne Multi-Purpose System (LAMPS), known as LAMPS MK III, is a computer-integrated ship and helicopter system whose primary mission is antisubmarine warfare (ASW). The helicopter acts as an extension of shipboard systems by providing a remote elevated platform for deploying sensors. It then transmits and processes sensor data and attacks the targeted submarine. Antiship surveillance and targeting is a secondary mission for LAMPS MK III. The program is currently in full-scale development.

We reviewed the LAMPS program to evaluate its current status and plans for further development. The following matters were noted.

It is not clear whether LAMPS MK III, without improvement, will be adequate to meet the threat that will be encountered in the late 1980s and 1990s.

LAMPS MK III depends to a degree on other systems for full mission performance. Some of these systems, such as the new Tactical Towed Array Sonar (TACTAS) System and MK 46 torpedo, have had development delays or known performance limitations.

There is a serious and growing shortage of LAMPS MK I helicopters. Because the LAMPS MK I helicopter is an old airframe, its numbers have been decreasing through age and attrition. Presently, there are more MK I equipped ships than there are available helicopters. A number of newer ships planned to carry the MK III have been or are being built and equipped for the MK I until the MK III is available. The Navy, however, has not yet decided whether it should buy additional MK I helicopters. This is a dilemma for the Navy which it needs to resolve.

The Navy is not now planning to buy enough MK III helicopters to fully meet requirements projected by recent studies. Instead they are buying only what they can now "afford" based on what the Navy feels is a reasonable compromise between requirements and funds. Significantly more ASW helicopters may eventually be needed than the Navy plans to buy. The Navy needs to analyze how its

LAMPS helicopters can most effectively meet its requirements from a force mix perspective.

Although LAMPS MK III was approved with antiship surveillance and targeting (ASST) as a primary mission, the Navy has now reduced this function to a secondary mission as a cost savings measure agreed to with the Congress. Also, since the Navy predicts the LAMPS MK III helicopter will, at times, be highly vulnerable to anti-air missiles, it is questionable whether the helicopter will be able to successfully perform the ASST mission.

Although the Navy states it is following Department of Defense regulations, full cost of the LAMPS MK III program is not being reported in the Selected Acquisition Report (SAR). Realistic escalation estimates are not being used, and complete military construction funds for LAMPS MK III are not included.

There is potential for further LAMPS MK III program cost increases due to additional Navy LAMPS requirements or changes in the Army's Black Hawk helicopter procurement plans.

Development problems and hardware delivery delays of several months have been experienced with the LAMPS Recovery, Assist, Securing, and Traversing (RAST) System. Further delays or performance problems could seriously affect the Navy's installation and testing plans.

#### RECOMMENDATIONS

In light of the foregoing, we recommend that the Secretary of Defense require the Navy to:

- Assess and report on its current and future ASW helicopter requirements and delineate how such requirements will be achieved, including an assessment of how LAMPS MK I and LAMPS MK III can most effectively be used from a force mix standpoint.
- Determine how the Navy plans to equip LAMPS MK I designated ships, in light of the LAMPS MK I helicopters shortages, and assess the feasibility of this plan based on the helicopter's limited capabilities.

- Consider including other ASW helicopters currently in U.S. and North Atlantic Treaty Organization inventories that could possibly be used in conjunction with the MK III to achieve requirements.
- Determine whether the MK III is effective and still a key weapon in ASST requirements. If it is, determine how it can reduce its vulnerability to anti-aircraft systems; if it is not, assess whether antiship missile systems' performance will be affected.
- Give special management attention to the RAST Landing and Securing System to minimize schedule slippages and reduce development risks; determine whether the problems and delays experienced to date could continue in the production phase; and, if warranted, take appropriate action to assure successful performance of the landing and securing system effort.
- Prepare and report to the Congress an accurate estimate of total LAMPS MK III program costs associated with the program.

#### ACCESS TO RECORDS PROBLEMS

The Navy's LAMPS program manager did not provide us timely access to an evaluation of the MK III program made by an independent contractor. It was over 4 months before the evaluation was provided. This delay hampered our ability to review how the program is being managed and to follow up on our previous report on LAMPS.

#### AGENCY COMMENTS

A draft of this report was reviewed by agency officials associated with management of the program, and their comments have been incorporated as appropriate.

## STATUS OF THE NAVY'S FFG-7 CLASS

### SHIPBUILDING PROGRAM

The FFG-7 class guided missile frigate is a surface combatant ship designed to supplement planned and existing escorts in the protection of underway replenishment groups, amphibious forces, and military and mercantile convoys against subsurface, air, and surface threats. The FFG-7 is meant to operate in areas of low to moderate enemy threat, and its design features and weapons systems were chosen accordingly.

Technical risks associated with the FFG-7 class program were considered low by the Navy and the Department of Defense. However, several FFG-7 class shipboard systems appear to be in need of further study, testing, or improvement. Specifically:

- The AN/SQS-56 sonar has had significant development and performance problems. Selected under cost and weight constraints, its submarine detection range is limited. The AN/SQS-56 has been provisionally approved for service use despite continued shortcomings regarding torpedo detection requirements.
- Navy efforts to improve FFG-7 class survivability by the addition of Kevlar armoring and shock hardening are continuing.
- The FFG-7 class ships continue to have problems with the diesel generator system and starting air compressors.

Most of the 34 contracted FFG-7 class ships have not been or will not be delivered with their full planned antisubmarine warfare (ASW) and anti-air warfare (AAW) capability. These ships are planned to be returned to shipyards at various times after delivery for substantial backfittings and alterations. Specifically:

- The AN/SQR-19 TACTAS System is still under development and will not be ready for installation aboard FFG-7 class ships before the mid-1980s.
- The Phalanx Close-in Weapon System (CIWS) is not scheduled for FFG-7 class installation until the early 1980s.

--The planned replacement of the FFG-7's Light Airborne Multipurpose System (LAMPS) Mark-I (MK-I) System with the MK-III model will require major modifications for 26 of the 34 U.S. FFG-7 class ships presently completed or under contract. MK-III is presently under development, and is not scheduled for installation on FFG-7 class ships before the mid-1980s.

--The ship's fin stabilizer system is still under development and will be installed on fiscal year 1979 contracted ships during construction and backfitted on prior year ships.

--Other systems to be backfitted include the Satellite Navigation System (SATNAV), intership data link (LINK 11), the Single Audio System (SAS), and the Communications Security System (CSS).

The FFG-7 program funding shown in the Selected Acquisition Report (SAR) does not include additional equipment or modifications scheduled to be incorporated after ship delivery. Costs associated with the procurement and installation of LAMPS MK-III/recovery assist, securing, and traversing (RAST) modifications; stern redesign; and fin stabilizers on the first 26 FFG-7 ships are not required to be included in SARs. These costs will be paid largely from Operation and Maintenance and Other Procurement funds. We estimate additional costs to the program for presently planned backfits and modifications will be at least \$1 billion--not including the cost of LAMPS MK-III aircraft. Original program cost constraints for the FFG-7 program have been exceeded by nearly 50 percent in constant dollars. Weight and manning level limitations constraints were also exceeded.

The limited range of the AN/SQS-56 sonar and the unavailability of the AN/SQR-19 will limit FFG-7 class frigates to short-range sonar capability well into the 1980s. ASW capability of the FFG-7 class ships may also be affected by shortages of both LAMPS MK-I and MK-III aircraft. In addition, some LAMPS MK-III designed ships may have to be backfitted to use the MK-I.

Improvements are underway on some of the AAW weapons systems used by the FFG-7 to provide area air defense against the Soviet threat, but it does not appear that these will be completed before the mid-1980s.

FFG-7 class program policy of separating the construction of the lead ship and follow ships by 2 years in order

to minimize development problems appears to have been very successful. FFG-7 class construction is presently on or ahead of schedule, and there are no outstanding shipyard claims.

Our review of the FFG-7 program was limited by restricted access to documents and personnel at the FFG-7 project office.

#### RECOMMENDATIONS

GAO recommends that the Secretary of Defense:

- Consider initiating an effort to improve the passive torpedo detection capability of the AN/SQS-56 sonar.
- Ensure that all systems installed or backfitted on the FFG-7 class ships are subjected to and meet shock test requirements before being installed on follow ships.
- Intensify efforts to correct deficiencies associated with the diesel generator system and starting air compressors.
- Closely monitor the improvements being made to the ASW and area AAW capability of FFG-7 class ships.
- Show total FFG-7 program costs by reporting the type and cost of planned program post delivery backfits.

#### AGENCY COMMENTS

A draft of this report was reviewed by agency officials associated with the management of the program. Their comments have been incorporated as appropriate.

## STATUS OF THE CAPTOR MINE WARFARE PROGRAM

The MK 60 mine, an encapsulated torpedo (Captor), is a deep-moored, antisubmarine mine. It is in limited production pending the outcome of testing to determine its suitability for service use. In addition to the testing issue, two other issues are of critical concern in the Captor program.

--Will there be enough Captors to effectively create barriers at predetermined points?

--Will aircraft and other delivery vehicles be available for minelaying when needed?

The Navy may need more Captors than it currently plans to buy. Recent reviews of Captor deployment based on experience gained in minefield penetration tests indicate that under many circumstances a significant number of mines per minefield may be preferred and perhaps required.

Availability of delivery vehicles is critical to a successful mining operation. The Navy plans to deliver Captors by aircraft, surface ships, and submarines. None of the candidate delivery platforms, however, has minelaying as a dedicated mission and consequently may not be available when needed. To be most effective, Captor must be deployed prior to or immediately after hostilities begin before enemy submarines move into or out of designated areas. Aircraft are the most effective means of quickly deploying Captor.

Captor has been tested in the laboratory and the ocean in development and operational tests. As a result of tests completed in 1975, the Navy concluded that the weapon showed potential and limited production was approved. However, additional tests were mandated under the Follow-on Test and Evaluation (FOT&E) plan to test reliability and effectiveness.

Captor, however, was still not recommended for service use because of its limited effectiveness against certain targets. Consequently, the Navy's Operational Test and Evaluation Force (OPTEVFOR) has not recommended approval for service use.

In a prior report, 1/ we expressed concern about reliability testing. The Navy believes that enough reliability testing has been done to demonstrate that CAPTOR will function properly after remaining in the water for extended periods. However, because data was obtained from long-term testing of such a small number of units, we are not as confident as the Navy that the testing produced sufficient data to project overall system reliability.

CAPTOR's development cost is estimated at \$130.8 million. Procurement cost for 5,751 mines is estimated to be \$1,380.3 million, or \$238,000 per unit. These costs are based on current inventory objectives and do not include 34 additional units that will be needed for testing or procurement cost of nearly \$150 million for torpedoes and testing.

We recommend that the Secretary of Defense:

- Determine whether the performance problem can be resolved and whether sufficient testing has been done to establish in-water reliability before approving CAPTOR for full-scale production.
- Determine whether there will be adequate vehicles to establish effective minefields when needed and subsequently monitor and replenish them.
- Make sure that the Navy's planned procurement of mines will be adequate to provide effective minefields when needed.

#### AGENCY COMMENTS

A draft of this report was reviewed by officials associated with the management of the program, and their comments have been incorporated as appropriate.

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1/"Status of the Navy's CAPTOR Ocean Warfare Mining System," (PSAD-78-23, Apr. 10, 1978).

## SURFACE SHIP TOWED ARRAY SONARS--

### THE PROGRAMS AND THE ISSUES

We studied the Navy's experience with currently operational towed array sonar systems and examined the status and issues pertinent to two major surface ship towed array acquisition programs. We find no reason to question continuing support for the Tactical Towed Array System (TACTAS) program. However, the Navy has not yet satisfactorily resolved important issues in the Surveillance Towed Array Sensor (SURTASS) program.

A towed array consists of a string of listening devices (hydrophones) encased in a hose-like structure towed behind a ship or submarine to detect the sounds generated by threat submarines operating within the array's detection range. The detection range of these systems is characteristically greater than that of hull-mounted sonars.

The Navy first installed towed arrays on submarines in the late 1960s, and surface ship installations began a few years later. The superior capability of these sensors was quickly demonstrated and resulted in their enthusiastic endorsement by Navy operational personnel. Improved towed array sensors are integral parts of the latest sonar suites being installed on both attack and ballistic missile submarines, and there are now two fundamentally different types of improved systems for surface ships that are in the full-scale development phase of the system acquisition process: SURTASS and the AN/SQR-19 TACTAS.

Both of these surface ship towed array development programs have been beset by technical problems since full-scale development was initiated in 1974 (SURTASS) and 1976 (TACTAS). As a result both have experienced considerable cost growth and schedule slippage and were substantially restructured in 1978.

#### TACTAS

The AN/SQR-19 TACTAS will be optimized to detect, classify, and localize threat submarines. Sensor data from the TACTAS array will be fully processed aboard the tow ship, and Navy sonar operators aboard the ship will perform the functions of detection; classification; and, usually in coordination with other similarly equipped ships, localization. The Navy is presently planning to procure

121 AN/SQR-19 production units. Several different classes of combatant ships will be equipped with the system.

Full-scale development of the AN/SQR-19 TACTAS program has only recently resumed after a period of intensive Department of Defense and congressional review. We have analyzed the program from the perspective of a wide range of issues and find no reason to question continuing support for the program.

### SURTASS

SURTASS is optimized for detecting, classifying, and localizing threat submarines at very long ranges. The SURTASS array will be towed about a mile behind a T-AGOS ship. 1/ SURTASS sensor data will be partially processed at sea before being transmitted ashore for further processing, display, and integration with undersea surveillance information from other sources. The 12 proposed unarmed T-AGOS ships will be manned by civilian crews, and Navy personnel will perform detection; classification; and, through correlation with data from other surveillance sensors, localization functions at shore-based facilities.

The Congress appropriated fiscal year 1979 funds to procure the first two T-AGOS ships, and in January 1979 the Navy solicited technical proposals for ship design and production. However, this solicitation has been canceled because in June 1979, the House Appropriations Committee insisted that no ship construction contract be awarded until operational evaluation (OPEVAL) is complete. The Navy requested fiscal year 1980 funds to procure an additional five ships, but the Congress appropriated funds for only one.

We have previously issued two reports 2/ which questioned whether support for the SURTASS program should continue. Our skepticism was based on technical problems encountered in system testing during calendar year 1978

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1/An oceanographic survey ship specially dedicated as a SURTASS tow platform.

2/"Assessment of the Navy's Undersea Surveillance System and Planned Improvements," PSAD-78-142, Sept. 13, 1978, and "The Navy's Surveillance Towed Array Sensor: Technical Problems and Unresolved Issues," PSAD-79-35, Feb. 14, 1979.

and on unresolved issues pertaining to the cost effectiveness of the system.

Testing that was conducted in the October 1978-October 1979 time frame indicates that most of the serious technical problems which affected the program in the past have been resolved. The results of this testing suggest that satisfactory performance of the SURTASS sensor will probably be demonstrated by the time the Defense Systems Acquisition Review Council (DSARC) is expected to consider whether production of the SURTASS sensor should be authorized.

However, the Navy has not yet satisfactorily resolved issues pertaining to the cost effectiveness of the system; and, in our opinion, it will not be able to address those issues satisfactorily before the scheduled DSARC review.

The value of mobile surveillance units in crisis and conflict situations is apparent, but the characteristics of unarmed T-AGOS ships are likely to severely constrain their ability to survive and function effectively in these situations.

SURTASS/T-AGOS is fundamentally a system configured for peacetime use. However, because the Navy has not established quantitative requirements for peacetime surveillance, it is impossible to verify how many mobile surveillance units might be required to augment fixed surveillance assets on a continuous basis.

Lacking a mobile surveillance system with anything like the capability of SURTASS to develop and test a variety of operational concepts, the Navy is understandably hard pressed to demonstrate at what quantitative level it would be reasonable to establish an operational requirement for peacetime mobile surveillance coverage.

Because of the inherent vulnerability of T-AGOS, we believe the Navy should give balanced consideration to installing SURTASS sensors on some combatant ships primarily for use in crisis and conflict situations. At the same time, SURTASS/T-AGOS units could obviously augment continuous peacetime surveillance capability much more efficiently than SURTASS/combatant units.

We have analyzed the Navy's SURTASS Force Level Study report and believe that the Navy lacks an adequate empirical basis on which to rationalize force mix and force level requirements.

The Navy's SURTASS Force Level Study indicates that, beyond four deployed SURTASS/T-AGOS units, force effectiveness does not increase proportionately with the size of the SURTASS/T-AGOS force. Data we abstracted from the Force Level Study also indicates that the life-cycle cost of a mobile surveillance force composed of 4 SURTASS/T-AGOS units and 8 SURTASS/combatant units would be about \$560 million less than the cost of a 12-unit SURTASS/T-AGOS force. Consequently, if the SURTASS sensor demonstrates satisfactory performance and operational characteristics in the technical evaluations (TECHEVALs) and CPEVALs that are scheduled, we believe that limited numbers of SURTASS/T-AGOS and SURTASS/combatant units should be deployed to develop and test a variety of operational concepts for mobile undersea surveillance before a substantial commitment is made to procure a large number of T-AGOS ships.

#### RECOMMENDATIONS TO THE SECRETARY OF DEFENSE

We recommend that the Secretary of Defense direct the Navy to (1) develop and test a balanced variety of operational concepts using limited numbers of SURTASS/T-AGOS and SURTASS/combatant units and (2) rigorously compare the cost effectiveness of using surveillance buoys as alternatives to mobile surveillance units.

#### RECOMMENDATION TO THE CONGRESS

We recommend that the Congress not appropriate funds for more than four T-AGOS ships until the Navy carries out the direction of the Secretary of Defense which is recommended above.

#### AGENCY COMMENTS

Navy and Department of Defense officials associated with management of the SURTASS and TACTAS programs reviewed a draft of this report. Many of their comments have been incorporated, as we believe appropriate, to improve clarity, completeness, and accuracy.

The Navy, however, does not concur with the above recommendations. The Navy asserts that the cost of T-AGOS ships would increase if it were necessary to interrupt production after the fourth unit, and it does not believe that the relative cost effectiveness of SURTASS-equipped combatants is a substantive program issue.

In regard to this latter point, the Navy argues that in crisis and conflict situations (1) any SURTASS-equipped combatants would most likely be assigned to higher priority, tactical functions and (2) even if assigned to the surveillance function, such ships would not be much less vulnerable than SURTASS/T-AGOS units.

After considering these comments, we see no reason to change our recommendations. In our opinion, it is premature to be concerned about economies of continuous production before deciding whether and to what extent there is a need to perform continuous peacetime surveillance; that is, to do the job for which T-AGOS is best suited. Also, we think that a combatant ship could be equally valuable whether used as a mobile surveillance unit or as an escort. Consequently, we believe that the Navy should experiment with combatants that can function in both roles before it either dismisses the concept or decides what number of ships should be equipped with SURTASS. Further, the Navy did not support its assertion that a combatant ship, with its defensive armament, could be as vulnerable as an unarmed T-AGOS ship.

F/A-18 NAVAL STRIKE FIGHTER:

ITS EFFECTIVENESS IS UNCERTAIN

The F/A-18 strike fighter is planned to replace such aircraft as the A-7, A-4, and F-4 presently used by the Navy and Marine Corps for fighter and light attack missions. This twin-engined aircraft can be based on aircraft carriers and will perform such missions as fighter escort, fleet air defense, interdiction (bombardment of enemy lines), and close air support.

However, the F/A-18 and its armament systems have problems. The flight test program has identified problems in areas critical to performance, including acceleration and range. The aircraft's mission effectiveness is limited by the armaments it carries and by delayed development of its self-protection and all-weather capabilities. These problems must be corrected if the aircraft is to fulfill its mission requirements effectively.

Despite delays in testing and in correcting performance problems, the Navy is adhering to its tight program schedule. It is not delaying production decisions, and this may be costly. In past aircraft programs that developed and produced a system at the same time, numerous performance problems proved to be costly both in dollars and lessened aircraft performance. The Congress should not permit the F/A-18 program to follow this path.

Costs of the F/A-18 program have grown markedly and could grow more, even though cost reduction efforts have been made in such critical areas as testing for reliability and maintainability.

Contractors' production problems and problems in areas not controlled by the Navy, such as

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inflation and fluctuations in the number of aircraft planned for production, have contributed to cost growth.

These problems, together with expected costs to develop the F/A-18's advanced self-protection and all-weather capabilities, are expected to cause further cost growth. Also, contractors have had to purchase long-lead parts and materials in advance of Navy funding authorizations, which could significantly affect the program's cost.

The Department of Defense and the Navy have been ineffective in developing and monitoring various data important to proper management of the F/A-18 program. Also, Defense reports have not adequately presented information to keep the Congress informed of progress in the program.

#### RECOMMENDATIONS

The Secretary of Defense should:

- Delay increasing the F/A-18's monthly production rate until performance problems have been corrected and adequate testing has been completed for the Navy to assess the aircraft's mission capability.
- Give priority attention to developing the advanced self-protection and all-weather capabilities the F/A-18 will need to fulfill its missions.
- Develop strategies for assuring advance funding when needed to support contractors in their long-lead purchase obligations.
- Reassess the estimated cost of the F/A-18 program in light of identified problems and report this to the Congress.
- Ensure that needed management reporting devices are established and monitored.
- Revise reporting requirements to ensure reporting of most recent testing data.

AGENCY COMMENTS

This report was discussed with Department of Defense officials responsible for the F/A-18 aircraft program. Their remarks were included as appropriate.

A DECISION BY THE SECRETARY OF DEFENSE IS  
NEEDED ON THE AV-8B AIRCRAFT PROGRAM

The AV-8B aircraft, with its ability to take off and land vertically, is being designed for the Marine Corps, which contends that the plane will provide its forces with the most effective close air support through the end of this century. However, the program is experiencing severe cost growth, and its mission is a subject of controversy in the Department of Defense. Much of this growth is attributable to inflationary estimates because of delays in carrying out the program.

Although the Secretary of Defense decided not to request AV-8B development funds in the fiscal year 1980 budget and withheld much of the 1979 AV-8B development funds, strong congressional interest enabled the program to survive. In the fiscal year 1980 Defense budget, the Congress appropriated \$180 million to permit its continued development.

Although it did this with the intent that it would achieve an initial operational capability in 1984, delays by Defense have forced this capability back 2 years to 1986. Should the AV-8B program proceed, these delays will add almost \$1 billion to the total estimated cost.

If an initial operational capability were achieved in 1985, more than \$350 million could be saved. This can be accomplished if procurement funds are granted in 1981 rather than in 1982 as now planned.

Further, at maximum production, Defense plans to acquire only four and one-half AV-8Bs each month. As in many other weapon

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procurements, low production rates are inefficient and stretching programs over many years allows inflation to drive costs upward.

Controversy over the AV-8B in the Department of Defense continues. Opponents argue that conventional aircraft provide greater speed and carry a greater payload; thus, they are more effective. Proponents argue that the AV-8B will provide more responsive close air support. In the midst of this controversy, the Marine Corps remains convinced that the AV-8B will provide it with the most effective close air support.

The AV-8B program will incur other cost increases. For example, trainer aircraft will have to be purchased and a more effective gun system is needed. A 25-millimeter gun now being developed, which has a higher rate of fire and is more economical to maintain than the gun planned for the AV-8B, is one system being considered by the Navy.

#### RECOMMENDATIONS

The Secretary of Defense should decide to either proceed with or terminate the AV-8B program.

If he does decide to proceed with it, he should:

- Consider the cost savings attributable to the AV-8B program by requesting procurement funds in 1981 and changing the initial operational capability milestone to 1985.
- Evaluate alternatives to determine the most efficient AV-8B production rate.
- Include cost for necessary trainer aircraft and a more effective gun and ammunition in the AV-8B program.

If a decision is made to terminate this program, the Congress should be made aware of whether Defense has any plans for an alternative vertical and short takeoff and landing aircraft.

A draft of this report was reviewed by officials associated with the management of the program, and their comments have been incorporated as appropriate.

**CHAPTER 4**  
**AIR FORCE PROGRAMS**

THE MX WEAPON SYSTEM--A PROGRAM WITH  
COST AND SCHEDULE UNCERTAINTIES

The new MX weapon system has entered full-scale development, yet many uncertainties remain to be resolved.

- Will the method of survivable basing selected by the President be approved for funding by the Congress while it is considering the fiscal year 1981 budget?
- Can the land necessary for deployment be obtained soon enough, and will the large amounts of electricity, water, and building materials for construction and operations be available at the appropriate time?
- Can the cost, schedule, and performance goals be attained?
- What impact would the lack of arms control agreements have on the survivability of the proposed MX system?

The Air Force estimates that the MX weapon system will cost about \$33 billion (1978 dollars). Inflationary adjustments will increase this estimated cost to at least \$56 billion. These estimates do not include Department of Energy costs for warhead development, acquisition, and maintenance.

The \$33 billion estimate may not be meaningful because of uncertainties concerning the size of the missile force, the number of surviving intercontinental ballistic missile warheads needed to be able to counter an attack, the number of base support facilities, and the design of the weapon system. These design uncertainties include such things as the spacing between shelters, the size of the shelter, and the size of the transporter-erector-launcher vehicle.

The high cost of the MX system raises a serious question regarding its affordability. In view of current budget limitations, the Department of Defense is faced with determining what is affordable in terms of a large number of weapon systems. Although this has been a matter of discussion with the Congress as recently as February 1980, it seems that Defense has not established priorities in case all planned programs are not fully funded.

Initial deployment of the system is planned for July 1986, with full deployment to be accomplished by 1989. It is questionable, however, whether the July 1986 date can be met because land necessary for deployment may not be obtained soon enough.

Normally, public land is acquired through a formal process, known as withdrawal, in accordance with Federal statutes. Withdrawal of public land for a project the size of MX has a large potential for program delay because the process is complex, time-consuming, and politically sensitive. That potential is being compounded because the Air Force is still attempting to determine what site(s) will be considered for MX deployment and what criteria will be used in comparing alternative sites. Further, the Air Force is still in the process of determining what issues will be addressed in the site selection environmental impact statement and what additional analytical work remains to be done.

In a letter to the Secretary of Defense on April 18, 1979, GAO reported the potential for schedule delay because the Air Force estimate of the time required for land withdrawal was unrealistic and recommended that the Secretary of Defense establish a memorandum of agreement with the Secretary of the Interior setting forth a time-phased action plan.

Defense agreed with GAO's recommendation but declined to take action until after a basing decision was made. Those steps have been initiated but not completed. Until a basing

decision is made, the Air Force will not know precisely what must be done by whom to accomplish the land withdrawal process within the prescribed time frame.

The MX weapon system will require large amounts of electricity, water, and building materials for construction and operations. The Air Force has yet to conclusively demonstrate that sufficient resources can be made available at the appropriate time.

The MX basing mode can ensure survivability of a sufficient retaliatory force only if the location of a substantial number of missiles is unknown to an attacker. Lack of such knowledge will force him to attack all possible locations to ensure destruction of any one missile. Whether the Air Force can keep the location of the missile unknown using planned security concepts is uncertain.

Ratification of the Strategic Arms Limitation Talks treaty, as proposed, is currently being held in abeyance. Treaty limitations on the number of Soviet warheads is a critical element in assuring that the MX weapon system with 200 missiles and 4,600 shelters spaced 7,000 feet apart will have the desired level of survivability. Without such limits, the Soviets could build enough weapons to neutralize the MX. In such a situation, the Air Force could expand the system, but expansion would raise questions on funding, resource availability, and land use.

There may not be sufficient qualified personnel to effectively manage the program during the critical first year of full-scale engineering development. This could have an adverse impact on the entire program.

#### CONCLUSIONS

GAO recognizes that as development of the MX progresses, many of the uncertainties will be

resolved. This does not, however, prevent the need, at the very beginning of full-scale development, for a complete disclosure of program uncertainties and the potential impact on cost, schedule, and performance goals.

#### RECOMMENDATIONS

The Secretary of Defense should:

- Identify the potential increases or decreases in program cost due to the many uncertainties which still have to be resolved. Related potential impact on schedule and performance goals should also be shown.
- Assure that the high cost of the MX system is adequately analyzed in the context of the overall DOD budget to determine if it is affordable and whether any other major weapon system programs would have to be terminated or delayed.
- Expedite efforts to establish a memorandum of agreement with the Secretary of the Interior setting forth a time-phased action plan which will allow public land to be withdrawn for the MX weapon system. This information should include a listing of statutory requirements which cannot be satisfied within prescribed time frames and, therefore, may require special congressional action.
- Identify the changes to the MX weapon system that may be required without arms control agreements. If these changes involve construction of more shelters, information should be provided identifying (1) the additional land, electricity, water, and construction materials needed and (2) the availability of those resources.

#### AGENCY COMMENTS

This report was reviewed by agency officials associated with the management of the program, and their comments have been incorporated as appropriate.

WILL THE PRECISION LOCATION STRIKE

SYSTEM BE EFFECTIVE UNDER

WARTIME CONDITIONS?

The Precision Location Strike System (PLSS) program has several issues that should be thoroughly assessed or resolved before proceeding with the full-scale development program. These issues include:

- The potential use of countermeasure that could degrade PLSS performance.
- Questionable central processing system survivability.
- Possibility of interference from friendly forces.
- Uncertain availability/suitability of the prime standoff weapon.
- Questionable suitability of alternate standoff weapons.
- Uncertain program plans.
- Questionable cost effectiveness.
- Diverse opinions over the PLSS mission.

In addition, the PLSS Selected Acquisition Reports (SARs) may be misleading regarding PLSS program cost and performance.

PLSS is being developed for the air defense suppression mission. The system is being designed to detect, identify, and locate electronic emitters (primarily air defense radars) and to direct strike aircraft against them. It is also intended to guide strikes on nonemitting targets which have been identified by other reconnaissance and intelligence systems.

POTENTIAL  
COUNTERMEASURES

PLSS' ability to detect and locate emitters is derived from using detection equipment aboard three airborne relay vehicles which intercept enemy electronic emissions. The intercepted emissions are relayed to a central processing

subsystem which computes the location of the emitters. The Soviets may reduce PLSS' ability to accomplish this with electronic countermeasures which could reduce PLSS' ability to detect, identify, and locate emitters.

#### CENTRAL PROCESSING SUBSYSTEM SURVIVABILITY

A recent Air Force study indicates that the central processing subsystem is extremely vital to the overall effectiveness and survivability of PLSS.

#### INTERFERENCE

Friendly forces could obscure enemy emitters if the relative geometry of the emitters, the friendly forces, and PLSS aircraft is correct. This interference is considered temporary and will cease when the relative geometry changes. The likelihood of interference increases when a significant number of friendly forces operate within the postulated battle area. The Air Force does not presently know the full extent to which the friendly forces will affect the PLSS detection capability. Air Force officials stated that PLSS susceptibility will be tested during initial operational test and evaluation, and tactics will be developed to minimize interference problems.

#### AVAILABILITY/SUITABILITY OF THE PRIMARY STANDOFF WEAPON

PLSS is currently planned to guide weapons to the target from a standoff position, thus permitting the strike aircraft to release weapons from outside the enemy's air defense range. This reduces the probability of aircraft loss during the strike mission. The primary weapon planned for PLSS is the Glide Bomb Unit (GBU-15) Planar Wing Weapon (PWW). The Air Force has made 14 GBU-15 PWW test launches that resulted in 7 failures. Because of the unfavorable test results, the GBU-15 Program Office has proposed a restructured GBU-15 PWW test program that will include additional testing. Since no funds are available for further testing, the Air Force has not established a firm schedule for the restructured test program. At this time, the continuation of the GBU-15 PWW test program is uncertain.

#### SUITABILITY OF ALTERNATE STANDOFF WEAPONS

Air Force officials said other weapons could be used to give PLSS a standoff strike capability. Two

weapons mentioned are the GBU-15 Cruciform Wing Weapon (CWW) and an air-to-surface version of the Army's Patriot missile. It does not appear that either of these weapons would provide the same effectiveness as that projected for the GBU-15 PWV. The GBU-15 CWW has less range than the PWV. No feasibility studies have been made to determine whether the Patriot is compatible with PLSS. Further, PLSS Program Office representatives said no funds were included in the fiscal year 1980 or 1981 budgets for alternate weapon studies or demonstration.

#### UNCERTAIN PROGRAM PLANS

For fiscal year 1980 the Air Force requested \$81.5 million to continue the PLSS development program. During the Department of Defense budget cycle, the Office of the Secretary of Defense reduced the PLSS budget request to \$24.9 million. This amount was incorporated in the President's fiscal year 1980 budget.

To accommodate the proposed \$24.9 million funding limitations, the PLSS Program Office was directed to develop alternatives for restructuring the development program. Accordingly the Program Office developed four alternative plans which provided various cost, schedule, and performance options. The PLSS Program Office briefed the Office of the Secretary of Defense on these four plans in May 1979. The Office of the Secretary of Defense did not approve any of the plans, but requested the Air Force to perform several other planning exercises assuming different funding levels and system configurations.

After the Congress reduced the PLSS fiscal year 1980 funding to \$15 million, the Air Force conducted other planning exercises which recognized the additional budget cut. These exercises influenced the preparation of the President's fiscal year 1981 budget.

#### QUESTIONABLE COST EFFECTIVENESS

PLSS' cost effectiveness has not been established. The Air Force's 1975 study of PLSS did not conclusively establish PLSS cost effectiveness and was based on what now appears to be invalid assumptions. No cost-effectiveness study exists which updates the assumptions or recognizes potential enemy countermeasures.

## DIVERSE OPINIONS ON PLSS MISSION

Although no changes have yet been made to the official PLSS concept, there are diverse opinions regarding the appropriate PLSS mission within the Department of Defense. Some Defense officials want PLSS to have both a location and strike capability. Other officials only want PLSS to have a means of determining emitter location (an intelligence gathering mission).

## QUESTIONABLE SAR

The PLSS SAR shows performance information that could be misleading and does not include pertinent performance data. For instance, the strike accuracy requirement reported in the SAR is subject to at least two interpretations. Omitted SAR data include performance requirements and estimates for the accuracy by which electronic warfare sources must be located and the strike accuracy for unguided weapons.

The PLSS SAR also does not fully disclose all of the full-scale development costs and, currently, does not include a production cost estimate. As such, the September 30, 1979, SAR reported PLSS costs about \$1.3 billion less than the Program Office's October 1979 estimate.

## RECOMMENDATIONS

We recommend that the Secretary of Defense:

- Direct the Secretary of the Air Force to have an independent organization determine the effect of potential countermeasures on PLSS performance.
- Have the Defense Systems Acquisition Review Council (DSARC) review the PLSS program after the above assessment is completed. This review should make a thorough evaluation of PLSS and should consider such matters as (1) the results of the countermeasures study, (2) the effect of Soviet air defense deployment on PLSS effectiveness, (3) central processing subsystem survivability, (4) PLSS strike effectiveness with and without standoff weapons, (5) the potential effect of friendly forces' interference with PLSS, and (6) an affirmation or redefinition of the PLSS mission. The DSARC review and its recommendation(s) should be supported by a current cost-effectiveness analysis that reflects the present PLSS program.

- Fund the PLSS program at a minimum level until a DSARC evaluation is completed and a Department of Defense decision is made on whether PLSS is cost effective for the selected mission.
- Take action to ensure that the weapon and PLSS development schedules are compatible and that sufficient funds will be available to finance both PLSS and weapon development programs if PLSS is to have a strike capability with a standoff weapon.
- Improve PLSS SARs by (1) clarifying the existing strike accuracy requirements, (2) reporting additional performance requirements and estimates for the location accuracy of electronic warfare sources and the strike accuracy for unguided weapons, and (3) disclosing total program cost estimates.

In January 1980 agency officials said that a restructured program has been proposed for inclusion in the President's fiscal year 1981 budget. This proposal would reduce the estimated program cost to about \$700 million, primarily by reducing the number of production systems and the number of support aircraft to be procured. The Air Force would not furnish us this proposal until the President's budget was submitted. By that date, there was not enough time to review the proposal and issue this report in a timely manner.

#### AGENCY COMMENTS

A draft of this report was reviewed by agency officials. Generally, they agreed with the report draft. As appropriate, their comments were included in the report.

IS THERE A NEED FOR THE ADVANCED STRATEGIC

AIR LAUNCHED MISSILE AND, IF SO,

CAN WE AFFORD IT?

The Advanced Strategic Air Launched Missile (ASALM), in concept, is a multipurpose missile to be carried on B-52, FB-111, and future strategic aircraft. It is intended for a dual role, air-to-air and air-to-ground. It is to be capable of suppressing selected airborne and ground defenses and striking primary objective targets.

In August 1979 we reported to the Secretary of Defense that the Air Force was planning to proceed with ASALM subsystem demonstration and validation prior to having a Defense Systems Acquisition Review Council (DSARC) review of the program. The Air Force subsequently revised its plans, and a DSARC I review was scheduled for early 1980.

The ASALM development program is structured to include a two-contractor, competitive subsystem demonstration/validation phase followed by a one-contractor, full-scale engineering development phase. The total development cost of the ASALM program through fiscal year 1986 is estimated to be \$2 billion, and the total procurement cost is estimated to be \$5.4 billion based on a quantity of 1,500 missiles.

The technology needed for ASALM is challenging. The air-to-air guidance subsystem required to counter the Soviet Airborne Warning and Control System (SUAWACS) includes three separate guidance units and is still very conceptual in nature. The radar cross section goal for the system represents a high risk, and the maturity of the propulsion subsystem has not been fully demonstrated.

Now that it plans to follow the DSARC review process prior to continuing the ASALM program to the subsystem development phase, we believe the Air Force is proceeding in an orderly fashion. There are certain critical issues, however, which need to be resolved before the ASALM program goes much further.

First, the ASALM range may be limited by the proposed Strategic Arms Limitation Talks (SALT) agreement, and this may have an effect on the missile's effectiveness. SUAWACS, the primary threat for which ASALM is being developed, might be able to detect a high-altitude bomber at a theoretical range which is limited by line-of-sight. Therefore, the

bomber could be detected at high altitude before ASALM is launched.

Further, because of the uncertainty surrounding the future options available for the strategic offense forces, there is a question on what penetrating aircraft will carry ASALM. The B-52s may all be converted to cruise missile carriers by the 1990s. This raises the issue of whether an air-to-ground role for ASALM is needed and what missile quantities are required.

Finally, the affordability of ASALM is a real issue. Since the research and development cost alone on ASALM is estimated to be \$2 billion and the possibility exists that it may be used in an air-to-air role only, the ASALM program may be too expensive.

In our opinion, each of these issues is so critical that an adverse decision on any one of them could have a dramatic effect on the future of the program. We believe, therefore, that the Air Force should come to grips with these matters now and not wait until the end of the subsystem phase, proposed to take about 3 years, to decide what to do with the ASALM program. We also believe that it would be useful to the Congress in its deliberations on this program to have the benefit of the Air Force's analyses and conclusions on the critical issues in the ASALM program.

#### RECOMMENDATION

We recommend that, in conjunction with the fiscal year 1982 request for funds for the ASALM program, the Secretary of Defense assure that the Air Force is prepared to discuss with the appropriate congressional committees (1) whether ASALM would provide adequate force effectiveness against SUAWACS if its range is limited, (2) what carrier aircraft will be equipped with ASALM and in what quantities, and (3) whether the program is affordable in view of other strategic offensive system priorities and in view of the potential for only an air-to-air role for the missile.

#### AGENCY COMMENTS

A draft of the report was reviewed by agency officials associated with management of the program, and their comments have been incorporated as appropriate.

B-52 MODERNIZATION: A MULTIBILLION DOLLAR  
PROGRAM TO RETAIN THE EFFECTIVENESS OF THE  
U.S. BOMBER FORCE

Our review of the B-52 modernization programs showed that (1) the high degree of development and production concurrency and other schedule challenges include an inherent risk in meeting program cost and schedule goals, (2) the offensive avionics system (OAS) and the cruise missile interface programs have not been managed according to prescribed weapon system acquisition procedures, (3) follow-on modernization programs are being considered which include penetration aids for both B-52G and B-52H aircraft, even though the B-52Gs are being converted to standoff cruise missile carriers and the ability of B-52s to penetrate Soviet defenses is declining, and (4) the Air Force's Strategic Air Command (SAC) is concerned about the B-52's decreased range when carrying cruise missiles.

MODERNIZATION PROGRAM FACES  
SCHEDULE CHALLENGES

Because of the leadtime required to manufacture some offensive avionics and cruise missile carriage (CMC) components, the Air Force has started production over 2 years before they plan to complete full-scale engineering development. Some parts will be produced before development and testing are completed, and problems identified during this period could require production line changes and retrofit to completed components. Other modifications to the B-52 and its related support systems present additional schedule challenges for the Air Force.

Both the B-52 modernization and Air Launched Cruise Missile (ALCM) development and production programs are success-oriented and must maintain their schedule if the B-52/ALCM weapon system is to be operational on the planned IOC date of December 1982. Both programs have experienced some schedule delays, but the Air Force believes the IOC can still be met. The history of past concurrent programs demonstrates that cost increases and additional schedule delays are likely to occur. The potential for increased costs and schedule problems, however, have been determined by the Air Force as risks that must be accepted to meet the cruise missile IOC date.

We recommend the Secretary of Defense closely monitor both the ALCM and B-52 modernization development and production schedules. If it becomes evident that either program cannot meet the IOC date, the Secretary should evaluate the cost effectiveness of schedule adjustment alternatives to determine if lengthening the other program schedule would reduce concurrency and help avoid large cost increases that have been experienced in past concurrent programs.

DEFENSE SYSTEMS ACQUISITION  
REVIEW COUNCIL SHOULD REVIEW  
PROPOSED MODERNIZATION PROGRAM

Although the offensive avionics and CMC program is estimated to cost over \$3 billion and should be considered a major system acquisition, the Air Force has authorized both full-scale engineering development and production without a formal review by the Defense Systems Acquisition Review Council (DSARC). Because of the program's high priority, however, members of DSARC have been involved in the decisionmaking process, and both Air Force and Office of the Secretary of Defense officials believe, in this case, a formal DSARC review is unnecessary. As pointed out in our July 1979 report 1/, recent congressional hearings, and the directive by the Armed Services Committees to the Secretary of Defense to submit a report on B-52 modifications, there have been many uncertainties in this program. It is precisely these types of programs where formal reviews are needed.

The Air Force is now considering follow-on avionics modernization programs that would provide major improvements to the B-52G and B-52H avionics systems and could cost over \$3 billion. We believe the acquisition procedures established in the Office of Management and Budget's Circular A-109 and Department of Defense directives should be applied to these programs. Therefore, we recommend the Secretary of Defense ensure formal reviews are conducted by the DSARC at important program milestones.

SOME FOLLOW-ON MODIFICATIONS  
MAY BE AVOIDED

The Air Force's follow-on avionics program under consideration include capabilities to aid the aircraft achieve

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1/"Information on Proposals Being Considered by the Air Force to Modernize the Strategic Bomber Force," (PSAD-79-92, July 13, 1979).

stated objectives even though questions have been raised as to whether the B-52 have the flexibility to meet the demands of the late 1980s and 1990s.

On December 14, 1979, the Secretary of Defense reported to the Congress that the B-52G will be converted to a standoff carrier by the late 1980s. He reported the B-52H would continue to penetrate, but the Department of Defense would maintain the option to convert it to a cruise missile carrier also if the threat develops as expected.

We believe B-52 follow-on modernization should be directly tied to the future role of the aircraft and recommend the Secretary of Defense consider the Air Force's proposals for strategic force modernization. If the B-52G is converted to a cruise missile carrier as planned, modifications designed solely to enhance certain other capabilities should be avoided. In addition, if the Air Force determines B-52Hs will be unable to penetrate Soviet defenses or if the Congress approves funds to modify FB/P-111 aircraft, to fill the penetration role, the Secretary of Defense should ensure only those B-52H modifications necessary for the standoff role are approved and that other costly modifications be avoided.

#### SAC CONCERNED ABOUT B-52 RANGE

A SAC analysis shows the B-52G operational range will be reduced when carrying ALCMs and used in the shoot and penetrate role. The drag from pylons and cruise missiles mounted under the aircraft's wings cause a range reduction, and a smaller load of fuel to offset the weight of the cruise missiles causes an additional range reduction. To maintain the B-52's current range, SAC has estimated that up to 59 more tanker aircraft might be needed to provide additional refueling. Part of the additional refueling will be available if more fuel efficient engines are installed on KC-135 tanker aircraft so they can offload more fuel to receiver aircraft. SAC is studying other options to increase the B-52's range.

We recommend the Secretary of Defense review the effect of reduced B-52G range on U.S. strategic bomber capabilities and determine if actions are necessary to maintain or increase the aircraft's range. If the Secretary determines certain actions are necessary, he should report these actions to the Congress, including a complete assessment of the cost and other relevant factors.

## AGENCY COMMENTS

This report was reviewed by agency officials associated with the management of the B-52 aircraft modernization programs, and their comments have been incorporated in the report as appropriate. These officials generally agreed with our conclusions and recommendations.

## PLANNING THE STRATEGIC BOMBER FORCE OF

### THE FUTURE--MANY ISSUES MUST

#### BE RESOLVED

The stated objectives of the strategic offensive forces are to deter all levels of actual attacks and attempts at coercion under threat of attack against the United States, its allies, or any nation whose security is vital to U.S. interests. If deterrence fails, the objectives are to conduct warfare in a manner that will achieve national objectives and terminate the conflict on the most favorable terms possible to the United States. These objectives are carried out with reliance on a Triad of diversified weapon delivery systems. In 1979 Triad consisted of 1,054 land based intercontinental ballistic missiles (ICBMs), 556 submarine launched ballistic missiles (SLBMs), and about 400 bombers.

Major programs approved to modernize strategic forces are the MX missile for the ICBM force, Trident submarine and C-4 missile for the SLBM force, and the air launched cruise missile for the bomber force. Our review concentrated on the bomber force, but recognized that the bomber force, ICBM, and SLBM forces are closely interrelated.

We issued a related report on July 13, 1979, entitled "Information on Proposals Being Considered by the Air Force to Modernize the Strategic Bomber Force" (C-PSAD-79-92). Other reports issued on the MX missile system, cruise missiles, B-52 modernization, and the advanced strategic air launched missile (ASALM) are discussed in this report. These reports contain several major issues concerning whether the programs approved to modernize Triad will provide the focus necessary to meet stated objectives.

#### DISAGREEMENT ABOUT THE ADEQUACY OF STRATEGIC FORCES

There is a general consensus that the Soviet's are improving the capabilities of their strategic forces. But, a consensus does not exist within the Department of Defense on the degree or meaning of these improvements. The Secretary of Defense and the Strategic Air Command (SAC) both analyzed the forces using different approaches and are not in full agreement concerning the adequacy of the programed forces to provide continued deterrence.

ABILITY OF B-52s TO PENETRATE SOVIET  
DEFENSES IS DECLINING

Despite the capability to modify, update, and change the mission of B-52s, they are aging and their effectiveness as penetrating aircraft will decline as the Soviet Union improves its defenses. Because of its basic design, serious questions have been raised as to whether the B-52s have the flexibility to meet the demands of the late 1980s and 1990s.

If this flexibility is not met, it might be necessary to rely on cruise missiles, which have not yet been fully tested to accomplish the objectives of the bomber force.

PLANS FOR FUTURE BOMBER FORCE  
PROGRAMS ARE UNCERTAIN

Some Defense officials stated that the Five-Year Defense Plan reflects funding for the bomber force. To our knowledge, though, there is no comprehensive long-range plan that assesses alternatives and specifies the total needs for an effective bomber force into the 1990s or beyond. There is a continuing debate within the Department of Defense about how to best accomplish the mission assigned to the bomber force. Even though plans must be made now if the United States is to field new weapon systems by the early 1990s, there is a great deal of uncertainty concerning the need for and timing of new aircraft, weapons, and defensive systems for the future.

The major programs involved in the debate about the future bomber force include:

- Further modifying the electronics systems of the B-52Gs and B-52Hs.
- Developing and maintaining an option to procure new cruise missile carrier aircraft (CMCA) at an eventual cost of about \$22.0 billion.
- Developing an advanced strategic air launched missile with possible procurement following at a total cost of about \$7.4 billion for 1,500 missiles.
- Developing a new manned bomber with possible procurement which would be a multibillion dollar program.

SAC has also proposed modifying 66 FB-111As and 89 F-111Ds to provide a near-term penetrating bomber at a

cost of about \$7.4 billion. The Air Force has not approved that proposal and has not requested funding for that program.

The proposals for future bomber force programs are not cohesive and are not built around a long-range plan. The difficulty in defining the types and quantities of aircraft, weapons, and defensive systems needed for the future is caused by many factors including the undefined Soviet reaction to cruise missiles and the high cost of new weapon systems. Several officials of the Air Force and OSD noted that another difficulty is a perception within the Department of Defense that the current administration would not be receptive to a major initiative for a penetrating manned bomber. Without a more comprehensive long-range plan for the bomber force, it is difficult to evaluate the need and timing for aircraft, weapons, and defensive systems; to identify the alternatives; and to assess their cost effectiveness.

### RECOMMENDATIONS

We recommend that the Secretary of Defense reconcile the differences between his conclusions and those reached by SAC. To narrow the differences in future analyses of the strategic offensive forces, we recommend the Secretary of Defense:

- Establish more precise guidance on the desired capabilities of the strategic offensive forces.
- Evaluate the critical assumptions and analytical approaches used to make comparative force projections.
- Where possible, narrow the range of differing assumptions and analytical approaches.

We also recommend that the Secretary of Defense resolve the major issues concerning the future of the bomber force and produce a comprehensive long-range plan for the bomber force compatible with the overall objectives for the strategic Triad. That plan should, at a minimum, address the contribution expected from the bomber force through the mid-1990s, as well as:

- The required mix of standoff cruise missile carriers and penetrating aircraft.
- The equipment required to effectively penetrate in the mid to late 1980s and in the 1990s.

- The future role of the B-52s and need for further modifications.
- The need for new cruise missile carriers in the 1980s.
- The cost effectiveness of replacing B-52s in the 1980s, rather than modifying all of them.
- The trade-offs among certain Triad systems and cruise missile carriers to stay within Strategic Arms Limitation Talks (SALT) limits that could exist after 1985.
- The most appropriate method of dealing with Soviet Union Airborne Warning and Control System (SUAWACS) and fighters with improved capabilities beginning in the mid to late 1980s.
- The need to replace SRAM with an improved air-to-ground weapon and the most cost-effective choice of systems.

While we recognize that these issues are not easily resolved and the decisions will be accompanied by some risks, we believe a more comprehensive long-range plan is required to bring more formal discipline and structure into the planning for the future bomber force.

Therefore, we recommend that the House and Senate Appropriations and Armed Services Committees require the Secretary of Defense to provide his proposed resolution to all of those issues cited above before the fiscal year 1982 budget is presented to the Congress.

#### AGENCY COMMENTS

This report was reviewed by agency officials associated with the management of the program, and their comments have been incorporated in the report as appropriate. These officials generally concurred with the conclusions and recommendations.

**CHAPTER 5**  
**JOINT PROGRAMS**

## CRUISE MISSILES: STATUS AND ISSUES AS

### THEY NEAR PRODUCTION

Five cruise missile variants are being developed for use in a variety of roles. Most problems associated with planning, scheduling, and funding are unique to each variant. Some problems are shared; these relate to such common systems as the guidance and engine. Cruise missiles can carry nuclear or conventional warheads and be launched from the air, sea, or ground. The commonality and versatility allows all the variants to be considered as viable weapon system options; however, the need for some variants has not been clearly established. Estimates for their development, procurement, and necessary facilities total \$7.7 billion as of September 1979, exclusive of warhead and support costs. Additional cost, quantity, and schedule data are included in appendix I.

### AIR-LAUNCHED CRUISE MISSILE

A competitive flyoff of this variant between the two competing contractors--General Dynamics and Boeing--was completed on February 8, 1980. The air-launched cruise missile (ALCM) production decision is scheduled to be made in early April 1980. After the decision, many questions will remain concerning total system performance. The competitive flyoff was not a complete test of the total system and its support subsystems because the B-52G carrier aircraft launch equipment and several hardware and software support components were not available for the flyoff.

Because the results of the competitive testing are source-selection sensitive, we did not review detailed test data. Moreover, much of it is just now being analyzed and becoming available. Nevertheless, our review showed that weather conditions and several failures during testing contributed to the competitive flyoff completion being delayed by 2 months to February 1980. This has, in turn, caused a 2-month delay in the production decision. Total system flight testing will also be delayed due to concurrent development and production of equipment to modify B-52Gs into cruise missile carrier aircraft (CMCA).

The potential magnitude of the ALCM procurement is not fully reflected in the approved program. A procurement of 3,418 missiles has been approved by the Office of the Secretary of Defense (OSD); however, this could change

based on alternative weapons mix proposals. This issue is compounded by uncertainties in quantities needed for various sea-launched roles and a recent decision to deploy a ground-launched version.

A program to study a new carrier to supplement or replace the B-52 has been underway since 1977. Many new aircraft designs have been investigated, and the most recent studies have focused on multipurpose aircraft. To date, the Air Force has not issued a Mission Element Need Statement (MENS) identifying the aircraft's specific need.

### SEA-LAUNCHED CRUISE MISSILE

There are three variants of the sea-launched cruise missile (SLCM): the land attack with a nuclear warhead, the land attack with a conventional warhead, and the antiship version. Many components of these variants are common with the General Dynamics ALCM.

OSD seems reluctant to produce and deploy the nuclear, land attack SLCM. This is evidenced by the

--lack of an approved SLCM Decision Coordinating Paper (DCP) and MENS,

--extended development program,

--wavering in procurement funding, and

--lack of a deployment date.

The Navy is developing a conventional land attack SLCM without a formal statement of need or review by the Department of Defense (DOD). Currently, the Navy is conducting a study of conventional long-range attack weapons.

The antiship version being developed by the Navy, while using many subsystems common to other sea-launched variants, requires an entirely different guidance system. Critical elements of this guidance system have yet to be tested. A reliable over-the-horizon (OTH) targeting capability is essential to realize the range capability of this antiship SLCM. The capability that now exists is seriously deficient.

In addition, inventory objectives for all sea-launched variants are unclear. The Secretary of Defense has not supported the Navy's program in terms of quantities and, to this point, has approved procurement for only 447 of the Navy's planned 1,173 missiles. Navy officials do not believe the approved program is realistic, and they envision a much larger buy.

#### GROUND-LAUNCHED CRUISE MISSILE

The ground-launched cruise missile (GLCM) variant is an adaptation of the General Dynamics SLCM. This missile program entered full-scale development without a MENS or approved DCP.

In December 1979 the North Atlantic Treaty Organization (NATO) allies decided to modernize their theater nuclear forces with medium-range GLCM and Pershing II missiles capable of striking Soviet territory. Until NATO decides on the appropriate mix and specific locations of weapons, questions on missile basing and quantity requirements will remain open.

The GLCM development and production schedules are considered very optimistic by the Air Force, and the project office is closely monitoring them.

#### CRUISE MISSILE ENGINES

After almost 8 years of development, the cruise missile engine is undergoing qualification testing. If approved, it will begin low-rate production in 1980. The engines now being qualified are not the final configurations to be produced for all cruise missile variants. Additional changes are expected as development progresses and reliability improvements are made.

The uncertainty surrounding engine reliability during storage and the absence of a procedure to ensure engine operability before use requires reexamination. Representatives of the engine contractor and the project office are discussing warranty terms and conditions and a reliability demonstration program.

The engines met or exceeded most specification requirements during early qualification tests. Engine experts, however, believe that engines produced under high-rate production conditions may not perform as well, and this could affect ALCM's reliability. Consequently, both the Air Force and the engine contractor have recommended a program to improve its performance.

## LAND ATTACK CRUISE MISSILE GUIDANCE

The guidance program has two shortcomings involving data availability. In 1977 and 1978 the Defense Mapping Agency (DMA) overestimated its capability to produce digital maps for the Terrain Contour Matching System's (TERCOM's) use. Its current estimated production schedule is now the minimum acceptable to the using commands. In addition, DMA has recently found that some source data from which maps were planned to be made is unusable due to accuracy requirements being more stringent than expected. In December 1979 DMA stated that this situation has improved because of the recent acquisition of better source data.

A formal operational requirement for a precision guidance system for a conventional land attack cruise missile has not been established, although the Navy says one is reflected in the guidance from OSD. The project office is developing such a system without fully adhering to Office of Management and Budget Circular A-109 and a Deputy Secretary of Defense requirement that cruise missile programs involve wide industrial participation to introduce innovations.

## SURVIVABILITY TEST PROGRAM

The project office implemented the cruise missile survivability test program to provide a technical basis on which to evaluate cruise missile survivability. The program is being accomplished in three phases. Phase I has been completed, and it has provided initial assessments of cruise missile susceptibilities to a group of existing and potential Soviet defenses, but many questions remain unanswered. Phase I shortcomings have been corrected for Phase II. Phase II is now addressing cruise missile survivability to the degree necessary to answer the questions of the production decisionmakers for each cruise missile variant. Phase III will occur after the production decision is made and will address objectives not fully satisfied in Phases I and II.

## RECOMMENDATIONS

We recommend that the Secretary of Defense:

- Expedite preparation of a CMCA MENS.
- Initially approve only a limited production quantity of ALCMs and postpone the full-scale production decision until remaining tests of the total weapon system can be conducted to confirm its capabilities.
- Determine the potential adverse effects on the ALCM initial operational capability (IOC) date as a result of program delays due to extended or additional development testing. In addition, the Congress should be advised of the effect that a delay will have on the strategic balance.
- Verify the quantities of ALCMs needed and ensure that the production capability exists to meet this demand.
- Evaluate the need for the nuclear land attack SLCM program and, if it is positive, demonstrate it by (1) approving the DCP and MENS to validate the weapon's role and requirement and (2) developing plans for procuring and deploying the missile.
- Review the results of ongoing studies of long-range conventional weapons. If they show a need for a conventional land attack SLCM, direct the Navy to conduct development as a separate program so that it will be required to proceed through each of the decision points established for all major system acquisitions beginning with validation of mission need.
- Establish realistic program inventory objectives for all sea-launched variants.
- Monitor the Navy's actions to resolve targeting and terminal guidance uncertainties in the antiship SLCM program.
- Complete preparation of the DCP for GLCM which will address mission need and include design-to-cost goals.
- Identify the additional cruise missile engine development work needed and the time required to reach a final engine production configuration.

- Assess the costs and benefits of proceeding with an engine full-scale production decision before development is complete and reliability is assured.
- Closely monitor the results of engine storage testing to ensure the engines meet storage specifications.
- Evaluate current operational requirements for the air-launched variant of the engine and accelerate near-term engine improvements if demonstrated performance falls short of what is needed.
- Determine the extent of the problem of usability of TERCOM source data and give collection of source data top priority.

The Secretary of the Navy should ensure that the project office adheres to Office of Management and Budget Circular A-109 regarding competition in developing a cruise missile precision guidance capability, if that capability is added to an existing cruise missile or becomes part of a future cruise missile operational requirement.

#### AGENCY COMMENTS

This report was reviewed by DOD officials associated with management of the cruise missiles program. Their comments have been incorporated as appropriate.

THE JOINT TACTICAL INFORMATION DISTRIBUTION

SYSTEM--HOW IMPORTANT IS IT?

The slow progress and ineffective management of the program to develop the Joint Tactical Information Distribution System and recent actions by the Office of the Secretary of Defense raise questions about the crucial need for and high priority of the System.

Currently, most U.S. military communications are neither secure nor jam resistant. The Office of the Secretary of Defense believes U.S. forces may not be able to operate effectively for an extended period in a hostile environment where electronic countermeasures are present. The new system will provide a secure, digital, jam-resistant communications capability.

The System, which has estimated life-cycle costs of \$7 billion, will transmit and receive data between users equipped with terminals in surveillance, antisubmarine warfare, attack and fighter aircraft, ground centers and command posts, and naval surface ships and submarines. Both the Air Force Tactical Air Command and the Navy believe the need for the System is of high priority.

In a February 1979 report, 1/ GAO identified a number of issues adversely affecting the program, including ineffective program management and direction, differences between the Air Force and Navy on the technical approach to be followed, lack of an analysis to determine the System's vulnerability to enemy jamming, and incomplete operational testing.

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1/"An Assessment of the Joint Tactical Information Distribution System," PSAD-79-39, Feb. 28, 1979.

The Office of the Secretary of Defense has resolved some of these issues, but similar problems continue to adversely affect system development. For example:

- The System's vulnerability to the threat has not been adequately analyzed.
- Operational testing is still limited.
- Service requirements have not been firmly established.
- Air Force and Navy technology differences have not been resolved.
- A full Defense System Acquisition Review Council meeting has again been postponed until June 1980.
- Key Joint Program Office personnel continue to change.
- Potential integration problems continue.
- Since the System is not being reported on Selected Acquisition Reports, the Congress has a limited view of its progress.

Because of program uncertainties, the services have not been able to develop reliable data on program cost, schedule, or performance. In addition, the life-cycle cost estimate of \$7 billion is questionable because it was developed using dissimilar technology and pricing methods for the Air Force and Navy. Schedule milestones have not been formally established; and although class 1 terminals were operationally tested, the tests were severely limited.

Since GAO's previous report was issued, a number of events have occurred which caused doubts about the high priority and crucial need for the system.

- The Office of the Secretary of Defense only recently began a study to determine the System's cost effectiveness and military worth.
- Officials of the Secretary's Office testified before the Congress that the services could not afford the System and began a cost-reduction study.
- The Air Force withdrew all class 2 fighter aircraft terminal development funds from its fiscal year 1981 budget support documents on the basis that it could not afford the System.
- The Secretary's Office has completely re-directed the program, in effect, deferring most major decisions until June 1980, at the earliest.

GAO believes that the latest program revision deferring major program decisions until June 1980 is a sound management decision because it aligns the program with the prescribed acquisition process. However, GAO cannot reconcile the actions of the Office of the Secretary with the stated high priority and crucial need for the System.

#### RECOMMENDATIONS

The Secretary of Defense should

- determine the need for and importance of the System;
- establish its priority in the context of the Department's overall budget requests;
- revalidate the Joint Operational Requirements to assure it includes only those characteristics necessary to meet the need; and
- resolve the existing, and the potential for, future interservice conflicts.

If the need, priority, and characteristics of the System are reconfirmed and the existing interservice conflicts resolved, the Secretary should also:

- Evaluate, because of cost concerns, the alternative of installing the System in fewer selected platforms, using pods where operationally feasible on selected aircraft instead of internal platform installation, or relying on other jam-resistant communications equipment to satisfy the military's needs.
- Require the Joint Program Office to perform a countermeasures vulnerability study. The study should consider the basic, advanced, and distributed technologies and the use of sophisticated and multiple jammers in the most threatening situation anticipated.
- Direct that the cost-effectiveness study group consider the results of the cost-reduction program which could involve significant degradation of the Joint Operational Requirements. If the group's final report does not consider these reduction efforts, the study will not be valid.
- Require the Joint Program Office to prepare a Selected Acquisition Report that would show the total System program cost. Defense officials have indicated that if such a report were prepared, it may only show research, development, and test costs--actual procurement cost would be shown in host platform reports. The officials also indicated that the cost of the digital system display or control display interface may not be included as a System acquisition cost, but as a part of aircraft modification accounts.
- Assure that designated weapon platforms can accommodate the System. Although the exact

configuration of the System is not currently known, many platforms are already approaching their space, weight, power, and cooling limitations and will not be able to provide one or more of these requirements for this System or others under development without costly modifications.

- Require that all future major program decisions are reviewed through the Defense System Acquisition Review Council/Decision Coordinating Paper process so that final program decisions are in compliance with established major system acquisition policy.
  
- Require the Program Office to prepare a joint program life-cycle cost estimate which would be based on a common technology, reflect the impact of inflation, and consider the cost-reduction efforts.
  
- Establish schedule milestone dates through the Defense System Acquisition Review Council/Decision Coordinating Paper process.

AGENCY COMMENTS

A draft of this report was reviewed by Defense officials, and their comments were incorporated as appropriate.

## STATUS OF THE MAVERICK AIR-TO-GROUND

### WEAPON SYSTEMS PROGRAM

The television-guided Maverick weapon system provides the Air Force with an air-to-ground missile for destroying tanks, armored personnel carriers, small field fortifications, and similar hard targets in daylight and good weather conditions. Additional capability is needed, however, for destroying targets at night and in adverse weather conditions and for a Navy antiship role.

The Maverick missile is the Air Force's most important antiarmor weapon. Successful development of the imaging infrared version is crucial to the employment of the A-10 aircraft against armor under adverse weather conditions. Failure to successfully develop the imaging infrared Maverick will have an affect on the Air Force's ability to perform its tactical role in support of Army ground forces.

The imaging infrared Maverick is one of four projects the Air Force has initiated in a joint service effort at an estimated total cost of \$1.95 billion to achieve increased capabilities with Maverick. A brief discussion of each project, its problems, and our recommendations follow in this chapter. The subsequent chapters of this report discuss these matters in greater detail and incorporate agency comments where appropriate.

### IMAGING INFRARED-GUIDED MISSILE

The Air Force plans to use a version of Maverick employing imaging infrared guidance for close air support and interdiction. In a close air support role, aircrews would have difficulty positively identifying targets under certain conditions. These conditions would have an adverse impact on the effectiveness of close air support.

Aircrews also have difficulty in finding targets, and the imaging infrared-guided missile has a problem in staying "locked" on targets after being launched. Since these problems inhibit the effectiveness of the weapon system, the Air Force is developing a plan to test for improvement in these areas during the contractor's development effort. The specific test procedures and simulated battlefield conditions have not yet been determined.

Because infrared systems sense heat, the imaging infrared-guided missile is susceptible to certain countermeasures. These limitations detract from the missile's

ability to destroy targets and are to be studied in developmental and operational testing. Test plans to determine the significance of these weaknesses are still being developed.

### LASER-GUIDED MISSILE

The Air Force canceled its procurement requirements for a laser-guided Maverick missile in August 1978 because its operational effectiveness was questionable. Critical issues such as (1) the capability of the laser Maverick missile in some situations and (2) the survivability and utility of laser designators are still unresolved. In addition, the Army canceled its requirements for the laser seeker used in the Maverick. The Army selected another seeker which costs less and performs better in the Army's operating environment.

After canceling its requirements in 1978, the Air Force restructured the laser-guided missile development to satisfy Navy and Marine Corps requirements for the laser Maverick.

Within a year, Navy officials said that due to funding priorities they no longer planned to procure the laser-guided missile for an antiship role, but planned to procure the imaging infrared-guided version instead. The Marine Corps, however, still wants the laser-guided missile. Unlike the Air Force and Navy, the Marine Corps expects to use personnel on the ground with laser designators to locate targets. Questions still remain, however, as to whether the missile (1) will have more than only limited use in certain operational environments and (2) will be cost effective in view of the other services' canceling their procurement requirements. These questions will have to be answered in the Air Force's development testing and the Navy's and Marine Corps' missile operational testing.

### ALTERNATE WARHEAD

The alternate warhead is a kinetic energy penetrator which is designed to penetrate targets deeply before detonating. The alternate warhead has been experiencing fuze problems, particularly premature detonation. This will extend the Air Force's laser-guided missile development testing and the Navy's operational evaluation by 13 months. We do not believe this will seriously affect the laser-guided missile project, however, since procurement is not planned until at least fiscal year 1983 due to funding priorities.

The alternate warhead is about 175 pounds heavier than the standard warhead, which could affect the missile's

performance. The effect on performance has not been fully determined, but the services plan to do this during development and operational testing.

The alternate warhead's fragmentation pattern requires a greater delay in fuze arming after launch than the standard warhead to provide aircraft safety in the event of early detonation. The fuzing delay increases the missile's minimum launch range, but Department of Defense officials claim the impact is insignificant because missiles are generally launched at much greater ranges than the stated minimum to enhance aircraft survivability.

The Navy requires additional safety tests before it will launch any live alternate warhead Mavericks. These additional tests will require about 120 days and could cause a slippage in operational testing. Such a delay may not affect the program since the fuze problem delay will probably be longer and could envelop this delay.

#### SINGLE RAIL LAUNCHER

The single rail launcher was designed to supplement Air Force triple rail launchers and to satisfy Navy equipment requirements. The single rail launcher gives the Navy its initial Maverick missile carriage capability and the Air Force its operating flexibility.

In determining operating requirements, the Air Force decided that each A-10, A-7, and F-4G aircraft needs two single rail launchers and two triple rail launchers. This degree of launcher flexibility for the three aircraft appears questionable since these aircraft have just two missile launching stations. Furthermore, (1) a percentage of these aircraft are usually not operationally ready all of the time, (2) all operational aircraft are not generally flying missions at the same time, (3) some aircraft may be carrying other ground attack weapons besides Maverick, and (4) all airborne aircraft will not be equipped with the same type of launcher because they will be operating in different threat environments.

#### RECOMMENDATIONS

We recommend that the Secretary of Defense:

- Ensure that the Air Force conducts imaging infrared missile developmental and operational testing in a realistic battlefield environment. (The scenario should include tank gun firings, battlefield fires,

simulated artillery impact explosions, and intentional enemy countermeasures.)

- Monitor the test results to ensure that the imaging infrared missile operational problems are corrected or reduced to an acceptable level before deciding to produce the missile. (This should include the impact of the operational problems in performing close air support.)
- Assess the operational value and cost effectiveness of the laser-guided Maverick for the Marine Corps considering the (1) issues critical to its operational effectiveness that led to the Air Force's cancellation of its procurement plans, (2) potentially high unit cost for the reduced quantity required, and (3) alternative solutions, such as the imaging infrared-guided Maverick with a target acquisition device.
- Evaluate alternate warhead testing to ensure the penetration-before-detonation capability is demonstrated.
- Monitor Maverick testing to ensure that the impact of the alternative warhead's weight on missile performance is acceptable.
- Evaluate the appropriateness of the triple and single rail launcher ratio for the Maverick-capable aircraft; direct a reduction in the launcher-aircraft ratio if installation requirements are overstated; ensure that any reduced requirements are considered before launcher procurement; and ensure that excess launchers are applied against installation, spare, and mobilization reserve requirements.

#### AGENCY COMMENTS

A draft of this report was reviewed by agency officials associated with management of the program, and their comments have been incorporated as appropriate.

THE HIGH SPEED ANTIRADIATION MISSILE MAY

NOT BE THE ANSWER TO THE SERVICES'

LETHAL DEFENSE SUPPRESSION REQUIREMENT

The military services' need for lethal air defense suppression has little likelihood of being satisfied by the High Speed Antiradiation Missile (HARM). It appears unlikely that HARM will be able to meet the specifications prescribed for it. However, even if it could, enemy tactics and inherent HARM limitations would restrict effectiveness. Almost yearly, HARM's scheduled introduction into the fleet is pushed further into the future, while development and expected production costs become increasingly higher. For these reasons, Defense should reappraise the HARM program and consider other alternatives to meet the services' lethal defense suppression requirements.

In 1972, the Navy began developing a new antiradiation missile, HARM, to replace existing antiradiation missiles for attacking and suppressing Soviet air defense systems. However, HARM has some critical performance shortcomings. It is possible that there may be an additional erosion of performance when the missile goes into production. HARM is nearing the point where cost and schedule penalties in changing the missile are too high to be acceptable. Yet, testing to date has disclosed performance problems which have not been solved, and a large amount of development testing remains to be done.

Meanwhile, the Soviets have been making defense suppression more difficult. The addition of new air defense systems incorporating improvements in missile and radar technology makes the task of developing a low-cost, all-purpose antiradiation missile more formidable.

The Navy is pursuing opposing objectives in trying to develop an all-purpose, highly complex, but low-cost HARM. Low cost is generally derived from simplicity, while complexity and high cost go hand in hand. The cost history of HARM demonstrates these parallels. As HARM increased in complexity by greatly expanding its frequency coverage, increasing its maneuverability, and adding capability against continuous wave signals, more time was needed for development and the design became more costly. Because of this, its development cost increased to almost 600 percent of the original 1972 program estimate. HARM's unit procurement cost increased more than 200 percent from \$30,000

to about \$87,000 since this time even though almost five times as many missiles are now planned for procurement.

Although the initial requirement was for an inexpensive missile that could be used in large quantities, the services are now faced with a HARM that may well be too expensive to buy in the quantities needed or too costly to use against many of its targets.

As high as HARM costs are now, cost increases are likely as the program incurs additional delays.

After 7 years of HARM development, the Navy and Air Force still need an effective, low-cost antiradiation missile. Evidence that we have examined leads us to doubt whether HARM can meet this need. The current technical status and past history of HARM development delays lend little confidence to the Navy's current prediction for delivery of operational missiles.

Currently HARM is in full-scale development. In our opinion, the time has come to reappraise how best to accomplish lethal defense suppression. The next Defense review is not scheduled until 1982. At that time Defense will consider entering production. We believe this is too long to wait for HARM to be reappraised. The approach used in the HARM program may not answer the services' needs.

#### RECOMMENDATIONS

Accordingly, we recommend that the Secretary of Defense:

- Determine the lethal defense suppression capability needed within the defense suppression mission area and evaluate HARM's known performance against this requirement.
- Initiate development programs, if HARM cannot meet the requirement, to provide the services a realistic, affordable lethal defense suppression capability as soon as possible.

#### RECOMMENDATION TO THE CONGRESS

We also recommend that the Congress require Defense to provide to it the results of the study recommended above before appropriating production funds for the HARM program.

AGENCY COMMENTS

A draft of this report has been reviewed by representatives of the Department of Defense who furnished oral comments. The services believe the HARM program should continue because HARM would substantially improve their lethal defense suppression capabilities and alternatives would almost involve starting a new acquisition program. We modified the report in accordance with the services' comments as appropriate.

NAVSTAR SHOULD IMPROVE THE EFFECTIVENESS

OF MILITARY MISSIONS--COST HAS INCREASED

The NAVSTAR Global Positioning System has recently demonstrated that it can provide significantly more accurate navigation data than any current navigation system, is not deterred by adverse weather conditions, and has the potential to improve certain weapons delivery and coordinated operations.

However, this space-based radio system, designed to provide users with three-dimensional position measurements in addition to time and velocity, has some unresolved problems which could have substantial implications. For example, current Soviet testing of an anti-satellite system could eventually result in a weapon which could threaten the survivability of our forces. The Department of Defense (DOD) should closely monitor this emerging Soviet threat and continue to assess its impact in developing and planning the NAVSTAR system.

Another problem with the satellite's reliability emerged during the demonstration and validation phase when 80 percent of its atomic clocks turned on in space either failed or acted abnormally. If the clocks do not operate properly, military users may not obtain the accurate navigation and position information needed. Solutions may have been found; however, they cannot be confirmed until the clocks operate reliably in space. Alternative solutions could cost millions of dollars.

Beginning in 1983, DOD plans to use the Space Shuttle to launch the operational NAVSTAR satellites. However, Space Shuttle problems could delay its availability for supporting NAVSTAR and thus jeopardize a fully operational NAVSTAR by September 1987. Atlas or Titan boosters as an alternative could cost an additional \$12 million to \$38 million for each satellite launch

PSAD-80-21  
2-15-80

as compared to projected Space Shuttle launch costs.

Acquiring and maintaining the NAVSTAR system through the year 2000 will cost an estimated \$8.6 billion. Though significantly greater than reported previously, the current estimate includes several items that had not been included earlier such as Space Shuttle launch costs, user equipment procurement, and replenishment satellites.

Because the cost of NAVSTAR far exceeds any expected savings from reducing DOD's use of other systems, NAVSTAR's implementation depends heavily on the benefits provided by its increased navigational accuracy, global coverage, and other characteristics. Numerous DOD studies indicate that NAVSTAR should improve the effectiveness of military missions.

GAO's January 1979 NAVSTAR report indicated that NAVSTAR development was not started to satisfy unmet military needs or operational deficiencies but rather to generally improve navigation capabilities. Despite the lack of specific user needs, DOD had estimated there were many military users who would need NAVSTAR capabilities. Since then, however, the services have defined specific mission requirements for improved navigation accuracies which are not met by any current navigation system or combination of systems. With few exceptions, these requirements will be satisfied by NAVSTAR.

#### AGENCY COMMENTS

A draft of this report was reviewed by agency officials associated with the management of the program, and their comments have been incorporated as appropriate.

LISTING OF OTHER RELATED REPORTSISSUED FROM MARCH 23, 1979, THROUGH MARCH 7, 1980

<u>Report title</u>	<u>Report number</u>	<u>Report date</u>
Improving Warship Survivability-- A Billion Dollar Program (SECRET)	PSAD-79-43	3/23/79
U.S. Air Defense Capabilities in Europe (SECRET)	PSAD-79-27	4/4/79
A New Approach is Needed for Weapon Systems Coproduction Programs Between the U.S. and Its Allies	PSAD-79-24	4/12/79
Army's XM-1 Tank	PSAD-79-67	4/16/79
Air Force Activities and Plans for Basing the MX Advanced ICBM Weapon System	PSAD-79-76	4/18/79
Navy's Ship Acquisition Process	PSAD-79-79	4/19/79
NATO's Theater Nuclear Forces Modernization	PSAD-79-68	4/20/79
Initial Assessment of the EF-111A Tactical Jamming System Continuing Development Program (SECRET)	PSAD-79-74	4/25/79
Digests of Major Weapon System Reports Issued January and February 1979	PSAD-79-64	4/25/79
The Navy's Strategic Communica- tions Systems--Need for Manage- ment Attention and Decision- making	PSAD-79-48A	5/2/79
Navy Surface Ship Electronic Warfare (SECRET)	PSAD-79-78	5/3/79
Aerial Fire Support Weapons: How Useful Would They Be in a European Conflict? (SECRET)	PSAD-79-65	6/11/79

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<u>Report title</u>	<u>Report number</u>	<u>Report date</u>
Military Services' Development Test and Evaluation	PSAD-79-86	6/25/79
The Multinational F-16 Aircraft Program: Its Progress and Concerns	PSAD-79-63	6/25/79
Evaluation of the Decision to Begin Production of the Roland Missile System (SECRET)	PSAD-79-91	6/29/79
Information on Proposals Being Considered by the Air Force to Modernize the Strategic Bomber Force (SECRET)	PSAD-79-92	7/13/79
Progress in Strengthening Interdiction Capabilities in the NATO Central Region (SECRET)	PSAD-79-83	7/26/79
Implementation of Major System Acquisition Process--A-109--Is Inconsistent Among Civil Agencies	PSAD-79-89	8/14/79
Advanced Strategic Air Launched Missile	PSAD-79-101	8/10/79
Evaluation of the Decision to Begin Production of the Roland Missile System	PSAD-79-100	8/17/79
Review of the Department of Defense's Implementation of Procurement Reforms	PSAD-79-106	9/25/79
Need for a New International Fighter Aircraft (SECRET)	PSAD-80-4	11/1/79
Proprietary Cost and Schedule Information on F-5G & F-16/79 Aircraft (SECRET)	PSAD-80-4A	11/1/79
Electronic Warfare--Its Ramifications and Effects (SECRET)	C-PSAD-80-1	11/9/79
Army Operational Test and Evaluation Needs Improvements (CONFIDENTIAL)	C-PSAD-80-2	11/13/79

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<u>Report title</u>	<u>Report number</u>	<u>Report date</u>
Lack of Full Disclosure of EF-111A Program Cost	PSAD-80-16	12/4/79
Better Navy Management of Shipbuilding Contracts Could Save Millions of Dollars	PSAD-80-18	1/10/80
Financial Status of Major Federal Acquisitions September 30, 1979	PSAD-80-25	2/12/80
How Good is Navy Force Planning? (SECRET)	C-PSAD-80-5	2/13/80
Is a Reassessment Needed of the Navy's Ability to Conduct Carrier Operations in High-Threat Areas? (SECRET)	C-PSAD-80-8	3/7/80

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