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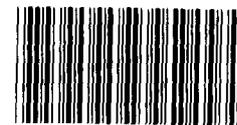
Report To The Secretary Of Transportation

Metro Needs To Better Manage Its Railcar Procurement

To complete the planned Metrorail system, the Washington Metropolitan Area Transit Authority is acquiring 294 railcars at a total estimated cost of \$275 million. The Department of Transportation's Urban Mass Transportation Administration is funding almost 85 percent of the cost. The remainder is funded by local jurisdictions in the Metropolitan Washington, D.C., area.

GAO found that major acquisition decisions, such as an increase in the railcar order from 94 to 294 cars, were based on limited testing and that contractual requirements for railcar quality assurance plans have not been enforced. Also, to improve the contractor's cash flow the Transit Authority agreed to a new progress payment schedule for the additional cars ordered. This schedule allows payment for limited work and will result in substantial payments to the contractor before railcar delivery. The first two cars arrived in April 1983, 22 months behind schedule, and the contractor's ability to meet the delivery schedule for the remaining cars is in doubt.

The Transit Authority could improve its management control over this procurement through better enforcement of contract requirements and development of a master plan to test cars. Stronger procurement oversight by the Urban Mass Transportation Administration also is needed to ensure that federal funds are effectively used.



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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

NATIONAL SECURITY AND
INTERNATIONAL AFFAIRS DIVISION

B-206261

The Honorable Elizabeth H. Dole
The Secretary of Transportation

Dear Mrs. Dole:

This report discusses the need for better management by the Washington Metropolitan Area Transit Authority to ensure successful railcar procurement. It also recommends stronger procurement oversight by the Urban Mass Transportation Administration to ensure that federal funds are effectively used.

This review was made because of the continuing public and congressional interest in the system and the delays that have occurred in delivery of the railcars.

A draft of the report was provided to the Department of Transportation, the Transit Authority, and the contractor. Their comments are included as appendixes to the report.

This report contains recommendations to you on page 24. As you know, 31 U.S.C. 720 requires the head of a federal agency to submit a written statement on actions taken on our recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Operations not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to the General Manager, Washington Metropolitan Area Transit Authority, and the Director, Office of Management and Budget.

Sincerely yours,

Frank C. Conahan
Frank C. Conahan
Director

D I G E S T

The Washington Metropolitan Area Transit Authority (WMATA) is building and operating the Washington Regional Rapid Rail Transit System, commonly called Metrorail. WMATA is acquiring 294 railcars from the Breda Costruzioni Ferroviarie, S.p.A., an Italian firm. Almost 85 percent of the total estimated cost of \$275 million is being funded through the Urban Mass Transportation Administration (UMTA) and the remainder by local jurisdictions in the Metropolitan Washington, D.C., area. (See pp. 1 to 3.)

GAO examined the procurement of these railcars because of the continuing public and congressional interest in the completion of the rail system. Metrorail represents the largest federal investment for a subway system currently under construction. GAO also had indications that the railcar delivery schedule was slipping, a factor that has delayed the opening of new stations. The first two cars arrived in April 1983, 22 months behind schedule. Subsequent deliveries were delayed by testing problems at the assembly facility. Initial testing of the first two cars in Washington, D.C., is behind schedule and serious technical problems have been identified. Testing, delivery, and station opening schedules are in doubt pending WMATA review. (See pp. 3 to 5.)

GAO found that WMATA increased its acquisition risk by supplementing the original 94 car order with 200 additional cars without the benefit of test and evaluation. WMATA also increased its acquisition risk by agreeing to pay the contractor more than half the contract price of the additional 200 cars before their delivery. Quality assurance activities during production and testing of the railcars could reduce acquisition risk, but WMATA has neither enforced contract provisions which call for submission of quality assurance plans nor developed a master test plan. GAO is making several suggestions to improve WMATA's management control over the railcar contract and thus better ensure product quality.

Federal oversight of the railcar acquisition has been limited. UMTA has not complied with requirements for monitoring this procurement and has made funding decisions without sufficient knowledge of WMATA's management and the contractor's performance. In December 1983, WMATA will request federal funding for the last 34 cars of the 294 car purchase. GAO believes that UMTA needs to strengthen its oversight to adequately assess how federal funds have been spent and needs more detailed information than WMATA has provided to determine whether funding for the remaining 34 railcars is justified.

ADDITIONAL CARS ORDERED
BASED ON LIMITED DATA

WMATA operates 298 railcars purchased in 1971 from Rohr Industries, which no longer builds transit cars. To expand the rail system, WMATA ordered 94 railcars from Breda in June 1979 at a \$75 million estimated cost with a scheduled June 1981 delivery of the first cars. In June 1981, WMATA agreed to postpone first car delivery 1 year and at the same time contracted for an additional 200 cars at a cost of approximately \$200 million. (See p. 2.)

As a result of a subcontractor's equipment breakdown, improper break-in of the replacement equipment, and improper manufacturing procedures, the agreed upon delivery dates for the 94 cars were postponed 1 year. However, WMATA's contractual deadline for ordering additional cars did not change. WMATA had originally planned to receive and test four cars before deciding whether to order more cars. But to meet the contract deadline, WMATA ordered an additional 200 cars without receipt and testing of a single car. In commenting on GAO's draft, WMATA said it ordered the additional cars to obtain a favorable price and ensure delivery when needed. Yet, WMATA had limited information on the quality and performance of the cars it would receive. WMATA's ability to assess production quality was further limited because the contractor had not submitted or received approval on key quality assurance plans which were over a year late when WMATA ordered the additional cars. (See p. 7.)

WMATA also decided to equip the 200 cars with an advanced propulsion control system before testing could determine whether it would be compatible with existing equipment. Before WMATA made its final decision on the new propulsion system, limited testing of the propulsion unit was performed using a flatbed railcar. According to the WMATA engineer responsible for these tests, the tests were not representative of realistic operating conditions but were the best that could be done without having an actual railcar available. This limited testing of the propulsion system unit showed that electrical interference generated by the system could, in certain situations, reduce the existing train control and communication system safety margin to an undesirable level. Because of this problem, WMATA has modified both the propulsion and communication systems. In commenting on this report, WMATA said the new propulsion system does not pose a high risk, but it agreed that test results need to be closely monitored. (See pp. 8 and 9.)

PROGRESS PAYMENT SCHEDULE
RESULTS IN SUBSTANTIAL PAYMENTS
BEFORE DELIVERY

When the additional 200-car order was negotiated, car deliveries from the first order of 94 cars were over 1 year behind schedule and requirements for plans intended to help WMATA assess contractor performance prior to delivery were not being met. No cars under the original order had been delivered. WMATA agreed to incorporate a new progress payment schedule in the option contract. Compared to the 94-car contract, this schedule allows payments for limited work and will result in substantial payments (over half the contract price) to the contractor before railcar delivery. (See pp. 12 and 13.)

WMATA agreed in commenting on this report that the option contract payment schedule is more lenient than the original contract, but said it provided leverage in negotiating the contract price. Because the progress payment schedule provides substantial payment before product quality or contractor performance can be determined, GAO believes that the need for quality assurance activities during production and testing of each car is even more critical.

UNENFORCED CONTRACT REQUIREMENTS
LIMIT QUALITY CONTROL ASSURANCES

WMATA has not enforced contract requirements that are needed for quality assurance. Quality assurance plans needed to monitor contractor performance in critical areas such as systems integration (making sure subsystems work properly together) and equipment compatibility with WMATA's existing system, although contractually required, have not been provided to or approved by WMATA. (See pp. 14 to 16.)

Without these plans, WMATA's ability to monitor and evaluate contractor performance during production is handicapped. WMATA will have to rely more heavily on testing of completed cars to determine quality.

In commenting on this report, WMATA said the contractor gives more emphasis to actual railcar production and much less to required quality assurance plans. WMATA said that while quality assurance plans are desirable, they are not critical to a quality production. Without these plans, GAO questions how WMATA can be ensured of quality during production or be confident of receiving cars that meet contract specifications.

A MASTER TEST PLAN HAS
NOT BEEN DEVELOPED

Test and evaluation of the two railcars delivered in April 1983 began in May but critical testing of several cars operating in a train configuration begins later this year and extends through 1987. Yet, WMATA has not developed a master test plan to ensure that testing will be comprehensive and that the railcars will meet contract requirements. WMATA officials told GAO that a list of tests the contractor plans to perform is sufficient. Yet, industry recommended master test plans are much more detailed. Compared to the recommended test plans, WMATA's list of tests does not (1) explain the purpose of the test, (2) define criteria for successful performance, (3) explain how testing will be performed, or (4) identify the time needed to conduct the

tests and take corrective action. While the contractor's individual test procedures include some of this information for initial delivery tests, they have not been submitted for all tests. (See pp. 16 to 18.)

GAO believes a master test plan covering contractor and WMATA testing is needed to ensure that any design or production problems are identified and resolved before cars are placed in service.

To strengthen WMATA's control over the rail-car procurement and improve management of this procurement, GAO believes that WMATA's General Manager should:

- Obtain outstanding quality assurance, systems engineering, and interface management plans and documents required by the contract. (See p. 19.)
- Prepare a comprehensive test plan to ensure that safety, reliability, and contractual requirements are met. This plan should identify the test schedule and objectives, including pass/fail criteria, the test environment and basis for establishing the test criteria, required equipment, facilities, personnel and instrumentation, special test conditions to be used, such as vibration, and evaluation procedures. (See p. 19.)
- Thoroughly test the high technology propulsion system before placing it into revenue service. (See p. 9.)

IMPROVEMENTS NEEDED IN UMTA'S OVERSIGHT OF RAILCAR PROCUREMENT

Although almost 85 percent of WMATA's railcar contract is federally funded, UMTA's role in overseeing the procurement has been limited. UMTA has not done onsite inspections to review WMATA's management control system and evaluate the engineering work as required by the Office of Management and Budget (OMB) and by UMTA's operating procedures. Also, UMTA has not received needed project status information to

effectively monitor the program. In December 1983, WMATA will request additional federal funding for the last 34 cars of the 294 car procurement. (See pp. 22 to 24.)

In commenting on a draft of this report, the Department of Transportation agreed that WMATA should provide UMTA with more information on significant project activities and the progress and difficulties encountered by the contractor. The Department said that in the future WMATA will be required to provide this information. However, the Department believes that periodic onsite inspections are beyond UMTA's role. This position is not consistent with OMB's requirements for monitoring program performance under federal grants or with UMTA's operating procedures that clearly require onsite inspections.

RECOMMENDATIONS

To ensure the appropriateness of federal funding requests for the railcar and future acquisitions, GAO recommends the Secretary of Transportation direct the UMTA Administrator to:

- Make periodic onsite inspections as required by OMB and UMTA's operating procedures. (See p. 24.)
- Enforce existing reporting requirements to provide more information on the progress and difficulties encountered by WMATA and the railcar contractor. In connection with the enforcement of these requirements, UMTA also should ensure that it receives sufficient information to evaluate WMATA's progress in obtaining quality assurance plans and performing comprehensive tests on the railcars. (See p. 24.)

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ABBREVIATIONS

DOT	Department of Transportation
GAO	General Accounting Office
OMB	Office of Management and Budget
UMTA	Urban Mass Transportation Administration
WMATA	Washington Metropolitan Area Transit Authority

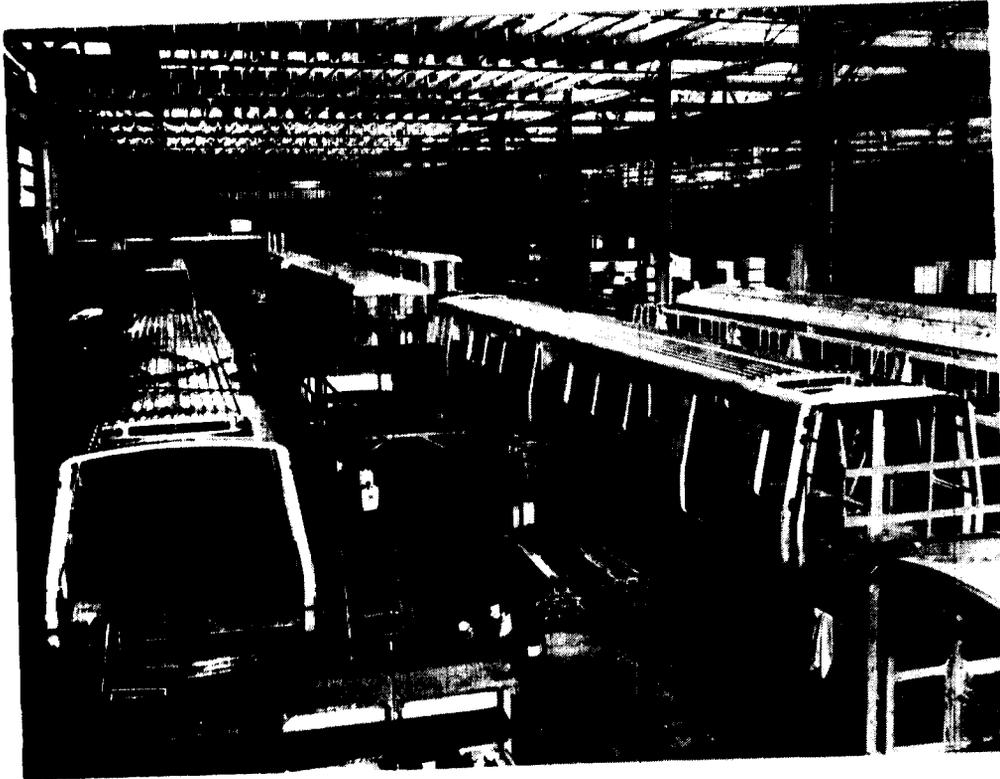


Photo Provided By Breda Costruzioni Ferroviarie S.p.A.

Subway railcars under construction at contractors plant, September 1982.



CHAPTER 1

INTRODUCTION

The Washington Metropolitan Area Transit Authority (WMATA) is building and operating the Washington Regional Rapid Rail Transit System, commonly called Metrorail. To complete the planned 75-mile system and to expand to the ultimate goal of 101 miles, additional cars are needed. We examined the procurement of 294 railcars needed to complete 75 miles of the system because of continuing public and congressional interest in the completion of the subway system. This report addresses the status of the acquisition and problems we identified to assist the Congress in its oversight of the system and to suggest improvements to WMATA in managing the procurement.

FEDERAL, STATE, AND LOCAL PARTICIPATION

WMATA is a public agency established in 1966 to plan, construct, finance, and provide for the operation of a rapid rail and bus transit system for the Washington metropolitan area. It is comprised of representatives from seven local governments, the District of Columbia, and two state governments--Maryland and Virginia. Local governments include the counties of Montgomery and Prince Georges in Maryland; Arlington and Fairfax in Virginia; and the cities of Alexandria, Fairfax, and Falls Church in Virginia. It is directed by a board comprised of elected officials or their appointees from Maryland, Virginia, and the District of Columbia for the purpose of improving the public transportation system for the National Capital area. The board's decisions are carried out by the WMATA staff, which is headed by the General Manager.

Metrorail ground breaking took place on December 9, 1969. Since that time the system has progressed to its present 39.12 miles in operation, including 44 stations. The original cost estimate of the 101-mile system was \$2.5 billion. Inflation, delays by federal, state, and local governments, strikes, and storm damage have increased the cost estimate. The ultimate cost and completion of the system depends, in part, on the annual level of funding by the Congress. We believe that WMATA's cost estimate of \$11.8 billion, based on current funding levels with completion in the year 2002, is the most realistic. As of December 1982, WMATA had received approximately \$5 billion for Metrorail construction and procurement of railcars and other expenses, \$3.2 billion of which were federal funds.

The funds for procuring the Metrorail cars are comprised of 85 percent federal funds and 15 percent local funds. The federal portion is paid through the Department of Transportation's (DOT's) Urban Mass Transportation Administration (UMTA).

UMTA, which carries out the federal mandate to improve urban mass transportation, is the principal source of federal financial assistance to help urban areas plan, develop, and improve comprehensive mass transportation systems. UMTA provides financial aid under several programs authorized by the Urban Mass Transportation Act of 1964 (Public Law 88-365), as amended, and the Federal Aid Highway Act of 1973 (Public Law 93-87), as amended. UMTA also has oversight responsibility for the projects it funds and is guided by DOT's Policy Toward Rail Transit, last published in March 1978, which states that the federal government has a strong obligation to ensure that federal assistance dollars are spent prudently and with maximum effectiveness.

THE RAILCAR PROCUREMENT

WMATA is operating a fleet of 298 railcars purchased at a cost of approximately \$305,000 each from Rohr Industries in 1971. These railcars support the completed portion of the system. To extend the system to 75 miles, 294 additional cars are needed.

In June 1979, WMATA contracted with Breda Costruzioni Ferroviarie, S.p.A., an Italian transit car builder, for the manufacture and delivery of 94 railcars which they estimate will cost approximately \$75 million. The contract is fixed price with escalation for labor and material price inflation. Delivery of the first cars was scheduled for June 1981. The procurement was competitively advertised and contained an option provision for the purchase of up to 200 additional cars. The purpose of including such an option was to give WMATA the opportunity to acquire additional cars from the same manufacturer at a low price, by avoiding startup costs and engineering development time associated with a new procurement.

In May 1981, WMATA's Board of Directors approved exercise of the option clause for 200 additional cars required for the 75-mile Metrorail system. To exercise the contract option, however, all 200 cars had to be purchased at once. Because of funding limitations, the option could not be exercised as stated in the contract so the procurement was spread over several years, and the contract price and certain other terms were renegotiated. Through this renegotiation, WMATA introduced four separate increments into the contract with approval to begin work on each increment subject to the availability of funds. The cars are being ordered in 4 lots consisting of 70, 36, 60, and 34 railcars, respectively. As of January 1983, the contractor had been notified to begin work on three of the four increments. Notice to proceed on the fourth increment is not scheduled until December 1983. The total cost for all 294 railcars is estimated at \$275 million.

The first two railcars, originally scheduled for delivery in June 1981, arrived in Washington, D.C., in April 1983, 22 months behind schedule.¹ An equipment breakdown in April 1980 at a subcontractor's plant that produced parts of the railcar bodies delayed delivery by 1 year. A November 1981 strike at the brake subcontractor's plant delayed delivery by an additional 10 months. The remaining cars from the original 94-car order will be delivered at the rate of approximately 8 per month through May 1984. The 200 additional cars will be delivered beginning in May 1984 and extending through January 1987.

According to WMATA officials, opening of new stations to expand Metrorail service depends on receipt of the new cars. The schedule for opening new stations has slipped because of the delay in delivering new railcars.¹ The 94 cars in the original contract and the 70 cars in the first increment are needed to open or expand service on three lines: the yellow line shuttle between Gallery Place and the National Airport, scheduled to open in August 1983, was opened in April 1983 using cars diverted from the red and blue lines currently in revenue service; the blue line between the National Airport and Huntington is scheduled to open in December 1983; and part of the red line from Van Ness to Shady Grove is scheduled to open late in 1984. The yellow line opening would have been delayed had the cars not been diverted from the red and blue lines. Also, the planned opening of the Huntington station represents a 1-year delay caused by delays in delivery of the Breda cars. The second and third option lots, consisting of 96 cars, are needed to complete the red line and to open part of the orange line to Vienna in early 1986. The last option of 34 cars will be used to complete the orange line. Due to reliability problems with existing cars, WMATA is considering several proposals, one of which is to use initial deliveries of new cars to improve service on existing lines. The 294 cars are required

¹Delivery of the next 10 railcars, scheduled for June and July 1983, has been delayed. According to WMATA officials, the delay occurred at the assembly plant and is due to inadequate contractor test staff and delay in receiving test equipment for certain tests performed at the assembly facility. WMATA has not yet determined when these railcars will arrive in Washington, D.C., and is currently evaluating what effect testing problems will have on later scheduled deliveries. The same problems are delaying completion of initial performance tests on the two cars delivered in April 1983. Testing already performed on these two railcars identified technical problems with the brake system and the interface between braking and propulsion systems. WMATA is evaluating the impact on scheduled openings of new stations.

for the 75-mile system. WMATA officials estimate that between 100 and 130 additional cars will be needed for the 101-mile system.

Breda

Breda is a holding of an Italian state-owned enterprise that administers companies which operate in various manufacturing fields. In past years, Breda has manufactured electric trains and locomotives for subway and streetcar systems in major European cities.

In February 1978, Breda contracted with the Greater Cleveland Regional Transit Authority, its first United States customer, for the manufacture and delivery of 48 rail transit vehicles. WMATA's contract for 294 railcars represents the second contract Breda has obtained for the manufacture of rail transit cars in the United States.

Breda is the prime contractor and is relying on subcontractors, including some major United States firms, to build various subcomponents of the cars. AMTRAK will assemble the cars at its Indiana plant. Under the Buy America Act, a law designed to foster federal use of United States origin materials, the cost of domestic components must exceed 50 percent of total component costs and the cars must be assembled in the United States.

Louis T. Klauder and Associates

Louis T. Klauder and Associates, an engineering consulting firm based in Philadelphia, Pennsylvania, was selected in 1968 to assist WMATA in designing the railcars to be used on the rapid transit system. In recent years, it has worked predominantly for public agencies which operate bus, light rail, rapid transit, railroad, and people mover systems, both domestic and foreign. Klauder performs various engineering services for WMATA, including review of drawings and manuals, inspections at contractor's and subcontractor's plants, and provides a resident engineer and staff at Breda.

OBJECTIVES, SCOPE, AND METHODOLOGY

There has been continuing public and congressional interest in the Metrorail system and the delays which have occurred in the delivery of the railcars. Because of these factors and because the Metrorail system represents the largest federal investment in any subway system under construction, we made this review to evaluate how efficiently and effectively federal funds were being used to procure the new transit cars.

We evaluated (1) WMATA's contract management practices, (2) railcar test and evaluation planning, and (3) federal oversight and monitoring activities.

We did our review at WMATA and UMTA headquarters in Washington, D.C.; the contractor's production plant in Pistoia, Italy; and various subcontractors' facilities in Italy and Germany. During our review, final arrangements for assembly were being made at an AMTRAK facility in Indiana. We did not visit the assembly plant. In addition to interviewing responsible officials at each of these locations, we interviewed officials from the Greater Cleveland Regional Transit Authority; the Transportation Test Center; the National Transportation Safety Board; Louis T. Klauder and Associates; and the Department of State.

We examined applicable laws and their legislative histories, regulations, procedures, guidance, and available documents maintained by DOT, UMTA, WMATA, and the engineering consultants. Key documents reviewed included the railcar contract, management circulars, Inspector General reports, quarterly and monthly progress reports, procurement directives and procedures, research studies, and available correspondence between UMTA, WMATA, the contractor, the subcontractors, and the engineering consulting firm.

We did not assess the reliability, safety, and quality of the railcars. At the time of our review, the first two cars had not been fully assembled; therefore, tests to determine the overall acceptability and performance of these subway cars had not been performed. Our review was thus limited to identifying management actions which could affect product reliability, safety, and quality.

A draft of this report was provided to DOT, WMATA, and the contractor. Their summary comments and our evaluations are included in the report at the end of each chapter. Full comments are included in Appendixes II, III, and IV.

Our review was performed in accordance with generally accepted government auditing standards.

CHAPTER 2

MAJOR CONTRACT DECISIONS MADE WITH LIMITED INFORMATION AND ANALYSIS

WMATA has made several decisions concerning the railcar procurement based on limited documentation and analysis. Specifically, WMATA

- excused a 1-year delay in railcar delivery without justification to support the entire year,
- modified the contract to buy 200 additional cars before receiving any cars to test and without contractually required plans on which to base the decision, and
- chose a new railcar propulsion technology even though there were some questions about safety and a need to adequately test the equipment before making a final decision.

As a result of the manner in which these procurement and contract administration decisions were made, WMATA's acquisition risk in terms of cost increases, schedule delays, and other problems has increased.

DECISION TO EXCUSE CONTRACTOR DELAY QUESTIONABLE

WMATA allowed the contractor a 1-year excusable delay in railcar delivery because of a breakdown of a subcontractor's 7,200-ton extrusion press (equipment used to make parts of the railcar body). WMATA officials cited a contract provision which stipulates that the contractor is not liable for excess costs due to delays if failure to perform is beyond the control and fault or negligence of the contractor or subcontractor. WMATA excused the delay as unavoidable and, in effect, waived damages of over \$3 million. However, several factors suggest part of the delay was within the control of the contractor and subcontractor.

Available documents indicate that the subcontractor was not in a position to meet its delivery schedule when the press broke down. The breakdown occurred just 4 days before scheduled delivery of the first railcar body parts. Furthermore, WMATA's consulting engineers had not been contacted to make formal inspections of the parts produced, inspections that are required before shipment commences.

After the new press arrived and was installed, the delay increased and was attributed to improper equipment break-in procedures. Contractor records show that in an attempt to expedite production, the contractor pressured the subcontractor to follow what both recognized were improper equipment break-in procedures. According to WMATA, the contractor was attempting to meet WMATA's demands and pressures to expedite delivery and thus acted with WMATA's concurrence.

Delivery of railcar body parts was further delayed when improper production procedures resulted in rejection of parts. In March 1981, 10 months into the delay, the contractor was still rejecting most of the railcar body parts produced by the subcontractor. A consultant to the contractor confirmed that defects in the parts were caused by an incorrect production process.

WMATA CONTRACTED FOR 200 ADDITIONAL CARS
DESPITE KNOWLEDGE OF CONTRACTOR PROBLEMS

Under its original contract for 94 railcars, WMATA would have received 4 cars to test before it had to decide whether to contract for up to 200 additional cars from the same manufacturer. Due to the equipment breakdown at the subcontractor plant, WMATA negotiated two contract modifications which postponed car deliveries by 12 months. WMATA did not, however, postpone its decision to contract for additional cars. WMATA said it ordered the additional cars to obtain a favorable price and ensure delivery when needed. As a result, WMATA made a major acquisition decision without the benefit of testing new cars. Also, at the time this decision was made, the contractor had not submitted or received approval on contractually required engineering and quality assurance plans and procedures. (See pp. 14 to 16.)

We found that, at the time of WMATA's decision to contract for additional railcars:

- Some components were still under design and most had not completed qualification testing.
- A car was not available for inspection and testing.
- Several critical plans and engineering and quality assurance documents required by the contract were late, some by as much as 1 year.

In contracting for the additional cars, it was WMATA's intent to hold down costs and avoid further contract delays. Yet, it made the decision with limited knowledge of contractor performance and little or no information on the quality of cars already ordered.

EARLY TESTING OF HIGH TECHNOLOGY
PROPULSION SYSTEM IDENTIFIED PROBLEMS

WMATA's decision to equip the additional 200 cars with an advanced electronic propulsion system, known as a chopper control, rather than a mechanical cam control, was a major acquisition decision intended to reduce operating costs. Early testing of the chopper propulsion system by WMATA and a subcontractor identified potential electromagnetic interference problems with Metrorail's automatic train control and communications equipment. Pressured by a deadline to make a decision on which propulsion system to use, WMATA selected the chopper control.

Chopper propulsion technology is not new and is successfully used by several United States transit systems, including the Bay Area Rapid Transit and the Metropolitan Atlanta Rapid Transit Authority. However, it is new to the WMATA system. According to a 1980 DOT document on "Rail Transit Vehicle EMC Testing" and a February 1981 report prepared for UMTA on electromagnetic interference characteristics of advanced propulsion systems for urban rail vehicles, a chopper's electrical noise can interfere with the system's automatic train control and thus interrupt service or create unsafe operating conditions. The February 1981 report stated that the potential for electromagnetic interference problems either affecting a safety-related vital function or causing a major nuisance has become a serious concern. A December 1981 report of the Rail Transit Steering Committee of the American Public Transit Association termed electromagnetic interference a "major concern" and further stated that "the possibility of unsafe and unreliable conditions resulting from electromagnetic interference is apparent."

WMATA recognized the potential safety hazards of the chopper system and originally intended to test chopper compatibility with the existing Metrorail system before deciding whether to equip the 200 additional cars with chopper control. Under the initial contract delivery schedule, WMATA was to receive 2 cars equipped with the chopper system and take 90 days to test them before deciding on cam or chopper control for the additional 200 cars.

However, when production delays postponed the first chopper car deliveries by 15 months, WMATA's deadline for making a final chopper/cam decision was postponed by only 3 months. As a result, WMATA's decision had to be made before (1) the first chopper car was built, (2) the chopper propulsion system had completed the design phase, and (3) WMATA could perform the

tests it had planned to determine compatibility with the existing system.

Because a new railcar equipped with a chopper propulsion system was not available, the subcontractor did laboratory tests and a test on WMATA's tracks using a chopper propulsion unit mounted on a flatbed railcar. According to the WMATA engineer responsible for the tests, the tests were limited and not representative of realistic operating conditions; however, it was the best that could be done without having an actual railcar available. Nonetheless, test results showed that the electrical interference generated by the chopper system could, in certain situations, reduce safety margins to an undesirable level. Because of this problem, WMATA is taking some action to modify both the existing train control equipment and the new propulsion system.

CONCLUSIONS

WMATA has made several important contract decisions based on limited information and analysis. Although the evidence available at the time of WMATA's decision to excuse the delivery delay suggested that part of a 1-year delay due to an equipment breakdown may have been within the control of the contractor and subcontractor, WMATA officials nonetheless allowed the contractor the entire year of excusable delay. Without a railcar to test and without documents required by the contract outlining engineering and quality assurance plans and procedures, WMATA ordered 200 additional cars from the same manufacturer. Finally, WMATA ordered the new propulsion system for all 200 cars even though limited test results showed potential safety problems as a result of electromagnetic interference.

To ensure that electromagnetic interference problems are controlled, we believe that the General Manager, WMATA, should thoroughly test the high technology propulsion system before placing it into revenue service.

AGENCY COMMENTS AND OUR EVALUATION

WMATA disagrees that its decisions to (1) excuse a 1-year delay due to the press breakdown, (2) contract for 200 additional cars, and (3) equip these option cars with chopper propulsion were made without adequate analysis. Regarding the press breakdown, WMATA accepted responsibility for the further delay caused by improper break-in procedures on the new press, stating that it had made demands and applied pressure on the contractor to expedite delivery.

Our point remains that several factors suggest that not all the delay was beyond the control of the contractor and subcontractor. Documents indicate that the subcontractor would not have been in a position to meet its delivery schedule if the press had not broken down. In addition, defects in the parts produced on the new press, which may have accounted for part of the delay, were attributed by the contractor's consultant to an incorrect production process. When parts made on the new press continued to be defective, a letter from WMATA to the subcontractor stated that

"additional delay for this related problem is simply not an acceptable solution to a management issue which should have been brought under control by this time."

Finally, WMATA's contract files on the delay do not contain documents to support its decision.

WMATA believes that it had sufficient information on contractor performance when it decided to contract for 200 additional cars from the same manufacturer. According to WMATA, it was satisfied that delivery delays were beyond the control and fault of the subcontractor and discussion with the engineering consultant established acceptable performance of the contractor and subcontractor. Because contract requirements were not being met and information on contractor performance and product quality was limited, we believe that WMATA's decision to contract for 200 additional cars should have been postponed at least until required contractual plans for ensuring quality assurance of the cars had been submitted.

We believe that testing before the decision to equip the option cars with chopper propulsion was not sufficient to fully determine its performance acceptability. WMATA planned extensive testing of the prototype chopper cars before the decision deadline. However, production delays were later granted without a corresponding postponement of WMATA's decision deadline. Thus, WMATA selected the chopper propulsion system with only a limited opportunity to conduct tests before the decision was made. The tests that were performed were not on a railcar.

WMATA agreed with the need to closely monitor test results on the chopper propulsion system. However, WMATA stated that chopper propulsion does not pose a high risk and the testing performed provided the necessary assurance to select chopper propulsion for the 200 option cars. We believe that thorough testing should be done to demonstrate the safety and compatibility of the chopper cars before use on WMATA's existing rail system.

CHAPTER 3

BETTER ENFORCEMENT OF CONTRACTOR PERFORMANCE NEEDED

The success of major acquisitions, especially those that involve sophisticated equipment purchases such as the Metrorail cars, depends on realistic and definitive performance requirements and strong contract management. Without them, control over contractor performance is limited and may provide little assurance of product quality and timeliness.

On-time product delivery of the new railcars is the critical pacing factor influencing whether new stations can be opened. WMATA cannot provide service to planned stations without additional railcars even if construction of the new stations is completed. The new cars will also be much more sophisticated in design and operation than existing railcars, thus requiring assurances that the new cars are compatible with the current system and are thoroughly tested to meet contract requirements.

WMATA's 200 railcar option contract allows substantial payments to the contractor before any cars are delivered. Greater financial emphasis is placed on the design and production phases rather than the railcar delivery and acceptance phases. In several cases, the option contract allows the contractor to be paid for performing less than under the initial 94-car contract. Important contractually required documents needed to monitor and evaluate contractor performance early in the contract life, have either not been submitted or not approved by WMATA and thus are not available to assess contractor performance during the design and production phases. Some of these documents are over 3 years late, and WMATA has taken limited action to obtain them.

The final determination of a successful contract is the meeting of the contract's final product specification. Therefore, testing of the railcars to determine if they meet contract requirements is critical. However, no requirement for a master test plan was included in the contract, and WMATA has not developed a complete plan for testing railcar acceptability. Initial testing has been hampered by insufficient contractor staff and delay in receiving test equipment. Testing already performed found critical problems in the brake system and the interface between brake and propulsion systems.

WMATA, without contractually required quality assurance plans and a master test plan, will have little basis for evaluating the adequacy of contractor performance. Without a comprehensive test plan, WMATA may have difficulty identifying problems with the railcars when delivered. If problems are

identified upon delivery or later, rather than during the production and assembly phases, WMATA could encounter further delays and costly retrofits.

WORK PROGRESS PAYMENTS MORE
LENIENT UNDER OPTION CONTRACT

Work progress payments are a means of providing the contractor with financing and are based either on percent of completion or costs incurred by the contractor. When they are based on progress critical to the success of a program and do not exceed the contractor's actual expenditures, progress payments can be an important control for WMATA while providing an incentive to the contractor for timely performance. Our analysis revealed that WMATA's work progress payments in the 200-car option contract are lenient compared to the original 94-car contract in that they (1) pay for less work completed and (2) pay out substantially more of the contract price before the railcars are formally accepted.

WMATA makes work progress payments according to two basic schedules--one for the original 94-car contract and another for the 200-car option contract. WMATA had originally planned to exercise the option contract after inspecting and testing a railcar produced under the original contract. Because of an equipment breakdown, the contractor was 1 year behind schedule and the test car was not available. In addition, critical management documents required under the original contract which were to aid WMATA in evaluating contractor performance were either not submitted or not approved by WMATA. Instead of negotiating more stringent controls over work progress payments, WMATA's option contract was considerably more lenient. Under these less stringent controls, the amount of WMATA progress payments under the option contract is already more than twice the amount paid under the original contract for much less work performed.

Under the 200-car option contract, WMATA makes progress payments for less work completed than it does under the original 94-car contract. The result of paying for less work completed under the option contract is that the contract price is paid more quickly and the contractor's ability to receive payment is less dependent on WMATA acceptance of the railcars. The following chart illustrates the difference between WMATA's original contract and the 200-car option contract.

Comparison of Work Progress Payments

	<u>94-car original contract</u>	<u>200-car option contract</u>
	-----	-----
	----- (percent) -----	
Amount of contract paid before first cars are delivered	34	65
Amount of contract paid on railcar shipment and delivery	-	25
Amount of contract dependent on formal acceptance of railcars	61	9
Amount of contract paid on expiration of warranty and reliability periods	5	1

As shown above, WMATA will pay out 34 percent of the total 94-car contract price before the first railcar is delivered, but under the option contract will pay out 65 percent before the first railcar of the 200-car order is delivered. According to WMATA's calculation, this translates into paying \$24.6 million for work completed on the original contract's 94 cars, versus \$49.8 million (about double) for the same work completed on the first 106 cars of the 200-car option contract. Because the option contract price is paid out sooner, it links only 9 percent of the total price to railcar acceptance versus 61 percent under the original contract.

WMATA's contracting officer explained that the lenient progress payment schedule was intended to improve contractor cash flow and provide WMATA with additional leverage in renegotiating an option contract price. Adequate contractor cash flow may be an important factor in assisting the contractor to produce the railcars; however, WMATA may have allowed contractor cash flow needs to overshadow its own need for a balance between performance and payments and to ensure that an acceptable product is delivered.

GREATER CLEVELAND RAPID TRANSIT AUTHORITY
EXPERIENCE WITH BREDA

In 1978 the Greater Cleveland Rapid Transit Authority contracted with Breda to produce 48 light-rail vehicles. According to WMATA, the Cleveland cars are less sophisticated in design than the WMATA cars; however, the production, assembly, testing, and delivery process are similar.

The Greater Cleveland Rapid Transit Authority also encountered acquisition problems in acquiring railcars from Breda. For example:

- Breda was at least 1-year late in delivering light-rail vehicles.
- Adequate testing of the vehicles was not performed at the contractor's plant in Italy. Some of the vehicles that were certified as passing static electrical tests failed to properly operate when delivered.
- Poor interface between the brake and propulsion systems initially resulted in temporary loss of brakes.
- Breda had not provided a complete parts and price list, mechanical drawings, or propulsion unit diagnostic equipment.

Also, Cleveland officials told us of other acquisition problems involving Breda's development of the test plan, consideration of design features, quality control, and provision for sufficient numbers of technical personnel during assembly and testing.

According to Breda, some of the problems were due to (1) Cleveland's delays in responding to drawing submittals, (2) defects in the Cleveland rail system, and (3) subsuppliers' problems.

WMATA IS NOT ADEQUATELY ENFORCING IMPORTANT CONTRACT REQUIREMENTS

Several important plans and other documents intended to help WMATA ensure proper railcar design and construction have been delinquent for up to 3 years. These documents were to be a basis for evaluating contractor performance. Even if the plans are submitted now, some will be too late to be useful. Although WMATA lists these plans as "contract deliverables in default" in periodic correspondence with the contractor, it has taken no further action to obtain them. Because WMATA has not enforced these contract requirements, it may pay for plans and documents it never receives.

The railcar contract required that the contractor submit written plans and other documents to help WMATA monitor contractor performance and progress. Eleven of these have not been submitted or were not approved by WMATA. Although this number may not seem significant, many have been delinquent since 1979 and include three key documents intended to help control quality: the quality assurance program, the systems integration plan, and the plan to ensure compatibility with current equipment. Without these documents, WMATA has no meaningful basis for measuring contractor performance during design and production or for requiring the contractor to take any corrective action.

Quality assurance program

The contractor is responsible for product quality assurance. It should identify unsatisfactory products or workmanship and take the steps necessary for preventing further problems. WMATA's railcar contract required that the contractor submit a document outlining the policies and practices it would establish to ensure that an adequate quality assurance program was implemented. Although this document was due in August 1979, a program satisfactory to WMATA was never submitted.

According to WMATA's contracting officer, the contractor has been performing adequate quality assurance activities. However, WMATA's engineering consultants located at the contractor's plant told us that they saw little indication that a quality assurance program had been implemented and, in fact, they had to increase their inspections because of poor production quality. Furthermore, they said that even after problems were corrected on the first cars, they reoccurred on subsequent car bodies, thus requiring continued review by the engineering consultants.

The engineering consultants also said that, had a quality assurance program existed, the problems they identified would have been noted early and could have been corrected by the contractor. Since the program does not exist, they explained that they have no formal basis for measuring contractor performance or for recommending remedial actions. Without a good quality assurance program, WMATA could encounter additional delays and costly retrofits.

Systems engineering plan

A systems engineering plan was included as a contract requirement so that WMATA could see how the contractor planned to integrate the technical, physical, and functional aspects of railcar subsystems to achieve the best overall railcar design. The plan was needed to ensure that the contractor treated the car, both in design and in production, as a single system rather than an assembly of independently engineered and manufactured components.

WMATA officials and its engineering consultants said that system integration is the contractor's weakest point. The plan, if it had been submitted on time, would have provided WMATA an opportunity to assess the contractor's intentions for system integration. However, now without a plan, WMATA has no formal basis for determining whether the contractor took the necessary steps for system integration. Also, WMATA will not be able to

adequately assess systems engineering until the cars are delivered and tested in Washington, D.C.

Interface management plan

Critical to the purchase of new equipment is the compatibility of the new railcar design with current railcars and system equipment. Compatibility is particularly important when the new equipment is more technically advanced or has different design and system features. The purpose of an interface management plan is to show the methods the contractor will use to demonstrate compatibility of the new railcars and the existing railcars and equipment. For example, many of the new railcars will have a sophisticated propulsion system called the chopper control. (See p. 8.) The interface management plan is intended to show how the contractor will demonstrate the compatibility of this new propulsion system with existing railcars and train control equipment. Since the propulsion system is new to WMATA, this plan would help to ensure that appropriate interface exists to ensure effective total system operation.

WMATA's railcar contract did not set out a specific time for the submission of an interface management plan. According to the engineering consultant, the plan was expected to be submitted as a part of an overall management plan which was due 4 months after the contract was signed and then updated every 6 months. However, the plan has never been submitted.

WMATA believes that the necessary steps have been taken by the contractor to ensure equipment compatibility even though a plan was not submitted. However, without such a plan, WMATA could not adequately assess the contractor's performance. Therefore, WMATA will not know if the new railcars will adequately interface with its existing system until the cars arrive in Washington.

BETTER TEST PLANNING COULD LEAD TO IMPROVED RAILCAR PERFORMANCE

Since contractually required plans intended to assist WMATA in monitoring and assessing contractor performance have not been submitted, testing of the railcars becomes very important. Well-planned and thorough testing would help WMATA identify problems and risks. It will also ensure that the time available for testing is effectively used and that sufficient time is available for corrective action before placing the railcars into revenue service.

Test and evaluation process

Test and evaluation of the first two railcars began in May 1983. The contractor is responsible for planning and conducting required tests to ensure compliance with contract specifications. In addition to the contractor's tests, WMATA can conduct tests of its own design. Initial performance tests by the contractor were to be completed by July 25 but problems in conducting the tests and technical problems identified during testing are delaying completion. According to WMATA officials, the contractor did not provide sufficient staff to do the tests and is late in providing test equipment. Testing is delayed both at the assembly plant, where the contractor does certain equipment checks, and in Washington, D.C., where the contractor does performance and acceptance testing. Also, testing already performed in Washington D.C., identified two technical problems which WMATA officials describe as critical. They involve the brake system and the brake and propulsion system interface. According to WMATA officials, the brake system problem will require partial redesign and retrofit. WMATA is evaluating the effect of these testing problems on its test schedule.

When the initial performance tests are complete, substantial testing will remain. The railcar test and evaluation process will extend into 1987. Performance testing requiring six to eight cars was scheduled to begin in October 1983. Current testing problems may delay this date. One of the scheduled October tests is the car compatibility testing needed to demonstrate successful operation of the new cars with WMATA's existing cars and train control and communication system. The contractor must verify that new and existing cars can be mixed in any order in a train. Before testing problems occurred, WMATA expected the first cars to be accepted in early November 1983. After acceptance, a 3-year period of reliability testing will begin. During this phase of testing, the cars will be placed and used in revenue service. Cars equipped with the chopper propulsion system will also undergo some special tests. Car compatibility testing of these cars must show they do not suffer or cause interference with existing cars or train control which might affect rail system operation and/or safety. Also, an energy consumption test will be performed on the first chopper-equipped cars accepted which is expected to occur in March 1984. Another energy consumption test on a six-car train in revenue service follows acceptance of the last delivered chopper-equipped car in 1987.

WMATA has 30 days after the contractor completes the initial performance and acceptance tests to perform any additional or special tests. At the end of this period and after correction of known defects, the decision whether to accept a car must be made.

A master test plan has
not been developed

Transit industry recommended contract provisions¹ require a master test plan to ensure that railcars meet performance specifications. According to the criteria provided by these specifications, the plan should identify all the tests to be performed, how long each test would take, what would constitute meeting test requirements, and how much time is needed to assess the test results and take corrective action. The list of tests originally submitted by the contractor did not provide this information.

WMATA's contract contains no provision for preparing a master test plan. At first, a WMATA official said that the absence of a master test plan requirement was an oversight. In February 1982, the contractor, although not required to do so, submitted a test plan which WMATA considered to be adequate as a master plan. Our review of the contractor's plan, however, disclosed that it was only a list of the individual tests required by the contract and did not include details about testing methods or specify on what basis the tests would be evaluated.

Instead of a comprehensive planning process culminating in a master test plan, the contractor is fragmenting test planning. First it made a list of tests it would perform; a year later it submitted test procedures for the first phase of testing. These procedures included performance criteria and testing methods but the contractor has not yet submitted them for later tests. Still to come are procedures for tests scheduled to begin in October 1983 and for later testing which runs through 1987. For example, the contractor has not submitted test procedures for the critical car compatibility testing or for testing on cars equipped with the chopper propulsion system. WMATA thus approves individual test plans as they are submitted over time and cannot analyze and evaluate the testing process as a whole.

Also, WMATA has no plans for the tests it will conduct. Although they said that test planning will eventually be done, they believe such planning is not critical and can be done just before performing the tests. WMATA's test schedule does not allow time for this 30-day test period. Since test and evaluation is a long complex process extending into 1987, and because both WMATA and contractor testing is involved, we believe WMATA needs a master plan to evaluate the adequacy of testing and ensure it will be comprehensive.

¹Transit Industry Core Technical Specifications for the Procurement of Rapid Railcars, July 1981.

CONCLUSIONS

The success of major acquisitions depends on realistic and definitive performance requirements and strong contract management and oversight. However, limited contract enforcement has placed WMATA in a position where it must place greater importance on test and evaluation to show that the railcars meet contract requirements.

The railcar contract payment schedule for the 200-car option is different from the initial 94-car buy and provides more money for work performed than under the initial contract. A substantial percentage of the contract price will be paid before any cars are delivered.

WMATA has not enforced several critical contract requirements needed to help ensure design and production of quality railcars. The quality assurance program, systems engineering plan, and interface management plan are up to 3 years late. Without these documents, WMATA has no formal basis for assessing the adequacy of contractor performance until the cars arrive in Washington, D.C. By then, WMATA could encounter additional delays and costly retrofits.

A requirement for a master test plan was not included in the railcar contract. Even though the contractor provided a list of tests to be performed, it does not outline essential details necessary to adequately plan for thorough testing. Early test and evaluation of two railcars has been hampered by insufficient contractor staff and delay by the contractor in providing test equipment. Testing already performed identified technical problems, one requiring redesign and retrofit. Critical testing of the train system will begin late this year and extend through 1987.

WMATA has not begun planning its own tests and believes that sufficient test planning can be done just before performing the tests. With railcar delivery critical to the opening of new stations, we believe early and comprehensive test planning could minimize delays and ensure that the cars are thoroughly tested before entering revenue service.

To strengthen control over the railcar procurement, we believe that the General Manager, WMATA, should:

- Obtain outstanding quality assurance, systems engineering, and interface management plans and documents required by the contract.

--Prepare a comprehensive test plan to ensure that safety, reliability, and contractual requirements are met. This plan should identify the test schedule and objectives, including pass/fail criteria, the test environment and the basis for establishing the test criteria, required equipment, facilities, personnel and instrumentation, special test conditions to be used, such as vibration, and evaluation procedures.

AGENCY COMMENTS AND OUR EVALUATION

WMATA believes the railcar contract provides adequate control over contractor performance. It stated that the option contract's progress payment schedule was tailored to closely follow the contractor's cash flow requirements and thereby permit the negotiation of a much more favorable price. The contractor agreed with WMATA that the option progress payment schedule allowed it to limit its price for the option cars. Although WMATA stated that it obtained a lesser unit price on the option lots in consideration of more lenient payment provisions, the renegotiated option purchase increased the average cost per car over that of the original option provision by \$165,588, or a total cost increase of \$16.6 million. Since specific contract requirements were not being met and car deliveries were over 1 year behind schedule when the option contract was negotiated, we believe WMATA should have placed greater importance on the use of progress payments to encourage timely contractor performance.

Breda and WMATA agreed that Breda places greater emphasis on railcar production and much less on the plans and programs required by the contract to ensure quality production. Both believe that the quality assurance program, systems engineering plan, and interface management plan, which have not been submitted by the contractor, are not critical. Further, WMATA believes it has been able to evaluate and enforce good management by the contractor without these plans. In addition, WMATA believes it has enforced contract requirements by notifying the contractor that all delinquent items must be submitted. Although WMATA notified us that a revised schedule for delivery of these items had been received, our review of that schedule showed that the items we identified in this report were not included. Given the advanced technology and complex engineering requirements involved in the railcar procurement, we believe that quality assurance, systems integration, and interface management are critical to a successful acquisition program and for assessing contractor performance.

WMATA agreed that a master test plan, although not required by the contract, is essential to ensure adequate coordination of

all testing activity and to ensure that tests demonstrate that contract requirements are met. However, WMATA stated that the list of tests submitted by the contractor in February 1982 is an adequate master plan. The list of tests did not include details on testing methods for all tests to be performed or specify the basis by which the tests would be evaluated. This does not satisfy industry specifications of what constitutes a master test plan. Industry recommended contract specifications require a master test plan (including detailed procedures for components, subsystems, and systems), pass/fail criteria, test conditions, and objectives. We believe that in the absence of a contract requirement, WMATA should prepare a master test plan.

CHAPTER 4

UMTA'S OVERSIGHT OF THE RAILCAR

PROCUREMENT HAS BEEN LIMITED

As of May 1983, UMTA had funded almost 85 percent (\$220 million) of WMATA's railcar procurement. Yet, UMTA's role in overseeing this procurement has been limited.

As we discussed in Chapters 2 and 3, problems in controlling contractor performance and enforcing contract requirements could result in increased contract costs, poor product quality, and additional delays. Although some of these problems have existed since the beginning of the railcar contract, UMTA has not been fully aware of them and did not have the information it needed to evaluate WMATA's requests for continued federal funding.

Our review of the railcar procurement showed that UMTA has not complied with its oversight requirements. UMTA has not made required onsite inspections and the information it receives from WMATA is insufficient to effectively monitor program performance and evaluate funding requests.

REQUIRED ONSITE INSPECTIONS WERE NOT PERFORMED

UMTA has not complied with requirements to make periodic onsite inspections of the railcar project. The Office of Management and Budget (OMB) Circular A-102, Uniform Requirements for Assistance to State and Local Governments, requires grantor agencies to make site visits as frequently as practicable to review program accomplishments and management control requirements and provide technical assistance if needed. UMTA's External Operating Manual implements the provisions of OMB Circular A-102 and states that UMTA will make periodic onsite inspections of projects. These inspections are required to evaluate the effectiveness of the grantee's arrangement for supervision and inspection, and to evaluate the engineering work done on the project.

Under current UMTA regulations, site visits are also required when a grantee reports a significant event, defined by UMTA as delaying completion of the project by more than 30 days. The breakdown of equipment at WMATA's subcontractor plant delayed delivery by 1 year; yet, no UMTA site visit was made. According to UMTA officials, UMTA has not reviewed documents on the press breakdown and is depending on a final audit after completion of the grant to determine whether the delay represents

an allowable cost. According to UMTA grant management officials, the final audit will be made when all of the grant projects are completed. Since the railcar procurement is only one part of a large grant, the final audit may not be done until long after the railcar component of the grant is completed.

Although WMATA officials and their engineering consultants make onsite inspections, UMTA has no first-hand knowledge of contractor performance or of WMATA's management and supervision, and has little basis for determining whether problems require UMTA's attention.

PROJECT REPORTS DO NOT ADEQUATELY PORTRAY PROGRESS

UMTA has made funding decisions without sufficient knowledge concerning funds already distributed. Furthermore, the project reporting system on WMATA's railcar procurement does not provide adequate project progress and status information.

UMTA receives information on WMATA's grant projects in monthly and quarterly reports, during informal weekly meetings, and from minutes of WMATA board meetings. However, WMATA's formal reports do not provide details on the railcar procurement. According to an UMTA official, the weekly meetings concentrate on construction and policy issues and railcar procurement is not discussed.

Although written requirements exist for quarterly progress reports, UMTA has not enforced them with WMATA. According to an UMTA official who formerly monitored WMATA, UMTA and WMATA mutually agreed on a format for the quarterly progress report and information to be supplied. Yet, we found that information needed to evaluate progress is not included in these reports. Objectives for the quarter are not described, anticipated problems are not identified, and the schedule does not identify changes made from prior reports. Little narrative information is included on the railcar procurement and, because quarterly reports do not summarize information from prior reports, progress cannot be readily determined.

The current project reporting requirements on the railcar procurement do not allow UMTA to adequately track progress. UMTA approved three grant amendments that funded additional WMATA railcars. It did so without full knowledge of progress on the initial car procurement and of problems that had occurred. UMTA did not know that (1) production began without approval of all drawings, (2) quality control problems occurred at the plant, or (3) the contractor had not provided required essential documents.

UMTA grant management officials acknowledged that oversight of the railcar procurement was limited. For UMTA to base funding decisions on information that WMATA provides, it needs to ensure that the information adequately identifies progress made and also any problems that could affect meeting program objectives.

CONCLUSIONS

Although the first two railcars were delivered 22 months behind schedule, UMTA has done little to review and monitor WMATA's railcar procurement. UMTA has not required that WMATA enforce contract requirements for important programs and plans needed to assess design and production quality and to monitor contractor performance.

From the standpoint of UMTA's direct oversight responsibilities, UMTA has neither made site visits required by OMB and by UMTA's own operating procedures nor enforced its project reporting requirements. It has not had sufficient information to evaluate progress and to analyze problems. The manner in which UMTA has carried out its oversight responsibilities to date indicates to us that it does not have a sufficient information base on which to evaluate railcar procurement progress and analyze problems. Before WMATA requests and UMTA approves funding for the remaining car order, UMTA should be in a more informed position to determine if additional funding is warranted and, if so, whether the funds will be effectively managed.

RECOMMENDATIONS

To ensure the appropriateness of federal funding requests for the railcars and future acquisitions, we recommend the Secretary of Transportation direct the UMTA Administrator to:

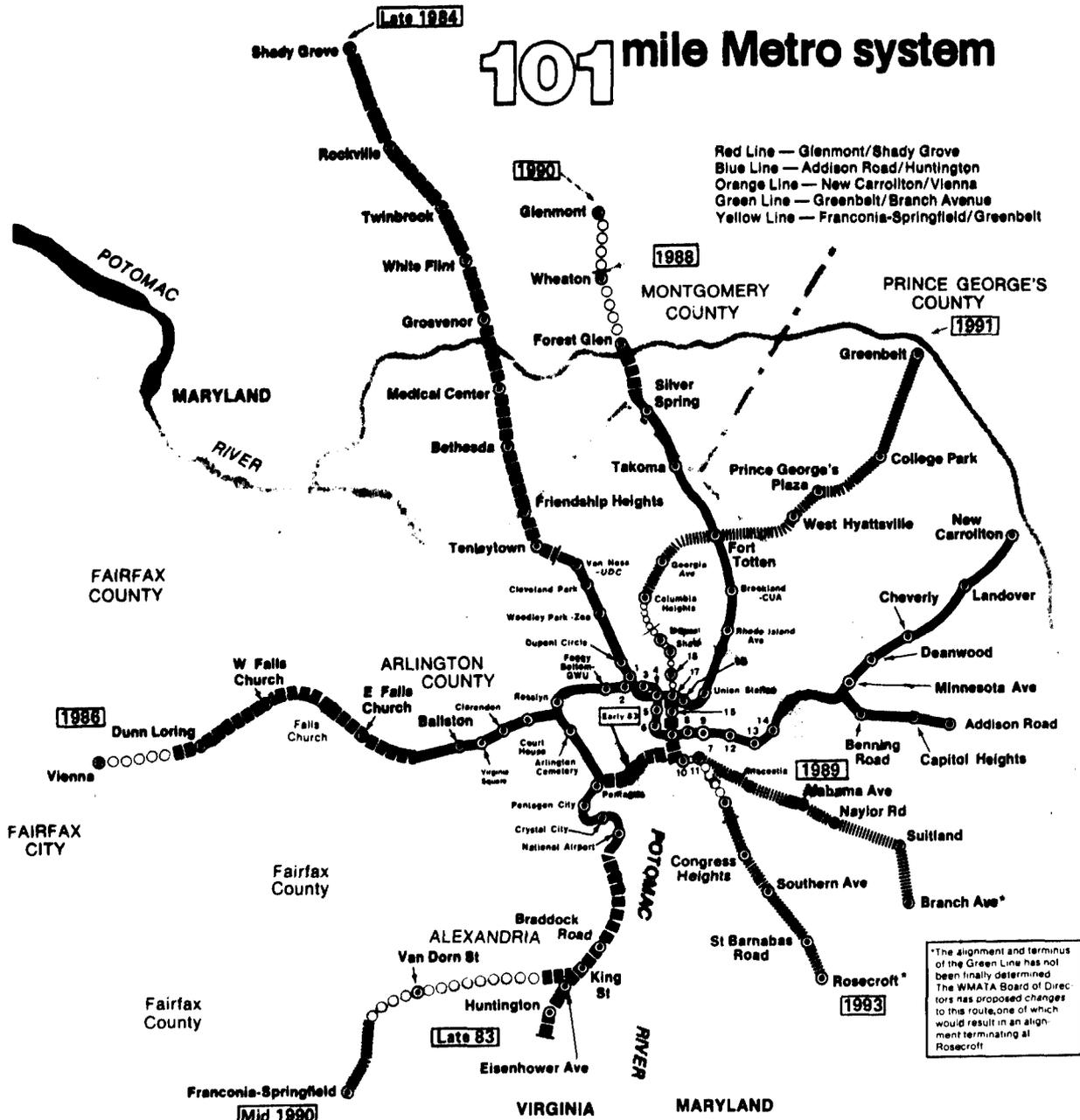
- Make periodic onsite inspections as required by OMB and UMTA's operating procedures.
- Enforce existing reporting requirements to provide more information on the progress and difficulties encountered by the railcar contractor. In connection with the enforcement of these requirements, UMTA also should ensure that it receives sufficient information to evaluate WMATA's progress in obtaining quality assurance plans and performing comprehensive tests on the railcars.

AGENCY COMMENTS AND OUR EVALUATION

DOT agreed that WMATA should provide information on significant project activities, including the progress and difficulties of the railcar contractor. DOT also stated that UMTA would require that WMATA provide more information in the future. We believe this is a positive step and should help UMTA evaluate WMATA's request in December 1983 for additional federal funding.

DOT stated that UMTA's policy precludes onsite inspections and that such inspections at the production plant and reviews of the contractor are not DOT's role. We agree that WMATA is responsible for reviewing contractor performance; however, UMTA is responsible for evaluating the grantee's supervision and its management control system. OMB Circular A-102 and UMTA's operating procedures specify that UMTA should make onsite inspections to evaluate the effectiveness of grantee supervision and to assess the adequacy of work under the contract. For WMATA's railcar procurement, this would include inspections at the contractor's plant in Italy and AMTRAK's assembly facility in Indiana. UMTA's procedures also require onsite visits when production problems delay the project more than 30 days. Delivery of the first railcars was delayed 22 months. We believe UMTA should comply with OMB's requirements and with its own operating procedures.

Although the WMATA railcar contract is an important and large single-item contract, DOT stated it is only one of a large number of such contracts at WMATA and other transit properties. We recognize that WMATA is one of many transit properties, and this railcar acquisition is one of many WMATA procurements. However, we believe the procurement of safe and reliable transit cars needed to operate an \$11.8 billion transit system requires greater UMTA attention.



LEGEND

- Operating Lines 39.12 miles 44 stations
 - ■ ■ ■ ■ Under Construction or Substantially Complete 33.52 miles 21 stations
 - ○ ○ ○ ○ Under Final Design 11.69 miles 9 stations
 - ■ ■ ■ ■ Remainder of System 16.85 miles 12 stations
- 1993** Projected start of operations for this segment based on approved schedule. Applies to all stations inbound from this point

Total mileage—101.18
 Total stations—96

- 1. Farragut North
- 2. Farragut West
- 3. McPherson Square
- 4. Metro Center
- 5. Federal Triangle
- 6. Smithsonian
- 7. L'Enfant Plaza
- 8. Federal Center SW
- 9. Capitol South
- 10. Waterfront
- 11. Navy Yard
- 12. Eastern Market
- 13. Potomac Ave
- 14. Stadium-Armory
- 15. Archives
- 16. Judiciary Square
- 17. Gallery Place
- 18. Mt Vernon Sq-UDC



BREDA COSTRUZIONI FERROVIARIE

s.p.a. capitale 8 000 000 000 interamente versato

Breda Costruzioni
Ferroviarie
società per azioni
sede e stabilimento:
Pistoia, via Cillegiole
cap 51100
tribunale di Pistoia: 2887
c.c.i.a. Roma 77488
c.c. postale 1388514
part. iva 00100040478
tel. 367801 (15 linee)
telex 570188 B C F I
telegr. Ferbreda Pistoia

Pistoia 30 November 1982
No. rif.
Vs. rif.
del

Mr. J. Dexter Peach
Director
U.S. General Accounting Office
441 G Street, N.W.
Washington, D.C. 20548
U.S.A.

Oggetto:

Dear Mr. Peach,

We are enclosing our comments on your draft report entitled "Better Management is Needed to Assure Successful Railcar Procurement."

We were grateful for the opportunity to read and comment on this draft. You will see, when reading our remarks, that we have tried to rectify inaccuracies contained in the draft. We did not comment on certain items which feel WMATA could clarify much better if they decide to do so. We hope that you will find our comments constructive.

It is our desire that this effort will lead to better comprehension of the problems involved in rail car procurements in general, and of the Breda-WMATA project in particular.

Very truly yours,

Alberto Bracco
Alberto Bracco

:jw
enc.





BREDA COSTRUZIONI FERROVIARIE S.p.A.

For reasons of clarity the page number of the draft appears at the beginning of each paragraph.

page 4 - We object to the description of Breda's activities as it appears on page 4. "Breda Costruzioni Ferroviarie S.p.A." is the new name of "Società Italiana Ernesto Breda" which, in 1908 celebrated the delivery of the 1000th (one thousandth) locomotive to the Italian State Railways. The old company, Società Italiana Ernesto Breda had its factory in Milan and transferred operations to Pistoia, in the early 1970's, where the currently existing plant was built.

The fact that another factory existed in Pistoia since the beginning of this century and was engaged in construction and repair of rail vehicles in addition to other activities does not mean that Breda Costruzioni Ferroviarie's (Breda) original activity was the repair of railway rolling stock. The Breda technical department has designed the most modern trains which are currently in service on the Italian State Railways as well as other vehicles listed in the report.

pages 8-9 - The payment conditions which are more or less favorable to the Contractor constitute an essential element in the calculation of the price. Thus, more restrictive payment conditions would have certainly resulted in higher quotations by any prospective bidder. As far as payments for the options are concerned, it must be emphasized that those conditions made it possible for Breda to limit its requests at the time the price of the option cars was renegotiated. Renegotiation, as we know, was necessary due to the lack of availability of funding.

One substantial payment at the time the contract is signed could make it possible for the contractor to accept a milestone payment schedule based on progress critical to the program (such as receipt of major subsystems from the subcontractors, e.g. motors, brakes, air conditioner, etc., and subsequent payments upon shipment and/or delivery of the cars).

page 10 - The draft is not clear. Breda signed a contract for the final assembly of the cars with the National Railroad Passenger Corporation (AMTRAK) last July on the basis of the car delivery schedule. Assembly will be done at the AMTRAK facility in Beech Grove Indiana.



page 11 - Lates Deliveries. Anyone with experience in this field and in particular, with the complexity of the end product in question, which includes important components from many sub-suppliers--and which constant technical progress renders even more sophisticated--knows the enormous difficulties which must be overcome in order to meet delivery deadlines. It is common knowledge that many problems are caused by the customers, the customer's consultants, and events, which in many cases are unforeseeable at the time the contract is signed and during construction as well. Experts also know how difficult it is to determine each party's responsibility.

Unreasonable liquidated damages can cause the disappearance of rail car manufacturers due to penalization, or they can make it impossible for operating authorities to obtain the overly sophisticated type of rail cars they want.

page 12 - First of all, there seems to be a lack of clarity regarding the titles of the documents. The listing of tests required by the contract is one thing. A detailed set of testing procedures for all equipment as required by the Specifications (giving performance, safety, etc. requirements) has been submitted to the Authority under the title Testing Procedures--this document gives pass/fail criteria for the equipment in question. It further appears that the writer(s) has created some confusion between acceptance testing, equipment qualification, routine testing, etc.

page 13 - Greater Cleveland Regional Transit Authority. This section makes no mention of the delays with which the GCRTA responded to drawing submittals. Those delays were in violation of the contract. Nor does it mention that the problems in operating the cars are due in large part to defects on the GCRTA line (insufficient voltage and/or voltage drops, etc.). The chapter does not mention that some of the problems with the propulsion equipment are the subsupplier's problem (Brown Boveri Canada, Inc.), including the lack of the diagnostic test equipment. Nor does the chapter mention that the choice of the subsupplier was guided by the GCRTA and their consultants. This does not relieve Breda of its responsibility as prime contractor, however, the purpose of these comments is to point out making Breda appear as solely responsible for the problems in operating the cars is oversimplifying the matter. Difficulties in running such high quality vehicles with sophisticated on-board equipment are also tied to the level of preparation of the operating authority's personnel,

available infrastructures and facilities (maintenance yards, etc.) condition of the line, etc.

Quite some time ago Breda supplied the GCRTA with a list of spare parts (with prices) which, for unknown reasons, GCRTA did not purchase.

page 14 - It is true that some documents required by the contract were not delivered by the required deadlines. However, the missing documents cannot be classified as "key document" just as it is also incorrect to state that "without these documents WMATA has no basis for evaluating contractor performance."

It is not a question of denying the observations that were made. Rather it is a question of different methods of working and Breda's emphasis on "doing"--hardware, rather than "writing"--software. We believe that the inspectors from L.T. Klauder & Associates and the WMATA representatives have had and still have the opportunity of judging the validity of Breda technology, and Breda's capability of managing the problems of interface and engineering.

The quality problems mentioned did not concern matters which are essential to the operation, functioning and aesthetics of the total vehicle.

Experts in rail car construction from many different countries who have visited the Breda facilities and have examined Breda's methods of working, and its finished products have always commended the high quality they encountered.

page 20 - Ample documentation on this fact was submitted to WMATA. That documentation shows that the cracks found on the press before Breda placed its order with VAW were not such as to hinder to damage extrusions. This was also confirmed by a report which was prepared and submitted by independent experts.



Washington Metropolitan Area Transit Authority

600 Fifth Street, N.W., Washington, D.C. 20001
(202) 637-1234



December 8, 1982

Mr. J. Dexter Peach, Director
Resources, Community and Economics
Development Division
United States General Accounting Office
Washington, D. C. 20548

Dear Mr. Peach:

This refers to your letter of October 25, 1982, transmitting a draft GAO report, entitled Better Management Is Needed to Assure Successful Railcar Procurement. Our respective staffs met on Wednesday, November 24, 1982, to discuss the Authority's position on the findings and recommendations set out in the report. A WMATA draft response was distributed and discussed at the time. It was agreed at that meeting that GAO would review our response in detail and meet again on Friday, December 3, 1982.

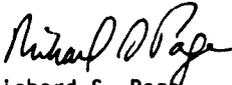
At WMATA's request our staffs met again on November 30, 1982, to discuss the draft report and our response. We were advised then that the Authority's position as stated in the draft response would be incorporated in the GAO draft report. Except for "Agency Comments" only minor changes to the draft report were anticipated by GAO staff.

A revised draft GAO report was received by the Authority on December 3, 1982, and at a meeting later that day it was mutually concluded that the opinions and positions of each party were recognized and understood by both.

The manner in which the Authority's suggestions and changes have been incorporated in the revised GAO draft report is acceptable. However, since we believe a number of requested changes although not incorporated are highly significant, it is requested that the Authority's draft response dated November 24, 1982, be considered our formal response and, as such, be included as part of your final report.

We appreciate very much the time your staff has taken to discuss the report and the areas of concern and the consideration given our position.

Sincerely yours,


Richard S. Page
General Manager

A PUBLIC TRANSPORTATION PARTNERSHIP OF THE DISTRICT OF COLUMBIA, MARYLAND AND VIRGINIA

I. COVER SUMMARY

The brevity of the Cover Summary does not provide an adequate background and presents conclusions out of context.

The Washington Metropolitan Area Transit Authority (WMATA) awarded a contract for 94 Rapid Transit Cars to Breda Costruzioni Ferroviarie on June 28, 1979, in the total amount of \$75,312,076. The contract contained a WMATA option for additional quantity of cars in lots of 50, 100, 150, or 200 vehicles. By the contract terms, this option expired on June 30, 1980. Prior to the deadline for exercising the option, WMATA and the Contractor renegotiated the option terms to allow for the acquisition of 200 additional cars on an incremental basis over a four year period subject to the availability of funds for each increment since sufficient Federal funds were not available for all 200 cars. Lots of 70, 36, 60 and 34 cars were established conforming to the requirements for subsequent Metrorail segment openings and availability of estimated project funding. Under the new terms of the option, WMATA has funded the first option of 70 cars in the amount of \$59,312,785 plus spares and the second option of 36 cars in the amount of \$31,273,470 plus spares. Funding must be provided for the third lot of 60 cars and the fourth lot of 34 cars by December 28, 1982, and December 28, 1983, respectively. The contract price for the third lot is \$53,904,540 plus spares and the fourth lot is \$39,454,012 plus spares.

A major breakdown of a subcontractor's (VAW) aluminum press extrusion and a major labor strike at the Westinghouse Air Brake Facility (near Pittsburgh, PA.) has delayed scheduled deliveries. WMATA acquisition decisions on option quantities have taken into account cost, technical risks, contractor performance and transit car availability for revenue service.

WMATA is dedicated to strict contract compliance and believes it has adequately assessed the projected assembly and car delivery status.

Federal oversight has occurred on this project, and we appreciate the contribution that the Urban Mass Transportation Administration (UMTA) has provided from the inception of the specification preparation through the current stages of project management.

II. DIGEST

Points raised in the Digest are addressed in detail below. In addition, we have prepared an edited draft of the Cover Summary and Digest (Attachment 1) which we respectfully submit as more representative of the facts.^{1/}

^{1/}WMATA's edited version of our cover summary and digest have been omitted because the General Manager's letter explains the authority's positions on our report.

III. CHAPTER 11. Federal, State and Local Participation

WMATA is a public agency and was created effective February 20, 1967, by Interstate Compact by and between Maryland, Virginia and the District of Columbia pursuant to Public Law 89-774, approved November 6, 1966.

While it is true that construction delays have occurred, approval of financing plans and funds availability in recent years has extended the project completion significantly thus compounding the effects of reduced construction economies and double-digit inflation. With regard to the original estimated costs and current estimates, please refer to our response dated October 22, 1982, to the GAO Draft Report entitled "Applying DOT's Rail Policy to Washington, D.C. Rapid Rail System could Save Federal Funds."

2. The Railcar Procurement

WMATA acquired its first 300 transit cars from Rohr Industries which are currently in revenue service. This program was marred by significant engineering, and manufacturing problems resulting in serious delays in receiving acceptable cars.

In 1978, WMATA initiated plans to acquire an additional 94 transit cars with options for up to 200 more cars. This procurement was solicited on an advertised sealed bid basis. Breda Costruzioni Ferroviarie, S.p.A., was the low bidder and on June 28, 1979, was awarded the contract for 94 transit cars with an option to acquire up to an additional 200 cars by a date certain. The award price to Breda was \$75,312,076. The second low was \$91,661,976, a spread of over \$16 million.

3. Breda Costruzioni Ferroviarie

Pursuant to the terms of the Invitation to Bid, a pre-award survey was conducted by the Contracting Officer. Data required was provided; a facilities survey was conducted at the contractor's plant; and a team was dispatched to Cleveland to investigate the experience of the Greater Cleveland Regional Transit Authority who was Breda's first U.S. customer. Each of these investigations established the responsibility of the apparent low bidder, Breda, and accordingly award was consummated.

4. Louis T. Klauder & Associates

Louis T. Klauder and Associates (LTK&A) was chosen by WMATA in the late 60's as its General Engineering Consultant firm for the procurement of transit cars. LTK&A performed in this capacity during the first procurement of cars (being awarded to Rohr) through the Breda procurement. LTK&E also provides technical inspection services and technical management of the contract.

5. Objectives, Scope and Methodology

The GAO conducted exhaustive interrogation of WMATA staff personnel, LTK&A personnel including on-site inspectors, and contractor and subcontractor personnel in Europe. WMATA has no direct information on the extent of the other contacts noted.

IV. CHAPTER 2

WMATA agrees that major acquisitions should emphasize adequate contract requirements in the specification development and strong contract management during contract performance and, contrary to statements made, contract provisions contain adequate control over contractor performance. WMATA is not a novice in the field having acquired 300 transit cars from Rohr. Every effort was made to preclude deficiencies and utilize lessons learned from the first buy in the new car procurement. Tighter controls were incorporated in the specification consistent with recognition of the economies of stricter requirements. Liquidated Damages provisions were constructed so as, in the judgement of the staff, to adequately compensate the Authority for damages while not imposing a "penalty" on the contractor. Probable actual damages were estimated and the contract provisions were adopted accordingly. Without reference to probable actual damages, any such estimate may be construed as a "penalty" and thus unenforceable. ^{2/}

1. Weak Contract Provisions Limit WMATA Control over Contractor performance

We disagree that the contract contains weak provisions. The contract includes provisions to assure adequate control over contractor performance. Progress payments are directly linked to approval of master program schedules, approval of production engineering drawings, full scale

^{2/}The section on liquidated damage provisions was deleted from the report.

underfloor mock-up, approval of car builder's specifications, successful completion of carbody compression test, first completed production pair of cars, etc. See Attachment 2, Schedules, Contract 2Z0065, Measurement and Payment.

Milestone progress payments for the option cars were established during contract negotiations on the option prices with the contractor. They too were linked to critical measures of contract performance such as Master Program Schedules, completion of major subsystem procurement, shipments to the assembly plant, etc. See Attachment 3, Table 2, Milestone Payment Schedule.

Although there is no specific final assembly schedule in the contract (this being left to the contractor's judgment in developing fabrication and final assembly plans), incentives in the form of payments are included in the option lots for shipment of partially completed transit cars for final assembly.^{3/}

Liquidated damages are included in the contract for late deliveries, excess weight and heat loss. Amounts and limitations in these provisions are considered adequate to protect the interest of the Authority and are further considered to be legally enforceable.

Master Test Plans, although not identified as a specific contractual requirement, are essential to ensure adequate coordination of all testing activity. WMATA insisted on such a master plan and Breda responded with an adequate and complete Master Test Plan. This will be followed by test procedures and test criteria, all of which are now being finalized. These were in progress well before the GAO Report.

2. Work Progress Payments should require Demonstrated Completion of Major Tasks

Progress payment provisions do require demonstrated completion of major tasks. The base order and the option order provisions were designed (1) to provide incentive to the contractor to produce, (2) to reasonably correspond to the contractor's estimated cash flow needs, and (3) to achieve the most favorable price for the option. More restrictive payment provisions would have resulted in an increase to the car price. The milestone payments for the base buy associate a greater percentage of the contract payment with the acceptance of the rail cars. This was done since the risk of obtaining an unacceptable final product

^{3/}The section on railcar assembly was deleted from the report.

was greater. This is not the case, however, with the option cars where the contractor at the time of delivery of these cars will have the experience gained in delivering and accepting the majority of the base buy rail cars. Therefore, the emphasis on the option milestones was obviously shifted from approval of design and work schedules (which were critical in the base buy) to procurement of hardware and deliveries (which are critical factors for the option cars).

The report indicates inaccurately that WMATA will make payments over \$100 million in option contract payments before the first railcar is delivered.^{4/} Based on our current estimated delivery of the first pair of cars, 35% of the contract price will be paid on the option lots before the deliveries begin under the original contract. In dollars and cents this is estimated to be approximately \$31 million (excluding escalation) which is substantially less than \$100 million stated in the report.

Although one can conclude that the option lot payment schedule is more lenient, it was tailored to closely follow the contractor's cash flow requirements and thereby permit the negotiation of a much more favorable price. It must also be remembered that payment agreements were reached on the option lots at the time of price negotiations on the option lots. During the negotiation process on the option procurement, inflation pressures were near a peak and the contractor was sensitive to the cost of money and its impact on product price. As a consequence, the Authority was able to obtain a lesser unit price in consideration of more lenient payment provisions.

3. Contract should have included a specific Provision for the Schedule and assembly of cars in the United States

It is a recognized fact that the assembly of the rail-car components into a finished product is an important milestone in the delivery and acceptance of the completed rail-cars, however, it is not one of the most critical stages of the production process as noted in the draft report. Delivery and acceptance is the most important milestone.

The criticality of final assembly stage has been minimized by insisting that the first pair of cam controlled and chopper controlled cars be assembled totally at the contractor's plant in Italy with a thorough static and dynamic

^{4/}WMATA subsequently provided more detailed costs for both the original and option contracts which we used in the report.

testing to verify and correct all possible interface problems and provide proper corrective actions to ensure smooth and routine assembly activities in the United States.

4. Limits on Contractor Late Delivery Damage Payments are Far Too Low^{5/}

The limit on WMATA liquidated damages for late delivery was included in WMATA's contract as a result of requests by a number of car builders during the pre-bid period to minimize their risk. In accepting this position, WMATA did not compromise its position or increase its risk. In accordance with UMTA's regulations, the amount of liquidated damages was based upon estimated probable damages. It is of no significance what probable damages may be at other properties. To be enforceable, which is demonstrated by case law, criteria must be established at the outset or otherwise be struck down as an unenforceable penalty.

5. A Master Test Plan Provision is Needed

A Master Test Plan was not specifically called for by the contract specification. However, it is a known fact that every contractor prepares its master plan in order to provide a systematic process for conducting the number of tests required by the specification.

This test plan was prepared by the contractor and submitted to WMATA on February 19, 1982, and is considered adequate as a Master Plan.

The test details referred to by the GAO draft report are a part of the test procedures which are required by contract Section 1.08(b) and are in the process of preparation by the contractor. They are not normally provided in a Master Test Plan.

WMATA has notified the contractor that such detailed test procedures must be submitted as soon as possible, at least 90 days prior to the arrival of the first pair of cars. Furthermore, test criteria are being prepared to insure that there is no misunderstanding in the interpretation of test results. The comment regarding a 30 day acceptance period for WMATA after contractor tests, refers to acceptance tests which are relatively uniform and common and contrary to the language in the report, these are being planned and pose one of the least controversial problems in the whole test sequence.

^{5/}In view of WMATA's explanation, we have dropped the section on liquidated damages from the report.

6. Greater Cleveland Rapid Transit Authority experience with Breda

WMATA visited Cleveland Transit Authority prior to award of the contract to Breda and made a subsequent visit later in the procurement cycle. Cleveland's favorable recommendation was one of the factors in awarding the contract to Breda.

WMATA is aware of Cleveland testing and interface problems and such knowledge has been helpful in assuring that similar problems will not be repeated.

7. WMATA is not Adequately Enforcing Important Contract Requirements

It is correct that Breda places greater emphasis on hardware and much less on software requirements. WMATA's objective has been to obtain the best possible product at the earliest date possible. The software requirements noted in the report are not critical, and contrary to the statement in the report, do not prevent an accurate evaluation of contractor performance. The lateness in delivery of required software has not hampered WMATA or its consultants in evaluating and enforcing good management. This is evident if one reviews the minutes of meetings and related correspondence between the contractor (Breda) and the engineering consultant (LTK&A).

8. Missing Plans Limit WMATA's Ability to Measure Contractor Performance

The comments in the preceding paragraph apply. However, WMATA has notified the contractor that all past due software items must be submitted and a satisfactory schedule was obtained from the contractor during the September 1982 interface meeting.

9. Quality Assurance Program

The Quality Assurance Program plan was submitted on January 11, 1980, but a detailed quality assurance program procedure has not been submitted. This, as stated previously by the Contracting Officer, while desirable, is not critical to providing a quality product.

We have not been able to confirm the statement made by the inspection staff at the contractor's plant. It is clear that detailed procedures must be developed and tailored to the manufacturing process associated with each new production item. Pressure by WMATA inspectors has accelerated the development of those procedures, which are in place even though the formal action document has not been forwarded.

10. Systems Engineering Plan

The existence of a Systems Engineering Plan is very helpful and assures the customer that the contractor understands this critical concept. On the other hand, the lack of such document does not mean that WMATA would not be able to assess the adequacy of the railcars system engineering, through the design reviews, system review meetings, drawing reviews, test plans and test procedures for each system. The entire car will be statically and dynamically tested, which will insure proper system engineering interface.

11. Interface Management Plan

The comments in the preceding paragraph apply. In addition, the reference to the Contracting Officer's confidence is misleading and incomplete. The drawing reviews and the design reviews are well known vehicles for assuring proper interface. These tasks have been thoroughly performed and it is on this basis that the Contracting Officer is confident of the Contractor's plan.

12. Conclusions

We have edited the draft report from our viewpoint and respectfully solicit revisions accordingly. The edited draft of the digest is appended as Attachment 1.

The railcar contract provisions do provide adequate control over the contract. More stringent provisions would be more costly and with questionable benefits since contractors would protect themselves against potential liability by increasing their bid price. Progress payments are designed to reduce the contractor's negative cash flow thus reducing the actual total cost to WMATA. Practices and Procedures followed by the Authority in the execution of this contract are within the provisions of WMATA and Federal Procurement Policy and Regulations.

Providing a schedule for final assembly would require nothing more than shipping time from the contract delivery schedule and would serve no useful purpose. The Liquidated Damages Provision is adequate without it being potentially construed as a penalty and thus unenforceable. The default clause provides further protection to WMATA.

A Master Test Plan has been supplied; acceptance and qualification detailed test procedures are in preparation by the contractor. The statement in the draft report concerning the relationship between the Master Test Plan, money

spent and late delivery has no logical basis. The contractor and WMATA properly have placed greater emphasis on hardware than software deliverables. The lateness of software delivery does not impair WMATA's ability to monitor and enforce the contract and ensure a quality product.

Management reenforcement has already been placed in effect. WMATA has been in continual contact with Greater Cleveland Rapid Transit Authority and lessons learned there are being applied in the WMATA program.

13. Suggestions

It is not feasible to re-negotiate a progress payment schedule, part of an executed contract between two parties, which is considered fair and equitable.^{6/}

Outstanding software items are either delivered or committed for a specific date of delivery; WMATA will enforce these revised dates. The test plan has been prepared and submitted by the contractor. Detailed test procedures are in the process of preparation and submittal.

Once again, bidders or contractors place risk factors on contingencies, such as liquidated damages, which are reflected in higher prices. We believe the terms of the contract represent reasonable cost/benefit tradeoffs resulting in the lowest price to the Authority.

V. MAJOR CONTRACT DECISIONS MADE WITHOUT ADEQUATE ANALYSIS

1. Decision to Excuse Contractor Delay Questionable

The excused one year delay was granted after investigation and analysis. This investigation included a visit to the VAW Extrusion Manufacturer for a first hand review of the facts, a review of all documentation, and detailed discussions among the WMATA staff and its engineering consultant. Based on this extensive review an extension was granted to the prime contractor. The report of the Extrusion Manufacturer insurance carrier provides an independent review of the press breakdown and supports the WMATA final decision, copy of which was submitted to GAO staff in June 1982. There is nothing in the record which can substantiate any other conclusion.

^{6/}The suggestion was deleted from the report.

2. WMATA Ordered 200 Additional Cars Despite Knowledge of Contractor Problems

The contract was modified to exercise the additional car options at the time stipulated by the contract. At this time, while delivery was delayed from its original schedule, WMATA was satisfied that such delay was beyond the control of the contractor. In addition, there were extensive discussions between WMATA and its engineering consultant to establish the contractor's performance and that of his team of subcontractors. Since this evaluation was definitely positive, WMATA had to recognize that failure to exercise the option would result in loss of a favorable price and an inability to obtain cars for subsequent Metrorail segments in a timely fashion.

3. Limited Testing of High Technology Propulsion System Identified Problems

WMATA did not rush to a new technology by adopting the chopper propulsion equipment. This technology was in existence for at least 20 years and applied to transit railcars for at least 10 years. Major users of this already established technology are BART, MARTA, SEPTA and GCRTA. Chopper cars are currently in regular revenue service in many parts of the world and are considered a well proven technology.

The development of chopper controllers, since their introduction in the 1960's, has shown a definite improvement in propulsion control. A chopper offers a stepless motor control and can also use motor dynamic braking to return a portion of the regenerated kinetic energy of the vehicle back to the power source. Initial studies estimated that an energy savings of 5% to 10% could result from the use of chopper cars in the WMATA system. A later study headed by Richard A. Uher of Carnegie-Melon University for WMATA indicated that the initial estimates may be conservative in energy savings. The reliability and maintainability of chopper equipment has also improved over the recent years due to several advanced design features such as automatic field weakening, use of reverse conducting thyristors, freon cooling, and micro-processor control.

WMATA in conjunction with the DOT/TSC, studied the feasibility of using this type of technology at WMATA prior to any decision to include chopper propulsion systems in the Breda railcar procurement. Early in the procurement process involving the acquisition of 94 railcars required to supplement the existing WMATA fleet of 298 cars, the Authority began investigating the advantages of operating a chopper controlled propulsion system with regenerative braking over the conventional cam controlled cars.

Although the WMATA system was not originally designed with chopper operation in mind, advancements in frequency management, noise amplitude control, and power line monitoring of choppers now enable this technology to be used. WMATA had previous knowledge of other transit properties experiencing some problems with different types of chopper technology. This knowledge led to a thorough examination of these technologies as they would apply to the WMATA system. The data from this examination is reflected in the contract Specification 2Z0065, Pgs. 10-6, Section S10.05(g) 9, 14, 15, 16.

Based on the above, the procurement was structured so that the first prototype cars (1 married pair cam controlled, 1 married pair chopper controlled) would contain both cam control and chopper control equipment. The next 74 cars would be cam controlled and the last 16 would be chopper controlled. The option would be all chopper controlled cars. This plan was to provide extra assurances that any potential problems with the chopper design could be identified in early operational tests and corrected before the production models arrived. Due to the delay in the procurement, it became apparent that the option had to be exercised without the advantage of the two early prototypes. It was, therefore, necessary in order to maintain the same high level of assurance that no difficulties would present themselves, to develop a separate testing program outside the scope of the contract. This testing program was conducted by Westinghouse with consultant and Authority personnel in attendance during the entire range of testing. The tests fully accomplished the purpose and isolated two changes necessary to avoid potential problems and did not reveal any surprises. This testing gave us the necessary assurance to proceed with the procurement and execute the option for 200 cars selecting chopper configuration. It is completely unsupported by the facts to conclude that WMATA chose technology that posed a high risk for the Authority. On the contrary, the energy savings would accrue to the chopper type of operation and provide benefits for years to come.

4. Conclusions

(a) As we indicated in response to the general comments of this chapter, WMATA had investigated thoroughly the extrusion press breakdown prior to considering the resultant delay excusable. Small cracks did exist in the press prior to the main failure but were unrelated to and did not cause the press breakdown. These minor fractures did not interfere with the press operation as clearly stated in the report by the independent insurance company.

The delay subsequent to the installation of the new extrusion press arm was due to the contractor's attempts to meet WMATA's demands and pressure to expedite delivery of needed extrusions. WMATA, therefore, considered the delays due to the break-in period of the new extrusion press arm excusable.

(b) A postponement of a decision to exercise the option cars would have increased WMATA's cost in obtaining the additional cars and would have further delayed Metrorail openings. Further, had WMATA failed to notify the contractor of its intent to exercise the option, it would have disrupted continuous production and WMATA would have lost the opportunity to have cars available to support line openings through the current approved system. Typical lead time for a new procurement of cars ranges from 20 to 22 months from the existing supplier to 36 months from a new source.

5. Suggestions

WMATA attempts to consider all facts in any of its acquisition determinations. If there was any procurement that had the total attention of the WMATA staff, its Board of Directors and UMTA, the transit car procurement was one.^{7/}

We wholeheartedly concur in the advice to closely monitor test results of the chopper propulsion system and are equally committed to the cam system tests.

VI. UMTA'S LIMITED OVERSIGHT PROVIDES INSUFFICIENT INFORMATION FOR FEDERAL FUNDING DECISIONS

This chapter we defer to UMTA for response.

^{7/}The suggestion was deleted from the report.



**U.S. Department of
Transportation**

Assistant Secretary
for Administration

400 Seventh St., S.W.
Washington, D.C. 20590

JAN 10 1983

Mr. J. Dexter Peach
Director, Resources, Community
and Economic Development Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Peach:

We have enclosed two copies of the Department of Transportation's (DOT) reply to the General Accounting Office (GAO) draft report, "Better Management is Needed to Assure Successful Railcar Procurement," dated October 25, 1982.

While we agree with GAO that the Washington Metropolitan Area Transit Authority (WMATA) might have given more attention to periodic status reviews in their railcar procurement, we believe they are aware of the need to improve in that area of management. We also continue to believe that the function of periodic on-site inspection and review of grant recipient contractors is beyond the role of the Department.

If we can be of further assistance, please let us know.

Sincerely,

A handwritten signature in cursive script, appearing to read "Robert L. Fairman".

Robert L. Fairman

Enclosures

**DEPARTMENT OF TRANSPORTATION REPLY
TO THE
GENERAL ACCOUNTING OFFICE (GAO) DRAFT OF A
PROPOSED REPORT ENTITLED
"BETTER MANAGEMENT IS NEEDED TO ASSURE
SUCCESSFUL RAILCAR PROCUREMENT"
(CODE 951661)**

I. SUMMARY OF GAO FINDINGS AND RECOMMENDATIONS

The Washington Metropolitan Area Transit Authority (WMATA) is acquiring 294 railcars at a total estimated cost of \$275 million. WMATA is funding 85 percent of that cost. GAO believes that better contract administration and enforcement is needed to improve contractor performance and to ensure delivery of a quality railcar. GAO also believes that Congress should be concerned about UMTA's interpretation of administration policy restricting active Federal oversight, characterizing this as abdicating responsibility to local authorities.

To ensure that future Federal funds are prudently spent on the railcar acquisition, GAO recommends the Secretary of Transportation direct the UMTA Administrator to:

- (a) Conduct periodic on-site inspections of the railcar production plant.
- (b) Perform an audit of the equipment breakdown at the subcontractor's plant to determine whether it is an allowable program cost.
- (c) Enforce existing reporting requirements to provide more information on the progress and difficulties encountered by the railcar contractor.

II. DEPARTMENT OF TRANSPORTATION RESPONSE

- (a) UMTA's policy on limiting Federal involvement in the local decision making process precludes the kind of on-site, intensive reviews suggested by the GAO report. Furthermore, although the WMATA railcar procurement contract is an important and large single item contract, is only one of a large number of such contracts underway at WMATA and other transit properties.

UMTA considers on-site inspections of railcar production plants to be an intensive contract management requirement more appropriately handled by grantees. UMTA should assure that grantees conduct necessary on-site inspections, and should make this determination when reviewing progress reports or conducting site visits at grantee locations.

We believe this view is consistent with Paragraph 1., Attachment I of OMB Circular A-102 which specifies that the procedures described therein "are designed to place greater reliance on grantees to manage the day-to-day operations of the grant-supported activities." UMTA's role is to ensure the existence and proper functioning of appropriate management control systems, rather than to perform the control function per se. Site visits to grantees, rather than to third party contractors, are useful in carrying out this responsibility.

- (b) Current UMTA management procedures, in compliance with OMB Circular A-102, place project audit responsibilities upon grantees. Consistent with these procedures, UMTA expects WMATA to audit the railcar procurement contract properly to determine allowable costs. UMTA will review the audit report to determine its compliance with Federal allowability of costs charged to the project.
- (c) UMTA requires Quarterly Progress Reports from WMATA describing the progress of the entire UMTA Metrorail capital grant program. The reports and their contents are in compliance with guidelines prescribed by OMB Circular A-102. In addition, WMATA prepares and submits to UMTA a Monthly Progress Report outlining significant ongoing construction program activities. The rail car procurement program is outlined in both reports. In the future UMTA will require that WMATA provide more information on the progress and difficulties encountered by the railcar contractor.

III. SUMMARY OF DEPARTMENT OF TRANSPORTATION (DOT) POSITION

Although DOT agrees with GAO that WMATA may not have enforced some of the terms of the contract with Breda Costruzioni Ferroviarie with respect to the provision of periodic status reports on the railcar, this is viewed as a local contractor-agency issue, which we are confident WMATA will rectify.

We do not believe that periodic on-site inspections by UMTA of grantee contractors are appropriate.

With respect to auditing third party contracts, we expect WMATA to perform this function to properly determine eligible project costs.

We agree that WMATA should provide information outlining significant project activities, including the progress and difficulties encountered by the railcar contractor. WMATA will be required to do so in the future.

(951661)



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