

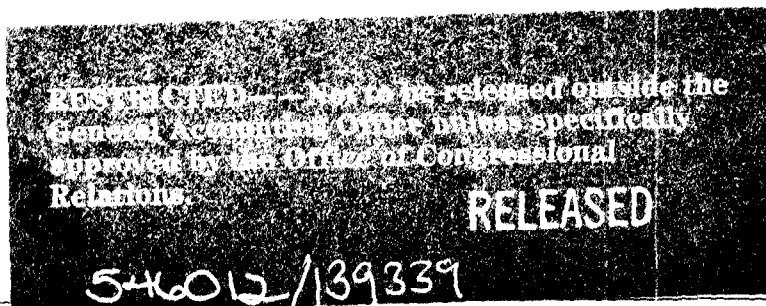
GAO

Report to the Chairman, Subcommittee on  
Procurement and Military Nuclear  
Systems, Committee on Armed Services,  
House of Representatives

July 1989

# ARMY PROCUREMENT

## The Selection of a Manufacturer for the 120-mm Mortar



---

---

National Security and  
International Affairs Division

B-235186

July 18, 1989

The Honorable Les Aspin  
Chairman, Subcommittee on Procurement  
and Military Nuclear Systems  
Committee on Armed Services  
House of Representatives

Dear Mr. Chairman:

As requested by the former Subcommittee Chairman, we reviewed the Army's cost analysis for selecting a U.S. manufacturer of the 120-millimeter mortar system. Our objective was to determine whether the Army had sufficiently reviewed the cost analysis to ensure that it was conducted in accordance with the Arsenal Statute (10 U.S.C., section 4532(a)) and pertinent regulations.

The Arsenal Statute requires the Army to manufacture supplies it needs in factories or arsenals owned by the United States to the extent that those factories or arsenals can make those supplies on an economical basis. Army regulations and decisions by our office<sup>1</sup> provide guidance on conducting Arsenal Statute analyses, that is, cost comparisons between the Army's cost to manufacture such items and the cost to have them manufactured by private companies.

## Results in Brief

We found that the cost estimate prepared by the Army's Watervliet Arsenal for the production of the 120-mm mortar system has been subjected to several levels of review. Our examination of the review efforts by the Army revealed that the reviews were consistent with each other and supported the conclusion that the Watervliet Arsenal's cost estimate had been developed in accordance with the Arsenal Statute and applicable regulations.

The Watervliet Arsenal's cost estimate for the production of the 120-mm mortar system was \$23.2 million less than the proposal submitted by Martin Marietta.

<sup>1</sup>Comptroller General Decisions B-143232, December 15, 1960; B-175703, July 23, 1973; and Action Manufacturing Company, B-220013, November 12, 1985.

---

## Background

The Army decided in 1984 to replace its 4.2-inch heavy mortar with a 120-mm mortar system that can be towed (the "towed" version) or installed in a tracked vehicle (the "carrier" version). Instead of developing a new mortar system, the Army decided to procure the technology for an existing 120-mm mortar system. The 120-mm mortar system will use newly developed ammunition.

In November 1985, the Army issued a request for proposals, soliciting private industry to compete for the manufacture of the mortar system. The solicitation specified that (1) the Army intended to compare the firm, fixed price submitted by the company with the winning technical data package to the estimated costs to produce the same mortar system at an Army arsenal and (2) the arsenal's cost estimate would be its out-of-pocket costs.<sup>2</sup>

Three U.S.-based companies, all representing foreign manufacturers of 120-mm mortar weapon systems, responded to the Army's request for proposals—Martin Marietta, representing Soltam of Israel; Honeywell, representing Thomson Brandt Armaments of France; and General Defense Corporation, representing Esperanza y Cia of Spain.

Between September 1986 and December 1987, the Army conducted competitive testing among the three competing companies to determine which of the three designs for mortar systems (both towed and carrier versions) met the Army's minimum requirements. The results of the competitive tests were used by the Army's Source Selection Evaluation Board to assess the technical and performance aspects of the proposed mortar systems. The Board determined that Martin Marietta's mortar system from Soltam of Israel met all the minimum requirements. In March 1988, the Army selected Martin Marietta's 120-mm mortar design.

The 1987 Defense Authorization Act required the Army to conduct a cost comparison of potential domestic sources for the manufacture of the 120-mm mortar system. The Congress further refined this requirement in the 1989 Defense Authorization Act by directing the Army to perform an "Arsenal Act" analysis prior to obligating any fiscal year 1989 funds for procurement of 120-mm mortars.

---

<sup>2</sup>The Army has defined "out-of-pocket costs" as all costs of producing the required item except for those costs that are incurred by the government-owned facility whether or not the particular contract is awarded to the facility. At a minimum, all direct labor and direct material costs should be considered as out-of-pocket costs. We have supported this definition in several decisions.

On December 14, 1988, the Army selected its Watervliet Arsenal to produce the 120-mm mortar system rather than Martin Marietta. This decision was based on the results of a cost comparison between Watervliet's cost estimate (based on its estimated out-of-pocket costs) and Martin Marietta's firm, fixed-price offer). Watervliet's estimate of \$44.7 million to produce 2,816 carrier and towed 120-mm mortars was \$23.2 million less costly than Martin Marietta's offer.

## Watervliet's Estimate Reviewed Several Times

Several Army organizations reviewed the Watervliet Arsenal's out-of-pocket cost estimate to produce the 120-mm mortar system. Reviews were conducted by the Army Audit Agency (AAA); an Army Armament, Munitions and Chemical Command (AMCCOM) team; and an independent Award Advisory Team.

The objective of these Army reviews was to ensure that Watervliet's out-of-pocket cost estimate had been developed and prepared in accordance with the Arsenal Statute, Comptroller General decisions, and Army regulations relating to cost estimates, out-of-pocket costs, and cost comparisons. The reviews focused on the Watervliet Arsenal's methodologies and practices in developing its out-of-pocket cost estimates for labor rates, direct labor hours, and materials to produce the mortar systems. The reviews also examined the appropriateness and consistency in applying the out-of-pocket cost estimates.

The assessments and conclusions in the reports issued by these Army activities were consistent with each other. They concluded that the Watervliet Arsenal's out-of-pocket cost estimate had been prepared in accordance with the Arsenal Statute, that the costs were reasonable and supportable, and that the Arsenal's cost estimate was responsive to the solicitation.

AMCCOM Regulation 37-25, which prescribes techniques for developing out-of-pocket cost estimates, requires that cost estimates that are used as input for decisions to produce items at Army-owned facilities must be validated. As stipulated by Army Materiel Command Regulation 37-4, Watervliet's cost analysis division validated Watervliet's cost estimate before it was submitted. The division validated Watervliet Arsenal's cost estimates as sound and supportable and as having been obtained through acceptable cost-estimating methods.

---

## AAA Finds Watervliet's Cost Estimate Complies With Arsenal Statute

AMCCOM, which has management responsibility for the Watervliet Arsenal, requested that AAA audit Watervliet's proposed costs and estimating methodology to ensure the soundness of Watervliet's estimate.

AAA conducted its first audit of Watervliet's out-of-pocket cost estimate from late 1986 to early 1987. In an April 1987 report, AAA concluded that, with some exceptions, Watervliet's out-of-pocket estimate was reasonable and supportable and had been prepared in accordance with regulations.<sup>3</sup> AAA reported, however, that Watervliet's estimate underestimated the costs because it had applied an incorrect inflation rate and understated the costs related to the first year production learning curve.

Subsequently, AAA again audited Watervliet Arsenal's estimate and issued a second report in January 1988.<sup>4</sup> This second audit was necessary because Watervliet had revised the cost estimates based on the changed delivery schedule in an amendment to the solicitation. Also, since the first audit, the three competing companies had modified their mortar designs to correct deficiencies identified during the first competitive testing.

AAA found that Watervliet's cost estimates for the 120-mm mortar were based on historical manufacturing information for component parts from similar weapons, such as the 120-mm cannon and the 81-mm and 4.2-inch mortars. AAA concluded that the general methodology Watervliet had used to prepare the estimate was reasonable and in accordance with AMCCOM Regulation 37-25 and the Arsenal Statute. It also concluded that appropriate actions had been taken to correct the inconsistencies identified in its prior audit.

---

## Ad Hoc Team Confirms AAA's Conclusions

In April 1986, AMCCOM established an ad hoc team to ensure that AAA's audit of the Arsenal's estimate was thorough. The team reviewed AAA's audit work and stated in its February 1988 report that it supported AAA's January 1988 report and that the Watervliet Arsenal's estimate required no alterations.<sup>5</sup>

---

<sup>3</sup>Arsenal Bids for the 120 Millimeter Mortar Program, U.S. Army Audit Agency, Audit Report: MW 87-713, April 6, 1987.

<sup>4</sup>Audit of Watervliet Arsenal Bids for the 120 Millimeter Mortar Program, U.S. Army Audit Agency, Audit Report: NE 88-701, January 28, 1988.

<sup>5</sup>AMSMC-PDA-F (715(A)), Subject: 120 Millimeter Mortar Arsenal Bid Review Team, February 3, 1988.

---

**Independent Analysis  
Confirms That  
Watervliet's Estimate  
Complies With Arsenal  
Statute**

The Army formed an independent Award Advisory Team in November 1988 to conduct the cost comparison of the Watervliet Arsenal's out-of-pocket cost estimate and Martin Marietta's fixed-price offer. The team also analyzed Watervliet's cost-estimating methodology and its development and application of out-of-pocket cost estimates.

The advisory team was staffed by Army and contractor experts in the fields of cost and systems analysis, production engineering, and procurement law. According to the advisory team's chairman, the team was formed and operated in a completely autonomous fashion to ensure propriety and fairness.

The advisory team conducted a detailed investigation of cost estimates for high-cost mortar components, such as the barrel, the breech, and the baseplate, to assess the reasonableness of the cost estimates. It evaluated the process used to estimate direct labor hours and direct material costs.

The Award Advisory Team issued a report in December 1988.<sup>6</sup> Overall, it found that the out-of-pocket cost-estimating procedure Watervliet had used was in accordance with the Comptroller General's decisions regarding the Arsenal Statute and AMCCOM Regulation 37-25 regarding out-of-pocket costs. The report stated that the standard estimating procedures that Watervliet had used to develop the out-of-pocket cost estimates appeared to be adequate. The report also concluded that the estimating methodology and resulting estimates for direct labor hours and direct material costs were reasonable and supportable. The out-of-pocket costs could be traced to supporting documentation and were accurate and consistent with standard Watervliet bidding procedures.

---

**Arsenal Estimate Less  
Costly Than Martin  
Marietta's Offer**

The Army's Award Advisory Team completed its cost comparison in December 1988 and concluded that Watervliet's out-of-pocket cost estimate was less costly than Martin Marietta's offer. The advisory team reported that the cost difference was so substantial that no set of factors, such as production delays and the resulting inflationary increases to the Arsenal's out-of-pocket costs, would likely change the cost relationship between the two submissions. Watervliet's estimate to produce

---

<sup>6</sup>The 120mm Mortar Award Advisory Team Report, December 14, 1988.

2,816<sup>7</sup> towed- and carrier-configured 120-mm mortars over an 8-year period was \$23.2 million, or 34 percent, less costly than Martin Marietta's offer to produce the same number of mortars.

As shown in table 1, Watervliet's estimate totaled almost \$44.7 million, while Martin Marietta's totaled \$67.9 million.

**Table 1: Comparison of Watervliet's Out-Of-Pocket Costs to Martin Marietta's Fixed-Price Offer**

Dollars in thousands			
Year of buy	Quantity	Towed	
		Watervliet	Martin Marietta
1989 <sup>a</sup>	58	\$1,123	\$1,732
1990	105	1,947	2,876
1991	100	1,872	2,898
1992	150	2,839	4,191
<b>Total</b>	<b>413</b>	<b>\$7,781</b>	<b>\$11,697</b>
Carrier			
1989	108	\$1,641	\$2,519
1990	193	2,807	4,124
1991	230	3,379	5,763
1992	387	5,764	8,492
1993	550	8,369	12,153
1994	425	6,627	9,998
1995	255	4,112	6,400
1996	255	4,204	6,739
<b>Total</b>	<b>2,403</b>	<b>\$36,903</b>	<b>\$56,188</b>
<b>Total</b>	<b>2,816</b>	<b>\$44,684</b>	<b>\$67,885</b>

<sup>a</sup>The solicitation estimated that production would start in 1989, a starting date that was the basis for the cost estimates. However, because of program slippage, first production will not occur before fiscal year 1990.

Watervliet's out-of-pocket costs represented about 70 percent of the estimated full production costs. Material cost was the largest single cost factor, accounting for 41 percent of the out-of-pocket costs, followed in order by manufacturing costs (26 percent), direct labor costs (25 percent), and variable general and administrative costs (8 percent). Army officials did not specifically know what accounted for the large cost difference between Watervliet's estimate and Martin Marietta's offer

<sup>7</sup>The Award Advisory Team calculated the 2,816 mortars by adding the midpoints of each quantity range for the production options for the towed- and carrier-configured mortars. This figure was the basis of its cost comparison. The Army may eventually buy more or fewer mortars, depending on its needs and funding.



---

because the Army did not have access to the breakdown of Martin Marietta's proposed costs. The company was required only to submit a best and final unit price for each line item in the Army's solicitation.

---

### Watervliet's Costs at Full Cost Still Lower Than Martin Marietta's Offer

The Army stated in its notification letter to the Congress that the Watervliet Arsenal's proposal was more economical than Martin Marietta's even when full costs were considered. We compared Watervliet's full production cost to Martin Marietta's fixed-price offer and found that Watervliet's full cost, including recurring and nonrecurring costs (all general and administrative, allocated overhead, direct and indirect labor, and materials), was still \$4.1 million, or 6 percent, lower than Martin Marietta's offer (\$63.8 million compared to \$67.9 million).

---

### Conclusions

The out-of-pocket cost estimate prepared by Watervliet Arsenal for the production of the 120-mm mortar system has been subjected to several levels of review, including an AAA audit and an analysis by an independent Army team of experts in cost estimating and production engineering. The results of these efforts were consistent with each other and supported the conclusion that the Watervliet Arsenal's out-of-pocket cost estimate had been developed in accordance with the Arsenal Statute and other applicable regulations.

Our review of the individual investigative efforts showed that, overall, the Army had thoroughly examined the policies, practices, and methodologies Watervliet Arsenal followed in developing its out-of-pocket cost estimate.

The Army's cost comparison of Watervliet's out-of-pocket estimate and the fixed-price proposal submitted by Martin Marietta clearly shows that production of the 120-mm mortar at Watervliet Arsenal is more economical. The cost difference between Watervliet's estimate and Martin Marietta's offer was \$23.2 million.

---

### Agency Comments

The Department of Defense agreed with our findings and conclusions (see app. I).

---

## Objectives, Scope, and Methodology

As requested, we reviewed the Army's cost analysis for selecting a manufacturer of the 120-mm mortar system to determine whether the Army had sufficiently reviewed its cost analysis to ensure that it was conducted in accordance with the Arsenal Statute and pertinent regulations.

In conducting our review, we made a limited examination of the Arsenal Statute, Comptroller General decisions, and Army regulations that provide guidance for the development and application of out-of-pocket cost estimates and cost comparisons. We examined documentation and reports produced by the various Army activities that reviewed the Watervliet Arsenal's cost estimate and that conducted the cost comparison of Watervliet Arsenal's estimate and Martin Marietta's offer. We obtained this information from the following Army activities:

- the Project Office for Mortars, Picatinny Arsenal, New Jersey;
- the Army Award Advisory Team, Picatinny Arsenal and Aberdeen Proving Ground, Maryland;
- the Arsenal Bid Review Team, Rock Island, Illinois;
- the U.S. Army Audit Agency, Northeast Region, Philadelphia, Pennsylvania; and
- Watervliet Arsenal, Watervliet, New York.

We also examined the workpapers generated by the Award Advisory Team and the Army Audit Agency's audit team to assess the scope and methodology of their work and to determine whether their work supported their conclusions and recommendations. We also examined the out-of-pocket cost estimate submitted by Watervliet Arsenal and the fixed-price offer submitted by Martin Marietta to verify that Watervliet's estimate was lower than Martin Marietta's offer.

We were briefed by the Chairman of the Army Award Advisory Team, and we interviewed officials from the team concerning its cost analysis and comparison. We also interviewed officials from the Arsenal Bid Review Team and the Army Audit Agency's audit team on the objective, scope, methodology, and results of their efforts.

We conducted our review from December 1988 to March 1989 in accordance with generally accepted government auditing standards.

---

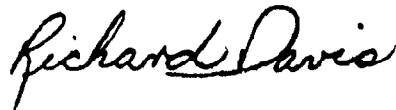
As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days from

---

its date. At that time we will send copies to the Secretaries of Defense and the Army; the Director, Office of Management and Budget; and other interested parties. Copies will also be made available to others upon request.

GAO staff members who made major contributions to this report were Raymond Dunham, Assistant Director, Army Issues; Noble Holmes, Evaluator-in-Charge, Army Issues; and Norman Krieger, Regional Assignment Manager, New York Regional Office. Please contact me at (202) 275-4141 if you or your staff have any questions concerning this report.

Sincerely yours,

A handwritten signature in cursive script that reads "Richard Davis".

Richard Davis  
Director, Army Issues

# Comments From the Department of Defense



DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING

WASHINGTON, DC 20301-3010

21 JUN 1989

Mr. Frank C. Conahan  
Assistant Comptroller General  
National Security and International  
Affairs Division  
U.S. General Accounting Office  
Washington, D.C. 20548

Dear Mr. Conahan:

This is the Department of Defense (DoD) response to the General Accounting Office (GAO) Draft Report, "ARMY PROCUREMENT: The Selection of a Manufacturer for the 120mm Mortar," dated May 10, 1989 (GAO Code 393308/OSD Case 7991).

The DoD has reviewed the report and concurs with the findings and conclusions. The Department appreciates the opportunity to comment on the report in draft form.

Sincerely,

A handwritten signature in cursive script, appearing to read "Robert C. Duncan".

Robert C. Duncan

---

**Requests for copies of GAO reports should be sent to:**

**U.S. General Accounting Office  
Post Office Box 6015  
Gaithersburg, Maryland 20877**

**Telephone 202-275-6241**

**The first five copies of each report are free. Additional copies are \$2.00 each.**

**There is a 25% discount on orders for 100 or more copies mailed to a single address.**

**Orders must be prepaid by cash or by check or money order made out to the Superintendent of Documents.**

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

**Official Business  
Penalty for Private Use \$300**

**First-Class Mail  
Postage & Fees Paid  
GAO  
Permit No. G100**