
January 1996

ARMY ACQUISITION

Medium Trucks Passed Key Operational and Technical Tests



**National Security and
International Affairs Division**

B-266242

January 8, 1996

The Honorable William V. Roth, Jr.
United States Senate

Dear Senator Roth:

In response to your request, we reviewed the Army's testing of its Family of Medium Tactical Vehicles (FMTV). Because of previous FMTV test failures, we reviewed the performance of the FMTV trucks during the Army's recently completed technical and operational testing. Our primary objective was to determine whether the FMTV demonstrated that it could meet contractual and operational requirements.

Results in Brief

The FMTV trucks passed technical and operational tests, paving the way for the Army's August 29, 1995, decision to approve full-rate production. Following the contractor's modifications of the vehicle to correct deficiencies identified in previous testing, the Army conducted (1) a limited follow-on technical test to determine whether the trucks could meet contractual reliability and performance requirements and (2) a full operational test to determine whether it could meet its operational reliability and other mission requirements when operated and maintained by soldiers. The trucks exceeded reliability requirements in both tests and met most performance requirements. In those cases where the performance did not meet requirements, the Army determined that the performance levels were satisfactory.

While the FMTV trucks overall performed satisfactorily, many of the technical test vehicles were not produced on the production line and/or were retrofitted to correct past deficiencies. Also, the contractor pretested both the technical and operational test vehicles and corrected deficiencies prior to delivering them to the Army for testing. However, the FMTV contract allows the Army to verify that the contractor has corrected the problems identified during testing through tests comparing the quality and performance of full-production trucks with that of the approved final configuration. If the Army's comparison tests include full-production and retrofitted trucks, it should have adequate assurance that the trucks continue to meet the Army's performance and reliability, availability, and maintainability (RAM) requirements.

Background

The FMTV program is one of the Army's largest acquisition programs at a projected cost of \$15.9 billion. With deliveries starting in 1993, the Army plans to purchase, over a 30-year period, 87,598 FMTV trucks to replace its aging medium truck fleet. The program consists of a family of 2.5- and 5-ton trucks based on a common truck cab and chassis. The 2.5-ton trucks, called light medium tactical vehicles, consists of cargo and van models and a 2.5-ton cargo trailer. The 5-ton trucks, called medium tactical vehicles, consists of seven models—cargo, long wheel base cargo, dump, tanker, tractor, van, and wrecker—and a 5-ton cargo trailer.

The Army is procuring the FMTV as a nondevelopmental item using a competitive testing approach. Army officials considered this approach low risk because of the availability of modified commercial components applicable to the FMTV. Under this approach, the Army contracted for FMTV prototypes with three contractors, tested the prototypes against each other, and awarded a production contract to the winning contractor. On October 11, 1991, the Army awarded a \$1.2-billion, 5-year contract for the production of the first 10,843 trucks to the winning contractor. The contract did not include the production of the 5-ton tanker and van models or the cargo trailers. These vehicles will be produced at a later date if funding is available. The contractor is currently in the third year of production under this contract.

Previous FMTV Tests

Because the winning contractor's prototype performed well during the competitive testing, the Army planned to perform only a technical test (Production Qualification Test) and an operational test (Initial Operational Test and Evaluation) before making the full-rate production decision. Also, the Army decided that the two tests could be performed concurrently. The Production Qualification Test was to determine whether the FMTV models fulfill the Army's requirements and meet contract specifications. The Initial Operational Test and Evaluation was designed to determine whether and to what degree the FMTV could accomplish its mission when operated and maintained by soldiers in the expected operational environment.

The contractor experienced some production start-up problems that delayed the start of the production and operational testing 6 and 10 months, respectively. The Army began the production test in June 1993 and the operational test in October 1993. The operational test was suspended in December 1993 because the trucks were not able to meet their operational reliability requirements. Following the operational test

suspension, the contractor identified over 50 problems and began developing fixes for these problems. The Army completed the full 20,000-mile production test in December 1994, but the trucks exhibited poor reliability and failed to meet some performance requirements. By the end of the production test, the Army had identified over 90 problems that the contractor needed to correct.

In June 1994, the Army began a series of limited user tests to help the contractor identify and validate potential solutions to the continuing problems. In August 1994, the Army started a second operational test with some of the FMTV models. In September 1994, operational and limited user testing was suspended. Test personnel were not available to conduct the testing because they were deployed to the Haiti peacekeeping mission. According to Army test assessment officials, the vehicles were not meeting their reliability requirements at the time the second operational test was suspended.

The Army conducted a limited 12,000 miles per vehicle production test from February 1995 to June 1995 and a new and complete operational test from April 1995 to June 1995. The limited production test was 60 percent of the mileage of the first test, which called for each vehicle to complete 20,000 miles of RAM testing. Army test assessment officials believed a 12,000-mile test was sufficient as the majority of the previous problems occurred in the first 8,000 miles of testing. Each van was run 20,000 miles because they were not included in the original test. In addition, all the dump truck's RAM problems identified during the original production test were either chassis, engine, or drive train problems. According to Army test assessment officials, since the dump truck has the same chassis, engine, and drive train as the 5-ton cargo, which was being retested, there was no need to retest the dump truck in the RAM portion of the production test.

FMTV Passed Production and Operational Tests

The FMTV's performance during the recently completed limited production and operational tests significantly improved. The trucks passed both tests.

The Army test data in tables 1 through 3 reflect the test results that supported the Army's decision to proceed to full-rate production. This data shows that all models of the truck met their RAM requirements during the tests. However, there were different results for some models according to the analysis performed by the Defense Director, Operational Test and Evaluation (DOT&E). For systems that are ready to enter full-rate

production DOT&E is required to independently assess the system’s operational test and provide a report of that assessment to Congress. DOT&E’s assessment does not enter into the Army’s full-rate production decision. DOT&E’s results are included in tables 1 and 2.

Table 1: Reliability Results of Production Qualification Test and Initial Operational Test and Evaluation

FMTV model	Production Qualification Test (MMBHM) ^a		Initial Operational Test and Evaluation (MMBOMF) ^b		
	Requirement	Army results	Requirement	Army results	DOT&E result
2.5-ton cargo	3,000	12,000	2,200	over 8,279	8,424
5-ton cargo	2,700	over 12,000	2,000	6,386	3,198
Dump	2,700	Not tested	2,000	2,812	1,688
Tractor	3,300	4,800	2,500	3,606	1,967
Van	2,700	10,000	2,000	4,346	3,380
Wrecker	2,300	4,800	1,900	4,720	2,754

^aMean miles between hardware mission failures.

^bMean miles between operational mission failures.

Table 2: Availability Results of Production Qualification Test and Initial Operational Test and Evaluation

(Percent of time available)

FMTV model	Requirement	Production Qualification Test	Initial Operational Test and Evaluation	
		Army results	Army results	DOT&E results
2.5-ton cargo	91	98	96	95
5-ton cargo	88	98	96	91
Dump	88	Not tested	90	83
Tractor	88	95	89	84
Van	91	98	93	93
Wrecker	90	97	93	86

Table 3: Maintainability Results of Production Qualification Test and Initial Operational Test and Evaluation

(Mean miles between essential maintenance actions)			
FMTV model	Requirement	Production Qualification Test	Initial Operational Test and Evaluation
2.5-ton cargo	450	2,182	3,369
5-ton cargo	250	1,286	1,521
Dump	250	Not tested	937
Tractor	250	857	952
Van	450	1,429	942
Wrecker	250	706	767

DOT&E's assessment of the operational test resulted in a general reduction from the Army's test results. As can be seen in tables 1 and 2, all FMTV models met or exceeded their reliability and availability requirements using the Army operational test results. Based on the DOT&E data, however, the dump and tractor models did not meet their reliability requirement, and the dump, tractor, and wrecker models did not meet their availability requirement.

DOT&E noted that the FMTV family reliability would probably be a better measure of the reliability of the dump and tractor models because they had no failures of model unique subsystems and the failures that occurred did not appear to be directly related to the models' missions. Using the family reliability for the dump and tractor models, DOT&E concluded that all models met their reliability requirements.

DOT&E also noted that the operational tempo during the test was increased 20 percent above the normal wartime operational tempo and concluded that the increased operational tempo would cause more failures during the test and decrease the trucks availability. Because of the increased operational tempo during the test, DOT&E concluded that the dump, tractor, and wrecker models should be considered to have adequate availability and, therefore, all models met their availability requirements.

In addition, all models met or nearly met their performance requirements, and the Army was willing to accept this level of performance as satisfactory. The Army has agreed to accept FMTV models, which do not fully meet four contractual performance requirements—external air transport, speed-on-grade, full-load cooling, and interior noise requirements.

- The contract requires all FMTVs to be externally air transportable—lifted by helicopter—without damage. However, in 4 of 17 lift tests, the FMTV windshield cracked. Army officials believe that a slightly different rigging during external transportation and a thicker windshield the contractor proposes to install should correct the cracking problem. The Army has agreed to accept the results of these fixes regardless of whether they correct the problem because the Army does not currently plan to use helicopters to air transport its trucks.
- The contract requires that each truck model with various loads maintain certain speeds on 2- and 3-percent road grades. Within the Army, there was a disagreement on whether this requirement should be tested with the cooling fan locked on to simulate the greatest load on the engine or with it locked off. The vehicles were tested both ways. With the fan locked off, all models except one met this requirement. With the fan locked on, three models missed meeting the requirement. The Army agreed to accept these results because the FMTV trucks' performances were an improvement over the current truck fleet.
- The contract requires that the engine oil, engine coolant, and transmission temperatures not exceed certain temperatures when operated under a full load on the engine and drive train, defined as a 0.6-tractive force. All FMTV models except the wrecker met these requirements. The Army test evaluation officials said that they believe the wrecker's inability to meet this requirement will have minimal operational impact.
- The contract requires that the interior noise be low enough that operators do not need hearing protection. This means that the interior noise may not go over 85 decibels. However, the 5-ton cargo and the van exceeded the interior noise requirement at 80 kilometers per hour, and the wrecker exceeded this requirement at 16 kilometers per hour. The Army has agreed to accept the need for single hearing protection on some models at some speeds.

Test Vehicles Modified Before the Tests

The trucks the contractor provided the Army for its most recent testing may not have been production representative vehicles because (1) either the Army or the contractor modified some test trucks off the production line and/or (2) the contractor tested the trucks and corrected any problems identified prior to delivering the trucks to the Army for testing.

The Army was required to conduct the production and operational tests with production or production representative vehicles. The FMTV contract required the contractor to provide production representative vehicles for the production test. Defense regulations require that production or

production representative vehicles be used in operational tests supporting the full-rate production decision. The operational test was designed to support the FMTV full-rate production decision.

All of the trucks used to demonstrate the RAM portion of the limited production test were newly produced trucks. However, some of them were produced before all of the required changes could be incorporated into the production line and had to be modified off the production line to incorporate those changes. Also, the trucks used for the performance portion of the limited production test were a combination of newly produced trucks and trucks used during the first production test. The trucks used in the first production test were modified at the test site to incorporate the required changes; however, some of these trucks did not receive all the required changes. All of the trucks used during the operational test were produced after the modifications were incorporated into the production line.

The contractor conducted a test of about 1,000 miles per truck on the limited production test trucks and about 600 miles per truck on the operational test trucks before delivering them to the Army. According to Army test officials, the contractor performed this test to check a new electrical system installed in the test trucks. However, according to Defense Plant Representative Office officials who monitored these tests, the contractor corrected any problems found on the trucks during the test. Although these problems did not require the contractor to make hardware modifications to the test trucks, they did require the contractor to modify the production process.

Additional Actions Resulting From the Testing

The contractor is required to develop corrective actions for all of the problems identified during the recent production and operational testing. If the corrective actions are design changes, they are to be incorporated into the final approved FMTV configuration—the truck design incorporating all required changes against which the production trucks will be compared.

Problems identified during the tests included the following six deficiencies that the operational assessment officials labeled as major safety deficiencies.

- The starter sometimes did not disengage and overheated, which could result in an electrical fire.

- The brake lines were too close to the exhaust system and could be damaged during an exhaust system leak. Such damage could result in the loss of brakes.
- The bumper was not compatible with the government-furnished tow bar, which could cause a loss of control of the towed vehicle.
- The wrecker main winch free spool switch was too close to the other switches and might be accidentally engaged during recovery operations. Accidentally engaging the switch could cause a loss of control over the vehicle being recovered.
- The tractor's gladhandle, a fixture for attaching the air hose that allows air pressure to be applied to the brakes on a towed trailer, was not compatible with all trailers. This incompatibility could cause a towed trailer's brakes to fail.
- A transmission indicator light was too bright in the blackout mode, which could cause a reduction in the driver's night vision.

According to Defense and Army assessment officials, the contractor must correct these deficiencies before the trucks can be fielded. The contractor is working on correcting these deficiencies.

As of June 30, 1995, the contractor had produced 2,163 trucks, and the Army has conditionally accepted 842 of them. The contractor is required to retrofit all these trucks and any additional trucks that were produced before the final configuration is determined. The 1,474 trucks produced during the first 2 program years of the contract will require an extensive retrofit effort, essentially replacing everything but the frame. Retrofitting trucks produced during the third program year will not be as extensive.

The Defense Plant Representative Office has estimated that the cost of the retrofit could be as high as \$24 million, and the Army may be required to pay as much as \$11.8 million for modifications it wanted over and above those required to meet contract requirements. This estimate was made before the recent testing was completed and does not include the cost of additional modifications required as a result of these tests. The office is currently working on a new retrofit cost estimate.

The FMTV contract allows the Army to verify that the contractor has corrected the problems identified during testing through tests comparing the quality and performance of full-production trucks with that of the approved final configuration. The contract calls for the Army to conduct up to three of these comparison tests per program year using two trucks per test. Each truck will be tested for 10,000 miles in up to 120 days.

If the Army's comparison tests include full-production and retrofitted trucks, it should have adequate assurance that the FMTV trucks continue to meet the Army's RAM and performance requirements.

Agency Comments

The Department of Defense concurred with our report and recommended that we include the operational test data from the recent DOT&E report. We have incorporated this data throughout the report where appropriate.

The Department also noted that the Army plans to perform the comparison tests on both retrofit and new production vehicles to verify that the quality and performance of the vehicles will continue to meet the requirements. We believe these tests will be responsive to our observations on the differences in the Army's and DOT&E's operational test results, the modifications of test vehicles, and the needed corrections of identified major safety deficiencies.

The Department's comments are provided in their entirety in appendix I.

Scope and Methodology

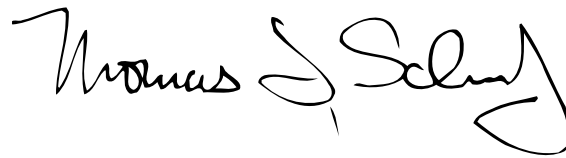
We interviewed and obtained documents from officials in the U.S. Army headquarters, Washington, D.C.; Program Executive Office for Tactical Wheeled Vehicles, U.S. Army Tank-Automotive and Armament Command, Warren, Michigan; U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, Maryland; U.S. Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Maryland; U.S. Army Test and Experimentation Command, Fort Hood, Texas; U.S. Army Operational Test and Evaluation Command, Arlington, Virginia; and Defense Plant Representative Office, Stewart and Stevenson, Sealy, Texas. Also, we observed the operational test scoring conferences at Fort Bragg, North Carolina. We conducted our review between August 1994 and August 1995 in accordance with generally accepted government auditing standards.

We plan no further distribution of this report until 10 days from its issue date, unless you publicly announce its contents earlier. At that time, we will send copies of the report to the Chairmen and Ranking Minority Members of the House Committees on Government Reform and Oversight, on National Security, and on Appropriations; the Chairmen and Ranking Minority Members of the Senate Committees on Governmental Affairs, on Armed Services, and on Appropriations; and the Secretaries of Defense

and the Army. We will also send copies to other interested parties upon request.

Please contact me on (202) 512-4841 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix II.

Sincerely yours,

A handwritten signature in black ink that reads "Thomas J. Schulz". The signature is written in a cursive style with a large, stylized "S" at the end.

Thomas J. Schulz
Associate Director, Defense
Acquisitions Issues

Comments From the Department of Defense



ACQUISITION AND
TECHNOLOGY

OFFICE OF THE UNDER SECRETARY OF DEFENSE

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21 OCT 1995

Mr. Louis J. Rodrigues
Director, Systems Development and Production Issues
National Security and International Affairs Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Rodrigues:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) draft report, "ARMY ACQUISITION: Medium Trucks Passed Testing," dated October 3, 1995 (GAO Code 707089), OSD Case 1033. The DoD concurs with the report, with the following comments.

The DoD official results of the initial operational test for the Family of Medium Tactical Vehicles (FMTV) are included in the Director, Operational Test and Evaluation (DOT&E) report dated August 18, 1995. That report concludes that the FMTV is operationally effective and operationally suitable, and has been provided to the Congress as required by law. The Department recommends that the GAO report include the data from the DOT&E report.

As noted in the GAO report, the Army plans to perform the contractually-authorized comparison tests, and both retrofit and new production vehicles will be tested to verify that quality and performance of production vehicles continue to meet production requirements.

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

Sincerely,

George R. Schneider
Director
Strategic and Tactical Systems



See p. 9.

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