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Report to the Honorable Barbara Boxer, House of Representatives

March 1990

ARMY PROCUREMENT

FMC's Quality Controls and Pricing Practices on the Bradley Fighting Vehicle

GAO/NSIAD-90-86

GAO

United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-222372

March 7, 1990

The Honorable Barbara Boxer
House of Representatives

Dear Ms. Boxer:

This report responds to your request that we examine the validity of the allegations raised by former FMC employees concerning FMC's quality controls and pricing practices on the Bradley Fighting Vehicle.

We are sending copies of the report to the Chairmen of the House and Senate Committees on Armed Services and on Appropriations; the Director, Office of Management and Budget; and the Secretaries of Defense and the Army. We will also make copies available to others upon request.

Please contact me on (202) 275-4141 if you or your staff have any questions. Other major contributors to this report are listed in appendix I.

Sincerely yours,

Richard Davis

Richard Davis
Director, Army Issues

While Bradleys with problem parts have been delivered to the government, GAO found no evidence that FMC had delivered such vehicles deliberately.

The government and FMC have control systems in place to identify problems with quality. However, after reviewing FMC's system for controlling nonconforming material (material that does not meet contract specifications) in August 1989, the Defense Contract Administration Services found it to be inadequate. As a result, the Defense Contract Administration Services requested that FMC review its entire system for controlling nonconforming material. As of December 1989, FMC had completed this review, and the results were being studied by the Defense Contract Administration Services.

Principal Findings

Spare Parts Prices Based on Negotiations—Not FMC Estimates

Since 1980, the Army has bought about $107 million of spare parts from FMC under 205 separate contracts. GAO reviewed documentation for 28 of the contracts, with a value of $20 million, and determined that the prices charged the Army were based on negotiations between the government and FMC. FMC's proposed prices had been evaluated by the Defense Contract Administration Services or the Defense Contract Audit Agency.

GAO also reviewed the records of negotiations between the government and FMC for 20 of the 28 contracts. Records of negotiation were not available for the other eight contracts. In each case, it was apparent that the government had not merely accepted the proposed prices but had developed its negotiation position based on evaluated cost or pricing data.

According to FMC officials, in the early stages of the Bradley program, many of the prices entered into the Army Master Data File were based on estimates, particularly for parts that had not been previously produced. Once the part prices are negotiated between the government and FMC, the negotiated price is entered into the Army Master Data File and replaces the estimated price.

Although GAO did not perform a review of the reasonableness of the prices charged the government on the spare parts contracts, GAO has

these instances, FMC issued instructions that employees were not to remove parts from vehicles that had been logged in for government inspection and acceptance and that exceptions would be allowed only if the government granted prior approval.

Representatives of the Defense Contract Administration Services told GAO that they were unaware of any other instances of unauthorized parts removal. They said that their inspection process before shipment and at the receiving point should identify further incidents of unauthorized parts removal. GAO found that the vehicle shipping documents did list the parts that were missing and contained notations that supplemental payment documents would be processed when the missing parts were received.

Internal Controls to Monitor Product Quality

As part of its Bradley contract, FMC is required to establish and maintain quality assurance systems. To ensure that FMC complies with these systems and to evaluate its performance, the government performs various independent tests, inspections, and monitoring functions.

GAO reviewed the government's oversight of the contractor's quality assurance systems and concluded that the in-place systems provided reasonable assurance that problems with product quality were identified and that the systems enabled the government and the contractor to work toward the resolution of identified problems.

Recommendations

This report provides specific information on the allegations made by the former FMC employees; it does not attempt to assess the overall management of the Bradley contract. For that reason, GAO is not making recommendations.

Agency Comments

As requested, GAO did not ask the Department of Defense to comment officially on a draft of this report. However, GAO did discuss the issues in the report with responsible officials of the Army and the Office of the Secretary of Defense and has incorporated their comments where appropriate.

Abbreviations

AMDF	Army Master Data File
BFV	Bradley Fighting Vehicle
DCAA	Defense Contract Audit Agency
DCAS	Defense Contract Administration Services
GAO	General Accounting Office
MMBF	mean miles between failure
TACOM	Tank-Automotive Command

6. FMC employees were instructed to charge hours to the BFV program even though they were working on other programs. Also, FMC charged a computer to the BFV program that was used on other programs.

7. FMC hired an excessive number of personnel for the Bradley program, as evidenced by the fact that about 1,000 personnel were laid off in 1986 when the BFV contract was converted from a cost to a fixed-price contract.

Objective, Scope, and Methodology

As agreed with the requester, our objective was to address allegations 1 through 4, concerning spare parts pricing, and FMC's use of defective parts in the BFV production process. In addition, the requester asked us to identify the in-place internal control systems to ensure that if quality problems occurred, the problems would be brought to the contractor's and the government's attention. The requester also asked us to determine whether the Army, in obligating funds, had overestimated the amount it would need to fund spare parts contracts with FMC and, if so, what use had been made of the funds when the contracts were definitized.

As part of our review, we met with the former FMC employees and one of their attorneys to discuss the allegations and to obtain any documentation they had to support their allegations.

To address the spare parts pricing issue, we reviewed FMC's pricing practices and discussed the pricing process with FMC and government contracting officials. We also selected a sample of spare parts contracts and reviewed the contract files at the Defense Contract Administration Services (DCAS), FMC price proposals, DCAS and Defense Contract Audit Agency (DCAA) reports on the proposals, government obligation documents, and price negotiation memorandums. We did not perform a review of the reasonableness of the prices charged the government on the spare parts contracts.

To assess the use made of de-obligated funds, we selected a sample of unpriced spare parts orders issued by the Tank-Automotive Command (TACOM) in 1982, 1984, and 1986. We determined the amount of funds that had been initially obligated, the amount of the definitized contracts, and how the de-obligated funds had been used.

We discussed FMC's quality assurance systems with contractor officials and obtained descriptive documentation on these systems from FMC and

Spare Parts Pricing Issues

Many of the spare parts prices that were entered into the AMDF were based on estimates developed by FMC. However, the Army did not pay these prices when it ordered the spare parts. Instead, the Army and FMC negotiated contract prices on the basis of evaluated cost and pricing data submitted by FMC as part of its contract proposal.

We also found that, in some cases, the Army had over-obligated funds for spare parts contracts. However, the Department of Defense took actions in 1986 to limit the amount of obligated funds that could be expended before unpriced orders are definitized. As a result, the number and dollar value of unpriced orders at FMC have been reduced.

Allegation That FMC Inflated Spare Parts Prices

The former FMC employees alleged that FMC had inflated the prices it charged the Army for BFV spare parts by arbitrarily establishing the parts prices that were entered into the AMDF. According to the former FMC employees, these prices then became the prices the Army paid when it contracted for the parts.

According to one of FMC's former employees, the price entered into the AMDF had no relationship to what the part cost to make or buy. For example, when a new part number was to be entered into the AMDF, employees were allegedly instructed to go to certain individuals to get estimated prices. If those individuals were not available, the employees were instructed to make up a price and enter it into the system.

For updating the AMDF, the former employee alleged that instructions had been given to increase the price by 32, 47, or 50 percent or some other arbitrary figure. The percentage of increase varied from time to time based on who was giving instructions. The former employee also alleged that these arbitrary and inflated prices became the prices that FMC charged the government.

The AMDF is a listing of the individual parts and prices that make up the total system and is a part of the Logistics Support Analysis Review system, which forms the basis for an analysis of each item that enters the Army inventory. The purpose of the analysis is to support Army decisions on where the items will be stocked, the level of stockage that will be authorized, and where and by whom the item will be maintained.

According to TACOM and FMC officials, a price must be shown for each part in the AMDF, or the automated portion of the Logistics Support Analysis Review System will not operate. FMC officials also told us that,

options. The production contracts included some of the same parts as those in the spare parts contracts and, like the spare parts contracts, had been evaluated by DCAS or DCAA.

In the early years of the BFV program, most of the contracts for spare parts were unpriced orders. In other words, the firm contract price was not determined, or definitized, until after the contractor was authorized to begin work and incur costs. In some cases, the contracts were not definitized for several years after award.

Over-Obligation of Funds for Unpriced Orders

At the time of contract award, the Army obligates funds for the contract based on its estimate of what the contract amount will be. When the contract price is negotiated, if it is less than the obligated amount, the difference is de-obligated and potentially available for re-obligation by the government.

We reviewed 14 unpriced spare parts contracts issued by TACOM to FMC during fiscal years 1980, 1982, and 1984. The amount of funds obligated by the Army for the 14 contracts totaled about $7 million. We eliminated five contracts, amounting to about $2.4 million, from our review because the amounts of the definitized contracts equaled or exceeded the amounts obligated. For the remaining nine contracts, $3.6 million had been de-obligated. The disposition of the de-obligated funds was as follows:

- For seven contracts, $332,543 was de-obligated. The funds were returned to the tracked and wheeled vehicles account. We could not determine what specific use had been made of these funds.
- For one contract, $256,543 was de-obligated. The appropriation for these funds expired, and the funds were returned to the Treasury.
- One contract for $3,037,922 was terminated, and the de-obligated funds were reprogrammed to the next BFV production contract.

In 1986, we issued a report on unpriced orders.[3] The report pointed out that the services had generally over-obligated funds at the time unpriced orders were issued, and as a result, funds had been tied up unnecessarily for extended periods of time, sometimes for several years.

[3]Contract Pricing: Obligations Exceed Definitized Prices on Unpriced Contracts (GAO/NSIAD-86-128, May 2, 1986).

BFV Quality Assurance Issues

FMC experienced problems with certain Bradley parts, particularly in the early phases of the Bradley program. For the most part, the problems have been or are being resolved. To compensate for the early parts shortages, FMC might have used nonconforming parts (parts that do not conform to manufacturing specifications) to keep the production line moving. FMC told us that, in such cases, it would have notified the government of the use of nonconforming parts. However, due to the lack of documentation, we could not determine the extent to which nonconforming parts had been used in the production process.

The government accepts Bradleys with missing parts. However, in such cases, the missing parts are to be identified on the shipping documents, and payments to the contractor are to be adjusted.

In a few instances, FMC had removed good parts, without government authorization, from Bradleys that had been submitted to the government for final inspection and acceptance and had not notified the government. However, after government inspectors identified these cases and brought them to FMC's attention, FMC instructed its employees to discontinue such practices.

Allegation That FMC Used Nonconforming and Problem Parts in BFV Production

Former FMC employees alleged that FMC had not rejected or disposed of nonconforming parts in accordance with nonconforming material procedures and that FMC had routinely used problem parts on the production line to increase spare parts orders from the government. They alleged that the high failure rates of the lower fuel cell, the personnel heater, the halon fire suppression system, the vehicle distribution box, and the bilge pumps were evidence of FMC's use of defective parts.

DCAS officials said that contractors sometimes temporarily install nonconforming parts or parts from previously inspected vehicles in order to avoid production line stoppages. In such cases, the contractor is required to document the parts involved so that they can be replaced when good parts become available.

FMC officials said that because of parts shortages early in the BFV program, they might have used nonconforming parts or parts from completed BFVs on the production line in order to keep the line moving. They went on to say that in such cases, the government representatives would have been notified and that the parts would have been exchanged when

strong but susceptible to water absorption and warping. FMC's suppliers have had difficulty in fabricating the cells to specifications because they warp, have a peculiar shape, and are difficult to measure.

Problems with the cell's peculiar dimensions and with warping caused several fuel cells to interfere with the turret or with surrounding hardware such as the electrical cables. FMC changed the dimensions, relocated hardware, and developed a fixture that allows more accurate measurement of the fuel cell's clearances and tolerances. The fixture was expected to be provided to suppliers late in 1989.

Information we obtained from various Army data sources showed the following:

- Between 1986 and 1988, eight fuel cell failures were reported. In six of these cases, warping was identified as the cause, and in the remaining two cases, hot exhaust air from the heater had damaged the cells.
- As a result of problem fuel cells, 13 were replaced from 1984 through 1988.
- Two engineering changes were issued between 1983 and 1989. The net cost to the government for these changes was $51,901.

Personnel Heater

In December 1987, we testified before the Subcommittee on Procurement and Military Nuclear Systems, House Committee on Armed Services, that Army units were experiencing problems with the BFV's personnel heaters.[2] In response to the hearing, a joint Army-contractor investigation team conducted further investigations in early 1988 and concluded the following:

- Improper training of maintenance personnel and operators had resulted in improper operation, repair, and installation of the heater. For example, heater ducts had not always been properly reconnected after repair or replacement, and as a result, heater components had been damaged. Also, fuel filters were clogged or missing, causing damage to the heaters.
- Some heaters were inoperable because of defective igniters and the poor quality of repair parts.

Corrective actions were recommended to enlarge the fuel filter and redesign the intake/exhaust system. According to FMC officials, the most

[2]Army's Modifications to Improve the Bradley Fighting Vehicle's Survivability, Reliability, and Performance (T/NSIAD-88-10, Dec. 17, 1987).

Halon Fire Suppression System/Release Valves

The former FMC employees alleged that the halon fire suppression system was so unreliable that Army personnel would shut off the automatic triggering feature of the system for fear that it would inadvertently discharge. However, FMC and Army officials said that the halon system works as intended and that there have been only a few instances of accidental discharge.

Army officials said that, in some cases, the system had accidentally discharged when the manual release cable was accidentally pulled by debris that caught on the rotating turret and snagged the manual release cable. In another instance, the system discharged when the automatic sensing system remained on while repairmen performed vehicle maintenance, such as spot welding. In other cases, repairmen broke the sensing circuits by disconnecting electrical connectors, causing the system to discharge.

FMC and the Army said that the poor location of the manual release cable might have caused the inadvertent discharges. The manual release cable was repositioned in the BFV A2 configuration.

Army data for the halon system showed the following:

- From 1983 through 1987, 11 failures occurred. Six of the failures were due to the system's not being properly pressurized, and accidental discharge was suspected or verified in three cases.
- Two engineering changes were made in 1984 at a net cost to the government of $30,731.

Bilge Pumps

The former FMC employees alleged that the bilge pumps were frequently malfunctioning as a result of a defective design. Each BFV has four pumps installed in the floor, and each pump is designed to pump 60 gallons of water a minute. According to Army officials, the vehicle can continue to operate with two pumps at either end and still float. The officials said that the pumps were malfunctioning because troops had not been properly removing debris that accumulated around pump openings, causing them to clog.

Army data showed the following:

- From 1983 through 1989, 100 of the 113 maintenance actions reported were for cleaning.

acceptance testing and inspection. Any exception to this policy was to be approved in advance by DCAS.

As an added measure against unauthorized parts removal or the substitution of defective parts for good parts, the vehicles are inspected and tested at the receiving point. The inspections and testing should identify any missing or nonfunctioning parts.

According to the DCAS Quality Assurance Chief, DCAS's identification of the 1983 incidents illustrates that the government was effectively overseeing FMC's operation. The DCAS official also said that there have been no other instances of unauthorized parts removal.

Allegation That FMC Delivered BFVs to the Army With Parts Missing

A former FMC employee alleged that BFVs had been delivered to the Army with parts missing because of shortages of and unexpectedly high failure rates of the parts. Also, he alleged that, because FMC did not adequately account for parts, it did not always know which parts were missing and were to be supplied at a later date.

The government accepts BFVs with parts missing as long as the missing parts are identified. In such cases, payment to the contractor is adjusted. We reviewed DCAS Material Inspection and Receiving Reports for June 1988 through August 1989 and identified 13 instances in which the government had accepted BFVs from FMC with missing parts. The 13 instances accounted for 253 parts valued at $322,770. Not included in this total was 156 missing parts, which were government-furnished material. In each of the 13 instances, the report contained a notation that payment to the contractor would be adjusted.

In addition to being inspected at the contractor's plant before shipment, BFVs are inspected at the receiving point before being turned over to the units. This additional inspection provides added assurance that any missing parts are identified.

Conclusions

Certain BFV parts have experienced problems with quality. However, we found no evidence to substantiate allegations that FMC had knowingly used problem parts in the production process to increase the Army's spare parts orders. Furthermore, the Army and the contractor have taken actions to resolve the problems or are working on solutions.

Internal Control Processes to Monitor Quality

Government specification MIL-Q-9858A requires the contractor to develop and maintain a quality assurance system that specifies responsibilities, functions, and control methods to ensure adherence to quality standards and practices. A separate specification covers the disposition of nonconforming material (MIL-STD-1520C). This specification is incorporated into the contract between the government and FMC.

The government also has the responsibility for ensuring product quality. In carrying out its responsibility, the government performs and monitors various vehicle tests, inspections, and actions to correct identified deficiencies. The government's monitoring mechanisms include

- initial and comparison production tests,
- physical inspections,
- a deficiency reporting program,
- a sample data collection program,
- quarterly review meetings, and
- quality system reviews.

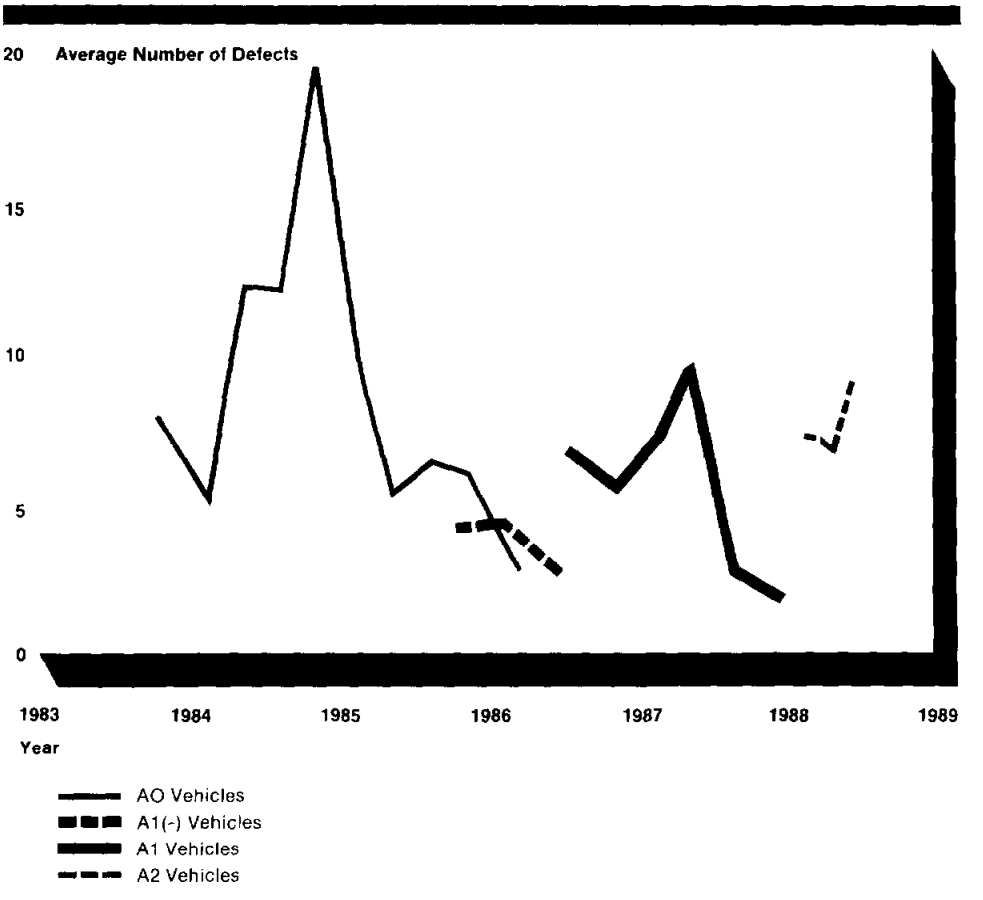
Initial and Comparison Production Tests

Initial production tests are conducted to establish performance limits under actual mission conditions and to make needed production modifications or design changes. Four of the first 10 vehicles produced under any new Bradley configuration are driven 6,000 miles over a 6- to 9-month period.

Then, each quarter, one vehicle is randomly selected for a 1,500-mile comparison production test to evaluate reliability and production quality over the production period, and the data is provided to the contractor for trend analyses.

The introduction of new Bradley models (the A0, the A1, and the A2) initially resulted in higher-than-normal deficiencies due to new systems, new components, or new production processes. Overall, however, test results and trend data have shown that mean miles between failure (MMBF) for the BFVs have exceeded the target of 225 MMBF for production vehicles. Table 4.1 shows the MMBF trends for the three Bradley models.

Figure 4.1: Historical BFV De-Processing Trend Data Comparing Vehicle Configurations



Source: TACOM.

Deficiency Reporting Program

During the oversight process, noncritical problems with quality are recorded in the vehicle logbook maintained for each BFV. Critical quality defects are recorded on a quality deficiency report, which requires the contractor to take corrective action within 30 days. From 1986 through December 1989, DCAS inspectors issued 1,265 quality deficiency reports to FMC for a variety of quality deficiencies.

Army personnel who operate and maintain the BFVs in the field also issue quality deficiency reports to TACOM documenting defects found during field operations or maintenance. TACOM, in turn, screens the reports to identify repetitive problems before referring them to FMC or to any of the other prime contractors for the BFV. The number of deficiency reports issued to FMC from 1984 to 1989 are shown in table 4.2.

A recent quality system review was conducted at FMC by DCAS personnel in August 1989. The review identified 35 quality deficiencies and 3 Method C violations. A Method C violation denotes a serious quality problem and requires high-level review and immediate contractor action. Including the three from the most recent review, six Method Cs have been issued to FMC over the past 2 years. The dates they were issued and the problems that were identified with the BFV are shown in table 4.3.

Table 4.3: Method C Violations Issued to FMC

Date of violation	Description of problem
Sept. 14, 1989	Failure to submit a Quality Program Plan for engineering and technical support.
Sept. 1, 1989	Lack of quality controls and corrective actions for nonconforming materials received from subcontractors.
Aug. 18, 1989	Calibrated gauges that were out of tolerance and computer software that was not in compliance with software engineering standards.
Nov. 9, 1987	Inadequate quality controls over subcontract purchases.
Oct. 19, 1987	No follow-up on a supplier-provided part to ensure that effective corrective actions had been taken.
June 15, 1987	Insufficient control over automated test equipment software.

Conclusions

The Army has established internal control mechanisms to oversee FMC's quality assurance program for the BFV. While these mechanisms will not, in and of themselves, prevent quality control problems from arising, the systems enable the contractor and the government to work toward the resolution of identified problems.

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Table 4.2: Deficiency Reports Issued by TACOM to FMC

Year	Deficiency reports issued
1984	110
1985	187
1986	120
1987	56
1988	47
1989	15[a]

[a]Through December 1989.

Sample Data Collection Program

Another measure of quality control is the Army's sample data collection program. Under this program, the Army uses unscheduled maintenance actions per vehicle per month as a measure of the BFV's quality. Operational, maintenance, and repair information is collected and analyzed for about 250 BFVs each month. From 1984 through 1988, the number of unscheduled maintenance actions for the A0 BFV decreased from five to three a month, and the A1 BFV averaged about four such actions during 1988, the first year data was available for that configuration. Data is not yet available for the A2 configuration.

Quarterly Review Meetings

Government and contractor officials meet on a quarterly basis to assess the reliability and quality of the BFVs, using data collected and analyzed through quality control processes. At these meetings, corrective action plans are developed, and previously initiated corrective actions are reviewed.

Quality System Reviews

Army officials may request that DCAS perform a quality system review, which is an independent review and evaluation of the contractor's quality assurance program. Quality assurance personnel from a DCAS regional office assess the adequacy of the contractor's documentation, its compliance with contract specification requirements, and the effectiveness of its systems or controls in ensuring product quality.

These reviews afford added assurance that the contractor is complying with contract quality and technical requirements, that the product being delivered is of acceptable quality, and that the contractor's quality assurance program is adequate.

Table 4.1: MMBF Trend Data for Three Bradley Models

Bradley model	Mean miles between failures: Initial	Mean miles between failures: Most current	Time period
AO	225	580	1979 through 1985
A1	474	841	1985 through 1987
A2[a]	857	780	1987
A2[b]	650	580	1989

[a]BFV with 500-horsepower engine

[b]BFV with 600-horsepower engine

Physical Inspection

DCAS representatives perform various inspections and functional tests at the FMC plant throughout the production cycle. The inspectors identify and report missing hardware or components, workmanship defects, and any nonworking or inoperative systems. A final inspection is done at the time the government accepts the vehicles and again before the vehicles are shipped to the Army's receiving units at Vilseck, West Germany, and Ft. Hood, Texas.

Before the government accepts the vehicles and after FMC conducts a 40-mile road test, DCAS representatives conduct a 10-mile road test for each BFV.

Before the BFVs are turned over to Army field units, Army receiving teams at Vilseck and Ft. Hood subject each vehicle to a "de-processing" inspection. The purpose of this inspection is to ensure that an accepted vehicle has not been adversely affected during shipment. The de-processing team follows a detailed checklist for visual inspection and functional testing. De-processing data and summaries are reported to the BFV project manager and to FMC. Figure 4.1 shows de-processing trend data by vehicle model since 1984.

Bradleys are accepted by the government with parts missing. However, the missing parts are to be identified on the shipping documents, and payments to the contractor are to be adjusted accordingly.

However, in 1983, FMC employees removed good parts, without government authorization, from Bradleys that had been submitted to the government for final inspection and acceptance. No additional instances have been identified by DCAS since FMC issued instructions to its personnel that were intended to prevent such actions.

- Over the history of the program, mean miles between maintenance action have averaged 1,258 miles.
- A value engineering change was issued for the bilge pump in 1986. The change resulted in a net cost reduction to the government of $588,933.

Allegation That FMC Removed Good Parts From BFVs Submitted to the Government for Final Acceptance

A former FMC employee alleged that FMC had routinely removed good parts from BFVs that had been accepted by the government and used the removed parts on the production line.

On the basis of documentation provided by DCAS, we found four instances, in 1983, in which FMC employees had removed parts from vehicles that had been submitted to the government for final testing and acceptance.

In one case, the government had inspected and accepted a Bradley on February 13, 1983. On February 24, 1983, government personnel noticed that the commander's intercom box had been removed. The vehicle was turned back to the contractor to have the box replaced. When the vehicle was returned to the government for reinspection on February 26, 1983, government personnel noticed that the gunner's intercom floor switch was inoperative, that the right rear squad compartment intercom box had been disconnected, and that an extra intercom box was lying on the floor.

In another case, as a result of a DCAS vehicle inspection on March 24, 1983, FMC installed two fire sensors. On March 25, 1983, the inspectors noticed that the two sensors were missing.

In the third case, on March 28, 1983, a government inspector observed an FMC employee removing the squad seat footrest on a vehicle that was being inspected.

In the fourth case, a vehicle was returned to the government on April 14, 1983, for a reinspection of previous deficiencies found during the initial inspection on April 7, 1983. During reinspection, the inspector noticed that the left side exterior ammunition rack, the rear squad seat, and the front squad seat footrest had been removed.

As a result of these four cases of unauthorized parts removal, FMC issued a policy statement to all production personnel saying that no parts were to be removed from any vehicle that had been logged in for

significant finding of the heater study was that the Bradley's heater and heater system appear to function well when they are properly maintained and serviced. Army officials agreed that the problems with the heater stemmed not from the design of the heater but from poor integration of the heater into the Bradley vehicle.

Army data for the personnel heater showed the following:

- Five instances of heater problems were reported from 1983 through 1986.
- The mean miles between maintenance actions averaged 3,554 from 1983 through 1989.
- Four engineering changes were issued from 1985 through 1989 at a net cost to the government of $532,670.

Vehicle Distribution Box

In our December 1987 testimony before the Subcommittee on Procurement and Military Nuclear Systems, House Committee on Armed Services, we also discussed the operational testing of the Bradley's vehicle distribution box. As a result of test failures, FMC changed the specification and modified the hardware design.

FMC also began to subject all boxes to a 100-percent Environmental Stress Screening to identify defective boxes before they were installed on the vehicles. According to Army officials, the new screening includes (1) a visual inspection of the internal circuit boards to disclose improper or weak solder connections, discolorations, and other indicators of poor workmanship; (2) a thermal/heat test that subjects the box to extremely high and extremely low temperatures and humidity; and (3) a vibration test that subjects the boxes to the kinds of vibrations that it will undergo. According to Army officials at the project manager's office, there have not been as many problems with the distribution boxes since the tests were implemented.

Army data for the distribution boxes showed the following:

- From 1983 through 1989, three boxes failed because of loose electrical cables, and two boxes were damaged during shipment.
- During post-production testing from 1983 through 1989, the mean miles between maintenance actions averaged 20,308.
- Three engineering changes were made from 1984 through 1987 at a net total cost to the government of $86,999.

FMC received additional parts. Due to the lack of documentation, however, we could not identify the specific items involved or the extent to which FMC had used nonconforming parts.

As part of its contractural requirement, FMC instituted an automated system in 1985 to track the disposition of nonconforming parts. At various locations on the production and inspection lines, FMC has identified "lay down points." When a nonconforming part is identified, it is taken to one of these areas, where information on the part is entered into the automated system. Periodically, members of the material review board[1] inspect the parts at the lay down points and determine whether the part should be (1) reworked, (2) used as is, or (3) discarded. These determinations are entered into the automated system and serve as checks on the disposition of parts.

DCAS reviewed FMC's tracking system in August 1989, as part of an overall quality system review, and found deficiencies in the controls over and the follow-up of actions taken to reduce the incidence of nonconforming materials' being received from subcontractors. In its review, DCAS examined two parts critical to the BFV's operations and identified problems with FMC's control over nonconforming material. The DCAS Chief of Quality Assurance requested that FMC review its nonconforming material tracking system to identify systemic problems. As of December 1989, FMC had submitted the results of its review to DCAS for review and approval.

Government representatives also inspect the vehicles at various stages in the production process, prior to final acceptance, and at field receiving locations. These inspections serve to identify any nonconforming parts that have been missed during previous inspections.

We determined that the parts identified by the former FMC employees as problems were, in fact, problems—particularly in the early stages of the BFV program. Generally, these problems have been resolved as a result of contractor and Army efforts, as discussed below.

Lower Fuel Cell

Army officials acknowledge that the lower fuel cell of the BFV was a problem item because it had a propensity to rupture or leak. The fuel cell is made of Nylon-6, a synthetic material, which is lightweight and

[1]The board is comprised of FMC and government personnel. A determination by the board on the disposition of a nonconforming part must include the concurrence of the government representative.

Since 1986, the number of unpriced orders issued by the services has declined significantly as a result of emphasis by the Department of Defense on (1) issuing priced contracts and (2) limiting the amount of obligated funds that can be expended before the unpriced orders are definitized. As a result of these actions, the number and dollar value of unpriced orders have been reduced significantly.

Conclusions

The prices charged the government for spare parts were not the prices in the AMDF. The government and FMC negotiated spare parts prices. DCAS and DCAA evaluated the prices proposed by FMC and challenged them when supporting documentation was inadequate.

Regardless of the review process that is in place, we are not offering an opinion on the reasonableness of the spare parts prices charged the government. Our prior review of FMC Bradley production contracts, which included some of the same parts as those in spare parts contracts, showed that FMC had overpriced the contracts because it had not disclosed actual subcontract awards, lower price quotations, or lower option prices.

The occurrence of the over-obligation of funds by the Army and of its failure to definitize unpriced orders for long periods has been reduced as a result of actions taken by the Department of Defense to curb the number of unpriced orders, limit the amount of funds that can be expended, and reduce the time allowed for definitizing these types of orders.

because they did not have a price history on many of the BFV parts at the time the Logistics Support Analysis Review System was being prepared, the prices entered into the AMDF were often estimates. According to TACOM officials, after the government and FMC negotiate the parts prices, the negotiated prices are entered into the AMDF and replace the estimated prices.

Spare Parts Prices Based on Negotiations

When the Army orders spare parts from the contractor, the contractor responds with a price proposal. At this point, government representatives (from DCAS or DCAA) evaluate the reasonableness of the proposed prices by tracing them to supporting documentation such as purchase orders, vendor quotes, or contractor estimates.

Since 1980, the Army has procured about $107 million of BFV spare parts on 205 spare parts contracts. We selected 29 of the contracts, valued at $26 million, and reviewed the DCAS/DCAA audit reports for 28 contracts, with a value of about $20 million.[1] In all cases, DCAS or DCAA had traced the large-dollar-value parts, which accounted for a vast majority of the material prices, to supporting documentation.

We also reviewed the contracting officers' price negotiation memorandums for 20 of the 28 contracts reviewed. Price negotiation memorandums were not available for the other eight contracts. The memorandums provide the essence of the negotiations between the Army and FMC. In all cases, the memorandums indicated that the government had not accepted the prices proposed by FMC but had based its negotiations on cost or pricing data submitted by FMC and evaluated by DCAS or DCAA.

Although we did not perform a review of the reasonableness of the prices charged the government on the spare parts contracts, we have made such reviews of FMC Bradley production contracts. In March 1987, we reported that FMC had overstated, by $10.3 million, the proposed prices provided to the Army's contracting officer for 8 of 24 subcontracted items reviewed as part of the 1982 and 1984 production contracts.[2] The overpricing occurred because FMC had not disclosed actual subcontract awards, lower price quotations, or lower price

[1]One of the contracts had been negotiated by the buying command, and the DCAS/DCAA report was not available at FMC.

[2]Contract Pricing: Material Prices Overstated on Bradley Fighting Vehicle Contracts (GAO/NSIAD-87-49, Mar. 10, 1987).

DCAS to determine whether the systems could identify the types of problems identified by the former FMC employees. We also selected five BFV parts identified by the former employees as problem parts and developed a chronology of actions taken by the contractor and the Army to correct the problems. As a part of this effort, we analyzed frequency of failure data developed by FMC and DCAS at San Jose, California, and the Bradley program office and TACOM at Warren, Michigan, to determine the frequency of the problems.

We did not assess FMC's overall performance on the Bradley program or determine whether there were issues, other than those alleged, that call FMC's performance into question.

We performed our review from January to October 1989 in accordance with generally accepted government auditing standards.

Introduction

The Army awarded FMC a full-scale development contract for the Bradley Fighting Vehicle (BFV) in 1972, and FMC began producing the vehicle in 1980. The current production contract for fiscal year 1989 calls for FMC to produce 641 BFVs. Through the fiscal year 1989 procurement, the Army has bought a total of 5,524 BFVs and plans to buy 8,524 by 1994.

There are two models of the BFV: the infantry fighting vehicle and the cavalry fighting vehicle. The infantry vehicle's mission is to support tanks by suppressing enemy infantry and lightly armored vehicles, while the cavalry vehicle's mission is to serve as a reconnaissance scout vehicle for armored cavalry units. Each vehicle has a 25-millimeter automatic cannon and a TOW-2 missile system.

On October 20 and December 1, 1988, a major news network aired programs in which former FMC employees alleged that FMC had participated in fraudulent practices concerning (1) the prices charged to the government for Bradley spare parts and (2) the use of defective parts in the production of BFVs. In response to these programs, Representative Barbara Boxer requested that we meet with the former FMC employees to determine the validity of their allegations. Before meeting with them, we received a letter from one of their attorneys, outlining allegations that FMC had engaged in fraudulent practices during the design, manufacture, and delivery of the BFV. More specifically, the allegations were as follows:

1. FMC defrauded the government by arbitrarily inflating spare parts prices. FMC entered fraudulent parts prices into the Army Master Data File (AMDF), and these prices became the prices the government paid when ordering the parts.

2. FMC used defective parts on the production line.

3. FMC knowingly delivered BFVs with rejected, defective, and nonfunctioning parts in order to justify engineering change proposals and increase the spare parts business.

4. FMC removed good parts from BFVs that had been accepted or purchased by the government and replaced them with defective parts.

5. FMC's inventory controls on BFV parts were inadequate and, at times, nonexistent.

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made such reviews of FMC Bradley production contracts. For example, in a March 1987 report, GAO determined that FMC had overstated, by $10.3 million, the proposed prices provided to the Army's contracting officer for 8 of 24 subcontracted items reviewed as part of the 1982 and 1984 production contracts. The production contracts included some of the same parts as those in the spare parts contracts and, like the spare parts contracts, had been evaluated by the Defense Contract Administration Services or the Defense Contract Audit Agency.

Use of Nonconforming and Problem Parts in Production

To avoid production line stoppages, contractors sometimes install nonconforming parts on vehicles as they proceed through production. In such instances, the contractor is required to keep track of the nonconforming parts and replace them when good parts become available.

FMC officials said that in the early stages of the Bradley program, they might have used some nonconforming parts on the production line because of parts shortages. Due to the lack of available documentation, however, GAO was not able to determine the extent to which FMC had used nonconforming material in the production process.

In 1985, FMC implemented an automated system to track the disposition of nonconforming material. However, after reviewing the system in August 1989, the Defense Contract Administration Services concluded that it did not provide adequate controls or follow-up to reduce the incidence of nonconforming materials' being received from subcontractors. At the request of the Defense Contract Administration Services, FMC initiated a review of the system to identify and resolve the systemic problems. The results of the review are being studied by the Defense Contract Administration Services.

GAO verified that the problem parts identified by the former FMC employees as experiencing high failure rates were, in fact, problem parts. However, GAO found no evidence that FMC had knowingly used problem parts in the production process.

Unauthorized Removal of Parts From Bradleys

Bradleys may be accepted by the government with missing parts. Such acceptance is permissible as long as the missing parts are identified and payment is adjusted accordingly. However, in 1983, government inspectors found that in four instances FMC employees had removed parts, without government authorization, from vehicles that had been submitted to the government for final inspection and acceptance. As a result of

Executive Summary

Purpose

Former employees of FMC Corporation, the builder of the Bradley Fighting Vehicle, have alleged that FMC inflated the prices of spare parts and knowingly designed and produced a faulty vehicle. After these allegations were aired by a major news network in October and December 1988, Representative Barbara Boxer requested GAO to determine whether (1) FMC had inflated spare parts prices that were entered into the Army Master Data File, which lists the individual parts that make up the Bradley; (2) the Army had paid the spare parts prices in the Army Master Data File; and (3) FMC had knowingly delivered Bradleys to the Army with defective parts. Representative Boxer also asked GAO to determine whether there were government and contractor internal controls to identify problems with the quality of the vehicles.

Background

In 1972, the Army awarded a full-scale development contract to FMC for the Bradley Fighting Vehicle. FMC began to produce the vehicle in 1980, and through fiscal year 1989, the Army has procured 5,524 Bradleys. By 1994, the Army plans to buy 8,524 vehicles.

There are two models of the Bradley: the infantry fighting vehicle and the cavalry fighting vehicle. The infantry vehicle's mission is to support tanks by suppressing enemy infantry and lightly armored vehicles, and the cavalry vehicle's mission is to serve as a reconnaissance scout vehicle for armored cavalry units.

Results in Brief

The spare parts prices developed by FMC and entered into the Army's Master Data File were often estimates that had little relationship to the actual cost of the spare parts. However, the Army did not use the prices in the Master Data File as a basis for negotiating the spare parts prices with FMC. Rather, the Army negotiated the prices with FMC based on FMC's cost or pricing data. The proposed prices were evaluated by the Defense Contract Administration Services or the Defense Contract Audit Agency.

GAO did not perform pricing reviews of the spare parts contracts. However, GAO has performed such reviews on Bradley production contracts and has identified significant overpricing. As with the spare parts contracts, the Defense Contract Administration Services or the Defense Contract Audit Agency had evaluated the proposed prices in the production contracts, which included some of the same parts as those included in the spare parts contracts.