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BY THE COMPTROLLER GENERAL

# Report To The Congress

OF THE UNITED STATES

## The Army's Multiple Launch Rocket System Is Progressing Well And Merits Continued Support

The Multiple Launch Rocket System--an unguided, surface-to-surface rocket system--has excellent potential for significantly increasing the Army's artillery capability. Although some important testing still lies ahead, the system, so far, has done well and merits continued backing by the Secretary of Defense and the Congress.



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COMPTROLLER GENERAL OF THE UNITED STATES  
WASHINGTON D.C. 20548

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

This report presents our views on the major issues concerning the Army's Multiple Launch Rocket System. The weapon's very high rate of fire is designed for surge conditions when existing artillery is unable to contend with the full force of the enemy's attack.

For the past several years, we have reported annually to the Congress on the status of selected major weapon systems. This report is one in a series that is being furnished to the Congress for its use in reviewing fiscal year 1983 requests for funds.

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

A handwritten signature in cursive script that reads "Milton J. Aroskar".

Acting Comptroller General  
of the United States



D I G E S T

Certain technical problems require resolution, but, the Army's Multiple Launch Rocket System has done quite well in testing so far. The system is also meeting its cost and schedule goals, after adjustments for inflation.

The Multiple Launch Rocket System is an unguided, surface-to-surface rocket system. It can fire up to 12 rockets individually or in rapid sequence. The system is to be mounted on a chassis derived from the Infantry Fighting Vehicle. The system is especially designed for use during surge periods when enemy forces present targets in sufficient quantities and density to strain the capacity of available fire support systems.

The weapon system, an almost \$4 billion program, depends on other systems for operational use. They include a target acquisition system, a meteorological data system to provide weather information, and a communication system. (See pp. 1 and 2.)

GAO conducted this review to determine the Army's progress in developing this system as it approaches its critical testing phase and as the Congress prepares to review requests for large-scale funding to finance its procurement.

Some of the system's more difficult technical problems involve the submunitions. Instances of their failing to explode on impact have been greater than the Army believes can be tolerated. Also, particularly in cold climate tests, a significant number of the submunitions cracked as they were dispensed. Other problems were experienced in testing with the vehicle's transmission, the fire control system, and the launcher's directional reference system which provides direction and elevation information. The Army will have the opportunity to test solutions designed by the contractors in upcoming operational tests this year before the production decision due in March 1983. (See pp. 5 to 7.)

Although the rocket system's survivability has been questioned by some Army analysts who believe some design changes may be needed, the Army believes its tactics should ensure adequate survivability. The Army would consider design changes only if future survivability evaluation strongly suggests they are needed. (See pp. 7 and 8.)

The program has two other concerns. A critical system still in development, the meteorological data system, will not, according to present plans, be available when the rocket system is due to begin deployment. (See p. 8.) Also, the Army may face difficulty in accommodating the procurement of a costly system, such as the Multiple Launch Rocket System, given the budgetary pressures it is facing as it introduces several new expensive systems simultaneously. (See pp. 3 and 4.)

The Army believes the existing meteorological data system is adequate for the interim but recognizes that a new one is needed to improve the rocket system's effectiveness when it is deployed. The Army believes that the budgetary process, in which weapon systems are ranked according to priority for funding purposes, should enable the rocket system to continue receiving the funding support it warrants.

#### RECOMMENDATIONS

GAO recommends that the Secretary of Defense

- investigate the possibility of accelerating the acquisition of the meteorological data system that would enhance the Multiple Launch Rocket System's effectiveness when it is ready for deployment and
- require the Army to review its survivability estimates and determine whether there is a need for improving the system's survivability in the light of the updated evaluation results.

#### VIEWS OF PROGRAM OFFICIALS

GAO did not request official comments on this report because of the need to issue this report in time for congressional consideration of the fiscal year 1983 defense budget request. GAO did, however, discuss a draft of this report with high level officials associated with

management of the program. These officials generally agreed with the material presented in this report and their views are incorporated as appropriate.





## C o n t e n t s

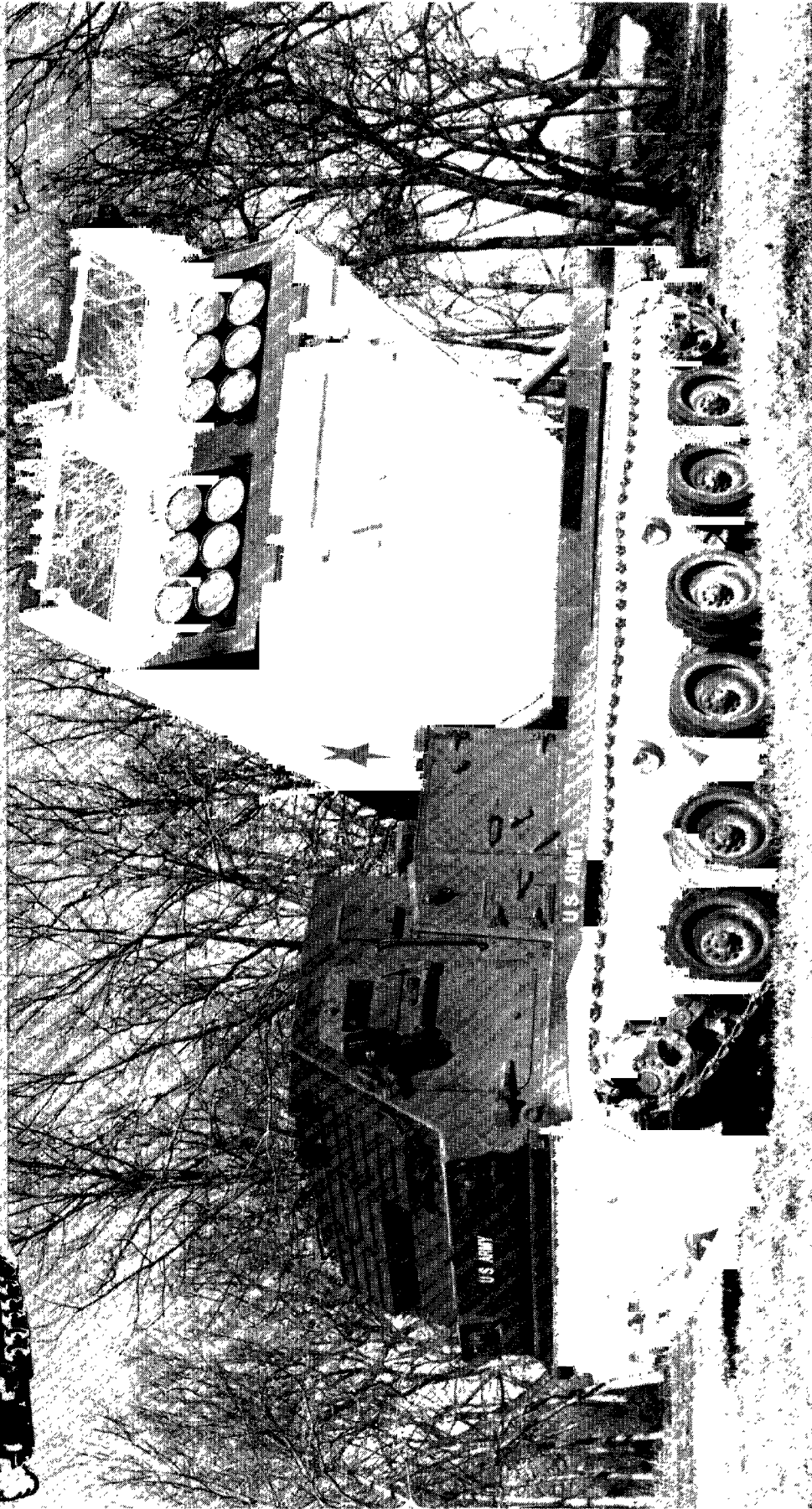
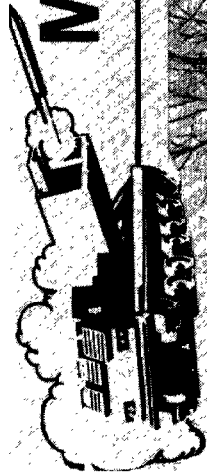
		<u>Page</u>
DIGEST		i
CHAPTER		
1	INTRODUCTION	1
	Why the review was made	2
	Program status	2
	Procurement strategy	3
	Actions on our prior recommendations	3
	Objectives, scope, and methodology	4
2	CONCERNS THAT SHOULD BE MONITORED DURING MLRS' CONTINUED DEVELOPMENT	5
	Some technical problems remain unresolved	5
	MLRS survivability may require upgrading	7
	Some support equipment will not be available when MLRS is ready to begin deployment	8
3	CONCLUSIONS AND RECOMMENDATIONS	9
	Conclusions	9
	Recommendations	9
	Views of program officials	9

### ABBREVIATIONS

AMSAA	Army Materiel Systems Analysis Activity
GAO	General Accounting Office
MLRS	Multiple Launch Rocket System



# Multiple Launch Rocket System





## CHAPTER 1

### INTRODUCTION

The Multiple Launch Rocket System (MLRS) is an unguided, multiple launch, surface-to-surface rocket system. The Army intends to use this system in a counterfire and air defense suppression role. MLRS is especially designed for use during surge periods when enemy forces present targets in sufficient quantities and density to strain the capacity of available fire support systems.

MLRS is to complement, rather than replace, current fire support weapons. It is designed for quick reaction and has the capability to quickly fire its complete load of 12 rockets. MLRS will be deployed 5 to 10 kilometers behind the forward edge of the battle area and will use a "shoot-and-scoot" technique to increase survivability; that is, it will fire all 12 rockets and move from its firing position in what the Army believes is sufficient time to avoid detection and attack.

MLRS consists of the following major elements:

- The rocket which can deliver a variety of warheads, including conventional submunitions, terminally guided submunitions, and binary chemical warheads.
- The launch pod/container which serves as a shipping container, a storage container, and a launch pod for 6 rockets.
- The self-propelled launcher loader which consists of a tracked vehicle carrier (a derivative of the Infantry/Cavalry Fighting Vehicle) and a launcher loader module (a lightly armored launch platform which houses two launch pods).
- Fire control equipment which consists of the fire control panel, fire control units, directional reference system, electronic units, remote fire units, and the boom controller. This equipment provides the information and control necessary to select, control, and fire from 1 to 12 rockets individually or in a preprogrammed ripple sequence.

When fielded, MLRS will require various support equipment to perform its mission. This equipment includes

- a target acquisition system, such as Firefinder radars, to locate targets;
- a weather information system, such as the meteorological data system, to update weather information that affects rocket ballistics;

--automatic test equipment for general support and depot repair of MLRS; and

--communication systems such as the Battery Computer System, the platoon leader's digital message device, and the Tactical Fire Control system.

#### WHY THE REVIEW WAS MADE

We made this review to determine the Army's progress in developing this important system as it approaches its critical testing phase and as the Congress prepares to review requests for large-scale funding to finance its procurement.

#### PROGRAM STATUS

To hasten its deployment, the program was approved for accelerated development. As a result, the system is scheduled to progress from the start of advanced development to initial operational capability within about 5-1/2 years. The Army estimates that accelerating the acquisition will enable it to field the system 21 months sooner than if it had proceeded at a more usual pace. To achieve this accelerated schedule, the Defense Systems Acquisition Review Council, in May 1980, approved a concurrent development and low-rate production phase to follow the validation phase. The Army refers to this postvalidation phase as a "maturation" phase.

Management's decision to proceed with the acquisition in this accelerated manner is a good illustration of the flexibility of Office of Management and Budget Circular A-109, which sets forth management principles applicable to the acquisition process.

Most critical production qualification tests will begin in February 1982, with final operational tests scheduled to begin in late 1982. These tests are to be completed before the full-rate production decision in March 1983.

MLRS is estimated to cost approximately \$4 billion. The system costs are within the approved program, after adjustments for inflation, according to the Selected Acquisition Report dated October 1, 1981. A program cost breakout is as follows:

<u>Expenditures</u> <u>thru FY 81</u>	<u>Budget year</u> <u>FY 82</u>	<u>Balance to complete</u> <u>FY 83 to FY 90</u>	<u>Total</u>
------(millions)-----			
\$452.7	\$243.1	\$3,277.1	\$3,972.9

The above costs include development costs and procurement costs for 362,832 tactical rockets, 27,648 training rockets, and 276 launch vehicles.

## PROCUREMENT STRATEGY

Currently, the Army is considering both competitive and sole-source acquisition strategies for the full-scale rocket procurement. The strategy selected could significantly affect program costs.

Since early in the program's development, the Army has planned to qualify a second contractor to compete with the prime contractor for the major rocket procurement. Its rationale was that a competitive procurement strategy could produce cost savings. Two Army studies recommended competition as an alternative and concluded that cost savings could result.

The Army has devised an acquisition strategy which retains options for either a sole-source, multiyear contract with the prime contractor, or for developing a second source. The Army expects to make its decision by January 1983.

## ACTIONS ON OUR PRIOR RECOMMENDATIONS

The Army has taken positive steps consistent with the first of two recommendations in our February 1980 report to the Congress, "Current Difficulties in Effectively Deploying Multiple Launch Rocket System Render Program's Concurrency Questionable" (C-PSAD-80-20). 1/ In the report, we recommended that the Secretary of Defense

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

During our current review we learned that the Army plans, in February through June 1982, to demonstrate target acquisition, command, control, and communication systems to be used with MLRS before full production of MLRS is to begin.

Additionally, we reviewed the Army's progress in reducing a problem we previously reported--the susceptibility of existing communications equipment to enemy electronic warfare

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1/We issued another report on MLRS when it was known as the General Support Rocket System, "Uncertainties in the Army's General Support Rocket System Program" (PSAD-79-31, Feb. 13, 1979).

countermeasures. We found that to overcome this problem, the Army is developing new communications equipment that will operate in a countermeasures environment. Until the new equipment is fielded, the susceptibility problem will continue.

Regarding the second recommendation, Army officials note that higher priority programs receive favored treatment when the 5-year defense plan and the annual budget are prepared as part of the Programing, Planning, and Budgeting System. The Army is confident that this system will enable MLRS to receive the support it warrants based on its standing in relation to other programs and defense needs.

#### OBJECTIVES, SCOPE, AND METHODOLOGY

The objectives of this review were to determine the overall development status of the MLRS program, including system performance, logistics, and cost and schedule issues. We also followed up on recommendations we made in our 1980 MLRS report to the Congress.

Our primary sources of information were officials at the Army Missile Command. We discussed the rocket system's demonstrated performance, planned use, and vulnerabilities with them and with officials of the Training and Doctrine Command, the Field Artillery School, the Test and Evaluation Command, the Electronics Warfare Laboratory, the Army Materiel Systems Analysis Activity (AMSAA), and the prime contractor--Vought Corporation. We also discussed the development status of MLRS support equipment with officials of the Army Tactical Fire Control system's software support group, the Atmospheric Sciences Laboratory, and the Communications-Electronics Command. In addition, we discussed logistics planning with officials in the Office of the Secretary of Defense and Headquarters, Department of the Army. We also examined pertinent records and documents at each of these locations. Our review covered MLRS development through fiscal year 1981.

Our review was performed in accordance with our standards for audits of governmental organizations, programs, activities, and functions.



## CHAPTER 2

### CONCERNS THAT SHOULD BE MONITORED DURING

#### MLRS' CONTINUED DEVELOPMENT

MLRS tests showed that the system essentially met or exceeded the validation phase goals. According to the Army's schedule, specifications for accuracy, reliability, availability, and maintainability need not be met until 2 years after the full production decision is made in March 1983. Interim thresholds exist that must be met before the production decision. Most critical production qualification tests are scheduled to begin in February 1982.

Although MLRS is meeting its interim performance goals, we identified several concerns that need to be resolved. These concerns include certain technical problems, the extent of survivability to be achieved, and the availability of support equipment when the system begins deployment. None of these are significant enough to alter any current program plans. We do believe, however, that each should receive close management attention to help ensure that the program suffers no serious delays or degradation.

#### SOME TECHNICAL PROBLEMS REMAIN UNRESOLVED

Technical problems with the warhead submunition, the vehicle transmission, the fire control system, and the launcher occurred during the tests. The contractor has been developing solutions to the problems and the Army plans to assess their effectiveness in upcoming tests.

#### Submunition dudding and cracking occurred in maturation tests

The warhead submunition experienced dudding and cracking problems in maturation phase tests. Dudding results when a submunition (1 of 644 bomblets contained in a warhead) fails to explode on impact. In flight testing completed through fiscal year 1981, dud rates exceeded the limits allowed by the specification in a majority of individual rocket firings.

The Army determined that using different manufacturers' submunition fuzes affect dud rates. To meet the specified dudding limit that can be tolerated, the project will use a submunition fuze that demonstrated lower dud rates than others. Flight tests with the selected fuze began in December 1981 and will continue through January 1983.

In addition, a cracking problem occurred with the bomblets primarily during cold weather flight tests. Cracking occurred at varying rates as submunitions were dispensed from the warhead. Extensive cracking occurred in the cold weather portion of the flights.

Army officials believe that the number of bomblets cracking varies with the use of different manufacturers' submunitions. They found that using one manufacturer's submunition eliminated the cracking problem, and they plan to use only that submunition in future tests. The Army is also analyzing how cracking affects submunition lethality against both personnel and armor.

Solutions to vehicle transmission problems remain unverified

During validation, numerous transmission failures occurred in the MLRS vehicle. There were instances of complete failure, operation in only one gear, inability to power the vehicle up an incline, and shift linkage malfunction. The transmission problems contributed to the vehicle achieving a reliability score of 576 kilometers between failures as compared to a specification requirement of 700 kilometers. Army officials believe the transmission problems have now been corrected and will verify the solutions during mobility and endurance tests scheduled for July through December 1982.

Fire control system hardware and software changes are needed

Fire control system problems occurred in validation tests and continued to occur in maturation tests because the Army used the same hardware and software. The MLRS fire control system is an onboard computerized command, control, and communications system that

- receives, processes, and stores target, weather, and positioning data;
- computes firing data, instructs the launcher drive system to aim the launcher, and fires the rocket;
- monitors built-in test equipment; and
- provides other miscellaneous control functions.

During the maturation tests, the fire control system occasionally responded incorrectly or displayed incorrect data, gave incorrect instructions to the launcher, or failed to respond.

Due to those problems, the Army suspended flight tests until maturation phase hardware and software became available in December 1981. Army officials expect all known fire control system problems to be resolved with the new hardware and software design. Testing of the updated design began in December 1981.

Launcher component hardware  
changes are needed

During maturation tests, the launcher directional reference system and launcher drive system experienced some performance problems. The directional reference system provides direction and elevation information to the fire control system, and the launcher drive system responds to fire control system commands to aim the launcher.

On occasion, the directional reference system failed to align properly, and the launcher drive system did not rotate properly, made loud grinding noises, oscillated during firings, and slowed in cold conditions. Army officials expect these problems to be resolved when new equipment is evaluated in tests that began in December 1981.

MLRS SURVIVABILITY MAY REQUIRE UPGRADING

Disagreement exists within the Army as to how well MLRS will withstand the threat posed by enemy munitions. According to AMSAA, MLRS was designed against an unrealistically low threat from artillery munitions that could damage the rockets.

MLRS operators cannot determine whether the rockets have been damaged before attempting to fire them without a visual examination. Damage from fragmentation can cause erratic rocket flight or catastrophic motor malfunction at ignition.

Solutions are available to improve MLRS survivability, according to AMSAA. One solution would add armor to the launcher and another solution would incorporate a rocket damage detection system.

Others in the Army have not accepted AMSAA's vulnerability assessment and proposed solutions to improve survivability. Using data from the Ballistic Research Laboratory, project office officials have concluded that the current launcher design is less vulnerable to larger caliber munitions than AMSAA claims.

Army representatives explained that the AMSAA and Ballistic Research Laboratory analyses were done at different times and were based on different threat assessments. Threat assessments have recently been revised, and the Army anticipates updating the survivability estimates.

Army and Department of Defense representatives anticipate no design changes to enhance survivability. They believe development has progressed too far to consider such changes. More armor protection would add weight and adversely affect the system's air transportability. The alternative, considered undesirable, is to achieve a weight reduction by reducing the number of rockets carried. However, the Army acknowledges that design changes would

have to be considered if updated survivability evaluations are sufficiently compelling to warrant them.

Army representatives felt a damage detection system would be too complex and of doubtful use.

SOME SUPPORT EQUIPMENT WILL NOT BE AVAILABLE  
WHEN MLRS IS READY TO BEGIN DEPLOYMENT

Two support systems, important to the effective operation of MLRS, will not be available when MLRS is deployed. They are a meteorological system to provide timely and accurate weather information to the MLRS battery and automatic test equipment capable of diagnosing hardware faults.

AMSAA's independent evaluation of MLRS shows that the number of rounds required to defeat the target array increases as the weather data ages. The evaluation showed significantly fewer rounds would be required to defeat the MLRS target array if more timely weather data is available.

To provide more timely weather data, the Army is developing a new meteorological data system. The system is designed to provide a marked improvement in timeliness of weather information. Technical and funding problems, however, have delayed the planned deployment of the meteorological data system until at least 1 year after MLRS is deployed.

In addition, automatic test equipment required for fault detection and repair of MLRS will not be fully operational when MLRS is deployed. Since all test programs will not be available when MLRS is fielded, the automatic test equipment will be limited to detecting about 88 percent of the known failure modes. For other failure modes, the Army will have to return the parts to the contractor to be identified.

Department of Defense representatives explained that the standardized automatic test equipment is being developed as quickly as feasible. The Army is assessing whether it is cost effective to diagnose and repair the remaining failure modes or return the failed components to the contractor.

## CHAPTER 3

### CONCLUSIONS AND RECOMMENDATIONS

#### CONCLUSIONS

It is likely that the Army, for the foreseeable future, will continue to have difficulty accommodating its future weapon system procurement needs to the constraints of the defense budget. MLRS is a system that has shown to good advantage in testing. It is one that warrants continued strong funding support.

Some important tests, still to be completed, will provide the opportunity to resolve remaining open questions about MLRS performance and survivability. MLRS effectiveness will be limited unless certain support equipment is made available at the time it is ready for deployment. These matters should receive close management attention to help ensure that the system suffers no serious degradation or delays.

#### RECOMMENDATIONS

We recommend that the Secretary of Defense

- investigate the possibility of accelerating the acquisition of the meteorological data system that would enhance MLRS effectiveness when it is ready for deployment and
- require the Army to review its survivability estimates and determine whether there is a need for improving the system's survivability in the light of the updated evaluation results.

#### VIEWS OF PROGRAM OFFICIALS

We did not request official comments on this report because of the need to issue the report in time for congressional consideration of the fiscal year 1983 defense budget request. We did, however, discuss a draft of the report with high level officials associated with management of the program. These officials generally agreed with the material presented in this report and their views are incorporated as appropriate.

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