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**INDEPENDENT STATE AUDITOR'S REPORT ON
CERTAIN ACTIVITIES OF THE
MASSACHUSETTS BAY TRANSPORTATION
AUTHORITY
OCTOBER 1, 2001 THROUGH APRIL 30, 2008**

**OFFICIAL AUDIT
REPORT
FEBRUARY 24, 2009**

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On July 11, 2002 the Massachusetts Bay Transportation Authority (MBTA) Board of Directors voted to award a \$75 million contract to Scheidt & Bachmann USA, Inc., for the manufacture and delivery of an automated fare collection (AFC) system. The AFC system was designed to replace the MBTA's aging mechanical fare collection infrastructure with automated equipment capable of better performance and reliability. The MBTA's new AFC system is composed of three major components: (1) fare collection equipment, including bus fare boxes, fare vending machines, and station turnstiles; (2) hub station management, which provides an enhanced level of customer service and security; and (3) the hardware and software necessary to link the fare collection system together.

By modernizing its fare collection system, the MBTA has complied with one of the key recommendations made to the Governor and Secretary of Transportation in the Blue Ribbon Committee report on Forward Funding legislation that was enacted in July 2000. The intent of this advance funding structure was to enable the MBTA to become a self-sustaining entity funded by fare box revenues as well as new dedicated state sales tax revenues. The AFC system was considered an integral part of the MBTA's projected success under Forward Funding by reducing fare evasion, reducing revenue collection costs, and creating a fare system with greater pricing flexibility with the introduction of new Smart Card technology.

Our audit, which covered the period October 1, 2001 to April 30, 2008, was conducted in accordance with applicable generally accepted government auditing standards for performance audits. The objectives of this audit were to review the MBTA's compliance with competitive negotiation requirements; contract costs incurred, including those resulting from change orders; and internal controls and procedures over the award, monitoring, and payment for contract activities. Our review indicated that, except as noted in the Audit Results section of this report, the MBTA had adequate internal controls over its contract procurement practices and complied with applicable laws, rules, and regulations for the areas tested.

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Our review indicated that the MBTA did not properly oversee the activities of its design engineer, improperly planned its AFC system, and inadequately communicated those needs to various MBTA departments. As a result, the MBTA incurred \$15.4 million in increased negotiated costs and delayed the implementation of the AFC system for over one year, thereby losing the opportunity to earn approximately \$2.9 million in potential fare revenue.

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The initial Request for Proposals for the AFC contract required that the successful bidder obtain a performance bond in the amount of 100% of the contract. However, prior to the submission of the best and final offer bids from the two AFC bidders, the MBTA reduced the performance bond requirements from 100% of the bid price to only 50% of the total bid. Therefore, the performance bond requirement covering this \$75,042,016 contract was reduced to \$37,521,008, and ultimately placed the MBTA at risk if the successful bidder failed to complete its obligations under the contract at the stated price.

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To protect themselves from the vagaries of newly developed and modified equipment, the MBTA prudently asked the AFC system bidders to provide pricing on a basic one-year warranty designed to cover all parts and labor required to maintain and repair the fare vending machines, gates, boxes, media, computer software, and other equipment that would comprise this proprietary AFC system. Subsequently, the MBTA agreed to modify the AFC contract, and reduced the warranty period for approximately 75%, or 1,200 fare boxes from one year down to a range of only one to six months (the installation period for fare boxes), leaving 400 fare boxes uncovered by the repair warranty. In addition, for other critical components of the AFC system, the MBTA agreed to begin the warranty period upon delivery of the equipment, and to end the period when either the testing for that type of equipment was successfully completed, when 75% of the fare boxes were installed and verified as functionally operational, or when 50-70% of certain equipment was delivered to the MBTA. The net effect of this contract change served to enrich the contractor, while at the same time adding to the maintenance and repair costs of the MBTA. Effective April 22, 2008 the maintenance and repair responsibilities for AFC fare-boxes and gates passed from the contractor to the Authority. MBTA maintenance and repair records for the AFC system indicate that during the period from April 22, 2008 to December 22, 2008 the Authority paid approximately \$606,000 in labor and materials for repairs to AFC equipment that would otherwise have been the responsibility of the contractor under the original terms of the procurement contract.

INTRODUCTION

Background

In 1990, as part of its continuing efforts to improve its automated fare collection (AFC) operations, the Massachusetts Bay Transportation Authority (MBTA) retained the consulting services of J. W. Leas & Associates to review the then-current fare collection system and to recommend a suitable replacement system. Their report, entitled, “MBTA Evaluation of Fare Collection Alternatives” dated December 4, 1990, first explored the use of advanced fare technology, including automated ticket dispensing machines and stored-value ticketing. The goal of this 1990 study was to evaluate the MBTA’s fare collection procedures and make recommendations to increase revenues, reduce costs, and enhance customer service. The study found that the MBTA’s token-based mechanical system contained the following inherent weaknesses:

- Susceptible to fare evasion
- Labor-intensive to operate and maintain
- Poor reliability
- Minimal management information
- Limited security features
- Poor customer service

In order to correct these deficiencies, the study recommended that the MBTA implement a stored-value ticketing system. Some of the benefits cited for this new type of system include:

- Reduced fare evasions
- Elimination of the need to handle cash by employees at station locations
- Enhancement of the MBTA’s ability to track more closely the cash and ticket fare media
- More accurate and timely ridership and revenue information
- Lower operating costs
- Reduced labor costs
- Greater fare pricing flexibility

Although the recommendations of this study were not implemented at that time, it ultimately became a resource document upon which the MBTA's new AFC system is based.

In 1994, the MBTA issued a Request for Proposals (RFP) No. CAP 15-94, entitled "MBTA Rapid Transit Fare Collection System Replacement." The RFP invited bidders to submit proposals in accordance with MBTA contract specifications for the delivery and construction necessary for the installation of AFC equipment throughout the MBTA system.

Three firms submitted proposals: Scheidt & Bachmann USA, Inc. (S&B), Thorn Transit Systems Inc., and Cubic Transportation Systems, Inc., (Cubic). An MBTA procurement committee awarded the contract to S&B based on its bid price of \$39.96 million and highest weighted rankings for product quality. However, the committee's decision was legally contested by Thorn Transit Systems Inc. and Cubic based on the principle that the Massachusetts General Laws require all construction contracts to be awarded on a sealed competitive-bid basis. The plaintiffs argued that, accordingly, the construction work necessary to install the AFC equipment is required under state law to be competitively bid and not negotiated. The court ruled in the plaintiffs' favor that the installation of a fare system and station modifications necessary to accommodate the system are indeed a public works construction contract that can only be awarded by sealed bid and not via an RFP process. Ultimately, the MBTA decided to split the AFC system procurement into two parts: (1) equipment and software to be purchased through an RFP process and (2) construction services required for station modifications to be awarded via a sealed competitive-bid process.

Legislation enacted in July 2000, commonly referred to as "Forward Funding," established the MBTA as a self-sustaining authority. Currently, the MBTA receives a dedicated revenue stream composed of annual assessments to 175 member cities and towns in the MBTA's service area. In addition, each year the MBTA receives dedicated sales tax revenue equal to 20% of the Commonwealth's sales tax levy. Accordingly, the Commonwealth is no longer responsible for funding the MBTA's operating deficit and is not the guarantor of any new MBTA bonds issued after July 1, 2000. A key recommendation of the Forward Funding legislative report was the implementation of an AFC system that would help to increase fare revenue, decrease operating costs, and improve management and reporting capabilities.

Request for Proposals

On October 19, 2001, the MBTA issued RFP No. 35-01 soliciting proposals for the furnishing/design/manufacture/delivery/activation and oversight for an AFC system. To comply with Massachusetts state law, the MBTA deleted the equipment installation and station modifications work items from this new request and obtained competitive bids for this work under different proposals. RFP No. 35-01 was issued under the guidelines for competitive negotiations and included confidential weighted selection criteria. The MBTA decided to award the contract to the highest-ranked proposal using a 100 total point system, with a weighted price factor of 45% and a weighted technical quality factor of 55%. Four firms submitted proposals that were received on February 15, 2002. The MBTA evaluation committee deemed that two of the four proposals received were unresponsive, and the remaining two proposals received from Cubic and S&B were allowed to continue through the competitive negotiation process.

After the initial round of negotiations, the rankings of the two remaining bidders were as follows:

		February 15, 2002 (1 st submission)		
		Relative Weightings Price vs. Technical Quality		
		45%	55%	100%
<u>Bidder</u>	<u>Amount</u>	<u>Price Points</u>	<u>Technical Quality Points</u>	<u>Total Points</u>
Cubic Transportation	\$87,080,784	45	55	100
Scheidt & Bachmann	\$133,480,921	46.748	20.997	67.745

First-round tabulations revealed that Cubic was ranked first with a combined score of 100 points in price and technological evaluations. The competitive negotiation process continued, with demonstrations scheduled on March 25 and 26, 2002. During this time the MBTA met privately with each bidder to review their pricing and technologies.

Subsequently, the bidders submitted their best and final offers (BAFO) on May 17, 2002.

The results of the BAFO were as follows:

		May 2002 (Best and Final Offer)		
		Relative Weightings Price vs. Technical Quality		
		45%	55%	100%
		<u>Price Points</u>	<u>Technical Quality Points</u>	<u>Total Points</u>
<u>Bidder</u>	<u>Amount</u>			
Cubic Transportation	\$88,422,938	36.977	55	91.977
Scheidt & Bachmann	\$75,042,016	45	48.285	93.285

The results of the BAFO indicated that S&B had reduced its original bid price by 56%, from \$133,480,921 to \$75,042,016, whereas Cubic had increased its final bid price by 1.5%. The MBTA met with S&B to discuss the reasons for the \$58 million decrease in its bid price from the first round to the second. S&B claimed that its initial bid was overly conservative, and contained research and development costs that it felt could be absorbed by S&B. The MBTA accepted S&B's explanation for the bid reduction and, based on the weighted scores tabulated in this second round, deemed S&B the winner based on a total score of 93.285 out of 100 points.

On July 11, 2002, the MBTA's Board of Directors voted to award the AFC procurement contract to S&B. The \$75 million AFC procurement consisted of the following components:

- Replace the current fare collection system for subway, bus, and Green Line and Silver Line services (introduction of automated fare vending machines and fare gates).
- Furnish maintenance and money room equipment.
- Supply computer equipment and software.
- Deliver fare media (smart cards/magnetic ticketing)
- Provide training and training manuals.

Bid Protest

As a result of the significant bid reduction by S&B as well as other bidding concerns, Cubic initiated several actions to protest the impending award of the AFC contract to S&B. One such action was the preparation of a position paper delineating some of Cubic's concerns regarding the bid process.

This position paper, which was supplied to the MBTA's Board of Directors as well as to members of the Legislature, outlined the following objections:

1. **Scheidt & Bachmann's failure to adhere to the "Buy America" standard:** Since Federal Transit Administration (FTA) grant monies funded a portion of the AFC procurement, all vendors had to comply with a "Buy America" provision requiring that the AFC components had to be manufactured in the United States. Cubic claimed that S&B planned to manufacture some components in Germany and Belgium.
2. **Scheidt & Bachmann's limited experience:** Cubic noted that S&B possessed experience in only small- to mid-size transit systems, such as the Metro-North Railroad, the Long Island Rail Road, Portland-Sound Transit, and the Houston Area Transit Authority. Moreover, it was stated that S&B had never produced a working bus fare box application. Cubic felt that, due to its inexperience in the transit fare box area, S&B would be unable to meet the technical scope and magnitude of the MBTA's AFC contract. On the other hand, Cubic noted that its company was a leader in the AFC industry and had successfully completed similar AFC installations in New York, Los Angeles, Chicago, San Francisco, and Washington, D.C.
3. **Scheidt & Bachmann's pricing methodology:** S&B reduced its final bid price by 56%, or \$58.4 million, from its original bid. Cubic stated that S&B's final bid was unrealistically low and therefore should have been rejected by the MBTA.
4. **Extension of installation schedule:** In the original RFP, the MBTA provided a start date for installation, but did not provide a required end date. Cubic claimed that in April 2002, the MBTA changed the schedule for the fare box installation, which unfairly favored S&B.
5. **Reduction of performance bond:** After S&B met with the MBTA pricing committee on March 26, 2002, the MBTA agreed to reduce the performance bond from 100% of the contract price to 50%. Cubic contended that meeting the original performance bond requirements is a standard business practice. Cubic further claimed that S&B could not meet the original performance requirement, and that by reducing the bond by 50%, the MBTA was in effect favoring S&B.

Subsequently, Cubic filed formal written protests of the award to S&B with the FTA as well as in Suffolk County Superior Court. These bid protests and subsequent legal proceedings spanning a seven-month period were as follows:

- July 10, 2002 - Cubic filed protest with FTA in connection of S&B's noncompliance with the federal "Buy America" legislation.
- November 14, 2002 - FTA issued a decision denying Cubic's protest.
- November 18, 2002 - Cubic filed a petition to reopen the process for reconsideration by the FTA, which was denied.

- November 18, 2002 - Cubic filed a protest with the MBTA in accordance with the bid protest procedures in the RFP.
- November 26, 2002 – The MBTA’s General Counsel denied Cubic’s bid protest.
- December 3, 2002 - Cubic filed a complaint against the MBTA in Suffolk Superior Court.
- December 10, 2002 - Cubic filed a memorandum in support of its application for preliminary injunction in Suffolk Superior Court.
- December 10, 2002 – The MBTA filed an opposition to motion of Cubic for injunctive relief in Suffolk Superior Court.
- December 12, 2002 - Cubic’s motion for preliminary injunction was denied.
- January 17, 2003 - A single Justice of the Appeals Court denied a petition brought by Cubic seeking injunctive relief from the Superior Court’s decision.
- February 10, 2003 - Cubic filed a petition for relief under Chapter 211, Section 3, of the General Laws with a single Justice of the Supreme Judicial Court (SJC).
- February 27, 2003 - Cubic’s petition for relief in the SJC was denied.

Upon the conclusion of these various legal and administrative appeals, the MBTA and S&B signed the \$75 million procurement contract for an AFC system on February 4, 2003, or six months after the original board vote to award the contract to S&B on July 11, 2002. Due to the protracted Cubic bid protest, the Notice to Proceed (NTP) date was changed to February 13, 2003 from the original NTP date of July 15, 2002, and the estimated completion date was ultimately extended from December 31, 2004 to September 1, 2006.

AFC Phase II

As of April 30, 2008, the MBTA has established a preliminary budget of approximately \$35.5 million to expand the AFC system to its commuter rail, ferry boat, and parking facilities. Currently, the MBTA has tentatively awarded a \$3 million contract for design services to Parsons Transportation Group with the objective of developing technical specifications to ensure system-wide integration of the AFC system.

Audit Scope, Objectives, and Methodology

Our audit, which covered the period October 1, 2001 to April 30, 2008, was conducted in accordance with applicable generally accepted government auditing standards for performance audits. The objectives of this audit were to review the following:

- The MBTA's compliance with competitive negotiation requirements.
- Contract costs incurred, including those resulting from change orders.
- Internal controls and procedures over the award, monitoring, and payment for contract activities.

Our methodology included reviewing (1) MBTA documents for the various AFC RFPs and evaluations; (2) signed contracts and related work specifications; (3) approved and pending change orders; (4) consultant contracts and correspondence; (5) correspondence files between the MBTA and S&B; and (6) approved policies and procedures for the reporting and monitoring of contract activities. In addition, we interviewed MBTA officials responsible for overseeing and awarding the AFC system contract.

Our review indicated that, except as noted in the Audit Results section of this report, the MBTA had adequate internal controls over its contract procurement practices and complied with applicable laws, rules, and regulations for the areas tested.

AUDIT RESULTS

1. THE MBTA INCURRED COST OVERRUNS OF \$15.4 MILLION AND LOST THE OPPORTUNITY TO EARN \$2.9 MILLION IN POTENTIAL FARE REVENUE DUE TO INADEQUATE PLANNING AND OVERSIGHT OF DESIGN ACTIVITIES

Our review indicated that the Massachusetts Bay Transportation Authority (MBTA) did not properly oversee the activities of its design engineer, improperly planned its automated fare collection (AFC) system, and inadequately communicated those needs to various MBTA departments. We noted that from November 26, 2003 to April 30, 2008 the MBTA authorized 14 change orders totaling approximately \$19.6 million for additional equipment, design changes, technical specifications changes, spare parts, and equipment maintenance services to correct design errors and omissions and to incorporate requested changes after the contract was awarded. We determined that \$15.4 million, or over 78%, of these total added contract costs could have been reduced or avoided by the MBTA through improved oversight, planning, and communication between its design engineer and its user departments. Moreover, approved time extensions granted to the contractor extended the AFC implementation date by an additional year, costing the MBTA approximately \$2.9 million in additional potential revenue that would have been realized due to reduced fare evasions once the AFC was fully operational.

A summary of these questioned change orders and the reasons for these changes are as follows:

Reason for Changes	Amount
Designer Error and Omission	\$ 1,005,135
Inadequate Departmental Planning	8,020,561
MBTA/Designer Errors (Joint Responsibility)	<u>6,400,000</u>
Total	<u>\$15,425,696</u>

Change Order No.	Description of Extra Work	Initiator	Additional Cost	Reason for Change Order
3	Replace 10.4 LCD display on Fare Vending Machine with 15-inch touch screen and PinPad/Keypad	MBTA	\$493,052	Design Error
4	Add secure firewall, make changes to infrastructure of station controller, bus garage, and fare media handling	Designer	\$512,083	Design Error
6	Replace tripod and POR gates with TGH high bi panel parting glass gates	MBTA	\$2,309,040	Inadequate Departmental Planning
8	Implementation Proactive Plan (Transition from paper-based review to working prototype reviews/test/ modification)	Joint	\$6,400,000 and adds 365 days to the schedule	Design Error
11	Procurement of spare parts for AFC equipment	MBTA	\$5,711,521	Inadequate Departmental Planning

Furthermore, correspondence for Change Order No. 3 between the MBTA and its design engineer indicated that, despite the implementation of 15-inch touch screens at a cost of \$493,052, their performance continued to be adversely affected by exposure to moisture from rain and snow. Moreover, the new touch screens' readability was markedly reduced when exposed to direct sunlight. As a result, although fare vending machines that were placed indoors operated as intended, those placed outdoors, such as at Green Line surface stations, did not operate as specified. As a result, the MBTA had to incur approximately \$200,000 in additional installation costs to construct shelters for these highly sensitive machines.

In addition, the original contract with S&B contained a \$1 million allowance for the purchase of spare parts to service the AFC system. The MBTA's contract strategy was to increase the level of this spare parts inventory once the AFC system was designed and tested. However, the final spare parts inventory level and unit pricing was principally determined by the contractor, S&B, and submitted to the MBTA for approval. Because the pricing and spare parts inventory was derived on a negotiated basis, rather than through a competitive-bid process, the MBTA had to ensure due diligence in acquiring the spare parts for the AFC system. However, our audit

revealed that the MBTA basically accepted the pricing and inventory levels without comparison pricing from competing manufacturers for similar spare parts. Therefore, there is inadequate assurance that the MBTA acquired these spare parts in the most economical method possible.

Finally, we noted that by adding 365 days to the final installation date in Change Order No. 8, the MBTA lost the opportunity to realize approximately \$2.9 million in additional fare revenue that the AFC system would have garnered by reducing fare evasions during this 12-month period. Indeed, the MBTA's own internal documents listing the improvements resulting from the implementation of the AFC system stated that the new fare system was expected to virtually eliminate the estimated \$ 2.9 million, or 1.5% of total annual fare revenues of \$ 193 million, that are lost each year due to fare evasions.

According to sound business practices, the most efficient and economical method of procurement is by incorporating all necessary work into the original contract specifications and awarding this work via a competitive-bid process. However, because the MBTA did not properly oversee the activities of its design engineer and MBTA user departments did not properly plan for their operational needs, \$15.4 million in extra work orders was incurred that may have been reduced or eliminated through a competitive-bid process.

Recommendation

To improve its procurement efficiency and cost-effectiveness, the MBTA should:

- Improve its oversight between the MBTA and any future consultant activities to ensure that the final design specifications are unambiguous and meet the various needs of the MBTA and the end users, in order to minimize the potential of having to initiate costly negotiated change orders.
- Coordinate the needs of the various MBTA departments during the design specification stage, which will reduce work scope changes before the contract is awarded.

Auditee's Response

- a. ***Reason for Change Orders #3 and #4 (total: \$1,005,135) was for use of the Value Engineering Budget, not design error or omission.***

Value Engineering Support Services were included in the original \$75,042,016 contract price as a line item in the amount of \$1,000,000 or 1.3% of the total contract value.

The purpose of including Value Engineering Support Services in the original contract was to use the funds for value engineering based on investigations, analysis, alternative

approaches and related means to implement cost-effective improvements to the existing contract deliverables. These services were anticipated to be required during any period up to 48 months after Notice to Proceed and the use of these funds had no impact on the contract value.

Change Order #3 and #4 were executed to define and describe specific design improvements that the Contractor and the MBTA had reached agreement on, such as: Provide 15" Touch Screen and Pin Pad/keypad instead of 10.4" LCD Display Screens and Buttons; and other best value items related to station infrastructure, HUB stations, and fare media handling. Timely review of the AFC System design documents by appropriate department within the MBTA and S&B enabled these no-cost change orders to be implemented in February 2004, early enough in the design process to avoid any extra work or material cost for either party.

- b. Primary Reason for Change Orders #6 and #11 (total: \$8,020,561) was to further reduce fare evasion and reconcile spare parts with the final design, not inadequate departmental planning.**

Change Order #6 (\$2,309,040) revised the fare gate design specification to reflect TGH high panel gate barriers instead of the lower Tripod and POR bi-parting leaf barriers that were identified in the original RFP submittals and included in the AFC Contract with S&B. The Tripod gates and POR gates were initially specified in the RFP based on commonly implemented technology at the time the original RFP was issued (1990's).

Because these low profile gates allowed for easy fare evasion by simply jumping over or ducking under the barriers, a better solution was identified with the new technology TGH high panel gates. After further review of barrier systems installed in New York City Transit and New Jersey/Newark locations, it was determined that TGH high panel gates not only allowed faster passenger throughput and wider aisles, but also would enhance the safety of our passengers by allowing unimpeded egress from the stations during emergency conditions. Consequently, the MBTA conducted a detailed assessment and review with departmental staff from each of the MBTA subway lines in order to determine accurate device requirements for this change order.

Change Order #11 (\$5,711,521) defined and resized the requirements for spare parts which had previously been provisioned as a \$1 million allowance based on the technology available at the time of the original RFP, for purchase of spare parts (item detail was to be determined).

This resetting of the content and quantity of spare parts for the AFC System was always intended to occur after completion of the design and testing phases, so that design changes to the FVM screens, fare gates, and other component-level items were accounted for. Staff was able to make a more informed decision about the actual requirements for spare parts after a review of similar equipment installed in Metro North and Long Island Railroad locations. Since all of the spare parts will be used, the Authority was able to save money by purchasing them under this change order. The Authority realized a cost savings of \$6.3 million on the \$12 million expenditure recommended by the equipment manufacturer (S&B).

- c. ***Clarification/Reason for Change Order #8 (total \$6,400,000) was to allow for sufficient proactive design verification and testing prior to the start of volume production, not joint responsibility for design errors.***

This change order amended the design review process and extended the project completion date by approximately one year. It allowed the MBTA to conduct a hands-on inspection on prototype devices and provide input early enough in the design phase prior to volume production, which resulted in a more thorough design customization that met MBTA needs, with added prototyping and pilot testing before full implementation in the live AFC system.

Additionally existing functional requirements, as originally documented in the functional specification, were refined, and in some cases expanded, to meet new operational and customer needs such as: 1) adding value to CharlieCards via the internet/web, 2) registering CharlieCards for loss protection via the internet/web, 3) a broader list of ridership and revenue reports, et al.

- d. ***Since full implementation of the Automated Fare Collection System, the Authority has seen an increase in fare revenues of \$13 million as well as a reduction in fare evasion***

Auditor's Reply

(a) The MBTA's portrayal of the \$1,005,135 contained in line item O1, which was used to fund change orders No. 3 and No. 4, as simply a "no-cost" way of paying for engineering enhancements to the AFC system, is incorrect. In fact, this line item amount simply represented a contract reserve to fund future change orders. Specifically, the contract states that (1) the MBTA reserves the right to activate or not activate this item, and (2) the purpose of this line item is to implement revisions (change orders) to the original contract specifications. Ultimately, if the original contract engineering specifications were adequate, then the MBTA would not have expended the contract allowance for this Value Engineering line item, and thereby saved \$1,005,135.

Finally, as of May 3, 2007, the MBTA and its Board approved over \$19 million in change orders to the AFC Contract. Therefore, if the original contract had allotted \$19 million to the reserve contained in line item O1, then by the MBTA's reasoning, all of the change orders to the contract would have been at no additional cost to the Authority.

(b) The MBTA's original RFP (CAP 15-94), which contained the specification for tripod gates, was issued in 1994; however it was subsequently withdrawn due to statutory non-compliance. The Authority did not issue another RFP (CAP 35-01) for the design and manufacture of the AFC System until October 19, 2001. At the time of the 2001 RFP, high barrier gate technology

already existed and was in use in several European and Canadian transit systems, as well as in some airports in the United States. Therefore, high barrier gate technology could have been part of the final contract bid specifications, if desired.

Also, the MBTA included in its revised RFP of 2001 an allowance of \$1 million for unspecified spare parts. We believe that S&B's lack of a proven track record within the AFC design and manufacturing field and the lack of due diligence by the MBTA to establish an accurate and comparable listing of anticipated spare parts necessitated that this item be a negotiated line item, rather than a more cost-effective competitively bid item.

(c) The MBTA should have anticipated that a newly designed and manufactured AFC system had to adhere to the specific idiosyncrasies of its unique transportation system, and it would therefore be implicit that the MBTA must be involved in a hands-on inspection of prototype and design inputs at the start of the contract. Ultimately, the additional time needed to create a working prototype was necessary because S&B had never developed a working fare box prior to this contract, and the MBTA was paying S&B for the opportunity to create one.

(d) Any savings attributable to reductions in fare evasions could have been more than the \$2.9 million cited, since actual revenues increased above the MBTA's initial estimate.

2. THE MBTA'S DECISION TO REDUCE CONTRACT PERFORMANCE BONDING REQUIREMENT PUT THE MBTA AT RISK FOR \$37.5 MILLION

The initial RFP for the AFC contract required that the successful bidder obtain a performance bond in the amount of 100% of the contract. However, prior to the submission of the best and final offer bids from S&B and Cubic, the MBTA decided to reduce the performance bond requirements from 100% of the bid price to only 50% of the total bid. Therefore, the performance bond requirement covering this \$75,042,016 contract was reduced to \$37,521,008, and ultimately placed the MBTA at risk if the company selected as the successful bidder failed to complete its obligations under the contract at the stated price.

Requiring a contractor to obtain a performance bond from an insurance company is a means of guaranteeing that all contracted work will be completed in accordance with the contract specifications, and is normally used to ensure the successful completion of both construction

and large procurement contracts. This type of insurance would also cover the MBTA against possible contractor default and failure to meet contract-scheduling milestones.

Our review of the MBTA's RFP for the proposed AFC system indicated that the designed system would contain numerous highly sophisticated software and mechanical elements critical to its overall success. The MBTA was requiring that the selected vendor provide an AFC system for its buses, subways, and ultimately its commuter rail and parking systems that was capable of accepting a variety of fare media, such as cash, credit/debit cards, magnetic ticketing, and "smart card" technology. Necessary equipment would include fare vending machines, bus fare boxes, retail sales machines, and fare gates. These fare-system components would then need to be linked via a proprietary software and computer system in order to properly integrate the AFC throughout the MBTA.

Accordingly, the decision by the MBTA to reduce the amount of insurance required of the bidders is even more perplexing considering the history of previously installed AFC systems by the bidders. Although Cubic had successfully installed fare systems for New York, Los Angeles, Chicago, San Francisco, and Washington, D.C. prior to its MBTA bid, S&B had only provided AFC equipment for several small- to mid-sized transit systems and had never installed an automated bus fare-box. Moreover, both vendors would have to be capable of designing and installing a unique AFC system to meet the specific needs of the MBTA. However, in response to these unique AFC requirements and to the bidders' AFC limitations, the MBTA still chose to reduce the performance bond requirement by 50%.

Sound business practices advocate that management should limit their exposure to risk. In fact the losing bidder, Cubic, claimed that meeting the original performance bond requirements is a standard business practice. However, by reducing the performance bond requirement, the MBTA increased its exposure to risk if the selected bidder failed to successfully design and integrate this new automated fare system at the contracted price.

Recommendation

To limit its exposure to future financial and contractual risk, the MBTA should ensure that all procurement contracts for large and complex tasks such as the AFC system be required to have 100% performance bonding coverage provided by all selected bidders.

Auditee's Response

The Authority made the decision to reduce the performance bond to 50% after Scheidt and Bachmann, Inc. requested the bond be reduced to 10%. This decision, did in fact, put the Authority at risk for 50% of the contract value, however, this was an instance of managing risk to save money. As we approach contract closeout, none of the bond has been required and the amount far exceeds estimated closeout costs.

Prior to 9/11, the Authority typically required 100% Performance Bonds. These bonds are significant cost drivers that affect bid submissions during the RFP process. Following 9/11, the bonding industry experienced a level of volatility that caused prices to skyrocket and the availability of bonds was very tight. Since that time, the Authority has never required more than 50% on material-based procurements, and it often goes lower depending on the type of work and risks to the MBTA. It has always been the standard practice for the Authority to require 100% performance bond in public works construction contracts. The Federal Transit Administration does not require performance bonds in transit management solicitations and other non-construction contracts and discourages unnecessary bonding because it increases the cost of the contract and restricts competition, particularly by disadvantaged business enterprises. Bonding companies exercise their discretion and assure their profits primarily by declining to undertake excessive risks. Consequently, many bidders have limited "bonding capacity." Unnecessary performance bonds reduce their ability to bid on bonded work. Small businesses with short histories may have particular difficulty obtaining a bond. The Federal Transit Administration has stated, "It is the responsibility of each transit agency to assess the risks involved in any given procurement and carefully balance those risks against the cost and competitive impacts of bonding requirements." The Request For Change from Scheidt & Bachman was given serious consideration and granted, although not to the level requested. Within public procurement, generally, performance bonds are deemed anti-competitive. The Federal Transit Administration demands full and open competition for all procurements and objects to unnecessary bonding requirements.

Finally, Section C10.01B of FC No. 640 requires specific achievements in the form of Milestones that must be completed before any money is released by the project. Due to this contract requirement, the MBTA has never been 100% exposed.

Auditor's Reply

The two bidders for the AFC procurement were large corporations with established business histories that should have been able to acquire 100% performance bonding for this procurement. Moreover, S&B's inability or reluctance to obtain this contract bond insurance would seem to have been a reason for the MBTA to be concerned about S&B's viability to successfully complete this project. Ultimately, as the Authority has acknowledged, the decision to reduce this bonding requirement did place the Authority at risk for 50% of the contract value of \$37.5 million in the hopes of saving a fraction of this amount.

3. THE MBTA UNJUSTLY REDUCED AFC SYSTEM CONTRACTOR'S WARRANTY REPAIR AND MAINTENANCE OBLIGATION BY \$2.5 MILLION

The proposed AFC system for which the MBTA solicited bids was designed to incorporate both pre-existing fare collection technologies and new equipment, with the new technologies to be developed by the successful bidder. Accordingly, the bid proposals were evaluated on technical quality as well as price.

To protect themselves from the vagaries of newly developed and modified equipment, the MBTA prudently asked the bidders to provide pricing on both a basic one-year warranty and an additional extended two-year warranty period. These warranties were designed to cover the parts and labor required to maintain and repair the fare vending machines, fare gates, fare boxes, fare media, computer/software, and other equipment that would comprise this proprietary AFC system. Subsequently, the MBTA reconsidered the need for the extended two-year warranty, and instructed the bidders that only a one-year warranty requirement would be included in the bid evaluations. The minimum one-year warranty requirement was prudent, considering that the successful bidder, S&B, had no track record of designing and installing a working fare box for buses.

On February 15, 2002 S&B, the awarded AFC contractor, submitted a bid of \$2,549,456 for the basic warranty, which, according to Specification No. AFC-001:

. . . shall include all preventive corrective service, excluding repair of vandalized equipment. During the warranty/service period the contractor shall be responsible for all maintenance of the system, including full time, on site support service and support personnel, field warranty troubleshooting and remediation.

On August 24, 2005, the MBTA authorized Change Order No. 10 to the AFC contract, which adversely affected the hardware repair portion of the warranty. Prior to Change Order No. 10, the basic one-year warranty period began upon the MBTA's acceptance of the installed hardware devices (e.g., fare vending machines, fare gates, fare boxes) and successful completion of a Revenue Service Test (RST). According to the original contract specifications, an RST was to be performed upon delivery and installation of the AFC system to verify that the AFC equipment satisfies MBTA requirements for reliability, system accuracy, and maintainability. The basic warranty would then expire one year from this RST and acceptance date.

However, Change Order No. 10 redefined the basic warranty coverage into three separate categories: hardware repair, hardware design, and software. The change order amended the hardware repair warranty for the bus system by changing the start date from the date of installation and acceptance of RST, as originally specified. Instead, the warranty period now commences upon the delivery of equipment, and expires when (a) the RST on the new fare boxes are successfully completed and (b) 75% of the fare boxes are installed and verified as functionally operational. As a result of this modification to the basic warranty, the MBTA agreed to reduce the one-year warranty period for approximately 1,200 fare boxes to a period of one to six months (the installation period for fare boxes), leaving the remaining 400 fare boxes uncovered under the hardware repair warranty. In addition, for other critical components of the AFC system, the MBTA agreed to adjust the warranty period to commence upon delivery of the equipment and to expire either when the RST for that type of equipment was successfully completed or when 50-70% of certain equipment was delivered to the MBTA, as shown below:

Equipment Type	Delivered
Fare Vending Machines (Full Service)	50%
Fare Vending Machines (Credit/Debit)	60%
Fare Gates	70%

Because this portion of the warranty would now be based on delivery, rather than installation, Change Order No. 10 waived the coverage period of the basic one-year warranty to expire upon delivery of the equipment, and not one year after this equipment was installed, inspected, accepted and in operation within the AFC system. In effect, the MBTA allowed this equipment to have no warranty from the manufacturer.

Furthermore, Change Order No. 10 reduced S&B's responsibilities to provide, at its expense, warranty personnel to troubleshoot and perform maintenance up to 30 days after equipment had been installed. Thereafter, the MBTA was deemed responsible for this first line of maintenance to malfunctioning equipment.

Sound business practices advocate that procurements of new technologies and proprietary equipment should not be exposed to the risk of open-ended repair and maintenance costs. Ultimately, Change Order No. 10 left the \$75 million procurement of AFC equipment with a limited and reduced hardware repair warranty. It reduced the time of the warranty, and also

unjustly reduced S&B's contractual obligation by \$2.5 million, which was its original bid for the basic warranty line item.

The MBTA position was that Change Order No. 10 would provide a more robust, time-phased warranty and expedite the AFC conversion of the Blue Line. Although the negotiated change order did increase the design and software warranties, it reduced the crucial mechanical repair and maintenance warranty for this proprietary fare equipment and extended the project completion date by four months (to December 31, 2006). The MBTA felt that this change to the warranty was prudent, since the AFC equipment had undergone extensive review and testing (functional, cycling, environmental, voltage, compatibility, and simulated) prior to the installation. However, although the agreed-upon extension of the warranty for the AFC design and software was a positive change to the contract, its benefit was far outweighed by the additional risks and costs associated with a limited and reduced repair and maintenance warranty. The net effect of this contract change served to enrich the contractor while at the same time adding to the maintenance and repair costs of the MBTA.

Effective April 22, 2008 the maintenance and repair responsibilities for AFC fare-boxes and gates passed from the contractor to the Authority. MBTA maintenance and repair records for the AFC system indicate that during the period from April 22, 2008 to December 22, 2008 the Authority paid approximately \$606,000 in labor and materials for repairs to AFC equipment that would otherwise have been the responsibility of the contractor under the original terms of the procurement contract.

Recommendation

To protect its investment in future proprietary equipment procurements, the MBTA should ensure that a basic warranty of at least one year is required from contractors and that the cost benefits of obtaining an extended warranty are thoroughly evaluated.

Auditee's Response

Neither MBTA nor S&B were unduly enriched or unjustly compensated for the overall warranty restructuring as agreed to in Change Order #10, which had no cost impact on the value of the contract. The original value of S&B's contractual obligation was not reduced by \$2.5 million.

In August 2005, the MBTA successfully negotiated an agreement with Scheidt & Bachmann on Change Order #10 which restructured the maintenance and warranty

provisions in a way that augmented the overall coverage of each new device type and the AFC System as a whole. This change order also accelerated the first delivery date and extended the final installation acceptance date from the agreed upon contract schedule.

From the time of the first installation of fare gates and vending machines for the Blue Line in May 2005, through the settling period of the last installation of fareboxes and subway equipment in December 2006, every piece of equipment was under full design warranty coverage for any hardware or software defects.

In consideration for extending the contractual delivery and installation period from one year to 20 months (May 2005 – December 2006), the parties agreed to an offsetting reduction in the field maintenance & preventive maintenance that S&B would provide. After review and advice from consultant and legal resources, the MBTA determined it would be more beneficial and provide greater risk protection to have longer-term design defect coverage in lieu of shorter term cleaning and corrective maintenance coverage. The conclusion was reached after analysis of the detailed costs associated with the obligated provisions as outlined in the contract, and upon legal advice regarding the warranty coverage that the MBTA would remain entitled to receive.

The following synopsis of tradeoffs in Change Order #10 were evaluated and determined to be reasonable, fair and equitable:

- *Acceleration of Blue Line Implementation*
- *Extended Hardware and Software Design Warranty Timeframe*
- *Extended Technical Field Support (2nd level Maintenance)*
- *Extended Helpdesk Support (Tracking and Troubleshooting systemic errors)*
- *Increased Workbench Support for Garage and Money Room Equipment*
- *Common End of Warranty – Rail and Bus System separate*
- *Reduced Contractor Supplied Field Maintenance Services*
- *Transition 1st Level Field Maintenance to MBTA after 30-Day Settling Period*
- *Reduced Equipment Reliability Thresholds (MCBF metrics)*
- *Set Device-specific Revenue Service Test parameters which allow transfer of Workbench maintenance responsibility to MBTA*

Auditor's Reply

Contrary to the MBTA's assertions, its decision to amend the basic repair and maintenance portion of the contract did indeed unjustly reward the contractor by \$2.5 million, which was the bid amount for the one-year warranty. The MBTA incorrectly contends that enhanced warranty coverage for failure of parts due to design defects somehow offset the contractor's reduced responsibilities under the contract. As the MBTA previously stated in its responses to this report, the contract was extended by over one year in order to ensure that a working, defective-free prototype would be developed to the satisfaction of the MBTA prior to commencement of full production. Therefore, by the end of this exacting design and testing stage, the urgency of acquiring additional protection against design defects should not have been an issue. If the

designed items were approved and tested properly, then risk would be minimal. In fact, greater savings would have been obtained through the one-year maintenance and repair coverage than was contained in the original contract.

As for the specific “tradeoffs” in Change Order No. 10 that the MBTA claims were evaluated and determined to be reasonable, fair, and equitable, we note the following observations:

- **Acceleration of Blue Line Implementation:** Any fast tracking of the installation of this equipment would have increased the MBTA’s contract costs, since the actual installation work was done under a separate construction contract and would have created a change order to accelerate the work schedule at no cost to S&B.
- **Extended Hardware and Software Design Warranty Timeframe:** This represents no cost item to S&B and a “no benefit” item to the MBTA, since prior change orders for enhanced design work and component testing reduces the chance of hardware and software component design flaws to zero at this point.
- **Extended Technical Field Support (2nd level maintenance):** This represents telephone assistance to MBTA maintenance personnel and is not a cost item to S& B.
- **Extended Help-Desk Support:** This represents telephone support for computer system troubleshooting and should be of minimal use to the MBTA since software was upgraded and enhanced through prior change orders.
- **Increased Work Bench Support:** This consists of telephone assistance only, and is a minimal cost since MBTA personnel complete all workbench repairs.
- **Common End of Warranty:** This is of no benefit to the MBTA and no cost to S&B since the real value of the warranty for hardware failures and maintenance are sole responsibility of the MBTA.
- **Reduced Contractor Field Maintenance:** This represents a savings to S&B and an increased cost to the MBTA.
- **Transition First Level Field Maintenance:** This represents accelerated and increased costs to the MBTA and a cost savings to S&B.
- **Reduced Equipment Reliability Thresholds:** This accelerates shifting of maintenance costs to the MBTA and results in cost savings to S&B.
- **Set Device Specific Revenue Test Parameters:** This represents increased costs to the MBTA and reduced costs to S&B since reliability test parameters were decreased and the timeline for shifting maintenance to the MBTA was accelerated.