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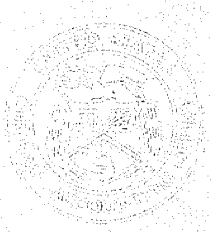
M1 TANKS

Status of Proposed Overhaul Program



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National Security and
International Affairs Division

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The Honorable Floyd D. Spence
Chairman
The Honorable Ronald V. Dellums
Ranking Minority Member
Committee on National Security
House of Representatives

The Honorable Glen Browder
House of Representatives

M1 TANKS: STATUS OF PROPOSED OVERHEAD PROGRAM

House Report 104-131 to the National Defense Authorization Act for Fiscal Year 1996 expressed concerns about the absence of a procurement program to modernize the M1 tank fleet beyond the upgrade of existing tanks and to address new tank threats that are appearing. The report requested that we determine whether the (1) current readiness level of the M1 tank is adequate to meet its war-fighting requirements, (2) operating condition of the tanks at the National Training Center (NTC) is adequate to meet training requirements, and (3) change in repair parts funding has adversely affected unit maintenance. In discussions with members of your staff, we were also asked to report on the status of the Army's proposed M1 tank overhaul program, which is referred to as the Abrams Integrated Management XXI (AIM XXI) program.

Background

The Army started fielding the M1 Abrams tank (the Army's main battle tank) in the early 1980s. Table 1 shows as of October 1995, there were about 7,600 M1s (in various configurations) in active and reserve Army and Marine Corps units and war reserve and prepositioned storage sites. Since the initial fielding, the M1 has undergone several modernization and enhancement upgrades.

Table 1: Number of M1 Tanks by Configuration as of October 1995

Configuration	Number	Description
M1/IPM1	3,141	The IPM1 is the improved version of the basic M1. The IPM1 has an extended turret, increased capacity shock absorbers, and added armor.
M1A1	4,351	The M1A1 has a larger gun (120mm) than the M1; nuclear, biological, and chemical overpressure system; and additional armor protection.
M1A2	87[a]	The M1A2, an enhanced version of the M1A1, has depleted uranium armor, digital electronics, an improved commander's weapons station, a positioning navigation system, a commander's independent thermal viewer, an intervehicular information system, a radio interface unit, and a commander's integrated display.
Total	**7,579**	

[a]When fielding is completed in about 2004, the M1A2 fleet will consist of 1,079 tanks, which is sufficient to equip all the early deploying contingency forces (force package 1) and some of the forward deployed forces (force package 2).

The M1 tank was not designed with a depot overhaul maintenance strategy.[1] The maintenance strategy envisioned that maintenance would be performed at the organizational, direct support, and general support levels. Tank items that could not be repaired at those maintenance levels would be sent to the depot for repair. It was never planned for the entire tank to be completely overhauled, unless the tank was involved in an accident, suffered battle damage, or experienced some other catastrophic failure.

How much maintenance would be performed and where it would be performed was influenced by the Department of Defense's decision to change repair parts funding. Beginning in 1992, Army units had to use their operation and maintenance funds to buy repair parts and major components. Prior to this, units did not pay for major components, such as engines or transmissions. These items were "free issue" to units and there was little incentive to repair them. It was easier and cheaper to order a new engine or transmission from the supply system. Concerns have been raised that under the new system, commanders might defer maintenance to conserve unit operation and maintenance funds.

[1]If a tank has a depot overhaul maintenance strategy, it is shipped to the depot where it is completely disassembled. The disassembled items are inspected and repaired or replaced. The tank is then reassembled and considered to be in like-new condition.

Results in Brief

As of March 31, 1995, over 94 percent of the active and reserve Army units reported that their M1 tanks were ready to perform the majority of the assigned wartime missions; about 56 percent of the units reported that their M1 tanks were ready to perform all of their assigned wartime missions.

Because of the high operating tempo of the training tanks, the M1 tanks at NTC are experiencing more maintenance problems than tanks in active Army units. However, in spite of the maintenance problems, NTC has fielded the required number of tanks to meet all of its training requirements. On average, the NTC M1 fleet maintained an operational readiness rate of about 82 percent for the 8-month period that ended December 1995.

Commanders at three Army divisions that have 834 M1 tanks told us that the change in repair parts funding had not caused them to alter their maintenance approach. The commanders cited some instances in which they had experienced repair parts shortages. However, they emphasized that lack of funds to buy the parts was not the reason for the shortages. The parts were generally not available in the supply system.

Notwithstanding, some Army officials have proposed a M1 overhaul program, at a cost of $559,000 a tank, because they were concerned that latent deficiencies that do not show up during routine readiness inspections could show up during wartime and affect the tanks' performance. Other Army officials, however, are resistant to the overhaul program because of concerns that the program would take funds away from the ongoing M1A2 upgrade program. The Army does not maintain data that shows the extent, if any, of the latent deficiencies, nor does the Army have a predictive readiness system that would show what would happen to operational readiness if there were no depot overhaul program. At the time we completed our review, the Army had not made a decision concerning the proposed overhaul program.

Reported Readiness of the M1 Tank Fleet Is High

We used the Status of Resources and Training System (SORTS) report to assess the readiness of M1 tanks. SORTS uses C-rating designations to denote degrees of readiness: C-1 is the highest readiness rating and C-5 is the lowest.

Our analysis of the SORTS data as of March 1995 showed that over 94 percent of the units with M1 tanks reported that their tanks were C-3

(can accomplish the majority of the assigned wartime missions) or higher and that about 56 percent of the units reported that their tanks were C-1 (can accomplish all of the assigned wartime missions). Table 2 shows the distribution of C-ratings.

Table 2: Readiness Ratings as of March 1995

C-rating	Number of M1 tank units	Cumulative percent
C-1	39	55.7
C-2	25	90.9
C-3	2	94.3
C-4	3	98.6
C-5 or lower	1	100.0
Total	**70**	

Discussions with officials at three Army divisions that have 834 M1 tanks confirmed that they were not experiencing any major readiness-related maintenance or supply problems with their tanks. The officials were confident that they could deploy as required and carry out their assigned missions.

The M1 tanks at NTC and the M1 tanks that were in prepositioned storage were also reported to be in a high state of readiness (as shown in table 3).

Table 3: Reported Readiness Rates of M1 Tanks at NTC and in Prepositioned Storage (as of October 1995)

Prepositioned storage location:	Number of tanks	Operational readiness rate (percent)	Comments
2	348	99	Equates to C-1 readiness rate
3	123	100	Equates to C-1 readiness rate
4	116	81	Equates to C-2 readiness rate
5	116	96	Equates to C-1 readiness rate
NTC	109[a]	82[b]	Equates to C-2 readiness rate

[a]The number of tanks at NTC ranged from 89 to 122 during the 8-month period ending December 1995.

[b]The operational readiness rates of the NTC are an 8-month average as of December 1995.

Training Not Adversely Affected by Operating Condition of M1 Tanks at NTC

NTC is authorized 122 M1 tanks (2 battalions) for training. These tanks are operated at a higher tempo than tanks in a typical tactical unit. For example, each tank averages about 2,300 miles a year, compared with the Army-wide average of about 630 miles a year. The NTC M1 tank fleet averages about 8,400 miles, compared with the Army-wide average of about 3,500 miles.

As a result of the high operating tempo, the NTC M1 tanks have experienced many more maintenance problems than the tanks in the tactical units. However, according to NTC officials, the tanks have not missed any training days due to the maintenance problems. The officials said that they are always able to provide the training unit with the required number of tanks because only one of the two tank battalions is being used at a time[2]. Another factor that has enabled NTC to meet its training requirements is that its tanks are cycled through the Anniston Army Depot under the Army's inspection and repair only as needed (IRON) program.

Under the IRON program, the tanks are inspected and those components and systems that do not meet the minimum operating characteristics are repaired or replaced.[3] For example, if an engine does not meet its 1,350 horsepower characteristic, repairs are performed. Anniston officials told us that the NTC tanks generally need a lot of work when they arrive. They said, however, that the tanks' condition is about what could be expected considering the tanks' high usage rate.

NTC officials and officials from a unit that was training at NTC at the time of our visit said that the condition of the tanks and the maintenance problems had not detracted from the realism of the training. Unit officials also said that the condition of the NTC tanks may not be as good as the condition of the tanks at their home station, but this added to the training realism because, in a wartime situation, tanks will have maintenance problems and personnel need to know how to deal with them.

[2]The training unit is issued 58 M1 tanks. While these tanks are being used for training, the remaining tanks are being readied for the next training rotation.

[3]The average cost of the program is $196,000 a tank, and the program is expected to be completed in fiscal year 1996.

Change in Repair Parts Funding Has Not Adversely Affected Unit Maintenance

Some Army officials have expressed concern that the change in repair parts funding could lead unit commanders to delay maintenance because they may not have the funds to buy the needed repair parts. In prior reports,[4] we stated that this is generally not the case. With few exceptions, the lack of funds to buy repair parts has not been a problem. In fact, we have reported that units often transfer funds intended for repair parts and maintenance to other operation and maintenance purposes.

None of the officials we spoke with at three Army divisions cited the lack of operation and maintenance funds to buy repair parts as a problem. The commanders said that the shortages they experienced were not caused by a lack of repair parts funds, but rather by a lack of repair parts in the supply system.

During our visits to the three divisions and NTC, we compiled a list of repair parts that were in short supply at the units and determined their supply position at the wholesale level inventory control points. The results of our analysis are shown in table 4.

Table 4: Wholesale Inventory Level for Repair Parts in Short Supply at the Unit Level

	Wholesale inventory level		
	On hand		
Repair part	Serviceable	Unserviceable	Back ordered
Rear engine module	8	653	75
Hydraulic motor	0	118	104
Front engine module	45	740	50
Exhaust seal[a]	0	0	1,116

[a]The exhaust seal is not a reparable item. Therefore, there are no unserviceable items on hand.

The problems being experienced with the M1 tank's rear engine module is illustrative of the type of problems the Army faces with the other parts shortages. As of December 7, 1995, there were only eight serviceable M1 tank rear engine modules in the supply system, and all eight modules were

[4]Depot Maintenance: Some Funds Intended for Maintenance Are Used for Other Purposes (GAO/NSIAD-95-124, July 6, 1995).

Army Training: One-Third of 1993 and 1994 Budgeted Funds Were Used for Other Purposes (GAO/NSIAD-95-71, Apr. 7, 1995).

Army Inventory: Reparable Exchange Items at Divisions Can Be Reduced (GAO/NSIAD-95-36, Dec. 28, 1994).

Army Inventory: Opportunities Exist for Additional Reductions to Retail Level Inventories (GAO/NSIAD-94-129, June 6, 1994).

in prepositioned war reserve. At the same time, there were backorders for 75 modules, of which 53 were high priority backorders.

According to Army officials, there are sufficient engine rear modules in the supply system, but most of the modules are unserviceable because of a shortage of repair parts to fix the modules. The officials attribute the shortage of repair parts to (1) insufficient demand forecasting due to Bosnia operations, (2) implementation of an engine service life extension program before the needed repair parts were in the system, (3) worsening condition of returns from the field (the returned items require extensive repairs), and (4) a reduced number of qualified part suppliers in the industrial base.

Cost and Benefits of Army's Proposed M1 Tank Overhaul Program Are Uncertain

Some Army officials in the maintenance community believe that an M1A1 overhaul program is needed because of the fleet's age and because there is no new tank production planned. The officials acknowledge that reported readiness rates are high. However, they are concerned that there may be latent deficiencies in the tanks that are not detected during readiness inspections and that these deficiencies could affect the tanks' operational capabilities during a conflict.

To address the potential latent deficiencies, the officials proposed a joint proof of principle test program with General Dynamics (the M1 manufacturer) to essentially overhaul the M1A1 tanks. The proposed joint effort is referred to as the AIM XXI program, and the officials believe that it would produce a better-than-original M1A1 tank that would enhance training, be more reliable, and have sustained go-to-war capability. Additionally, the officials believe that the program would reduce the tank's life-cycle operating and support costs.

Under the AIM XXI proof of principle test, the Army would bring 17 M1A1 tanks to the Anniston Army Depot and completely rebuild and update them with the latest modifications. The estimated cost of this effort is $559,000 per tank, about $9.5 million total. The Army Materiel Systems Analysis Activity (AMSAA) would compare certain operational characteristics, for a 9-month period,[5] of the AIM XXI tanks with IRON tanks and with tanks that had not received any depot level maintenance. On the basis of evaluation of the test data, the Army would decide whether to

[5]The operational characteristics would include maintenance actions per mile, operating cost per mile, availability, and reliability.

expand the AIM XXI program. Appendix I shows the scope of work under these two programs.

AIM XXI program officials estimate that over a 20-year life cycle, the program for the 17 tanks would result in operating and support cost savings of about $28.8 million, compared with the IRON program. However, if the investment cost differential is considered, the overall savings for 20 years is reduced to about $24.4 million, about $1.2 million a year.

AMSAA officials who have responsibility for validating the estimated savings told us that they could not project cost savings for an AIM XXI program beyond the proof of principle because any projected savings would not be data driven. They said that they believe the AIM XXI program would result in some operating and support savings, but they were unsure how much. The officials also said that they would be in a better position to estimate the savings after the proof of principle test was completed and the operational characteristics of the AIM XXI, IRON, and nondepot maintenance tanks are compared and evaluated.

AMSAA and depot officials also told us that the savings calculations were based on certain assumptions on tank mileage and repair and maintenance costs that may not be representative of the M1 tank fleet. AMSAA officials said that the mileage (1,500) used to compute the annual operating and support cost was not typical of the usage in an operating unit, which averages about 630 miles a year. Consequently, the estimated savings between AIM XXI and IRON tanks would be much less and this, in turn, would reduce the life-cycle savings. Depot officials also told us that the direct IRON program costs had been reduced to $196,000 a tank for fiscal year 1996, compared with the $266,000 used in the analysis. This reduction would reduce the investment cost for the 17 IRON tanks to about $3.9 million.

AIM XXI program officials told us that one of the difficulties they are facing is that there is no empirical data that shows there are latent deficiencies in the tanks as a result of not having a depot overhaul program. Additionally, the Army does not have a predictive readiness system to demonstrate that if the tanks are not overhauled, the tanks will not be able to maintain a high rate of operational readiness.

The officials also told us that if the test data proved what they expected and that if the AIM XXI program was approved, they would like to begin

inducting an average of 66 M1A1 tanks into the depot beginning in fiscal year 1998 and continue the program for 20 years.

The concern raised by Army officials and unit commanders about the AIM XXI program centered on the impact the program could have on the M1A2 modernization effort. The officials said that in today's budget environment the funds for the AIM XXI program would probably come from some existing program as it was unlikely that the Army would receive additional budget authority for the program. They said that while it would be nice to have overhauled M1A1 tanks, they would much rather have M1A2 tanks. Therefore, if the AIM XXI program would result in M1A2 fielding delays, they would opt for the M1A2 tanks.

Anniston officials said that because General Dynamics is involved in both the AIM XXI and M1A2 programs and both programs could be performed in the same facilities, the M1A2 unit cost should be reduced. However, they were not able to estimate the extent of the cost reduction.[6]

Anniston officials also told us that in the absence of the AIM XXI program or some other heavy armor work, the depot could lose as much as 50 percent of its heavy armor repair capability and the lost capability would be difficult to replace in a surge situation. They said that when the IRON program is completed in fiscal year 1996, the depot's workload will consist primarily of component repair.

The officials also said that, in their opinion, the AIM XXI program would not only increase the availability, reliability, and fightability of the M1 tank fleet but also protect industrial base core capabilities that would be needed in time of conflict.

Scope and Methodology

To determine the readiness of the M1 tank fleet, we reviewed data from the Army's readiness reporting system along with readiness reports from three Army divisions and the NTC, which we visited during our review. We also interviewed brigade and battalion officials at the three divisions and officials at NTC to obtain their views on the operating condition of their M1 tanks and the tanks' ability to perform assigned missions.

[6]Under the AIM XXI proposal, Anniston would perform about 70 percent of the overhaul effort (2,700 hours per tank), and General Dynamics Land Systems would perform about 30 percent of the overhaul (1,300 hours per tank). Under the M1A2 program, Anniston performs about 33 percent of the work (1,560 hours per tank), and General Dynamics Land Systems performs about 68 percent of the work (3,200 hours per tank).

At NTC, we focused on the maintenance of the tank fleet and on training realism. We also obtained the views of contractor personnel who maintain the M1A1 tank fleet.

To determine whether the change in repair parts funding had affected the units' ability to maintain the M1 tank, we interviewed Army division officials at the three divisions. We also identified parts that were in short supply and that were (in the opinion of division officials) affecting the divisions' maintenance capabilities. We then obtained the supply position of these items at the wholesale level and discussed the reasons for the shortages with wholesale level supply management officials.

We interviewed Army and contractor officials and reviewed documentation relating to the proposed AIM XXI overhaul program for the M1 tank fleet. We obtained the officials' views on the need for such a program, along with their proposals to test and implement the overhaul effort. We also reviewed the effect of the proposed overhaul program on future tank repair workload at the maintenance depot by examining depot workload statistics and forecasts and obtaining the views of depot officials.

Our review was conducted at the

- Office of the Project Manager, Abrams Tank System, and the Army Tank-Automotive and Armaments Command, Warren, Michigan;
- Army Materiel Command, Alexandria, Virginia;
- Office of the Deputy Chief of Staff for Logistics, Pentagon, Washington, D.C.;
- National Training Center, Fort Irwin, California;
- Anniston Army Depot, Anniston, Alabama;
- 1st Infantry Division (Mechanized), Fort Riley, Kansas;
- 1st Cavalry Division and the 2nd Armored Division, Fort Hood, Texas; and
- Army Materiel Systems Analysis Activity, Aberdeen Proving Grounds, Maryland.

The Department orally commented that it fully concurred with our draft report. We conducted our review from August 1995 to February 1996 in accordance with generally accepted government auditing standards.

We are sending copies of this report to the Secretaries of Defense and the Army; the Director of the Office of Management and Budget; and the Chairmen of the House Committee on Government Reform and Oversight, Senate Committee on Governmental Affairs, House and Senate Committees on Appropriations and Senate Committee on Armed Services.

Please contact me on (202) 512-5140 if you have any questions concerning this report. Major contributors to this report are listed in appendix II.

Mark E. Gebicke
Director, Military Operations
and Capabilities Issues

Scope of Work for Abrams Integrated Management XXI Program as Compared With Inspect and Repair Only as Needed Program

SUBASSEMBLY	AIM XXI	IRON
AGT-1500 turbine engine	—Complete disassembly and 100-percent inspection —New high-pressure turbine blade assembly —New high-pressure nozzle —Improved double bellows recuperator (laser welded plate pairs) —New power shaft ring seal —New critical position bearings —New critical position seal	—Limited disassembly —Limited inspection —Minor repair —Components replaced as indicated by failure
X1100-3B transmission	—Complete disassembly and 100-percent inspection —New style steering pistons (aluminum) —New governor —New pump and motor cups —New output shaft —New internal wiring harness —Inspect/replace hanging ring —Non-destructive test of pistons/housings —Complete dynamometer testing	—Limited disassembly —Limited inspection —Minor repair —Components replaced as indicated by failure —Dynamometer tested to abbreviated acceptance testing procedure
Suspension/track	—100-percent disassembly, clean, and inspect —Replacement of mandatory replacement parts —Replacement of compensating idler arm bearings	—Compensating idler, roadwheel arm, and shock absorbers removed and inspected —Replaced only the degree of disassembly —Replaced only if inspection requires
Optical fire control	—100-percent disassembly, clean, and finish —Replacement of mandatory replacement parts —100-percent inspection of solder joints, connectors, and electronic components	—Disassemble only to degree necessary to correct deficiency —Replaced only to degree of disassembly —Visual inspection to degree of disassembly
Electro-hydraulic pneumatics	—100-percent disassembly of slip ring —Replacement of mandatory replacement parts —100-percent inspection of contact rings, solder joints, wipers, brushes, and connectors —Complete cleaning, inspection, and repacking of internal bearings	—Disassemble only to degree necessary to correct deficiency —Replaced only to degree of disassembly —Visual inspections to degree of disassembly
Thermal components	—100-percent vendor reclamation	—Repaired to direct support/general support level
Electronics	—100-percent disassembly, clean, and inspect —Replacement of mandatory replacement parts —100-percent inspection of solder joints, connectors, and wiring harnesses	—Disassemble only to degree necessary to correct deficiency —Replaced only to degree of disassembly —Visual inspections to degree of disassembly

Major Contributors to This Report

National Security and International Affairs Division, Washington, D.C.	Sharon A. Cekala Robert J. Lane
Kansas City Regional Office	James S. Moores Darryl S. Meador