

December 29, 2006  
AUD 07-076

# An Internal Audit Report by the Office of Auditor General On

## Review of Issues and Concerns on Alstom Rail Car Contracts

The objectives of our audit are to ascertain the contract issues and concerns that have arisen to evaluate what happened, why it happened, what the current status of the contracts are, what can be learned from these issues/concerns and make recommendations for improvement for current and future procurements.

In reviewing these contracts, we reviewed the award of the contracts, contract administration, financial issues, and performance on the contracts. Overall project management, quality issues, current status (time and budget), issues/concerns identified on the contract pertaining to Contractor performance, Subcontractor's performance and Consultant performance as well as lessons learned from the contracts that can be used to improve performance/administration/oversight of the contracts.

Our review of the issues and concerns on the Alstom Rail Car Contracts resulted in 48 issues of concern which we have summarized in our report.

The major issues of concern are:

- The 2000/3000 series rail car production schedule originally anticipated acceptance of the final car in November 2005. The current schedule estimates final car acceptance by WMATA in December 2007; 24 months behind schedule as a result of production being halted on several occasions over the course of the program.
- The 6000 series rail car production schedule estimated a completion of May 2006 for the base order of 62 cars. The expected completion date for the option cars is September 2007. The scheduled completion date for the project remains September 2007. However, this is considered to be no longer attainable and the schedule is being reevaluated. The current projection is for the project to be completed 3-4 months late.
- The Contractors, Subcontractors and WMATA Personnel do not appear to be working as a team. There is a lack of coordination within WMATA.
- Identification of a problem with a rail car concerning quality or technical issues creates a lengthy process for resolution resulting in delays to the production schedule.
- There have been several design and engineering issues with the 2000/3000 Series Rail Car Rehabilitation including the remanufacture of the trucks, Air Compressors, Doors, Automatic Train Control, Propulsion and Traction Motors.
- WMATA staff reports and Alstom representatives confirm that there have been significant issues regarding parts availability for Warranty and repair work at WMATA.
- Issues to date with the 6000 Series rail cars include the center pin, design of the HVAC system, car leveling valve and On-site warranty.
- Repair parts are not onsite at WMATA and cars are not being accepted or progressing through testing as a result of the shortage.
- We have made 42 recommendations for improvements for the current contracts and for future procurements.
- The Program Office, in coordination with the Chief Engineer Vehicles, provided a preliminary plan for action on each recommendation included in the report and has begun working towards implementation of the recommendations for these and future Railcar Procurement Contracts.

# M E M O R A N D U M

**SUBJECT: Review of Issues and Concerns  
On Alstom Railcar Contracts**

**DATE: December 29, 2006**

**FROM: AUDT – James C. Stewart**

**IN REPLY**

**REFER TO: AUD 07-076**

**TO: GMGR – Jack Requa**

## **Background**

Contract FK0154 for the rehabilitation of 364 2000/3000 Series railcars manufactured by Breda Construzione Ferroviarie (Breda) in the 1980's was awarded to Alstom Transportation, Inc. (Alstom) on December 19, 2000 in the amount of \$361,322,938. The rehabilitation of the railcars is expected to extend their useful life for an additional 20 years, increase subsystems reliability, and consequently, railcar reliability; improve passenger amenities, improve maintainability; facilitate procurement of replacement parts; improve operability and reduce time to correct mainline failures. The scope of the 2000/3000 Series railcar rehabilitation includes work in the areas of propulsion, brake, door controls, signs, interior, truck, heating, ventilation and air conditioning, lighting, communications, high voltage and control cables systems and equipment.

The first 2000/3000 Series railcar prototype married pair (railcar numbers 3114 and 3115) was completed and began static function testing in September 2002. The cars were delivered to WMATA (the Authority) on November 23, 2002 and conditionally accepted on October 3, 2003. The second prototype married pair (railcar numbers 2012 and 2013) was delivered on December 23, 2002 and accepted on October 10, 2003.

The first production 2000/3000 Series railcar married pair was accepted on November 21, 2003. As of November 16, 2006, WMATA has accepted 212 of the rehabilitated vehicles for service. Twenty-four cars are at the Alstom Manufacturing Plant in Hornell, NY undergoing final assembly and 12 vehicles are at the Alexandria Yard for Testing. The remaining 116 railcars are awaiting entry into the rehabilitation program.

The 2000/3000 Series railcar production schedule originally anticipated acceptance of the final railcar in November 2005. The current schedule estimates final railcar acceptance by WMATA in December 2007; 24 months behind schedule as a result of production being halted on several occasions over the course of the program.

The budget for the 2000/3000 Series railcar rehabilitation is \$381,598,700. A review of the WMATA October 31, 2006 Project Management Oversight Contractor (PMOC) Report, revealed that it is anticipated that the 2000/3000 Series railcar rehabilitation will be over budget by approximately 5% primarily due to increased WMATA internal and consulting costs as a result of longer than expected project duration. The \$16.0M contingency originally budgeted has been allocated for Contract modifications (\$11.3M)

and Consulting and Project Management Costs (\$4.7M). Modifications issued to date total \$10.6M in addition to the 3 options totaling \$11.9M for a total contract modifications of \$22.5M (Attachment 1). 70 change orders have been negotiated which require finalization and additional funding totaling \$8.0M (Attachment 2). In addition, there are 24 proposals submitted totaling \$2.6M which were negotiated in December 2006 (Attachment 3). Funding approval will be required by the WMATA Board of Directors. It is unknown when the additional funding will be requested.

As of October 31, 2006, 69.1% of the funds have been expended for the 2000/3000 Series railcar program including expenditures for vehicle rehabilitation including spare parts, consulting, equipment, force account and program management.

The Washington Metropolitan Area Transit Authority established the 6000 Series railcar procurement in April 2001 to increase its overall railcar fleet size to support existing system expansion and rapid growth of Metro Rail rider ship. Contract TC6000 was awarded to Alstom Transportation, Inc. (Alstom) on July 16, 2002 in the amount of \$129,291,458 for the design and manufacture of a base order of 62 railcars. The contract options were exercised for 120 additional railcars on November 14, 2004 in the amount of \$187,184,272 as part of the Metro Matters program. Two additional railcars are being provided by the manufacturer as a result of negotiations with Alstom for a total of 184 6000 Series railcars.

The 6000 Series railcar production schedule estimated a completion of May 2006 for the base order of 62 cars. The expected completion date for the option cars is September 2007. The scheduled completion date for the project remains September 2007. However, this is considered to be no longer attainable and the schedule is being reevaluated. The current projection by the WMATA Program Manager is for the overall project to be completed 3-4 months late.

Design of the 6000 Series railcar was completed on August 20, 2003 and the First Article Acceptance provided by WMATA on August 30, 2005. The first married pair (railcar numbers 6000 and 6001) was conditionally accepted on September 15, 2006 and entered revenue service on September 19, 2006.

As of November 16, 2006, 48 6000 Series railcars have been completed and have been delivered to WMATA. Twenty-two of the railcars are in revenue service, 26 are undergoing Acceptance testing and 6 railcars are in Hornell, NY awaiting delivery.

The original schedule called for the Prototype cars to be delivered in May 2005 with acceptance of the railcar in October 2005. However the railcars were not actually delivered to WMATA until September 2005. It was then anticipated that the pilot cars would be accepted in January 2006 based on the original schedule. However, the first married pair was not conditionally accepted until September 15, 2006. Alstom has continued production of the 6000 Series railcars.

The original budget for the 6000 Series railcar program is \$377,680,000 with a contingency in the amount of \$11,830,000. Approximately \$1.5M has been moved from

Contingency to Program Management due to a change in policy for the distribution of WMATA's internal overhead costs. A further refinement in the amount of \$2.4M occurred in September 2005 for additional internal overhead costs and Professional Services/Outside Engineering Costs. Contingency available as of October 31, 2006 was \$7,659,400. Modifications to the 6000 Series contract total 12 to date. The 6000 Series project is still early in the production process. There have not been many contract modifications. There is the potential for an increase in modifications as the project progresses.

As of October 31, 2006, 28.9% of the funds have been expended for the 6000 Series railcar program. Funds expended include costs for Vehicles, Consulting, Equipment, Force Account and Program Management.

Booz Allen Hamilton (BAH) is providing Program and Engineering Support for the 2000/3000 and 6000 Series Railcar Programs. They also provided the same service for the 5000 Series railcars that were manufactured by another Contractor. Their scope of work includes oversight and reviews of the work being performed by Alstom in Hornell, NY and Barcelona, Spain; determining if the contractor is meeting the contract requirements and complying with industry practice and making recommendations to WMATA; document control; quality control; contract management; and assisting with finding engineering solutions. Current task order authorization to BAH for the 2000/3000 and 6000 Series railcar programs are \$22.0M and \$15.6M respectively. Expenditures to date total \$18.8M for the 2000/3000 Series program and \$13.2M for the 6000 Series program.

### **Executive Summary**

Contract FK0154 for the rehabilitation of the 2000/3000 Series railcars and contract TC6000 for the procurement of the 6000 Series railcars were awarded to Alstom Transportation Inc by the Washington Metropolitan Area Transit Authority (WMATA or Authority) on December 19, 2000 and July 16, 2002 respectively.

The objectives of our audit are to ascertain the contract issues and concerns that have arisen to evaluate what happened, why it happened, what the current status of the contracts are, what can be learned from these issues/concerns and make recommendations for improvement for current and future procurements.

In reviewing these contracts, we reviewed the award of the contracts, contract administration, financial issues, and performance on the contracts. Overall project management, quality issues, current status (time and budget), issues/concerns identified on the contract pertaining to Contractor performance, Subcontractor's performance and Consultant performance as well as lessons learned from the contracts that can be used to improve performance/administration/oversight of the contracts.

We discussed the performance issues on these contracts with WMATA's contract administration staff, program management, WMATA rail operating employees, contractor program management, subcontractor representatives and consultants.

Our review of the issues and concerns on the Alstom Railcar Contracts resulted in 47 issues of concern which we have summarized in our report.

The major issues of concern are:

- The 2000/3000 Series railcar production schedule originally anticipated acceptance of the final railcar in November 2005. The current schedule estimates final railcar acceptance by WMATA in December 2007; 24 months behind schedule as a result of production being halted on several occasions over the course of the program.
- The 6000 Series railcar production schedule estimated a completion of May 2006 for the base order of 62 cars. The expected completion date for the option cars is September 2007. The scheduled completion date for the project remains September 2007. However, this is considered to be no longer attainable and the schedule is being reevaluated. The current projection by the WMATA Program Manager is for the overall project to be completed 3-4 months late.
- Change order issues have not been processed timely.
- The Contractors, Subcontractors and WMATA Personnel do not appear to be working as a team. There is a lack of coordination within WMATA.
- WMATA appears to lack internal communications and has not fully identified all of the stake holders on the Programs. Alstom reports they are not always sure who is in charge of the Programs and there is the appearance that the Program Office does not yet have the control in place to effectively manage the program.
- WMATA needs to provide clear focus to the Contractor and the organization needs to better coordinate between the Program Office and Railcar Maintenance.
- Identification of a problem with a railcar concerning quality or technical issues creates a lengthy process for resolution resulting in delays to the production schedule. The BAH Project Manager and Inspectors on-site in Hornell, NY also reported that this process is too long and needs to be addressed.
- There have been several issues with the production of the 2000/3000 Series railcars as a result of remanufacturing design and engineering issues and the original design of the Breda 2000/3000 Series railcars.
- The Program Office's Quality Assurance function reports that the contractor and subcontractors have been responsive in following up on Quality Audit Findings and Recommendations. However, there is no formal follow up by the Program

Office's Quality Assurance function to ensure that all of their findings and recommendations have been addressed.

- In June 2005, an Expert Review of the 2000/3000 Series Railcar Vehicle Procurement Program Quality Assurance was conducted to investigate and report to WMATA on the correlation, if any, between the quality activities being implemented and the reliability performance of the 2000/3000 vehicle fleets. The report had 16 findings with recommendations for the processes in Hornell, NY and 10 findings and recommendations for the processes at Alstom Signaling in Rochester, NY.

Findings at Alstom's Hornell, NY Facility were in the areas of Personnel, Quality, Inspections, Supplier Control Problems and Alstom Supplier Oversight. Findings at the Alstom Signaling Facility in Rochester, NY were in the areas of Personnel, WMATA's Software Specification, Alstom's Software Quality Assurance Plan, and lack of Software Quality Audits.

- WMATA/BAH on-site inspection activities on the 2000/3000 Series railcars contract were significantly reduced by the former WMATA Program Manager on January 20, 2004.
- According to BAH representatives, there is no accountability anywhere on the production line. The majority of their write ups are repeaters. For example: cleanliness or housekeeping. Metal shavings are regularly found throughout the railcars during inspection. There appears to be no responsibility for correcting the issues on the production line and the Alstom Quality Assurance personnel do not have the power to enforce changes.
- There have been several design and engineering issues with the 2000/3000 Series Railcar Rehabilitation including the remanufacture of the trucks, Air Compressors, Doors, Automatic Train Control, Propulsion and Traction Motors.

The most serious of the design and engineering issues is the remanufacturing of the trucks. As a result, cars are being delivered out of tolerance. Issues arising from the remanufactured trucks include the chevrons, lateral bumper clearance, uneven wheel wear, the traction motor resilient mount and the brake caliper studs.

Premature settling of the chevrons is one of the major issues with the rehabilitated 2000/3000 Series railcars.

- WMATA staff reports and Alstom representatives confirm that there have been significant issues regarding parts availability for Warranty and repair work at the WMATA facilities.
- Alstom has also experienced problems with their supply of production parts. The BAH Inspectors reported that often a railcar will be inspected with a missing part that will be installed at a later time and re-inspected for the missing part. In

addition, the line is often shut down due to the lack of parts.

- Contractor warranty support personnel have not been available to research and address problems with the design and manufacture of the railcars as problems are being identified during testing and revenue service on both contracts.
- The First Article Inspection on the 6000 Series pilot railcars took place in Hornell, NY between August 16 and 18, 2005. According to the Program Manager, at the completion of the Inspection Process, the FAI documents were signed by all the parties and accordingly a punch list of approximately 58 items was developed. It took approximately three months to resolve the punch list items to determine if they should be waived or a correction was required.
- A review of the FAI documentation provided by the WMATA Program Office showed that the FAI documentation was signed off on by all parties by September 7, 2005. Included with the documentation was a list of issues found during FAI which included 349 items. At the time of document approval, 13 of the items remained open.
- Recurring Quality Issues has resulted in only 30 of the railcars having been conditionally accepted as of December 4, 2006. Twenty railcars are currently at Greenbelt Yard unaccepted, 8 more than the contract allows for.
- The Quality Assessment of the Acceptance Process on the 6000 Series railcars completed in early November 2006 resulted in 33 findings which included observations and Corrective Action Required for the Program (8), the Engineering Consultant (6), and the Contractor (7) and in the area of Documentation (12).
- According to railcar availability reports reviewed, 20 of the 26 railcars conditionally accepted were available for use in revenue service on December 1, 2006. Three days later 30 railcars had been conditionally accepted but only 12 were available for service. Issues with the 18 railcars unavailable for service included Flashing Motor Overload, a ruptured airbag, a dark railcar repeater, adjustments required to the air compressor; broken power cable brackets and 2 pairs were in revenue preparation.
- Issues to date with the 6000 Series railcars include the center pin, design of the HVAC system, railcar leveling valve and On-site warranty. The Program Office reported the first 12 cars delivered to the Authority had good performance. However, the problem with the center pin delayed conditional acceptance.
- In February 2006, WMATA inspectors observed 16 loose center pins with unusual heat markings. The observation was recorded and an investigation by Alstom was requested. The root cause was found to be Hydrogen-assisted cold cracking caused by:
  - 1) Residual stress – stiffening ring joint design is constrained;

- 2) Improper execution of weld process in Barcelona; and
  - 3) Bad material – material properties of some raw material was not to specification. Once the root cause of the center pin issue had been identified; engineering solutions were developed for both an interim repair to continue pre-revenue testing of 8 cars already on site at WMATA and a permanent repair for acceptance of the cars.
- Repair parts are not onsite at WMATA and railcars are not being accepted or progressing through testing at an acceptable rate as a result of the shortage.

On December 27, 2006, the 6000 Series Program manager sent a letter to Alstom's program manager pertaining to Suspension of Deliveries to Greenbelt of 6000 Series railcars.

Several concerns were raised pertaining to the acceptability of the 6000 Series railcars in the following areas:

- Warranty/Reliability Program
- Technical Issue Resolutions and FMIs
- Contractual and Provisional Spare Parts
- Open Acceptance Issues
- Failed cars in Acceptance Program
- Unaccepted Cars on Site
- Warranty Spares and Subcontractor Support

**The letter concluded by stating that In order to give the 6000 team an opportunity to resolve these issues, the program office will suspend the delivery of new cars from Hornell, NY after the arrival of the 60<sup>th</sup> railcar until further notice.** WMATA requests that ALSTOM program management personnel be available to meet in Washington, DC the week of January 1<sup>st</sup> to develop a joint, project-level action plan to elevate performance to acceptable levels. In addition, an executive partnering meeting will be scheduled for January 19<sup>th</sup> at Alstom's headquarters in New York City to present the project recovery plan and schedule to upper management personnel.

There are 42 recommendations for improvements for the current contracts and for future procurements.

### Objectives and Scope

The objectives of our audit are to ascertain the contract issues and concerns that have arisen to evaluate what happened, why it happened, what the current status of the contracts are, what can be learned from these issues/concerns and make recommendations for improvement for current and future procurements.

In reviewing these contracts, we reviewed the award of the contracts, contract administration, financial issues, and performance on the contracts. Overall project



management, quality issues, current status (time and budget), issues/concerns identified on the contract pertaining to Contractor performance, Subcontractor's performance and Consultant performance as well as lessons learned from the contracts that can be used to improve performance/administration/oversight of the contracts.

We discussed the performance issues on these contracts with WMATA's contract administration staff, program management, WMATA rail operating employees, contractor program management, subcontractor representatives and consultants.

### **Contract Administration**

The Alstom Program Managers for both the 2000/3000 and 6000 Series Railcar Programs reported that WMATA has not followed the contract with regard to Change Orders, Payments and Warranty Used Parts. In our discussion, the Alstom Program Managers reported that they have been asked to do work or make a change verbally and then told by WMATA to submit a proposal for the work, payments have not been made on time and with held for additional work and the Program Office is adding language to the contract that does not exist with respect to Warranty Used Parts.

The 2000/3000 Series contract had a backlog of 160 requests for change; 100 were found to have merit with the biggest change orders to the contract being wiring; the change from 50% new wheels to 100% and new glass rather than the use of existing glass on the railcar. WMATA Railcar Maintenance had stopped replacing the damaged glass on the railcars when the program began. To resolve the backlog of change orders for the 2000/3000 Series railcar program, WMATA formed a team headed by Office of Procurement (PRMT) which included representatives from PRMT, the Program Office and Consultants. The Office of the Auditor General coordinated with the team providing audit assistance on the change orders. Negotiations are complete on all but 13 of the change orders which were returned to Alstom for additional information. Negotiations are ongoing for change orders and are expected to be completed for Board action in early 2007.

**A representative of Railcar Maintenances states that many of the vehicles had Plexiglas, rather than safety glass and required changing during this rehab program. As the program continued, it was determined that the original scope of replacement was not properly identified and under estimated in the original contract. That is the reason for the change order, not because CMNT stopped replacing damaged glass on vehicles.**

During our interviews of the Alstom Program Managers in July 2006, they also provided examples of this on the 6000 Series railcar program. The first was WMATA's change to solid side bearings on the railcars. WMATA requested Alstom to complete the work and make the change in July 2004. The final proposal for this work was submitted by Alstom in April 2006 but they had still not received a final negotiated change order at the time of our interviews. According to Alstom, WMATA Engineers informed them that they knew about this issue at the First Article Inspection (FAI). However; the final FAI was in January 2004 and Alstom was not told that it was a required change until July 2004.

When additional information was requested from the WMATA Program Office regarding this issue by the Office of the Auditor General in October 2006, we were informed that the work is being performed by Alstom. The change order will be included in a comprehensive contract modification. The amount of the change order has not been negotiated at this time. The Contracting Officer confirmed that this was a directed change and that it had been resolved except for the amount of the change.

A second issue on the 6000 Series railcar contract is Modification No. 008 for the left hand microphone. To add this equipment to the railcar, Alstom requested a slight schedule modification for time and weight (12 lbs). The Program Office to date has disagreed with the additional weight on the railcar and additional time requested. Additional information was requested from the Program Office and we were informed that Alstom requested an additional weight of 25 pounds and that as part of Contract Modification No. 010, the contract weight limit on the railcar was increased to 157,250 pounds per married pair. Based on data collected by the program office, the 10 cars delivered to date were generally within contract requirements and that no additional weight allowance was necessary. The Program Office also reported that Alstom had requested an additional 5 days as a result of this change. As of the request for information from the Program Office, Alstom had not provided any justification for the change in contract delivery schedule. It is WMATA's position that the specification changes made in Modification No. 008 had no impact on the production schedule and therefore, did not adjust the contract delivery dates. Adjustments were made to Alstom's proposed rates by WMATA's negotiators to reflect the results of the contract audit report recommendations.

Modification No. 008 was prepared and sent to Alstom on September 30, 2005. To date Alstom has not agreed to or signed Modification No. 008. In January 2006, Alstom sent a letter (Letter No. AL6.WM6.3570.L) to the Program Manager requesting WMATA to reconsider its position. During the week of November 27, 2006, the Authority offered to adjust the modification to include 20 pounds and 5 days for the microphone. Alstom is currently considering the offer.

The General Provision (GP 1-2) of both railcar contracts states that changes can be submitted in writing to the contractor at any time by the Contracting Officer. Further, if the changes cause an increase or decrease in the cost or the time required for performance, the WMATA Contracting Officer shall make an equitable adjustment in the Contract price, the delivery schedule or both, and shall modify the contract. The Contractor (Alstom) must assert its right to an adjustment within 30 days from the date of receipt of the written order. There is no provision in the contract for the length of time change orders and modifications will be resolved.

Another contract issue raised by Alstom program management was their claim that payments have not been made per the contract. They stated that payments appear to be withheld to force them to do work that may or may not be in the contract and are used as leverage by the Program Office. They also stated that payments are not made within 30 days per the contract. At the time this was only an issue with the 2000/3000 Series Railcar Program. The 6000 Series Program was not an issue since production had been

stopped due to the Center Pin Issue.

Item 8 of the General Provisions of both contracts specify that Payment will be made upon submission of proper invoices or vouchers, the prices stipulated herein for supplies delivered and accepted or services rendered and accepted, fewer deductions, if any as specified. Special Provision 5 of the contract specifies the payment Milestones and Special Provision 6 of the contract states *“Payment will be made on a monthly basis of all properly completed invoices.”* There were no references to payments within thirty days in the contract.

During our discussions with the Program Office in July 2006, they informed us that payments were being withheld for reliability issues on the 2000/3000 Series railcars. At the time, the Program Office was also working on a plan to restructure the 2000/3000 Series railcar milestone payments. In accordance with the contract, Alstom is paid \$478,000 to deliver a railcar and an additional \$118,000 upon conditional acceptance. The payment restructuring proposed would provide \$278,000 upon delivery of a railcar and an additional \$100,000 payment once the railcar passes a 60 day monitoring period, \$100,000 for performance and reliability of the cars at 90% and the remaining \$118,000 upon successful completion of the outstanding Field Modification Instructions.

After negotiations between WMATA and Alstom, Modification No. 033 to Contract FK0154 was issued In September 2006 adjusting the milestone payments to a payment of \$378,671 upon delivery of the railcar and upon completion of a “burn-in” test simulating 24 hours of revenue service and conditional acceptance of the railcar an additional payment of \$218,778.

The final contract issue raised by Alstom Program Management is that the Program Office has been adding clauses that do not exist to the 2000/3000 Series railcar contract. The example provided has to do with Use of Warranty Parts on Cars. When a warranty repair is required, Alstom sends new parts from the warehouse and returns repaired parts to the warehouse. Standard industry practice is to rotate parts through the system as the program progresses. WMATA is refusing to allow the use of warranty “used” parts on newly rehabilitated cars. This will become more of an issue as the program progresses, since there are a limited number of parts available for the rehabilitated cars. It is Alstom’s belief that Warranty is per the railcar not per item.

**A representative of CMNT states that the warranty process and warranty parts are not as cut and dry as Alstom would lead the auditor to believe. For example, air compressors. At the very beginning of the contract, WMATA has had a significant number of air compressor failures resulting in the entire fleet (with less than a year and a half service) having all the air compressors installed on the vehicles rebuilt to some level, and in some cases multiple times. In addition, the warranty process is becoming convoluted because of outstanding engineering and quality issues going unresolved. Consequently, Alstom’s belief regarding warranty applying to a vehicle and not a part is belief of escape of contractual responsibility. Another example can, and perhaps will be an up coming issue regarding traction motors. WMATA has removed contract spares from WMATA’s stock which are brand-new**

**components, and have installed them on 2k/3k rehab cars that was according to Alstom at the time “out of warranty.” The defects might be honored as warranty. What condition (new or used) replacement motors will be provided to WMATA?**

We spoke with the Program Office regarding this issue and were informed that they have refused to allow the Warranty Parts returned and repaired to be used on production cars. There is no issue for Alstom to return the repaired warranty parts to WMATA inventory.

The General Provision (GP 1-33) of both contracts covers New Materials. The contracts state that *“Except as to any supplies and components which the Specifications or schedule specifically provides need not be new, the Contractor represents that the supplies and components to be provided under this contract are new (not used or reconditioned, and not of such an age or so deteriorated as to impair their usefulness or safety). If at any time during the performance of this Contract, the Contractor believes...*

To date no approval has been given by the Program Office to use Warranty Used Parts on the production railcars. In instances where inspectors have discovered the use of the parts on production railcars, specifically 4 air compressors that had been reused, WMATA has requested that confirmation that the units would be fully warranted and that there be some commercial compensation for not providing new air compressors as specified. In addition, a complete list of all Warranty Used Parts used in the production cars was requested.

## **WMATA Program Management**

### **Program Management Changes**

WMATA Management has changed during the contract term for both the 2000/3000 and 6000 Series Railcar Programs at the executive and program manager levels. In February 2005, WMATA underwent a reorganization resulting in the Railcar Programs being moved from the Department of Operations to the Division of Planning, Development, Engineering and Construction. This resulted in a change to the Executive Leadership for the program. Program Office management changes were made as a result of the Organization’s restructuring and new Program Managers were assigned to the projects.

On August 25, 2006, WMATA’s Interim General Manager realigned and reorganized the Offices of the Chief Engineer, Vehicles. This action resulted in the Office of the Chief Engineer Vehicles reporting directly to the Chief Operating Officer, Rail rather than the Assistant General Manager of the Department of Chief Engineer/Project Management (formerly the Division of Planning, Development, Engineering and Construction).

The change in program management has been viewed as positive by the Alstom and BAH representatives. However, both companies believe the new Program Management Teams need to be empowered. Alstom further stated during our interviews that, WMATA appears to lack internal communications and has not fully identified all of the stake holders on the Programs. Alstom reports they are not always sure who is in charge of the

Programs and there is the appearance that the Program Office does not yet have the control in place to effectively manage the program.

Booz Allen Hamilton representatives stated that WMATA should provide clear focus to the Contractor and the organization needs to better coordinate between the program office and railcar maintenance. An example provided was the Chevron Issue. Railcar Maintenance (CMNT) was experiencing problems with the Lord Chevron after they were re-designed by the manufacturer. The decision was made by CMNT to stop using the part and resume using Breda Chevrons on the 2000/3000 Series railcars. The Program Office was unaware of the change and the project is now replacing Lord Chevrons installed on the remanufactured cars with Breda Chevrons. Booz Allen Hamilton representatives believe if the information from CMNT had been shared with the Program Office and subsequently with Alstom this would have been an opportunity for a re-design in the early stages of the contract. In addition, WMATA should have coordinated their views with suppliers for best practices on how to install the equipment. If WMATA had shared their experiences, the current technical issues may have been minimized.

**A representative of CMNT states that this issue is very convoluted and apparently presented to the auditor in a very misleading manner. First, the responsibility with engineering design, quality and all aspect of contract adherence is a requirement of the car builder. Car Maintenance is the customer of both Alstom and Program Management. Secondly, Car Maintenance historically has not been invited to early contract preparations and is not privileged to such information such as a vendor and materials selected by the car builder. WMATA is attempting to provide better internal partnering in this area. There is still a big gap. Thirdly, when the symptoms began to develop, further investigation by Car Maintenance was conducted and questions were asked of Program Management and BAH. They both indicated Car Maintenance, and specifically a retired CMNT Supervisor requested to use Lord Chevrons. Car Maintenance challenged that position and produced a document generated by the former Program Manager that provided a waiver to Alstom for qualification testing of the Chevron. The performance of the Lord Chevrons was well known and engineering was well aware of this issue. Vehicle Engineering and Program Engineering are under the direct control of the Chief Engineer. According to CMNT's representative, the letter is carefully worded indicating the wavier was granted because vehicle engineering has approved the Lords' chevrons for WMATA use, and that they are still a qualified vendor.**

**Railcar Maintenance's representative states this is not a CMNT issue; this is an Engineering issue. Redesign and any qualification testing for the Chevrons received a waiver by Program Management. Railcar Maintenance maintains that they shared an extraordinary amount of maintainability expertise and provided substantial resources to Alstom in an effort to help resolve many issues.**

**Our concern is that the process would be better if all parties are involved so that better communication and coordination can occur so that this type of issue can be avoided.**

## Issue Resolution and Development of FMI/EMIs

In our discussions with the Program Management Team at Alstom, we were informed that identification of a problem with a railcar concerning quality or technical issues creates a lengthy process for resolution resulting in delays to the production schedule. When issues are found, it is reasonable to slow down the manufacturing process to avoid increasing the number of railcars with the problem. Upon discovery of a problem, the procedure to resolve the issue is to initiate a detection process to determine the cause of the problem. An engineering solution is then developed to correct the problem which requires approval by the contractor and WMATA and its representatives (consultants). Prototypes are then built, tested and installed in a portion of the railcars and tested. If the solution is acceptable after testing, the entire fleet will be retrofitted and the change will be built into new cars. The BAH Project Manager and Inspectors on-site in Hornell, NY also reported that this process is too long and needs to be addressed.

According to BAH representatives, a clear dispute resolution process needs to be established to elevate issues. It was reported that the previous Program Manager “told” BAH inspectors not to rock the boat or to tell others anything. A process needs to be developed to hear each others’ concerns and resolve issues. Mistrust between the organizations and internal to WMATA has become an issue.

To date, 226 Field Modification Instructions (FMI) and 93 Engineering Modification Instructions (EMI) have been developed for the 2000/3000 Series Railcars. Field Modification Instructions have been required for all of the major subsystems of the Railcar.

The 6000 Series Railcar Program has developed 12 EMIs and 54 FMIs. 3 FMIs are currently under review. According to the Program Office, the length of time required to develop an FMI varies based on what the FMI is correcting. They reported that the turn around time as being from immediately to 3 weeks or longer. EMIs can be completed in 1 to 3 weeks.

We asked the Alstom Transportation Group representatives about the Booz Allen Hamilton inspection support on site in Hornell, NY. They felt that the inspection groups did not show enough urgency in accomplishing inspections and that they should be more closely aligned with WMATA’s Office of Quality Assurance rather than the Program Team. They also felt better control should be exercised over the on site consultants. For example: Alstom Program Management felt that issues from WMATA/BAH inspectors need to be filtered through WMATA Program Management.

**Railcar Maintenance’s representative states that there appears to be a contradiction between Alstom statements. Alstom initially felt that the Inspection group did not show enough urgency in accomplishing the inspections and that it should be closely aligned with WMATA Quality Assurance Department rather than the program team. Then they come back, and their feeling is that the issues from the Inspectors need to be filtered through WMATA Program Management. The two statements are in conflict. The CMNT’s representative believes one of the most**

significant problems WMATA is having from a Quality standpoint in the programs is that Quality Control and Assurance is under the authority and control of Program Management. Program quality should be completely removed from Program Management and realigned directly with the Director of WMATA Quality. The process of quality cannot be directly under the control of those who are driving production, engineering and scheduling because of an inherent conflict of interest. The representative believes if the fundamental business process of this conflict of interest is not corrected immediately, WMATA will not see the necessary quality improvements or expectations in any program.

**We do not consider Alstom's statements to be in conflict. Alstom is stating that they believe the Program issues should be filtered through the WMATA Program Office to ensure consistency and awareness of the proper issues by the WMATA Program Office. They believe that the quality issues should go to WMATA's Office of Quality Assurance rather than the Program Office who might put production goals ahead of quality issues.**

### 2000/3000 Series Railcars

There have been several issues with the 2000/3000 Series railcar project including quality and supply/inventory of parts, reliability and onsite warranty and commissioning. To date the most significant parts issues include the Trucks remanufactured by TTA and the brakes supplied by WABCO. The Office of Railcar Maintenance reports that 95% of the problems with the rehabilitated 2000/3000 Series railcars is quality. They further stated that they recognized performance issues with the cars early in the program in 15 major sub-systems in the cars. In addition, the WMATA Program Office stated that Alstom Program Management has changed several times during the contract term for the 2000/3000 Railcar Rehabilitation Program. Alstom presently has, the fourth management team assigned to the contract which has made the issue of stability problematic.



Inbound WMATA Railcar 3136 for Rehabilitation

### Production Schedule

There have been several issues with the production of the 2000/3000 Series railcars as a result of remanufacturing design and engineering issues and the original design of the Breda 2000/3000 Series railcars.

The first production delay in the program occurred in July 2003 as a result of a delay in

the prototype railcar acceptance. Production resumed in October 2003 upon acceptance of the prototype cars and delivery of production cars to WMATA began. A revised production schedule was prepared by Alstom which was reviewed by WMATA but never accepted.

Production schedule issues for the 2000/3000 Series Railcars are as follows:

1. In April 2004, Alstom began experiencing quality problems with the trucks being rebuilt by its sub-supplier TTA. The lack of acceptable trucks impacted Alstom's ability to achieve full production. In October 2004, the truck problems were resolved and the full production delivery rate of 12 cars per month was achieved by Alstom in November 2004.
2. In January 2005, delivery of cars was again interrupted to complete the retrofit modifications related to Automatic Train Control and brake components. Production resumed in February 2005.
3. In April 2005, a shortage of trucks was again reported to be impacting delivery of remanufactured railcars.
4. In September 2005, WMATA reported that rebuilt pneumatic/hydraulic brake units and air compressors continued to contribute to delays in production delivery.
5. In October 2005, it was discovered that wheels with an incorrect profile were installed on the railcars. An investigation by Alstom and WMATA showed that an incorrect drawing was used by the sub-supplier in ordering the wheels. An action plan was developed by WMATA and Alstom to identify the nonconforming wheels and re-machine them to the correct profile. Railcar deliveries and acceptances resumed in November and December 2005 respectively.
6. The most recent delay in July 2006 was prompted by a problem found on an accepted railcar. The issue cited was a failure of the quality system to detect the incomplete or incorrect application of FMI #079 on railcar number 2022 resulting in a safety hazard. A full inspection of the 194 railcars conditionally accepted resulted in the identification of 16 additional railcars with similar incomplete modifications.
7. Additional issues resulting in the July 2006 suspension of delivery and acceptance included three married pairs being delivered that could not pass the on-site acceptance tests due to thermal overload problems with the propulsion/traction motors; the truck suspension issues identified previously which remained unresolved and the continued deterioration of in-service fleet performance.
8. On August 30, 2006, WMATA resumed conditionally accepting railcars subject to Modification No. 033 which adds a 24 hour "burn-in" test to the current testing and inspection required for conditional acceptance. Production resumed in Hornell, NY on September 8, 2006.
9. Delivery of railcars to WMATA resumed in September 2006 when 8 railcars were delivered, six of which have been accepted. Four railcars were delivered and accepted in October.
10. Alstom's current schedule shows delivery of the final railcar in January 2008. The Program Office expects the date to be extended to June 2008, 30 months behind the original scheduled final railcar delivery of December 2005.





WMATA Railcar 3172 Being Rehabilitated in Hornell,



WMATA Railcar 3134 Being Rehabilitated in Hornell,

## Quality Control

In accordance with Section 1.6 of the Contract Performance Requirements of the Technical Specification *“the contractor is responsible for providing a quality product to the Authority under this contract. To this end the contractor shall have planned and established a quality assurance program which shall be maintained throughout the execution of the contract”*. Plan requirements include design control, materials control, manufacturing and process control, testing, record keeping and quality assurance procedures.

The Quality Assurance Plan for the 2000/3000 Series Railcar Rehabilitation Program dated May 24, 2000 is fully acceptable. In April 2005, WMATA requested an update and submission to PMOC for review. The updated plan was submitted in August 2005 for PMOC comment and a Revised Plan was submitted in March 2006. The PMOC is currently reviewing the plan.

### Quality Audits by Alstom

Alstom has a regular supplier process for Quality Audits which is in place. The Audit process looks at both capacity and quality of the sub-supplier. A schedule of supplier audits dated June 28, 2006 was provided by Alstom Program Management showing the supplier audits that have been completed for the 2000/3000 Series Railcar production. The schedule reviewed included information regarding the last time the sub-supplier was audited, a description of the item produced, the Auditor, Audit Score, sub-supplier rating, Follow-up determination and date and the expiration of the rating. Quality Audits appear to have been conducted on each of the sub-suppliers for the WMATA 2000/3000 Series Railcar Project.

Alstom has had problems with staffing the Quality function. As of our discussions in July 2006, a plan had been developed and staff was slated to be transferred to the program to

be more aggressive and conduct more quality audits. When the staffing is complete, the project will have an assigned Quality Engineer.

### Quality Audits by WMATA Program Quality Assurance

We reviewed 10 Quality Audit Reports prepared by the Quality Manager in the Railcar Program Office which were conducted from the period May 2003 through February 2006.

The Program Office audited Alstom's Hornell, NY facility's Engineering Change Proposal Process in July 2003 to determine if the process was in compliance with the Technical Specifications of the contract. It was found that Alstom's Engineering Change Proposal Procedure was in compliance with the Technical Specifications of the Contract. However, they found discrepancies in the application of the procedures. The discrepancies included:

- 5 engineering change orders to be non compliant with the WMATA Specification and Alstom Procedures;
- The WMATA inspectors office did not have a current drawing list which required them to rely on Alstom Engineering for current information; and
- The railcar history books were not being reviewed by WMATA inspectors. It was recommended by the Quality Auditor that WMATA and Alstom Program Management review the application for Engineering Change Order processing, Alstom investigate periodically updating the master drawing list to WMATA on-site inspectors or allowing access to updated drawing electronic files, WMATA should provide approved drawings to WMATA on-site inspectors and Railcar History books be available to Inspectors for periodic inspection and approval for shipment.

The ATC System Computer Software Maintenance at the WMATA Alexandria Yard was evaluated in November and December 2005 to determine if the contractor's software maintenance practices were in compliance with relevant standards. The quality audit found that Alstom Signaling had the capability to proficiently upgrade and test computer software as required by the technical specifications within the guidelines of IEEE 730 standards. This work is being accomplished through a subcontractor to Alstom Signaling. The recommendations included Alstom Signaling providing a job description identifying the scope of work and responsibilities for the subcontractor and to schedule a quality audit of the subcontractor using the job description as a guideline for compliance since one had not been conducted. It was also recommended that Alstom Signaling provide or identify ESD procedures to be used by the subcontractor.

The Program Office audited TTA's truck overhaul facility in Kanona, NY in May 2003 to assure WMATA's 2000/3000 Series Overhaul Management that the Contractor's overhaul practices were in compliance with the Technical Specifications of the Contract. It was found that TTA had the capabilities to overhaul the Breda Trucks in compliance with the Technical Specifications and TTA had the quality organization to maintain the Quality System. However, several recommendations were made. A concern with the truck float was identified. Due to the delay of final acceptance by WMATA, it was determined that

TTA would run out of trucks to overhaul. They had recently completed the thirty-second railcar set and would not have a float. It was recommended by WMATA Program Office Quality Assurance that this be addressed. The second issue raised was the truck tramming procedures. It was recommended that the procedures and recording of measurements be reviewed by TTA and WMATA Railcar Maintenance. The third recommendation was monitoring of the wheel replacement by UTC. The replacement was at 100% due to WMATA sending worn out wheels when the contract had specified 50% replacement.

In July 2003, TTA's overhaul practice for the Master Controller was audited to assure Program Management that their procedures were in compliance with the Technical Specifications of the contract. The audit team gave a positive assessment of TTA's capability as a supplier. However, the overhaul process was not observed since all of the Master Controllers had been completed and current railcar shipments were on hold. There were no recommendations for improvement as a result of the Quality Audit.

In December 2005, TTA's Hornell, NY Facility was reviewed to assess the manufacturing process control of each build station. The quality audit was conducted to assure WMATA Program Management that the contractor's overhaul practices were in compliance with the Technical Specifications of the contract and the WMATA approved processes or procedures as defined by the First Article Inspection. There were 39 findings in the areas of Management Review, Material Control and Traceability, Documentation, Calibration Control, Non-conformance Material and Training and Personnel.

Fifteen recommendations were made regarding TTA's Hornell, NY facility including maintenance of the management review system, increase of internal audits by Alstom, an increase in the frequency of Alstom's Quality Audits on this supplier and to supply detailed failure reports to TTA on the trucks, an increase in the number of inspectors and providing cross training, prepare written Material and Production Control procedures, development of job descriptions and training requirements, improvements to the Calibration System, update of the procedures to match the build cycle and update and maintain the Production Station Matrix.

In February 2006, the Program Office conducted a follow-up to review the progress on the findings and recommendations from the December 2005 Quality Audit of TTA's Hornell, NY Overhaul Facility.

A summary of the current status of recommendations was as follows:

- In the area of Management Review, progress had been made however changes in Quality left an area of concern in TTA's commitment to Quality being produced.
- The recommendations to increase internal auditing to ensure compliance with process documentation and material compliance in regards to traceability of hardware and components had been implemented and closed.
- The recommendations for Alstom to both increase the frequency of supplier audits and supply detailed failure reports had no response or proof of implementation had not been provided by Alstom.

- TTA was working on increasing the number of inspectors and providing cross-training. However, TTA was placing emphasis on verification and extension of the competency of the inspectors on their current assignments.
- It was noted by the quality auditor that this approach would provide a foundation for more effective cross-training when the opportunity is realized.
- The recommendations regarding Material and Production Control were under review and revision by TTA.
- There was no response or activity shown at the time of the follow-up in the development of job descriptions and training requirements. This item will be revisited on the next Quality Assurance Audit.
- The Calibration System review was assigned to a TTA employee and the system was under review. TTA was also reviewing the build cycle for possible process schedule improvements.

Testori, the interior liner sub-supplier to Alstom was audited in July 2003 to assure the program management team that the contractor's practices were in compliance with the Technical Specifications of the contract. The Quality Audit provided a positive assessment of Testori's capability as a supplier. The only recommendation was for Testori to improve their non-conforming parts area by segregating and isolating the non conforming parts.

Technical Metal Specialties (TMS), the seat rehabilitation subcontractor was audited in March 2005 to evaluate their seat manufacturing facilities and capabilities. This audit was initiated as a result of the finding of altered, defective and non-conforming products. The Quality Audit found TMS' capability to assemble railcar seating in compliance with the Technical Specifications of the contract. TMS reported that the practices used in the non-conforming seating products found by CMNT had been stopped at the direction of Alstom and Alstom had assigned an on-site inspector that was inspecting 100% of the work prior to shipment. The report recommended that TMS establish some type of Quality Control independent of production, establish witness hold points coordinated with Alstom's on-site inspector, and utilize a Certified Welding Inspector to audit the welding process, and determine and incorporate into drawings the configurations and dimensions of the seat frames and armrest shrouds. Also, the scope of work should be clearly defined and deviations, repair processes or use-as-is dispositions should meet WMATA approval. Technical Metal Specialties was subsequently replaced as the sub-supplier for seat rehabilitation.

Transitair, a seat rehabilitation subcontractor was audited in April 2005 to evaluate their seat frame manufacturing facilities and capabilities. This quality audit was also initiated as a result of the finding of altered, defective and non-conforming products. The Quality Audit found Transitair's capability to assemble railcar seating in compliance with the Technical Specifications of the contract. However, Transitair introduced one violation into the process by not performing a nondestructive surface inspection on the weld repairs. It was recommended that Transitair implement a nondestructive surface inspection for the weld repairs.

In November 2005, Manitowoc Composites' seat frame assembly facilities and capabilities were evaluated per a seat assembly First Article Inspection. This First Article Inspection was the result of moving the seat assembly process from TMS to Manitowoc Composites. It was found that the contractor had the ability to assemble the quality seating products required by the Technical Specifications. The Quality Audit found that Manitowoc had the capability to assemble quality seating products, the release drawings were needed for the seat shrouds and to trim the radius on the LF and RH transverse seats and increase the LH and RH longitudinal seats to better meet the 1/16' allowable gap between the cushion and shroud.

The Program Office's Quality Assurance function reports that the contractor and subcontractors have been responsive in following up on Quality Audit Findings and Recommendations. However, there is no formal follow up by the Authority to ensure that all findings and recommendations have been addressed.

### **Quality Audit by Office of Quality Assurance**

WMATA's Office of Quality Assurance conducted an audit of TTA in June 2004 to provide an objective assessment of TTA's quality management system and production process as it related to the 2000/3000 Series railcar rehabilitation. The audit resulted in 4 Significant Audit Findings:

- There is not enough Quality Auditing
- There is no discrepancy feedback process
- Top management is not being informed
- The effectiveness of training could not be confirmed

A follow-up Quality Assurance Audit was conducted in February 2005 to report on TTA's improvement progress and to document additional areas for improvement if observed during the follow-up. The following summarizes the Follow-up findings:

- Quality Auditing - improvement was found however, more was needed due to high personnel turnover.
- Discrepancy Feedback Process – little improvement was found.
- Top Management not being informed – Significant improvement found, TTA Quality began providing Management with contracted QMS Audits and began to organize key quality indicators. In addition, TTA appeared to be gaining in-house audit capabilities.
- Effectiveness of training – there was no change.

### **Parsons Brinkerhoff Report**

In June 2005, an Expert Review of the 2000/3000 Series Railcar Vehicle Procurement Program Quality Assurance was conducted by Parsons Brinkerhoff, an independent consultant to WMATA, to investigate and report to WMATA on the correlation, if any, between the quality activities being implemented and the reliability performance of the 2000/3000 vehicle fleets. In the course of the review, the panel visited both Alstom

Hornell, NY and Alstom Signaling in Rochester, NY. The report had 16 findings with recommendations for the processes in Hornell, NY and 10 findings and recommendations for the processes at Alstom Signaling in Rochester, NY.

Findings at the Alstom Hornell, NY Facility were in the areas of Personnel, Quality, Inspections, Supplier Control Problems and Alstom Supplier Oversight. Findings at the Alstom Signaling Facility in Rochester, NY were in the areas of Personnel, WMATA's Software Specification, Alstom's Software Quality Assurance Plan, and lack of Software Quality Audits.

In February 2006, the Railcar Program Office prepared a report showing that 24 of the 26 findings and recommendations regarding Alstom Hornell, NY and Alstom Rochester, NY Facilities in the Parsons Brinkerhoff Expert Panel Review Report had been implemented. The remaining Finding at the Alstom Hornell, NY Facility, replacement of the non-overhauled HP4 units, was being implemented with a projected completion date of May 1, 2006. This work was subsequently accomplished in December 2006. The Alstom Signaling Rochester, NY Facility was continuing to experience personnel turnover and was not expected to be able to conduct quality audits until May or June 2006.

**According to an Alstom Signaling representative, this issue was resolved in June 2005 by contracting with a third party to perform quality audits.**

WMATA was continuing to monitor the implemented recommendations as appropriate to ensure a successful program.

### **Inspections**

Discussions with the WMATA/BAH representatives on site in Hornell, NY and a review of the Vehicle Procurement Program Quality Assurance Expert Panel Review (QA Review) conducted by Parsons Brinkerhoff in June 2005, revealed that the WMATA/BAH on-site inspection activities were significantly reduced by the former WMATA Program Manager on January 20, 2004. The supporting documentation provided in Appendices 8 and 9 of the QA Review dated October 2005 supports this finding. The meeting notes in Appendix 8 for a January 8, 2004 Project Meeting show that the WMATA/BAH Quality Inspection Team was told to cease all documentation of workmanship issues, reduce the areas of inspection to only three points (the semi permanent coupling of the railcars; the current collector and related adjustment; and the remaining hold point at final completed railcar inspection) and to perform a cursory review of the railcar history books before they were placed in storage. That afternoon during a video conference call, Alstom was directed to "pick up all of the inspection requirements" associated with the program including the former customer hold points in the Hornell, NY plant and truck inspection and propulsion motor inspections at Alstom's Plant #2 in Hornell, NY. The Parsons Brinkerhoff Team assigned to perform the QA Review found this to be in conflict with section 1.6.3.3 A2 of Contract FK0154 (Parsons Brinkerhoff Report Section 4.3).

The Parsons Brinkerhoff review panel also found that this action resulted in *"The differing interpretations of the scope, responsibilities, obligations and rights of the WMATA/BAH*

*personnel has fostered a degree of animosity between WMATA/BAH and Alstom. There appears to be lack of mutual trust, and there is little motivation for the teams to work toward a common goal of shipping the vehicles from Hornell, NY with documentation signed by both parties attesting to a mutually agreed specification compliant condition of the cars and a commonly generated list of open items, if any.” (PB Report Section 4.3)*

The former WMATA Program Manager was not interviewed by the Expert Review Panel. However, he did provide a written response to the draft report in July 2005. In response to the above finding, the former Program Manager stated in his written comments that when he made these changes he was following the Specifications and directives from upper management. He considered it his responsibility to reduce WMATA’s role in railcar inspections and have Alstom perform the inspections as they were contracted to do. (Appendix 3.0 PB Report) As a result of our discussions with the WMATA/BAH on-site inspectors and Alstom Project Management Staff in July 2006, we found that this finding remains an issue. The WMATA/BAH inspectors feel that this action crippled their efforts and that they have minimal support from BAH Project Management. According to summary report provided by the Program Office, as a result of the implementation of the Expert Review Panel’s recommendations, a revised inspection plan reestablishing the hold points was completed in August 2005.

The Expert Panel also found that the on-site inspection team’s findings were not being corrected, specifically for railcar numbers 3114 and 3115. The Program Office summary report shows the recommendations for this finding were implemented in September 2005. These recommendations included (a) documentation and implementation of a proper protocol for closure of open items, consistent with good quality practices and (b) ceasing closure of non specification compliant open items. Review all shipping authorizations for all vehicles shipped to identify and verify correction of open items that had been closed inappropriately.

The BAH Inspectors on-site in Hornell, NY confirmed in July 2006 that the hold points have been reestablished. However, in their opinion, the hold points are in name only and cars will continue moving on the production line even if there are issues. The example provided was missing materials or parts shortages. Cars are being inspected with missing parts. The missing parts are written-up and re-inspected when installed. However, the missing parts are not holding up production.

They further reported that there is no accountability anywhere on the production line. The majority of their write ups are repeaters. For example: cleanliness or housekeeping. Metal shavings are regularly found throughout the railcars during inspection. There appears to be no responsibility for correcting the issues on the production line and the Alstom Quality Assurance personnel do not have the power to enforce changes. Another issue is staffing. Per their most recent union contract, Alstom now hires staff as an apprentice for two years. This new staff is provided with one or two days training and then left to do a job with little to no supervision. This has created problems since the work is not being checked by supervisors.

The BAH inspection team also reported that they are currently not witnessing any tests

with the exception of the water test. The water test was granted a waiver by the previous program manager allowing the exterior surfaces to be duct-taped prior to testing and the actual test is conducted at 45 psi which is less than the railcar wash you drive through at the local gasoline station. The previous program manager provided Alstom with a waiver for witnessing on all other testing. When asked, Alstom said that all railcar inspections are open and BAH is welcome to participate.

We asked the Alstom Transportation Group about the BAH inspection support on-site in Hornell, NY. They felt that the inspection groups did not show enough urgency in accomplishing inspections and that they should be more closely aligned with WMATA's Office of Quality Assurance rather than the Program Team. They also felt better control should be exercised over the on-site consultants.

### Reliability

In the early stages of the 2000/3000 Series Railcars revenue service, problems were found with the HVAC system, high-speed circuit breaker, ATC system and auxiliary power supply. Modifications were developed and the modifications were implemented on the railcars to correct the problems. Discussions with the Program Office revealed that the biggest issue with the rehabilitated 2000/3000 Series railcars is reliability. The Authority measures reliability based on the **Mean Distance between Delay (MDBD)** which is not a requirement of the contract. Section 1.8.3 of Contract FK0154's Technical Specifications establishes the System Failure limit Requirements as the **Maximum Allowable Failures per Million Miles** for each of the systems, subsystems and/or components. The contract requirement for railcar reliability is based on a nine month rolling average monitored by WMATA's Office of Rail Reliability and Technical Services.

The WMATA Office of Rail Reliability and Technical Services tracks the reported railcar failures of 22 categories of systems and subsystems based on a nine month moving average. Data collection began on the 2000/3000 Series railcars on April 30, 2003. As of RRTS Report for August 2006, there are 182 cars in the program. Results for August 2006 showed that 8 systems meet requirements, 11 systems are less than 5 times goal and 3 systems exceed 5 times the reliability goal.

A review of the data provided by the Program Office showed that during the months of September and October 2006 the MDBD for the 2000/3000 Rehabilitated Railcars was 74,384 and 84,003 miles respectively which is in excess of the Authority Goal of 72,600 miles. This was a substantial improvement in the railcars' reliability from the period April through August where the MDBD ranged from a low of 42,709 miles in August 2006 to a high of 59,989 miles in April 2006. A review of the October 2006 Railcar Fleet Performance Report from the Office of Chief Engineer, Vehicles Rail Reliability and Transportation Services Group shows a MDBD of 58,236 miles year-to-date for fiscal year 2007. The report further showed 13 delays for the month of October 2006 as a result of doors (46%), ATC (38%), Brakes (8%) and Head Controllers (8%). The Program Office expects this trend to continue.



## Design and Engineering Issues

### Issues with Components

There have been several design and engineering issues with the 2000/3000 Series Railcar Rehabilitation including the remanufacture of the trucks, Air Compressors, Doors, Automatic Train Control, Propulsion and Traction Motors.

The most serious of the design and engineering issues is the remanufacturing of the trucks by TTA. As a result, cars are being delivered out of tolerance. Issues arising from the remanufactured trucks supplied by TTA include the chevrons, lateral bumper clearance, uneven wheel wear, the traction motor resilient mount and the brake caliper studs.

Premature settling of the chevrons is one of the major issues with the rehabilitated 2000/3000 Series railcars. The contract specification required *“the chevrons be replaced with new equivalent springs of similar design that is available in North America”* (TP 12-8.11 Primary Suspension). Railcar Maintenance used Lord Chevrons at the time of design and they were approved by WMATA for use in the remanufacture of the railcar. CMNT discontinued the use of Lord Chevrons on the 2000/3000 Series railcars and reinstated the use of Breda Chevrons due to the Lord Chevrons not performing as expected. TTA has changed suppliers and is now using Breda Chevrons in production. However, the chevrons on the railcars already delivered to WMATA need to be replaced.



Breda Chevrons Located at TTA Plant in Hornell, NY



Lord Chevrons Located at TTA Plant in Hornell, NY

A temporary fix for the premature settling has been developed which will be implemented as part of the three phase recovery plan to complete all FMIs on the railcars already delivered. The temporary fix is intended to replace the B blocks with 1 inch blocks (FMI 219). The Lord Chevrons will be replaced with Breda Chevrons in phase 3 of the recovery plan once the lateral bumper clearance and uneven wheel wear issues are resolved. TTA stated in our discussions that it was their belief that the issue with the Chevrons is the captive which they considered tight at 4 mm.



Rehabilitated Trucks Located at TTA Plant in Hornell, NY

**Railcar Maintenance's representative states that he is not aware of a temporary fix that will address the cause of the failure. There has been no root cause of the failure identified and no final engineering disposition had been determined. Any temporary intervention will only address the issue at a symptomatic level. In addition, the Lord Chevrons may not be replaced for the Breda Chevrons in phase 3. It is his understanding that Alstom has documented their intentions to use the Lord Chevrons.**

The lateral bumper clearance issue is under review by Alstom Transportation Group. The specification does not require the bumper to be centered. However, the bumper is shifting on the cab side of the railcar. During our interviews in July 2006, Alstom reported that their engineers were studying the problem and to date had been unable to determine the cause of the shift in the bumper. In our discussions with TTA, the subcontractor responsible for rebuilding the trucks, we were informed that they felt that the issue was the result of WMATA's change from an Italian two-stage shock to the Monroe single-stage shock to save money. It was their belief that this change resulted in lateral stops at a higher impact.

As a result of the continuation of issues with the trucks on the rehabilitated railcars, in November 2006, CMNT recommended that Alstom conduct an Internal Audit of the entire Truck Assembly Process. Alstom is currently auditing the chevron process.

An issue with the wheels was discovered as a result of the vendor in the Czech Republic (Bonatrans) not meeting specification as a result of an incorrect drawing being provided by Alstom's sub-supplier TTA. The equipment made it through the system prior to the defect being discovered. The materials problem has been corrected. However, Alstom is currently investigating the uneven wheel wear on the cars placed in revenue service.

As a result of the Truck Remanufacturing, TTA is currently responsible for 2 FMIs; the

Ground Brush Box and the Emergency Brake Pin. TTA's subcontractor Shunk designed the motor mount with a wall that was thinner than the OEM box. Analysis of the box was conducted when the boxes began failing within 1 to 3 years. The analysis revealed that the wall was thinner and the fiberglass strands were shorter than the OEM box. Shunk has developed a new Ground Brush Box to replace the current box. The new box has been installed on 10 railcars and is being tested. If no problems are found with the new box, TTA will retrofit the entire fleet. In addition to the design of the box, TTA also believes that part of the problem is the acceleration rates of the motor. The change from DC to AC motors results in a faster acceleration creating more stress on the Motor Mount. They further believe that this could be an issue on all Series of railcars. The Emergency Brake Pin issue was the result of a wrong material call out which has been resolved. TTA is currently retrofitting the entire fleet.

Current issues with the Air Supply system include an oil leak in the high-side head which is causing reliability problems and oil seepage and oil migration. Additionally, WMATA CMNT requested that the Graham-White Air Dryer be used in the Air Supply system. The system works well with respect to moisture. However, it is not effectively filtering out the oil which results in oil migration. WMATA changed the specification as a result of the 4000 Series railcar O-ring issue resolution to correct for the oil leakages. The EMI was completed and WABCO started changing the O-rings and Alstom approved the change. BAH approved. In July 2006 CMNT rejected the EMI as a result of their finding the application of a supplemental sealant as back up to the seal to be an unacceptable maintenance practice and considered it a "bandage fix" for what may be a more serious problem with the sealing surfaces of the block and mating head.

**Railcar Maintenance's representative states that the Graham-White Air Dryer is a pre-existing component and was not requested to be utilized or replaced in the pneumatic system by Car Maintenance.**

- 1) It was his understanding that it wouldn't be changed due to cost. It was not a CMNT preference either way.
- 2) It should also be noted that CMNT is on record not approving the rev F version of the Wabco air compressor. However, a subsequent teleconference was conducted with WMATA Program Management directly with Alstom and WABCO, and Program Management went through with the Rev F modification to the Wabco air compressor in spite of CMNT rejection. Some time later and after additional rev F failures, the issue again came to approval of rev G modifications. Once again CMNT rejected and CENV approved moving forward with rev G. The rev G immediately failed.

As a result of continued reliability issues, the Authority is currently installing 3 Knorr compressors in the 2000/3000 Series railcar fleet to test. This air compressor is used in the 5000 and 6000 Series railcar fleets.

**A representative of CMNT states that as a result of continued reliability issues it is to be noted that WMATA has proposed a cost analysis from Alstom to incorporate Knorr air compressors on the 2000/3000 Series rehabilitated rail cars. This would**

be a costly endeavor and may force the Authority to purchase air compressors during a rehabilitation program, when WMATA has already spent \$360 million to overhaul the railcars.



Door Components of Railcar 3129 on Production Line in Hornell, NY

Reliability of the Railcar Doors was another issue raised by the WMATA Program Office. When this issue was discussed with Alstom, they reported that there were two reasons for the door failures; these are technical issues caused by voltage spikes and WMATA railcar maintenance not setting the doors correctly. The subcontractor IFE was developing a proposed maintenance revision for WMATA. Alstom recommended that there should be one or two members of the maintenance crew that works on doors and

the doors should be worked on only when there is a problem. When the same question was asked of the BAH Inspectors, they reported that there does not appear to be any routine maintenance on the railcar doors at the WMATA Facilities. WMATA Railcar Maintenance states that they regularly inspect and complete routine maintenance on the railcar doors.

Station Overruns is the result of a problem with the Automatic Train Control. When discussed with the Alstom Program Manager, we were informed that the problem cannot be analyzed unless the data is recorded. At the time of our discussions, some of the information had been collected. However, the system was not being widely used by the train operators. An automatic system has been installed on the railcars to capture the data. An internal ATC group reviews the failures and has provided recommendations to reduce overruns.

**Railcar Maintenance's representative states that the statements in the prior two paragraphs are bogus and inaccurate statements that cannot be substantiated. Perhaps a review of the railcar history and warranty repair would indicate a different finding than a statement made from Alstom.**

There have been problems with the propulsion system on the cars recently shipped to WMATA resulting in the motors going over temperature. Testing is currently underway. According to PRMT, it is an issue with the part supplied by the sub-supplier. There are two manufacturers that make the part. The part was originally procured from one sub-supplier and that part was approved by WMATA. Alstom found a cheaper source and used the new part that created the problem.

The Traction Motor has also become an issue. The engineers are seeing wear in the system. The composition of the rubber being used is being investigated and being replaced with the same material. The solution is being monitored and according to Alstom Project Management could be a torque problem.

## **On-Site Warranty and Commissioning**

### **Parts Shortages**

WMATA staff reports and Alstom representatives confirm that there have been significant issues regarding parts availability for Warranty and repair work at WMATA. Alstom is addressing this issue and recently enlisted Transit Life Services (TLS) another one of their subsidiaries to work with Alstom to improve the warranty parts support.

Alstom has also experienced problems with their supply of production parts. They are currently working on resolving the issues. However, the BAH Inspectors reported that often a railcar will be inspected with a missing part that will be installed at a later time and re-inspected for the missing part. In addition, the line is often shut down due to the lack of parts.

When the parts shortage issues were discussed with Alstom Project Management, they reported that they were having supplier issues with TTA, Testory and Merak.

Alstom has significant issues with TTA, the sub-supplier remanufacturing the Trucks. The Alstom contract with TTA calls for engineering and build. However; in Alstom's opinion, TTA is unable to accomplish the engineering required. To assist TTA, Alstom has been providing support since the beginning of the project. Further, Alstom is now painting trucks as a result of a back up in the TTA line (a result of Alstom shutting down the line to do a process review and delays in WMATA sending cars due to the significant number of issues with the cars that have been delivered).

TTA reports that they have had some issues with their suppliers and in obtaining parts for the work they are performing. One of the main issues is with the lack of schedule. The project being started and stopped has resulted in order processing being delayed resulting in the order no longer being included in the supplier's manufacturing cycle.

When an order is placed, it needs to be added to the manufacturing cycle which causes delays in delivery.

In addition to the problems with TTA, Alstom is also having problems with Testory, the subcontractor that supplies the internal panel. Late deliveries are forcing the project to work out of station.

### **Warranty Personnel Support**

Contractor warranty support personnel have not been available to research and address problems with the design and manufacture of the railcars as problems are being identified during testing and revenue service. Alstom agreed, in our discussions in July 2006, that they do not have enough support at WMATA to deal with all of the issues on the railcars. Additional staff should have been added as additional railcars were returned to WMATA for testing and revenue service. They are currently working on getting the correct

resources assigned to WMATA facilities to ensure that there are fewer delays in returning the cars to revenue service.

There are also problems with Alstom's sub-supplier Merak with regards to field support. Merak had two people to support 202 railcars. Merak informed us in July that they were planning on moving additional field support personnel to WMATA to address the issues.

### Recovery Schedule

A three phase recovery schedule was developed between WMATA and Alstom Transportation Group to address the maintenance and warranty issues with the rehabilitated railcars. Phase 1 of the plan is to accelerate the implementation of priority FMIs and expedite the return of railcars to service. Phase 2 of the program will return railcars from deferred maintenance. Phase 3 will accomplish the Truck Rework program and implement any remaining FMI's.

According to Alstom representatives, Phase 3 will be the most difficult to implement. The causes of the Bumper and unusual wheel wear (some wheels are wearing faster than others) need to be resolved by the engineers prior to determining a solution for the problem. It was anticipated that this work would begin in October 2006. However, start up will be dependent on finding the cause and an engineering solution to correct the problem.

Phases 1 and 2 of the program are nearing completion at WMATA's old New Carrollton Facility. However; there are some cars that will need to be returned to the facility to have some of the priority modifications completed. Phase 3 which will incorporate the truck work is in the planning stages. The majority of the work under Phase 3 will be to get the truck dimensions back into specification on the 188 railcars that have the Lord Chevron. It is anticipated by the Program Office that work will begin on this phase in the spring of 2007.

### 6000 Series Railcars

#### Production Schedule

To date the most critical delay in the 6000 Series railcar manufacturing process is the issue with the Center Pin. This issue has been resolved and production has resumed both in Barcelona, Spain and Hornell, NY. It is anticipated that all railcar shell construction will be completed in Barcelona next year. The facility in Hornell, NY plans to increase production line staff to close the gap. Alstom is committed to delivering 50 6000 Series cars by the end of 2006.



6K Railcar Shell from

## Quality Control

In accordance with Section 1.6 of the Contract Performance Requirements of the Technical Specification *“the contractor is responsible for providing a quality product to the Authority under this contract. To this end the contractor shall have planned and established a quality assurance program which shall be maintained throughout the execution of the contract”*. Plan requirements include design control, materials control, manufacturing and process control, testing, record keeping and quality assurance procedures.

The Quality Assurance Plan for the 6000 Series Railcar Program is under development. In April 2005, WMATA requested an update and resubmission to the PMOC of the previous plan reviewed in December 2003 but not accepted by the Federal Transit Administration. A preliminary copy of the update was submitted to the PMOC for informal review in July 2005. A revised draft incorporating PMOC comments was submitted to the PMOC in June 2006.

### Quality Audits by Alstom

Alstom has a regular supplier process for Quality Audits which is in place. The Audit process looks at both capacity and quantity of the sub-supplier. A schedule of supplier audits dated June 28, 2006 was provided by Alstom Project Management showing the supplier audits that have been completed for the 6000 Series Railcar production.

The schedule reviewed included information regarding the last time the sub-supplier was audited, a description of the item produced, the Auditor, Audit Score, sub-supplier rating, Follow-up determination and date and the expiration of the rating. Audits appear to have been conducted on each of the sub-suppliers for the WMATA 6000 Series Railcar Project.

Alstom has had problems with staffing the Quality function. As of our discussions in July 2006, a plan had been developed and staff was slated to be transferred to the project to be more aggressive and conduct more quality audits. When the staffing is complete, the project will have an assigned Quality Engineer.

We reviewed 11 Quality Audit Reports prepared by the Quality Manager in the Railcar Program Office which were conducted from the period September 2002 through April 2006.

The Program Office first evaluated Alstom’s railcar shell manufacturing facilities and capabilities in September 2002 to inform the Contractor of any non conformance or potential nonconformance and request corrective action where appropriate. It was found that Alstom’s Barcelona Quality Management System and Organization was implemented and functioning and the manufacturing process showed the ability to produce a quality project. Six recommendations were made to the Contractor including Implementation and maintenance of the current Quality System with adjustments reflected in the Project Quality Plan (which had not been submitted to WMATA), Submit a copy of the current

ISO 9000 Certificate (Audit had been completed however Certificate had not yet been received by Alstom Barcelona), obtain complete documentation for the Specifications and work instructions not at the Facility, Review with WMATA incoming material inspection requirements and implementation of a Material Review Board compliant with the contract.

Alstom's Barcelona Facility was inspected a second time in June 2003. Again the Quality Auditor found that Alstom's Barcelona Quality Management System and Organization was implemented and functioning. However, it had not been fully applied to the 6000 Series Project. The incoming material and handling and disposition of non-conformities required review and improvement. There were four recommendations for correction including Implementation and maintenance of the Alstom Project Quality Plan upon approval, more QA/QC involvement in the early processes of piece part manufacturing, updated supplier evaluations and conformance with established procedures for handling non-conforming material to be used for structural and floor fire test. The Alstom Barcelona Facility was audited a third time in November 2004 and made the following recommendations including resolve all open Surveillance Inspection Reports, open items and non-conformance reports, maintain inspection documents readily available, resolve sub assembly dimensional out of tolerance measurements and work to move hold point inspections to Series status, provide and keep current building and shipping schedule, control and maintain jigs according to procedure and review and adjust paint process to satisfy WMATA standards.

The most recent quality audit of Alstom's Barcelona Spain facility was conducted in April 2006. This audit focused on the manufacture of the Center Pin part. It was found that the organization was not providing the resources necessary to implement and maintain the Quality Management System and that supplier quality and internal auditing were not adequately staffed and more project specific and project audits were needed.

The Alstom Hornell, NY Facility railcar manufacturing and assembly activities were evaluated in March 2004. It was found that Alstom's Hornell, NY Quality Management System and Organization was implemented and functioning. The manufacturing operations in progress during the quality audit displayed the ability to produce a quality product. Recommendations included a review of Specification section 1.2.7 to determine when the Railcar History Book should be delivered and that WMATA and Alstom work on completion of the Contractor's provisions for the Authority's TC-6000 Specification, Section 5.1.3.7.3.

The Alstom Hornell, NY Facility was audited a second time in July 2006 in accordance with the Contract Specifications which require an audit of the Contractor's Quality Assurance Programs one month prior to acceptance of the first married pair of railcars. The manufacturing and assembly activities of the facility in Hornell, NY were audited to fulfill the requirement. It was found that Alstom's Hornell, NY Quality Management System and Organization was implemented and the manufacturing operations in process during the quality audit displayed the ability to produce a quality product but the process was not in control due to material shortages. Recommendations were made to upgrade the Quality Management Systems, increase the frequency of Management Reviews and



provide status reports, fill the vacant Quality Positions and continue to work towards resolving material shortages and bring the production process under control.

A 6000 Software Version Control Quality Audit was conducted at WMATA's Greenbelt Facility in April 2006. The Project Systems Assurance function evaluated the WMATA 6000 software version controls of the new 6000 Railcar Series. Alstom as the contract system integrator is responsible for supervising software version updates to ensure that the system design and performance is in compliance to the technical specifications. The objective of the quality audit was to learn the work processes and controls used in software installations and updates. It was recommended that WMATA authorization signatures be required on all software version updates.

The Project Office Quality Manager also audited several of Alstom's subcontractors including Merak in Madrid, Spain, Deliner Couplers, TMS, Trans-Lite and, Alstom Signaling.

A summary of the quality audits is as follows:

- An evaluation of Merak's HVAC system manufacturing facilities and capabilities were reviewed in October 2002. The Systems Assurance assessment found that Merak's Madrid Quality Management System and Organization were implemented and functioning and the manufacturing process displayed the ability to produce a quality product.
- Deliner Couplers of Charlotte, North Carolina was audited in July 2003 to conduct a site visit of their facilities and observe Alstom's Suppliers Classification Audit of the firm. Quality Assurance found that Deliner has the capabilities as a supplier of meeting the specifications and Alstom's Supplier Classification Audit provided confidence in the selection and maintenance of supply resources.
- TMS was audited by WMATA Quality Assurance in February 2005 with the objective of evaluating TMS seat manufacturing facilities and capabilities. TMS was found to not have a formal Quality Management System that raised concerns about their ability to repeat the quality seen in the First Article Inspection products. WMATA recommended that TMS should establish a Quality Control function independent of production, establish witness and hold points, utilize a Certified Welding Inspector to audit welding process and audit their sub-suppliers of seat backs, bottoms and powder coating and use independent inspection to assure consistent performance.
- Trans-Lite's light manufacturing facilities and capabilities were evaluated in March 2005. Trans-Lite was found to have a formal Quality Management System that provided confidence in their ability to repeat the quality seen in the First Article Inspection products.
- Alstom Signaling's ATC System Manufacturing facilities and capabilities were evaluated in May 2005. Alstom Signaling was found to have a Quality System implemented and functioning on the project. They were also found to have the capability to manufacture the quality ATC System required by the Technical Specifications of the contract. There were no recommendations for Alstom Signaling.

## Inspections and Railcar Acceptance

### First Article Inspection

The First Article Inspection took place in Hornell, NY between August 16 and 18, 2005. The FAI took place over 3 days and approximately 20 WMATA Staff were present. According to the Program Office, at the completion of the Inspection Process, the FAI documents were signed by all the parties and accordingly a punch list of approximately 58 items was developed. It took approximately three months to resolve the punch list items to determine if they should be waived or a correction was required.

**Railcar Maintenance's representative states that the FAI's punch list of 58 items seems to be inaccurate-there were well over 200 items that were documented.**

A review of the FAI documentation provided by the WMATA Program Office showed that the FAI documentation was signed off on by all parties by September 7, 2005. Included with the documentation was a list of issues found during FAI which included 349 items. At the time of the document approval, 13 of the items remained open.

The Program Office credited Alstom with their implementation of a First Railcar Configuration Inspection (FFCI) process during construction of the pilot cars. During construction of the pilot cars, a FFCI was completed by Alstom and WMATA Program Management Staffs at each of the build stations. This enabled problems with the configuration of the pilot railcars prior to the railcar moving to the next station. Issues corrected were then used to develop the production processes. The Program Office stated that this was the first time this type of process had been used on an Authority Railcar Contract and felt that it helped the FAI process go much faster.

When the FAI process was discussed with the Alstom Program Manager, he reported that the First Article Acceptance took longer than expected as a result of not understanding the process. The actual process took 3 months where it normally takes 5 days. One of the reasons for this delay was the need to develop criteria. They felt WMATA did not develop the criteria in advance.

### Production Line Inspection

The Inspectors for the 6000 Series railcars reported in July 2006 when we talked to them that they do not have the same issues that are being experienced with the 2000/3000 Series railcars since they are still at the early stages of the production schedule. For the 6000 Series railcars, there are 12 quality control hold points where WMATA on site inspectors check the work prior to the railcar moving forward. In the future the hold points will become audit points. Final inspection is being done prior to shipping. Alstom plans to add inspectors to the line to reduce the number of write-ups.

### Safety Certification

A Safety Committee was established during the early phases of the project to address safety issues related to the design and production of the 6000 Series railcars. The committee developed a process to achieve the Safety Certification which was written and approved by all parties. The specifications and drawings of the 6000 Series Railcars were reviewed and approximately 600 hazards were identified. The majority of the hazards identified were mitigated by testing.

According to the Program Office, during the Certification process which began in July 2006, the Office of Safety took exception to engineering reports signed by Qualified Engineers which were conditional. Issues were resolved and the Safety Certification was achieved in September 2006.

Representatives of Alstom reported during our interviews in July 2006 that this process had gone better than any other project. However, unless full approval of drawing or CDRL is received, an item could not be closed which created a hazard. At the time, Alstom was in the process of modifying documents with full approval so WMATA's Office of Safety would approve.

### Railcar Conditional Acceptance

Fifty 6000 Series Railcars have been delivered to WMATA. However, recurring Quality Issues has resulted in only 30 of the cars having been conditionally accepted as of December 4, 2006. Twenty Railcars are currently at Greenbelt Yard unaccepted, 8 more than the contract allows for. The number of unaccepted cars allowed on Authority property has been somewhat relaxed to achieve the goal of processing and conditionally accepting 50 cars by the end of the year.

Issues to be resolved on the unaccepted railcars include front door seals, door adjustment requirements, railcar leveling and dynamic and friction brake problems in addition to cars waiting for Inspection and Testing.

An additional problem with acceptance of the railcars has become the availability and content of the Railcar History Books. In accordance with section 1.2.7 of the contract, *"The Contractor shall provide a loose-leaf history book for each married pair of cars. (CDRL 110) ... Books shall be readily available for inspection by WMATA representatives."*



6K Railcars at Greenbelt Yard waiting to be tested in Revenue Service

It was reported by the Offices of Quality Assurance and Railcar Maintenance that Railcar History Books are not being made available or presented when the railcars are delivered to Greenbelt to undergo Acceptance testing. In addition, the books are reported to be incomplete or include information for other railcars.

The timing of the acceptance of the railcars is also at issue. The Program Office is conditionally accepting cars that based on Special Provision 21.2.a which reads *“At its discretion, the Authority may conditionally accept the cars when not completely*



**6K Railcar Undergoing Acceptance Testing at Greenbelt Facility**

*conforming to the Specifications in all respects. A written notice of conditional acceptance or rejection of the transit cars will be provided by the Authority within 30 days of completion of Acceptance Tests or, in the case of spare parts, verification of receipt on the Authority’s property as required herein. Such notice of conditional acceptance indicates that the cars and parts meet minimum standards for revenue service operations, however, deficiencies remain which must be resolved by the contractor in order for vehicle final acceptance to occur. The notices of conditional acceptance will include lists of such deficiencies known*

*to exist at the time of the conditional acceptance and shall not limit the Authority’s rights with respect to the correction or elimination of deficiencies subsequently discovered or identified.”*

According to correspondence reviewed regarding this issue, the Program Office stated that the conditional acceptance by the Program Office is a result of their determining that the cars meet the minimum standard for revenue service and presented the cars to the Office of Quality Assurance. The “WMATA” conditional acceptance occurs prior to placing the cars in revenue service.

To date, railcar numbers 6036/6037 and 6038/6039 were accepted on November 22, 2006 without a sign-off by the Office of Quality Assurance. The program office submitted these railcars to the Chief Operating Officer Rail for acceptance which was approved. Issues with railcars 6037/6038 preventing the Office of Quality Assurance sign off at the time of acceptance included:

- FMI documentation not included in Railcar History Books;
- Acceptance package had not been reviewed by the Office of Quality Assurance;
- Railcar 6037 required evidence that the front bulkhead door passed the WMATA approved water test;
- Evidence that the front bulkhead door seal was cut for installation in accordance with drawing requirements;
- The front brake cut-out handle was very hard to operate;

- Railcar Motor Overload History (MOL);
- Loose rear end corner vertical molding;
- Light fixtures not aligned; and
- Rear end doors not sealed at top and side

Railcars 6038/6039 were not put into service until after December 1, 2006 when they were leveled in accordance with all specifications.

The WMATA Office of Quality Assurance recently performed an assessment of the 6000 Series Railcar Acceptance Process. This assessment was completed as a result of the Office of Quality Assurance's findings from the 6000 Series Railcars which showed that the 6000 Series Program and Alstom QA/QC processes are not as effective as required.

The Quality Assessment of the Acceptance Process completed in early November 2006, resulted in 33 findings which included observations and Corrective Action Required for the Program (8), the Engineering Consultant (6), and the Contractor (7) and in the area of Documentation (12). A summary of the findings and observations provided to the Program Office was as follows:

- Program Management has not developed a process that ensures timely acceptance of quality cars.
- Contractor's resources (personnel, equipment and parts) have not been planned.
- The Engineering Consultant has not provided a qualified onsite Quality Manager. The role of Quality Manager is currently filled by a Site Manager.
- Poor workmanship and repeat discrepancies are slowing the acceptance process. A process for eliminating discrepancies before cars arrive is not established.
- Required documentation (Railcar History Book and Acceptance Package) is incomplete and often inaccurate slowing the acceptance process still further.
- A backlog of unaccepted cars at the acceptance site is resulting from the above causing additional problems. The Contractor cannibalizes them to correct discrepancies on cars further along in the acceptance process.
- Cars have been presented for acceptance without completion of safety related modifications (FMI's).
- Personnel responsible for quality lack a clear understanding of their roles, responsibilities and reporting paths.

The 6000 Series Railcars have only been in service for three months which is not a long enough period of time to determine the reliability of the railcar. Railcar Availability status reports were reviewed for the period November 28 through December 6, 2006. According to the reports reviewed, 20 of the 26 railcars conditionally accepted were available for use in revenue service on December 1, 2006. Three days later 30 railcars had been conditionally accepted but only 12 were available for service. Issues with the 18 railcars unavailable for service included Flashing Motor Overload, a ruptured airbag, a dark railcar repeater, adjustments required to the air compressor; broken power cable brackets and 2 pairs were in revenue preparation.

## Design and Engineering Issues

Issues to date with the 6000 Series railcars include the center pin, design of the HVAC system, railcar leveling valve and On-site warranty. The Program Office reported the first 12 cars delivered to the Authority had good performance. However, the problem with the center pin has delayed acceptance. At the time of our interviews, this program was still considered to be in its infancy and problems similar to those with the 2000/3000 and 5000 Series railcar projects were possible as the program progressed. A routine inspection schedule with 12 hold points has been developed and adopted for the production of the 6000 Series Railcars.

### Center Pin

In February 2006, WMATA inspectors while examining stored parts observed 16 center pins with unusual heat markings. The observation was recorded and an investigation by Alstom was requested. The root cause was found to be Hydrogen-assisted cold cracking caused by:

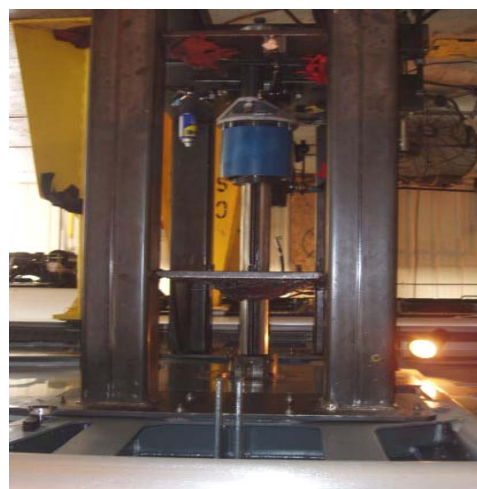
- 1) Residual stress – stiffening ring joint design is constrained;
- 2) Improper execution of weld process in Barcelona; and
- 3) Bad material – material properties of some raw material was not to specification. Once the root cause of the Center Pin issue had been identified; engineering solutions were developed for both an interim repair to continue pre-revenue testing of 8 cars already on site at WMATA and a permanent repair for acceptance of the cars.



A center pin ready to be installed in a railcar in Hornell, NY



Worker Preparing Boring Machine for Installing New Center Pin at Hornell, NY Facility



Boring Machine for New Center Pin at Hornell, NY Facility

This was not a high stress area so it was not considered a critical weld. It was found in the analysis that stress was added from the weld process resulting in the cracking. The Alstom Engineering Department now has new criteria for critical welds and this should not happen again.

At the time of discovery, 82 railcar shells were complete with 60 of the cars already shipped to Alstom's facility in Hornell, NY. Further, construction of twelve cars was complete and on WMATA Property when discovered. Railcar numbers 6000 and 6001 (the original married pair manufactured) did not have the problem due to a different manufacturing process used during production of the pilot railcars.

The Program Office is currently in the process of testing these railcars and achieving the Safety Certification to conditionally accept the railcars and put into revenue service. The remaining 10 cars at WMATA will be shipped back to Hornell, NY for repair. However, an interim fix was completed on six of the cars to allow testing upon approval from the Office of Safety. These cars will be more aggressively monitored than in the past for the first 30 to 60 days.



View of Top of Boring of Hole from Inside the Railcar

The permanent repair process is to cut the Center Pin installed in Barcelona, Spain from the railcar and bore the remaining piece from underneath the railcar. A new Center Pin is installed and welded in place at the top and base of the railcar. Alstom has set aside shop space and is working on 4 railcars at a time. We observed the Center Pin repair process at the Alstom facility in Hornell, NY.

Processes observed included the boring of the Center Pin from the railcar and in addition, we saw a completed Center pin replacement.

Railcar number 6083 was constructed using a new design in Barcelona to correct the issue and will not require repair upon delivery to the United States. This problem is considered by the Program Office to be resolved.



New Center Pin Installed in Railcar Ready for Painting of Railcar Floor

## HVAC

The major design issue for the HVAC system included the Go/NoGo Algorithm vs. a sight glass in the liquid receiver tank. During our discussions in July 2006 with Alstom Program Management, they reported that this issue was still open. They felt that the Go/NoGo LED would provide a better maintenance tool for the Authority. CMNT and the Program Office agreed in theory that the Go/NoGo LED would provide a superior system to the sight glass for determination if the system was functioning properly. However; the system never worked as presented by Alstom and Merak.



HVAC Provided by Merak

Rail Car Maintenance's representative states that this suggests that CMNT, in theory, believed that the Go/No Go LED would provide a superior system . . . is incorrect. CMNT never agreed to that as indicated. CMNT has always been in the position that the system requires a sight glass and not in lieu of an LED. Alstom can install an LED if they so desire, they can install several, but not in lieu of the sight glass. That has always been CMNT's position.

This sight glass issue is clearly a demonstrated breakdown in communication between the Program Manager and Alstom. According to CMNT's representative, there is a contract technical specification that is clear, cut, and decisive. What happens is that often there is a failure to meet that contract specification, and then there's lengthy exchange of commentary and nonsense that keeps us away from the technical specification of the contract. After great length and extended amounts of time, engineering efforts and energy wasted on an issue, it may finally reach a conclusion. The sight glass issue is just one example of a business process that compromises the Authority.

The Authority Technical Specification Section 12-4.3-H (Compressor/Condenser Units) calls for "a combination sight glass and moisture indicator located for convenient observation during servicing of equipment." During the Preliminary Design Review Phase of the Project, the Authority learned that the design of the HVAC System prohibited routine access to the liquid receiver tanks. The Go/NoGo indicator was proposed by Alstom and Merak. After a review of Merak's Go/NoGo Algorithm, the Authority found that the system did not meet WMATA's needs for refrigerant level determination and was not adequate to properly replace a properly positioned liquid receiver tank sight glasses. (WMATA Letter WM6.AL6.3283.L).

Alstom responded with Letter No. AL6.WM6.3702.L in which they stated that they believed the Go/NoGo logic would not interfere with WMATA maintenance activities, cause any delay for the train or any discomfort for the passengers. They further felt that



the logic would provide results to maintenance personnel that are equivalent to the use of a sight glass and requested approval of the Go/NoGo logic.

WMATA responded with Letter No. WM6.AL6.3427.L and stated that they considered Alstom's comments in letter No. AL6.WM6.3702.L to be non-responsive and did not approve the Go/NoGo Algorithm for use on the Railcars. A sight glass has now been added to the compressor/condenser units in accordance with Technical Specification Section 12-4.3-H.

An additional issue with the 6000 Series railcar Air Compressors is the resilient mounts. Vibrations from the original mounts were written up during the FAI and FMI-045 (ASU Resilient Mount Replacement) was developed and approved. Railcar acceptance has been held up by the Office of Quality Assurance on cars awaiting implementation of FMI-045. Alstom is working with the Authority to make available the required resilient mounts to modify the unaccepted cars.

### **Railcar Leveling Valves**

A recent issue with the 6000 Series rails is a problem with the railcar leveling valves with railcar numbers 6038/6039 delivered to WMATA in October 2006. During the Authority's quality inspection, it was found that the front leveling valve linkages on both cars were loose requiring the vehicles to be leveled after corrective action in accordance with revision level C of the Air Bag and Threshold Height Adjustment Procedure. To date this has been an issue on railcar numbers 6038/6039, 6018 and 6040.

According to CMNT, this issue is similar to the railcar leveling valves on the 5000 Series railcars which are causing low speed derails. Knorr leveling valves originally used on the 5000 Series railcars were found to not have enough dead band to assure proper adjustment of the air bag and threshold heights. It was recommended by the Office of Quality Assurance in July 2004 that the valves not be installed on the 6000 Series railcars and be removed from the 5000 Series railcars. The recommendation has not been implemented. However, Railcar Maintenance is currently testing the Westcode valves on the 5000 Series railcars that are now used on the 1000 – 4000 Series railcars.

**A representative of CMNT states that those low speed derailments as previously indicated is a combination of many factors. A defective leveling valve is one of those issues. In addition, the 5000/6000 series cars have a very stiff car body construction by design. Also, as previously explained, vehicle imbalance, rail conditions, vehicle leveling response, stiffness of the car body and duplex check valve operation are all contributing factors to the low speed wheel unloading derailment.**

### **On-Site Warranty and Commissioning**

The Alstom Program Manager reported that they were working on resolving the parts issues for the 6000 Series railcars. He reported that while he did not feel a sufficient amount of parts were in place on WMATA property at this point in the contract, they were

working to resolve this issue and correct the situation. Contractor personnel have been assigned to WMATA's Greenbelt Facility and additional staffing will be added as additional cars are shipped to WMATA.

Material availability for production is the number one issue with the 6000 Series railcar project. The Program Team is working on getting the spare parts on site at WMATA. The current level is about 50%, prior to the start of revenue service.

The 6000 Series program has been delayed getting the warranty personnel on site. They are currently in the process of interviewing additional resources and will be adding technical and administrative help. This problem is similar to the 2000/3000 Series railcar problem in that Alstom does not have enough staffing or parts to support the railcars delivered to or conditionally accepted by the Authority.

Railcar numbers 6034 and 6035 parts have been used to repair other cars. Authority representatives do not know when the parts taken from the cars will be available to conditionally accept these two cars.

The shortage of supply/inventory has been a result of supplier issues. On the 6000 Series project, Alstom tried to use the same suppliers as were used on the 5000 Series railcars. This resulted in Alstom completing proper due diligence to determine if the suppliers were capable of producing both the quantity and quality of the parts required.

Repair parts are not onsite at WMATA and cars are not being accepted or progressing through testing as a result of the shortage.

### **Suspension Letter**

On December 27, 2006, the 6000 Series Program Manager sent a letter to Alstom's program manager pertaining to Suspension of Deliveries to Greenbelt of 6000 Series Railcars.

Several concerns were raised pertaining to the acceptability of the 6000 Series Railcars. A summary of the issues raised in the letter are as follows:

The in-service performance of the 6000 Series cars and the effectiveness of the Greenbelt acceptance and warranty program have not met the shared expectations of WMATA and ALSTOM. The program will not reach its goal of fifty conditionally accepted cars by the end of 2006, and the reliability of the delivered cars is not consistent with WMATA's goals. An assessment of the 6000 Series railcars accepted to date reveals significant deficiencies that must be corrected soon in order to ensure the continued success of the program. Observations are as follows:

### **Warranty/Reliability Program**

Daily service reports reveal that on any given day, large numbers of 6000 Series railcars have been pulled from service due to defects. Problems are found in many systems,

including propulsion, brakes, doors, HVAC and windows. ALSTOM warranty response has improved over the past month, but cars still remain out of service for many days due to manpower and parts availability. Warranty response time is particularly lengthy following monthly CMNT inspections. Cars will remain out of service for a week or longer waiting repairs. The fleet is not meeting the availability goals of the contract.

### **Technical Issue Resolutions and FMIs**

ALSTOM response to technical issues has been slow. Basic engineering issues remain unresolved. Despite months of effort to develop new propulsion software, MOLs continue to plague the fleet. The Contract specification on Correction of Deficiencies requires ALSTOM to provide timely resolution to any defect or discrepancy. Many of the open technical issues have been dormant for months and many FMIs are still open when cars ship from Hornell, NY.

### **Contractual and Provisional Spare Parts**

ALSTOM has failed to honor their contract obligations with regard to spare parts. Per the contract, ALSTOM is to deliver contractual spares within 120 days of award. Contractual spares were awarded January 2005 and, to date, no spares have been delivered. The lack of spare parts negatively impacts WMATA's ability to maintain a running fleet and also results in delays to the acceptance program. Basic essentials such as brake pads, wiper blades, and seat cushions are needed on a daily basis to keep the fleet running. Without these parts, the railcars can not run in service. ALSTOM site personnel have resorted to "borrowing" parts from unaccepted railcars in order to satisfy the in-service needs of Railcar Maintenance. Two cars have been on site since early October, yet have not progressed through the acceptance program because they are missing parts that were delivered to CMNT for running maintenance.

### **Open Acceptance Issues**

Per contract clause, ALSTOM has 90 days to close all open issues recorded as part of the Conditional Acceptance process. To date, there are 38 conditionally accepted railcars, some in service for 90 days, and not a single open issue has been closed.

### **Failed Cars in Acceptance Program**

As of December 27, there are 8 railcars in the acceptance program with unresolved technical issues that prevent further processing. ALSTOM has provided no schedule for the re-introduction of these railcars.

### **Unaccepted Cars on Site**

ALSTOM currently has 18 unaccepted railcars on site in Greenbelt. The contract limit is 12.

### Warranty Spares and Subcontractor Support

ALSTOM does not have adequate spare parts on site to respond to warranty claims in a timely manner. Subcontractor technical support and consignment spares are not available on site, resulting in delays.

As of December 27, 2006, ALSTOM has delivered 56 railcars to Greenbelt. Four additional railcars are scheduled to ship from Hornell, NY during the first week of January, for an on-site total of 60 railcars. Shipping any additional railcars to the on-site program will only increase the stress on the available resources. In order to give the 6000 team an opportunity to resolve these issues, the program office will suspend the delivery of new cars from Hornell, NY after the arrival of the 60<sup>th</sup> railcar until further notice. WMATA requests that ALSTOM program management personnel be available to meet to develop a joint, project-level action plan to elevate performance to acceptable levels. In addition, an executive partnering meeting will be scheduled at Alstom's headquarters in New York City to present the project recovery plan and schedule to upper management personnel.

### Conclusions

**As a result of our review, the following conclusions/issues have been identified:**

#### 1. General

- a. **The 2000/3000 Series railcar production schedule originally anticipated acceptance of the final railcar in November 2005. The current schedule estimates final railcar acceptance by WMATA in December 2007; 24 months behind schedule as a result of production being halted on several occasions over the course of the program.**
- b. **The 6000 Series railcar production schedule estimated a completion of May 2006 for the base order of 62 cars. The expected completion date for the option cars is September 2007. The scheduled completion date for the project remains September 2007. However, this is considered to be no longer attainable and the schedule is being reevaluated. The current projection by the Program Manager is for the overall project to be completed 3-4 months late.**
- c. **Design of the 6000 Series railcar was completed on August 20, 2003 and the First Article Acceptance provided by WMATA on August 30, 2005. The first married pair (railcar numbers 6000 and 6001) was conditionally accepted on September 15, 2006 and entered revenue service on September 19, 2006.**
- d. **The original schedule called for the Prototype cars to be delivered in May 2005 with acceptance of the railcar in October 2005. However,**

**the cars were not actually delivered to WMATA until September 2005. It was then anticipated that the pilot cars would be accepted in January 2006 based on the original schedule. However, the first married pair was not conditionally accepted until September 15, 2006.**

Booz Allen Hamilton (BAH) is providing Program and Engineering Support for the 2000/3000 and 6000 Railcar Series Programs. The also provided the same services for the 5000 Series railcars that were manufactured by another Contractor. Their scope of work includes oversight and reviews of the work being performed by Alstom in Hornell, NY and Barcelona, Spain; determining if the contractor is meeting the contract requirements and complying with industry practice and making recommendations to WMATA; document control; quality control; contract management; and assisting with finding engineering solutions.

## 2. Contract Administration

- a. **The Alstom Program Managers for both the 2000/3000 and 6000 Series Railcar Programs reported that WMATA has not followed the contract with regard to Change Orders, Payments and Warranty Used Parts. In our discussion, the Alstom Program Managers reported that they have been asked to do work or make a change verbally and then told by WMATA to submit a proposal for the work, payments have not been made on time and withheld for additional work and according to Alstom the Program Office is adding language to the contract that does not exist with respect to Warranty Used Parts.**
- b. **Change order issues are not processed timely.**
- c. **The 2000/3000 Series contract had a backlog of 160 requests for change; 100 were found to have merit. To resolve the backlog of change orders for the 2000/3000 Series railcar program, WMATA formed a team headed by Office of Procurement (PRMT) which included representatives from PRMT, the Program Office and Consultants. The Office of the Auditor General coordinated with the team providing audit assistance on the change orders. Negotiations are now complete on all but 13 of the change orders which were returned to Alstom for additional information. Negotiations are ongoing for change orders and are expected to be completed for Board action in early 2007.**

## 3. Program Management Changes

WMATA Management has changed during the contract term for both the 2000/3000 and 6000 Series Railcar Programs at the executive and program manager levels. In February 2005, WMATA underwent a reorganization resulting in the Railcar Programs being moved from the Department of Operations to the Division of Planning, Development, Engineering and Construction. This resulted in a change to the Executive Leadership for

the program. Program Office management changes were made as a result of the Organization's restructuring and new Program Managers were assigned to the projects.

**The Contractors, Subcontractors and WMATA Personnel do not appear to be working as a team. There is a lack of coordination within WMATA.**

On August 25, 2006, WMATA's Interim General Manager realigned and reorganized the Offices of the Chief Engineer, Vehicles. This action resulted in the Office of the Chief Engineer Vehicles reporting directly to the Chief Operating Officer, Rail rather than the Assistant General Manager of the Department of Chief Engineer/Project Management (formerly the Division of Planning, Development, Engineering and Construction).

The change in program management has been viewed as positive by the Alstom and BAH representatives. However, both companies believe the new Program Management Teams need to be empowered. Alstom further stated during our interviews that, WMATA appears to lack internal communications and has not fully identified all of the stake holders on the Programs. Alstom reports they are not always sure who is in charge of the Programs and there is the appearance that the Program Office does not yet have the control in place to effectively manage the program.

**WMATA should provide clear focus to the Contractor and the organization needs to better coordinate between the program office and railcar maintenance.** An example provided was the Chevron Issue. Railcar Maintenance (CMNT) was experiencing problems with the Lord Chevron after they were re-designed by the manufacturer. The decision was made by CMNT to stop using the part and resume using Breda Chevrons on the 2000/3000 Series Railcars. The Program Office was unaware of the change and the project is now replacing Lord Chevrons installed on the remanufactured cars with Breda Chevrons. In addition, WMATA should have coordinated their views with suppliers for best practices on how to install the equipment. If WMATA had shared their experiences, the current technical issues may have been minimized.

**In a previous response, Railcar Maintenance's representative disagreed with the conclusion that this issue has been clarified. According to CMNT's representative, engineering is the responsibility of the car builder, and they sign the contract with that understanding. The report also suggests perhaps that WMATA has to somehow take on the role and responsibility of the car builder for engineering decisions. The car builder should be fully capable of addressing engineering issues and certainly building a truck. The Authority paid a substantial amount of money for Alstom to produce a product. Railcar Maintenance is not responsible for Alstom's inadequacies to solve engineering issues and provide a quality product. Partnering is one thing, but assuming someone else's responsibility is another. The report has come to a conclusion based on what is an assumption that Program Management was unaware of the Car Maintenance's practice of not utilizing Lord Chevrons.**

**We disagree with CMNT's statement in that our conclusion is that all parties should share information so that better coordination can occur and then this type of issue**

can be avoided.

#### 4. Issue Resolution and Development of FMI/EMIs

**In our discussions with the Program Management Team at Alstom, we were informed that identification of a problem with a railcar concerning quality or technical issues creates a lengthy process for resolution resulting in delays to the production schedule.** The BAH Project Manager and Inspectors on-site in Hornell, NY also reported that this process is too long and needs to be addressed.

According to BAH representatives, a clear dispute resolution process needs to be established to elevate issues. It was reported that the previous Program Manager “told” BAH inspectors not to rock the boat or to tell others anything. A process needs to be developed to hear each others’ concerns and resolve issues. Mistrust between the organizations and internal to WMATA is an issue.

Alstom Transportation Group felt that the BAH inspection groups did not show enough urgency in accomplishing inspections and that they should be more closely aligned with WMATA’s Office of Quality Assurance rather than the Program Team. They also felt better control should be exercised over the on site consultants by WMATA’s Program Office.

#### 5. 2000/3000 Series Railcar

**There have been several issues with the 2000/3000 Series railcar project including quality and supply/inventory of parts, reliability and onsite warranty and commissioning.** To date the most significant parts issues include the Trucks remanufactured by TTA and the brakes supplied by WABCO. The Office of Railcar Maintenance reports that 95% of the problems with the rehabilitated 2000/3000 Series railcars is quality. They further stated that they recognized performance issues with the cars early in the program in 15 major sub-systems in the cars.

#### 6. Production Schedule

**There have been several issues with the production of the 2000/3000 Series railcars as a result of remanufacturing design and engineering issues and the original design of the Breda 2000/3000 railcar Series.**

Some of the production schedule issues are as follows:

- The most recent delay in July 2006 was prompted by a problem found on an accepted railcar. The issue cited was a failure of the quality system to detect the incomplete or incorrect application of FMI #079 on the railcar 2022 resulting in a safety hazard. A full inspection of the 194 railcars conditionally accepted resulted in the identification of 16 additional railcars with similar incomplete modifications.
- Additional issues resulting in the July 2006 suspension of delivery and acceptance

included three married pairs being delivered that could not pass the on-site acceptance tests due to thermal overload problems with the propulsion/traction motors; the truck suspension issues identified previously which remained unresolved and the continued deterioration of in-service fleet performance.

- Alstom's current schedule shows delivery of the final railcar in January 2008. The Program Office expects the date to be extended to June 2008, 30 months behind the original scheduled final railcar delivery of December 2005.

## 7. Quality Control

The Quality Assurance Plan for the 2000/3000 Series Railcar Rehabilitation Program dated May 24, 2000 is fully acceptable. In April 2005, WMATA requested an update and submission to PMOC for review. The updated plan was submitted in August 2005 for PMOC comment and a Revised Plan was submitted in March 2006. The PMOC is currently reviewing the plan.

### a. Quality Audits by Alstom

Alstom has a regular supplier process for Quality Audits which is in place. The Audit process looks at both capacity and quantity of the sub-supplier. A schedule of supplier audits dated June 28, 2006 was provided by Alstom Program Management showing the supplier audits that have been completed for the 2000/3000 Series Railcar production.

### b. Quality Audits by WMATA Program Quality Assurance

We reviewed 10 Quality Audit Reports prepared by the Quality Manager in the Railcar Program Office which were conducted from the period May 2003 through February 2006.

The Program Office's Quality Assurance function reports that the contractor and subcontractors have been responsive in following up on Quality Audit Findings and Recommendations. **However, there is no formal follow up by the Authority to ensure that all findings and recommendations have been addressed.**

### c. Quality Audit by Office of Quality Assurance

**WMATA's Office of Quality Assurance conducted an audit of TTA in June 2004 to provide an objective assessment of TTA's quality management system and production process as it related to the 2000/3000 Series railcar rehabilitation. The audit resulted in 4 Significant Audit Findings:**

- **There is not enough Quality Auditing**
- **There is no discrepancy feedback process**
- **Top management is not being informed**
- **The effectiveness of training could not be confirmed**



A follow-up Quality Assurance Audit was conducted in February 2005 to report on TTA's improvement progress and to document additional areas for improvement if observed during the follow-up. The following summarizes the Follow-up findings:

- Quality Auditing - improvement was found however, more was needed due to high personnel turnover.
- Discrepancy Feedback Process – little improvement was found.
- Top Management not being informed – Significant improvement found, TTA Quality began providing Management with contracted QMS Audits and began to organize key quality indicators. In addition, TTA appeared to be gaining in-house audit capabilities.
- Effectiveness of training – there was no change.

#### d. Parsons Brinkerhoff Report

In June 2005, an Expert Review of the 2000/3000 Series Railcar Vehicle Procurement Program Quality Assurance was conducted by Parsons Brinkerhoff, an independent consultant to WMATA, to investigate and report to WMATA on the correlation, if any, between the quality activities being implemented and the reliability performance of the 2000/3000 vehicle fleets. In the course of the review, the panel visited both Alstom Hornell, NY and Alstom Signaling in Rochester, NY. The report had 16 findings with recommendations for the processes in Hornell, NY and 10 findings and recommendations for the processes at Alstom Signaling in Rochester, NY.

Findings at the Alstom Hornell, NY Facility were in the areas of Personnel, Quality, Inspections, Supplier Control Problems and Alstom Supplier Oversight. Findings at the Alstom Signaling Facility in Rochester, NY were in the areas of Personnel, WMATA's Software Specification, Alstom's Software Quality Assurance Plan, and lack of Software Quality Audits.

### 8. Inspections

Discussions with the WMATA/BAH representatives on site in Hornell, NY and a review of the Vehicle Procurement Program Quality Assurance Expert Panel Review (QA Review) conducted by Parsons Brinkerhoff in June 2005, revealed the **WMATA/BAH on-site inspection activities were significantly reduced by the former WMATA Program Manager on January 20, 2004.**

The WMATA/BAH inspectors feel that this action crippled their efforts and that they have minimal support from BAH Project Management. According to summary report provided by the Program Office, as a result of the implementation of the Expert Review Panel's recommendations, a revised inspection plan reestablishing the hold points was completed in August 2005.

The BAH Inspectors on-site in Hornell, NY confirmed in July 2006 that the hold points have been reestablished. **However, in their opinion, the hold points are in name only**

**and cars will continue moving on the production line even if there are issues.** The example provided was missing materials or parts shortages. Cars are being inspected with missing parts. The missing parts are written-up and re-inspected when installed. However, the missing parts are not holding up production.

**They further reported that there is no accountability anywhere on the production line. The majority of their write ups are repeaters.** For example: cleanliness or housekeeping. Metal shavings are regularly found throughout the railcars during inspection. There appears to be no responsibility for correcting the issues on the production line and the Alstom Quality Assurance personnel do not have the power to enforce changes.

**The BAH inspection team also reported that they are currently not witnessing any tests with the exception of the water test.** The water test was granted a waiver by the previous program manager allowing the exterior surfaces to be duct-taped prior to testing and the actual test is conducted at 45 psi which is less than the car wash you drive through at the local gasoline station. The previous program manager provided Alstom with a waiver for witnessing on all other testing. When asked, Alstom said that all railcar inspections are open and BAH is welcome to participate.

## 9. Reliability

**In the early stages of the 2000/3000 Series Railcars revenue service, problems were found with the HVAC system, high-speed circuit breaker, ATC system and auxiliary power supply.** Modifications were developed and the modifications were implemented on the railcars to correct the problems. Discussions with the Program Office revealed that the biggest issue with the rehabilitated 2000/3000 Series railcars is reliability.

## 10. Design and Engineering Issues

### a. Issues with Components

**There have been several design and engineering issues with the 2000/3000 Series Railcar Rehabilitation including the remanufacture of the trucks, Air Compressors, Doors, Automatic Train Control, Propulsion and Traction Motors.**

**The most serious of the design and engineering issues is the remanufacturing of the trucks by TTA. As a result, cars are being delivered out of tolerance. Issues arising from the remanufactured trucks supplied by TTA include the chevrons, lateral bumper clearance, uneven wheel wear, the traction motor resilient mount and the brake caliper studs.**

**Premature settling of the chevrons is one of the major issues with the rehabilitated 2000/3000 Series railcars.**

Railcar Maintenance used Lord Chevrons at the time of design and they were approved by WMATA for use in the remanufacture of the railcar. CMNT discontinued the use of

Lord Chevrons on the 2000/3000 Series railcars and reinstated the use of Breda Chevrons due to the Lord Chevrons not performing as expected. TTA has changed suppliers and is now using Breda Chevrons in production. However, the chevrons on the railcars already delivered to WMATA need to be replaced.

A temporary fix for the premature settling has been developed which will be implemented as part of the three phase recovery plan to complete all FMIs on the railcars already delivered.

**The lateral bumper clearance issue is under review by Alstom Transportation Group. The specification does not require the bumper to be centered. However, the bumper is shifting on the cab side of the railcar.** Alstom reported that their engineers were studying the problem and to date had been unable to determine the cause of the shift in the bumper. TTA, the subcontractor responsible for rebuilding the trucks, believe that the issue was the result of WMATA's change from an Italian two-stage shock to the Monroe single-stage shock to save money. It was their belief that this change resulted in lateral stops at a higher impact.

**An issue with the wheels was discovered as a result of the vendor in the Czech Republic not meeting specification due to an incorrect drawing being provided by the sub-contractor. The equipment made it through the system prior to the defect being discovered.** The materials problem has been corrected. However, Alstom is currently investigating the uneven wheel wear on the cars placed in revenue service.

**Issues with the Air Supply system include an oil leak in the high-side head which is causing reliability problems and oil seepage and oil migration.** Additionally, WMATA CMNT requested that the Graham-White Air Dryer be used in the Air Supply system. The system works well with respect to moisture. However, it is not effectively filtering out the oil which results in oil migration. WMATA changed the specification as a result of the 4000 Series railcar O-ring issue resolution to correct for the oil leakages. The EMI was completed and WABCO started changing the O-rings and Alstom approved the change. BAH approved. In July 2006 CMNT rejected the EMI as a result of their finding the application of a supplemental sealant as back up to the seal to be an unacceptable maintenance practice and considered it a "bandage fix" for what may be a more serious problem with the sealing surfaces of the block and mating head.

**Reliability of the Railcar Doors was another issue raised by the WMATA Program Office.** When this issue was discussed with Alstom, they reported that there were two reasons for the door failures; these are technical issues caused by voltage spikes and WMATA railcar maintenance not setting the doors correctly. The subcontractor IFE was developing a proposed maintenance revision for WMATA.

**There have been problems with the propulsion system on the cars recently shipped to WMATA resulting in the motors going over temperature.** Testing is currently underway. According to PRMT, it is an issue with the part supplied by the sub-supplier. There are two manufacturers that make the part. The part was originally procured from one sub-supplier and that part was approved by WMATA. Alstom found a

cheaper source and used the new part that created the problem.

**The Traction Motor has also become an issue. The engineers are seeing wear in the system.** The composition of the rubber being used is being investigated and being replaced with the same material. The solution is being monitored and according to Alstom Project Management could be a torque problem.

#### b. On-Site Warranty and Commissioning

##### o Parts Shortages

**WMATA staff reports and Alstom representatives confirm that there have been significant issues regarding parts availability for Warranty and repair work at WMATA.** Alstom is addressing this issue and recently enlisted Transit Life Services (TLS) another one of their subsidiaries to work with Alstom to improve the warranty parts support.

**Alstom has also experienced problems with their supply of production parts.** They are currently working on resolving the issues. However, the BAH Inspectors reported that often a railcar will be inspected with a missing part that will be installed at a later time and re-inspected for the missing part. In addition, the line is often shut down due to the lack of parts.

**Alstom has significant issues with TTA, the sub-supplier remanufacturing the Trucks.** The Alstom contract with TTA calls for engineering and build. However; in Alstom's opinion, TTA is unable to accomplish the engineering required. To assist TTA, Alstom has been providing support since the beginning of the project. Further, Alstom is now painting trucks as a result of a back up in the TTA line (a result of Alstom shutting down the line to do a process review and delays in WMATA sending cars due to the significant number of issues with the cars that have been delivered).

##### o Warranty Personnel Support

**Contractor warranty support personnel have not been available to research and address problems with the design and manufacture of the railcars as problems are being identified during testing and revenue service.** Alstom agreed, in our discussions in July 2006, that they do not have enough support at WMATA to deal with all of the issues on the railcars. Additional staff should have been added as additional cars were returned to WMATA for testing and revenue service. They are currently working on getting the correct resources assigned to WMATA facilities to ensure that there are fewer delays in returning the cars to revenue service.

**There are also problems with Alstom's sub-supplier Merak with regards to field support.** Merak had two people to support 202 cars. Merak informed us in July that they were planning on moving additional field support personnel to WMATA to address the issues.

### ○ Recovery Schedule

A three phase recovery schedule was developed between WMATA and Alstom Transportation Group to address the maintenance and warranty issues with the rehabilitated railcars. Phase 1 of the plan is to accelerate the implementation of priority FMIs and expedite the return of railcars to service. Phase 2 of the program will return railcars from deferred maintenance. Phase 3 will accomplish the Truck Rework program and implement any remaining FMI's.

According to Alstom representatives, Phase 3 will be the most difficult to implement. The causes of the Bumper and unusual wheel wear (some wheels are wearing faster than others) need to be resolved by the engineers prior to determining a solution for the problem. It was anticipated that this work would begin in October 2006. However, start up will be dependent on finding the cause and an engineering solution to correct the problem.

Phases 1 and 2 of the program are nearing completion at WMATA's old New Carrollton Facility. However; there are some cars that will need to be returned to the facility to have some of the priority modifications completed. Phase 3 which will incorporate the truck work is in the planning stages. The majority of the work under Phase 3 will be to get the truck dimensions back into specification on the 188 railcars that have the Lord Chevron. It is anticipated by the Program Office that work will begin on this phase in the spring of 2007.

## 6000 Series Railcars

### 11. Production Schedule

To date the most critical delay in the 6000 Series railcar manufacturing process is the issue with the Center Pin. This issue has been resolved and production has resumed both in Barcelona, Spain and Hornell, NY.

### 12. Quality Audits by Alstom

Alstom has had problems with staffing the Quality function. As of our discussions in July 2006, a plan had been developed and staff was slated to be transferred to the project to be more aggressive and conduct more quality audits. When the staffing is complete, the project will have an assigned Quality Engineer.

**The most recent quality audit of Alstom's Barcelona Spain facility was conducted in April 2006. This audit focused on the manufacture of the Center Pin part. It was found that the organization was not providing the resources necessary to implement and maintain the Quality Management System and that supplier quality and internal auditing were not adequately staffed and more project specific and project audits were needed.**

### 13. Inspections and Railcar Acceptance

#### a. First Article Inspection

The First Article Inspection took place in Hornell, NY between August 16 and 18, 2005. **According to the Program Office, at the completion of the Inspection Process, the FAI documents were signed by all the parties and accordingly a punch list of approximately 58 items was developed. It took approximately three months to resolve the punch list items to determine if they should be waived or a correction was required.**

**A review of the FAI documentation provided by the WMATA Program Office showed that the FAI documentation was signed off on by all parties by September 7, 2005. Included with the documentation was a list of issues found during FAI which included 349 items. At the time of the document approval, 13 of the items remained open.**

When the FAI process was discussed with the Alstom program manager, he reported that the First Article Acceptance took longer than expected as a result of not understanding the process. The actual process took 3 months where it normally takes 5 days. One of the reasons for this delay was the need to develop criteria. They felt WMATA did not develop the criteria in advance.

#### b. Production Line Inspection

The Inspectors for the 6000 Series railcars reported that they do not have the same issues that are being experienced with the 2000/3000 Series railcars since they are still at the early stages of the production schedule. For the 6000 Series railcars, there are 12 quality control hold points where WMATA on site inspectors check the work prior to the railcar moving forward. In the future the hold points will become audit points. Final inspection is being done prior to shipping.

#### c. Railcar Conditional Acceptance

**Fifty 6000 Series Railcars have been delivered to WMATA. However, recurring Quality Issues has resulted in only 30 of the cars having been conditionally accepted as of December 4, 2006. Twenty Railcars are currently at Greenbelt Yard unaccepted, 8 more than the contract allows for. The number of unaccepted cars allowed on Authority property has been somewhat relaxed to achieve the goal of processing and conditionally accepting 50 cars by the end of the year.**

**Issues to be resolved on the unaccepted railcars include front door seals, door adjustment requirements, railcar leveling and dynamic and friction brake problems in addition to cars waiting for Inspection and Testing.**

**An additional problem with acceptance of the railcars has become the availability and content of the Railcar History Books. In accordance with section 1.2.7 of the**

contract, *“The Contractor shall provide a loose-leaf history book for each married pair of cars. (CDRL 110) ... Books shall be readily available for inspection by WMATA representatives.”*

It was reported by the Offices of Quality Assurance and Railcar Maintenance that Railcar History Books are not being made available or presented when the railcars are delivered to Greenbelt to undergo Acceptance testing. In addition, the books are reported to be incomplete or include information for other railcars.

The WMATA Office of Quality Assurance recently performed an assessment of the 6000 Series Railcar Acceptance Process. This assessment was completed as a result of the Office of Quality Assurance’s findings from the 6000 Series Railcars which showed that the 6000 Series Program and Alstom QA/QC processes are not as effective as required.

**The Quality Assessment of the Acceptance Process completed in early November 2006, resulted in 33 findings which included observations and Corrective Action Required for the Program (8), the Engineering Consultant (6), and the Contractor (7) and in the area of Documentation (12).** A summary of the findings and observations provided to the Program Office was as follows:

- Program Management has not developed a process that ensures timely acceptance of quality cars.
- Contractor’s resources (personnel, equipment and parts) have not been planned.
- The Engineering Consultant has not provided a qualified on site Quality Manager.
- Poor workmanship and repeat discrepancies are slowing the acceptance process. A process for eliminating discrepancies before cars arrive is not established.
- Required documentation (Railcar History Book and Acceptance Package) is incomplete and often inaccurate slowing the acceptance process still further.
- A backlog of unaccepted cars at the acceptance site is resulting from the above causing additional problems. The Contractor cannibalizes them to correct discrepancies on cars further along in the acceptance process.
- Cars have been presented for acceptance without completion of safety related modifications (FMIs).
- Personnel responsible for quality lack a clear understanding of their roles, responsibilities and reporting paths.

**The 6000 Series Railcars have been in service for three months which is not a long enough period of time to determine the reliability of the railcar. According to railcar availability reports reviewed, 20 of the 26 railcars conditionally accepted were available for use in revenue service on December 1, 2006. Three days later 30 railcars had been conditionally accepted but only 12 were available for service. Issues with the 18 railcars unavailable for service included Flashing Motor Overload, a ruptured airbag, a dark railcar repeater, adjustments required to the air compressor; broken power cable brackets and 2 pairs were in revenue preparation.**

## 14. Design and Engineering Issues

Issues to date with the 6000 Series railcars include the center pin, design of the HVAC system, railcar leveling valve and On-site warranty. The Program Office reported the first 12 cars delivered to the Authority had good performance. However, the problem with the center pin delayed acceptance.

### a. Center Pin

In February 2006, WMATA inspectors observed 16 loose center pins with unusual heat markings. The observation was recorded and an investigation by Alstom was requested. The root cause was found to be Hydrogen-assisted cold cracking caused by:

- (1) Residual stress – stiffening ring joint design is constrained;
- (2) Improper execution of weld process in Barcelona; and
- (3) Bad material – material properties of some raw material was not to specification. Once the root cause of the Center Pin issue had been identified; engineering solutions were developed for both an interim repair to continue pre-revenue testing of 8 cars already on site at WMATA and a permanent repair for acceptance of the cars.

The permanent repair process is to cut the Center Pin installed in Barcelona, Spain from the railcar and bore the remaining piece from underneath the railcar. A new Center Pin is installed and welded in place at the top and base of the railcar. Alstom has set aside shop space and is working on 4 railcars at a time.

### b. HVAC

**The major design issue for the HVAC system included the Go/NoGo Algorithm vs. a sight glass in the liquid receiver tank.** During our discussions in July 2006 with Alstom Program Management, they reported that this issue was still open. They felt that the Go/NoGo LED would provide a better maintenance tool for the Authority. CMNT and the Program Office agreed in theory that the Go/NoGo LED would provide a superior system to the sight glass for determination if the system was functioning properly. However; the system never worked as presented by Alstom and Merak.

After a review of Merak's Go/NoGo Algorithm, the Authority found that the system did not meet WMATA's needs for refrigerant level determination and was not adequate to properly replace a properly positioned liquid receiver tank sight glasses. (WMATA Letter WM6.AL6.3283.L).

### c. Railcar Leveling Valves

A recent issue with the 6000 Series rails is a problem with the railcar leveling valves with railcar numbers 6038/6039 delivered to WMATA in October 2006. During



the Authority's quality inspection, it was found that the front leveling valve linkages on both cars were loose requiring the vehicles to be leveled after corrective action in accordance with revision level C of the Air Bag and Threshold Height Adjustment Procedure. To date this has been an issue on railcar numbers 6038/6039, 6018 and 6040.

**Railcar Maintenance's representative states that there was a lengthy process that got WMATA to the final revision for car leveling. The process is well documented and available from Program Management. According to CMNT's representative, this was once again a very lengthy process and Program Management agreed to some criteria for leveling the vehicle within WMATA infrastructures that can't be maintained and is in violation of the contract. The contract calls for the railcars to be maintained in all existing WMATA infrastructures.**

#### **d. On-Site Warranty and Commissioning**

The Alstom program manager reported that they were working on resolving the parts issues for the 6000 Series railcars. He reported that while he did not feel a sufficient amount of parts were in place on WMATA property at this point in the contract, they were working to resolve this issue and correct the situation. Contractor personnel have been assigned to WMATA's Greenbelt Facility and additional staffing will be added as additional cars are shipped to WMATA.

**Material availability for production is the number one issue with the 6000 Series railcar project.** The Program Team is working on getting the spare parts on site at WMATA. The current level is about 50%, prior to the start of revenue service.

**The 6000 Series program has been delayed getting the warranty personnel on site.** They are currently in the process of interviewing additional resources and will be adding technical and administrative help. This problem is similar to the 2000/3000 Series railcar problem in that Alstom does not have enough staffing or parts to support the railcars delivered to or conditionally accepted by the Authority.

**Repair parts are not onsite at WMATA and cars are not being accepted or progressing through testing as a result of the shortage.**

### **Recommendations**

We have made 41 recommendations and the Program Office suggested 1 recommendation as follows:

- 1. At the beginning of the contract performance, WMATA and Contractor Program Management representatives should have a joint partnering meeting where all aspects of the contract performance should be discussed and agreed upon to include:**

- **Contract Provisions and Requirements**
  - **Delivery Schedule**
  - **Staffing**
  - **Program Management Plan for WMATA and the Contractor**
  - **Quality Control**
  - **Quality Requirements and Oversight**
  - **Inspection Processes and Requirements**
  - **Subcontractors Performance**
  - **Procurement Processes and Procedures**
  - **Change Order Requirements and Process**
  - **Lines of Communication to Include Contractor's Representatives and the Owner's Contract and Technical Representatives**
  - **Maintenance Issues and Concerns**
  - **Acceptance Processes and Procedures**
  - **Lessons Learned from Prior Procurements**
2. **Continued Partnering meetings should be held with Program Management representatives and all applicable personnel to continue communications on all issues. These meetings should resolve issues as they arise in accordance with contract provisions and requirements.**
  3. **Partnering meetings should be resumed on both contracts for the purpose of discussing issues and resolving them.**
  4. **WMATA should require a formal delivery schedule be submitted and approved in a timely manner.**
  5. **The delivery schedule should be monitored for compliance. Deviations from the originally approved delivery schedule should be submitted and approved in writing in a timely manner.**
  6. **WMATA should immediately request and approve an updated official delivery schedule for both current Railcar contracts.**
  7. **COO, Rail assign a liaison who will ensure that the Program Office and Operations Maintenance communicate with each other and work together to resolve all technical issues as well as keep the other function informed on all issues that may affect the maintainability of the Railcars.**
  8. **COO, Rail should require the liaison to prepare a Communications Plan that will ensure that communications issues among WMATA Program Office, Contractor Program Office, Operations Maintenance and WMATA Quality Assurance are addressed and resolved.**

9. COO, Rail should assign a team to review the issues and concerns from these contracts and incorporate “Lessons Learned” into future Railcar Procurements to include the following issues:
  - Review Subcontractors past performance to ensure that they have the ability to meet quality and quantity requirements
  - Provide better control over on-site inspection services
  - Involve Safety, Quality Assurance, Quality Control and Operations Maintenance from the beginning of the Project
  - Update reliability requirements in contract specifications to be more in line with the existing Railcar fleet.
  - Ensure that all requests/contract issues are properly documented
10. WMATA should require the Contractor to have a formal quality control and quality audit process and schedule of audits of the Contractor’s Processes and of all of their major Subcontractors as well as a current schedule as of January 1, 2007 be submitted and approved in a timely manner.
11. COO, Rail, in coordination with the Assistant General Manager, SSRM, should review the organizational structure of Program Quality Assurance reporting relationship and determine the proper organizational responsibilities and placement.
12. WMATA’s Program Quality Assurance should monitor the Contractor’s Quality Control and Audit Process and officially report Quarterly on the Progress and Audits performed by the Contractor.
13. WMATA’s Program Quality Assurance should conduct its own audits of the Contractor and its major Subcontractors to ensure compliance with Contract requirements.
14. WMATA’s Program Quality Assurance should prepare a procedure for follow-up on all quality audit recommendations that includes a process for enforcement.
15. The Contractor’s quality control and quality audit plan, program and schedule should be submitted to WMATA Program Quality Assurance and the Office of Quality Assurance for review and formal approval.
16. All Contractor and Program Quality Assurance scheduled audits should be submitted to WMATA’s Office of Quality Assurance (QUAL) for their review and comment as applicable.

17. WMATA's Office of Quality Assurance should monitor all quality issues and quality audits performed by the Contractor and WMATA's Program Quality Assurance as part of its oversight role.
18. WMATA's Program Quality Assurance, with oversight by QUAL, should follow up on the Parsons Brinkerhoff Quality Report to ensure that Alstom has implemented all of the recommendations and that they are currently in compliance with the recommendations.
19. WMATA Program Management keep the Office of Procurement and Materials (PRMT) informed on all contractual issues and ensure that all changes that may be necessary are immediately communicated to the Contracting Officer prior to any action by the Program Office.
20. PRMT should assign a contract administrator to stay current on all contractual issues on the contracts and immediately address contract issues within WMATA and with the Contractor that arise.
21. WMATA PRMT ensure that the contract clauses and specifications are followed by the Contractor and the WMATA Program Office and ensure that any deviations from the contract terms should be documented and resolved in a timely manner.
22. The Program Office should ensure that Operations Maintenance and Quality Assurance are informed timely on all issues involving the contract performance, quality and acceptance of the Railcars.
23. Operations Maintenance and Quality Assurance should officially get involved with the contract performance at an early part of the contract, raise issues and participate in decisions affecting performance, quality and maintenance on the Railcars.
24. Operations Maintenance should inform the Program Office of any changes or issues concerning maintenance processes or procedures in a timely fashion to enable the Program Office to effectively communicate these changes to the Contractor.
25. WMATA Program Office should work with the Contractor to provide clear guidance and focus to the Contractor on all issues that may arise under the contract.
26. WMATA Program Office should review the processes and procedures for dealing with problems and/or technical issues that arise on the contract to streamline the process so that it will be more efficient and it won't take so long to resolve technical issues.

27. The Contractor should be required to immediately notify the WMATA Program Office of any technical issues, parts problems or technical problems being experienced with subcontractors so that they can be resolved timely.
28. WMATA Program Office assign a full-time liaison on-site at the Manufacturing facility to ensure that the manufacturing process is running properly and that inspection is supported and monitored.
29. The Contractor should be required to perform the contractually required quality control and inspection processes on their manufacturing line and during railcar acceptance on site at WMATA. WMATA Program Office should hold the Contractor's manufacturing line accountable for quality.
30. WMATA should define the inspection process at the beginning of the contract and enforce the compliance with the process.
31. WMATA Program Office should review the current inspection process and accomplish the following:
  - Determine whether WMATA should have in-house inspection personnel or continue to contract the inspection services out to a consultant
  - Establish the necessary staffing for the inspection process and ensure that funding is available to perform the inspection process.
  - Evaluate the current inspection process and make any changes as necessary.
  - Ensure that all inspection processes/points as specified in the contract are being accomplished and enforced.
  - Ensure that the Consultant is witnessing all tests being performed by the Contractor
  - Work with the Contractor and Consultant to ensure that the inspection process covers the necessary inspection areas without being too picky.
  - Develop a clear dispute resolution process regarding engineering issues raised by inspectors to ensure a quick resolution of the issues
  - Ensure that the Contractor Quality Control and Assurance personnel, Consultant Inspection personnel and WMATA Program Quality Assurance have a direct and unencumbered direct relationship with QUAL to include oral and written communication of issues.

32. WMATA Program Office should ensure that the Consultant has all contractually required inspection points reinstated on the 2000/30000 Series Railcar Rehabilitation contract.
33. WMATA Program Office should ensure that if issues arise at any inspection hold point on the contracts that the inspectors are listened to and supported so that quality issues are not passed over due to parts availability, workmanship, repeated quality issues or any valid reason.
34. WMATA Program Office assign an engineer to work with the Contractor to resolve all of the engineering and parts issues that continue to create problems on the 2000/3000 and 6000 Series Railcar contracts.
35. WMATA Program Office require the Contractor to evaluate its staffing and assign sufficient staffing to resolve issues of contractor warranty support, MERAK field support, parts availability and Quality Control/Audit processes.
36. WMATA Program Office, Operations Maintenance and the Contractor's Program Management review all issues that are keeping 2000/3000 and 6000 Series Railcars out of service and work together to resolve these issues.
37. WMATA Program Office require the Contractor to accurately maintain the Railcar History Books and to submit them to WMATA timely and in proper form when required.
38. WMATA Program Management and Quality Assurance ensure that all of the findings and observations included in the November 2006 Quality Assessment of the Acceptance Process be resolved.
39. WMATA Program Management and SSRM ensure that safety certifications are obtained on all applicable 2000/3000 and 6000 Series Railcars.
40. WMATA Engineering and PRMT review WMATA's Railcar technical, general and specific specifications to ensure that they are current, accurate and do not contradict each other.
41. The AGM, SSRM should review the structure and resources available in the Office of Quality Assurance to perform quality oversight of the Railcar Program and recommend the proper level of responsibility and resources necessary for the Office to perform its duties.

- 42. The Program Office recommends that a comprehensive plan should be developed to clarify roles, responsibilities, lines of communication and accountability for the railcar inspection, testing and acceptance process.**

**The Program Office, in coordination with the Chief Engineer Vehicles, provided a preliminary plan for action on each recommendations included in the report and has begun working towards implementation of the recommendations for these and future Railcar Procurement Contracts.**

## Management Responses

We provided a draft of the Audit Report to the Chief Operating Officer Rail, the Chief Engineer Vehicles, the Program Office, the Office of Railcar Maintenance, the Office of Quality Assurance, the Office of Procurement and Materials and the Contractor

The Chief Operating Officer, Rail (COO, Rail) commented that he was in support of the Recommendation that the COO, Rail assign a liaison who will ensure that the Program Office and Operations Maintenance communicate with each other and work together to resolve all technical issues as well as keep the other function informed on all issues that may affect the maintainability of the Railcars. Currently, the COO, Rail is developing a new approach to railcar commissioning, start-up and certification using an independent commissioning team to include representatives from Engineering, Maintenance, Operations, Safety and Quality.

### **The Program Office in coordination with the Chief Engineer Vehicles provided the following comments:**

- In general we concur with the findings, and we have suggested a number of next steps to address the issues raised. However, we see important themes that run through the findings that merit attention on a broader level.
  - Many of the findings/recommendations relate to systems and processes that are already in place and, we believe, are functioning well. The fact that there is a disconnect here means to us that there is a lack of understanding and/or a communication breakdown.
  - A number of the findings concern a lack of clear direction (too many cooks).
  - Other findings recommend that additional layers of review/approval/control need to be added (more cooks).
- Considering these themes, we feel a comprehensive plan is needed to clarify roles, responsibilities, lines of communication and accountability for the railcar inspection, testing and acceptance process.
- In that regard, we are preparing a white paper for the COO/RAIL to recommend establishing a consolidated group of WMATA professionals and technicians to provide start-up, commissioning and vehicle activation services for the new and rehabilitated railcars. The Commissioning Team/Organization will be accountable for verifying the quality and performance of delivered vehicles. Final decisions with enforcement authority will reside in the management of this group and will be governed by the policies and procedures established by the COO/RAIL. This new approach to accepting/commissioning assets to be operated and maintained by WMATA's workforce is being developed to resolve many of the concerns, disconnects and inconsistencies identified by the Audit Report. Additionally, the Audit Report identifies opportunities for improvement that will be incorporated in the Commissioning Plan.



- In addition, the Program Office provided to us a matrix detailing the Report Recommendations, the Office's preliminary response and actions.

**The Office of Rail Car Maintenance provided the following comments:**

- I found all the issues identified, most of which may be attributed to lack of production quality, as valid. The very same issues, stemming from Alstom's inability to deliver a quality product, are now evident in the 6K acquisition program. My comments are explanatory in nature, and are limited to addressing recommendations 7, 22, and 23, all of which relate to the major issues regarding lack of teamwork, cooperation and coordination.
- The Office of Rail Car maintenance provided examples of how they had supported the program including:
  - The COO, Rail's appointment of a senior CMNT manager within the past 60 days to act as "his voice" for all program related coordination and technical issues. This appointment has been ineffective as Program Office personnel continue to ignore the authority given this person. Over the course of the last three years with the rehab program, CMNT and WMATA QA have routinely been met with adversity or little cooperation and response from the Program Office. When requests are made for information, production data, root cause analysis, or technical feedback, there is little to no response. This pattern is accentuated on the 6K program. CMNT, along with WMATA/QA have been and remain driven by the need to acquire safe, reliable, and high quality equipment. The Program Office appears to be driven by schedule only.
  - Throughout most of the delivery period for the Breda Rehab program, interaction between CMNT and Alstom has been good. On several occasions, we worked with them, as well as their sub-vendors, to help identify performance problems and premature failure of pneumatic components. Specifically, we worked with Alstom to help resolve the following:
    - Early in the program, CMNT overhaul shops worked with Alstom to isolate problems being experienced with WABCO brake valves and actuators. Taking advantage of the knowledge our shop mechanics had, Alstom/WABCO was able to modify their overhaul/remanufacturing process, and reliability of the components is no longer an issue. Although serious problems still exist with the WABCO Air Compressor, our efforts in working with them may now result in the delivery of a compressor assembly that meets contractual and reliability expectations.
    - CMNT has worked endlessly with Alstom in trying to resolve quality issues with the remanufactured trucks. Much of the knowledge Alstom now has about tramming the trucks was provided by

WMATA mechanics.

- Alstom was having a problem with UTC, their vendor responsible for providing wheels for the rehab cars. UTC was delivering wheels that were concentric, and causing severe vibration on the cars delivered to WMATA. CMNT again worked with Alstom and agreed to cut the wheels so the cars could safely be put into service.
- Because of the multitude of performance problems with the rehab cars, CMNT has, for more than two years, provided shop space to Alstom that well exceeds contractual requirements. An entire facility at New Carrollton has been temporarily provided to them to work ongoing modifications and other quality / reliability maintenance needs. The loss of floor space to help Alstom has had considerable impact on availability of shop space for us to maintain the remainder of the WMATA fleet. Until recently, when some limited funds were made available, CMNT supported both the Program Office and Alstom for well over a year with loading, transporting, jacking and administrative support of the rehab cars for well over a year using operating funds.
- CMNT stands ready and very willing to continue supporting both programs. Along with WMATA/QA, we remain committed to standing firm to in ensuring the best possible railcar is delivered to WMATA, with or without cooperation from the Program Office.
- The Office also provided detailed comments pertaining to several areas of the report. We have incorporated the comments by CMNT's representative in this report as appropriate.

**The Office of Quality Assurance provided the following comments:**

- The recommendations (opinions) of Alstom and BAH have been solicited and listed in this draft. Their opinions are listed in a vacuum - the perspective - relative to their credibility should be explained so the reader will have an idea of what value these opinions should be given. For example, the facts are:
  - BAH has been the consulting engineer and assistant program managers for the 5K, 2&3K and the 6K programs. Each program has delivered cars very late with significant safety, quality, reliability problems and unsatisfactory performance.
  - Alstom - to the best of my knowledge - has not made a car delivery schedule on either the 2&3K or 6K programs to date. Both programs - the 2&3K and 6K programs contracted to Alstom - have delivered cars very late with safety, quality, reliability problems and unsatisfactory performance.
- CMNT is bending over backwards to help Alstom and the Program management team - to breaking point with shop space as they are short of the revenue service requirement almost daily.

- WMATA Q.A. is performing “QC” for the 6K effort, it is the only effective QC going (not from Alstom or BAH). QA has provided a list of items (via assessments) on what is needed to improve - what has the 6K program done to make these improvements.
- The meaning or importance of a contract ... the contract language, requirements and specifications ... too many program members seem to feel and have expressed that a contract is a wish list. An RFP may include wishes but after a contract is signed ... it is THE defining/guiding document.

**The Contractor provided the following comments:**

- In the Executive Summary Section, bullets 2,3, and 4 summarize a major problem in both projects. Frequently, it is not clear who is in charge at WMATA.
- There is a continuing problem on both projects of ignorance of or denial of inspection criteria. Issues are raised during inspections that are more related to the “eye of the beholder” or what a specific department would like to see rather than what the specification requires or what the agreed upon inspection criteria called for.
- Many issues could be readily resolved if all parties shared information openly and willingly to the benefit of the projects and the Authority. Example: what Alstom has learned about WMATA's experience with chevrons over the last 25 years has been "gleaned" little by little from various individuals within WMATA. At no time has WMATA been willing to provide Alstom with the complete history, the shop processes used by WMATA, problems encountered with the different chevrons, etc., etc., which would expedite resolution of this matter.
- Another point: cars are not being delivered "out of tolerance". Rather, Alstom has gone to the expense and effort of tramping the trucks on the WMATA property in order to ensure that the trucks are in full compliance with the technical requirements.
- Repair parts ARE on-site at WMATA and indeed, occasional shortages are encountered.....the sweeping statement in the report is inaccurate
- Payments for change orders have been withheld, typically, for YEARS on the 2000/3000 project.
- Alstom applauds the concept presented in recommendation number 7.
- Recommendation numbers 22 and 23 should receive special emphasis by the Authority; although it is late for recommendation number 22 to be implemented, there is still considerable value to be derived for all from this recommendation.

Due to a change in Management, the Office of Procurement and Materials has not yet had an opportunity to review and comment on the report.

James C. Stewart  
Auditor General

Cc: CHOS – Sara Wilson  
RAIL – Steve Feil  
CFO – H Charles Woodruff III  
PRMT – Raymond Griswold  
CENV – Dan Hanlon  
CENV - Jeff Pringle  
CMNT – Eugene Garzone  
SSRM – Fred Goodine  
QUAL – Richard Buettner  
Alstom – Roelof Van Ark  
BAH – David Strong

Attachment 1  
Modifications issued to Alstom Contract (FK0154)  
as of December 29, 2006

Change Order Number	Modification Number *	Subject	Proposal Amount	Modification Amount	Date of Modification	Audited Amount	Final Settlement Amount	Date Negotiated
	1	Delivery and Acceptance	-	-	4/19/2001		-	
WM001	2	HVAC Option	3,894,800.00	3,894,800.00	5/7/2001			6/1/2006
WM003	3	Asbestos Abatement	616,160.00	616,160.00	9/20/2001	614,930.00	614,930.00	6/1/2006
WM005	3	Replacement of Door Nose Rubber	201,846.00	203,711.00	9/20/2001	194,208.00	194,208.00	6/1/2006
WM006	3	Low Voltage Wire Replacement	6,381,751.00	6,381,751.00	9/20/2001	6,381,751.00	6,381,751.00	12/7/2006
WM007	3	Clevis Anchor for R-End Drawbar	306,546.00	306,546.00	9/20/2001	210,525.00	210,525.00	6/1/2006
	4	Transport 2 Damaged Rail Cars		17,400.00	8/21/2001	N/A		
	5	IETM		1,380,931.00	10/7/2003	1,380,931.00		
	6	120 VAC Lighting System Credit	(613,324.00)	(613,324.00)	4/6/2007	(613,324.00)	-	
	7	Radio Replacement Credit	(1,497,705.00)	-		(1,497,705.00)	-	
	8	Floor Fire Test	212,009.00	148,015.00	3/31/2003	148,015.00		
WM030	9	Replace Brake Pads	47,561.00	109,544.00	5/13/2003	47,603.00	47,603.00	6/1/2006
WM016	10	White Light Failure Indicator	97,388.00	97,388.00	5/13/2003	35,176.00		
WM044 Rev. A	11	Auxiliary Power Supply Modifications Replacement of 342 Carsets of End Door	477,632.00	490,922.00	5/13/2003	477,632.00	477,632.00	6/1/2006
WM017	12	Thresholds	166,136.00	166,136.00	5/14/2003	163,817.00	163,817.00	6/1/2006
WM024	13	Blinking Amber Light	94,993.00	94,804.00	5/15/2006	94,675.00	94,675.00	6/1/2006
WM023	14	Dynamic Brake with Failed Pneumatic	22,812.00	22,812.00	5/16/2006	N/A	15,000.00	6/1/2006
WM026	14	Slot to Hex Head Roller Bolts	39,682.00	39,682.00	5/16/2006	39,682.00	39,682.00	6/1/2006
WM015	15	Check Valve for Air Dryers	45,131.00	45,131.00	5/20/2006	42,510.00	42,510.00	6/1/2006
WM027	15	Safety Relief Valve	25,262.00	25,262.00	5/20/2006	24,135.00	24,135.00	6/1/2006
WM028	15	Twin Tower Air Dryer Failing Tests	3,869.00	3,869.00	5/20/2006	N/A	3,869.00	6/1/2006
WM031	16	EMR Relays	254,210.00	254,210.00	5/20/2006	245,602.00	245,602.00	6/1/2006
WM029	17	Additional Wheelset Scope	218,178.00	218,178.00	5/21/2003	214,381.00		
WM032	18	Elimination of Wheelchair Lock	12,481.00	12,481.00	5/21/2003	9,258.00	9,258.00	6/1/2006
WM034	18	FRP Backshell Operator Seat	53,917.00	53,917.00	5/21/2003	45,201.00	53,917.00	6/1/2006
WM036	19	Sleeves for HP-4 Disc Brake Units	763,124.00	763,124.00	5/23/2003	705,961.00	700,000.00	12/7/2006
WM037	20	Cab Door Window/Partition Window	53,931.00	53,931.00	5/29/2003	52,159.00	53,931.00	12/7/2006
WM040	20	Platform Detection Wiring Change	24,851.00	24,851.00	5/29/2003	24,346.00	24,346.00	6/1/2006
WM035	21	R-End Air Piping	154,086.00	154,086.00	6/6/2003	159,504.00	154,086.00	6/1/2006
WM041	22	Truck Journal Bearings	605,685.00	605,685.00	6/13/2003	598,282.00	598,285.00	12/7/2006
WM047	23	Floor Heater Elements	56,994.00	56,944.00	6/17/2003	57,878.00	57,878.00	6/1/2006
WM074	24	Provisional Spare Parts	6,632,592.32	6,632,592.32	7/28/2003			6/1/2006
	25	Under Car Conduit	-	-	1/29/2004		-	
WM107	26	Destination Sign Trainlines	44,061.00	41,161.00	4/15/2005	N/A		
WM102	27	Cab Console Terminal Boards	13,060.00	13,060.00	4/15/2005	N/A		
WM050	28	Heater Wire Securement	40,491.00	39,823.00	5/11/2005	40,298.00		
WM066	29	Damaged Side Sill Car No 2045	52,211.00	52,211.00	5/11/2005	50,327.00		
WM103	31	Current Collector Shunts	42,290.00	42,290.00	5/16/2005	41,890.00		
WM088	32	ATC Rack Sheild	80,605.00	80,605.00	5/16/2005	N/A		
	33	Milestone Payment/24 Hour Burn-in Total Modifications to Date	-	-	9/14/2006		-	
			<b>19,625,316.32</b>	<b>22,530,689.32</b>		<b>9,989,648.00</b>	<b>10,207,640.00</b>	

Notes:

\* All modifications are Part 1 and subject to settlement and finalization  
N/A - Audit Not Applicable

Attachment 2  
Change Orders Settled on Alstom Contract (FK0154)  
as of December 29, 2006

Change Order Number	Subject	Proposal Amount	Audited Amount	Settlement Amount	Date Negotiated
WM004 Rev. B	Replace 100 Carsets of Rubber Installed Under the ERRP Program	340,509.00	375,734.00	350,000.00	3/22-23/06
WM042 Rev. 1	Parking Brake Cable (Starts Car 57)	107,865.00	104,213.00	102,278.00	1/26-27/06
WM043	Knife Switch Insulator Modification	11,683.00	N/A	11,683.00	1/26-27/06
WM046	F-End Coupler Open Snap Eye Bolt	25,995.00	25,303.00	25,303.00	3/22-23/06
WM048 Rev. B	Seat Box Terminal Boards	119,278.00	119,137.00	119,137.00	1/26-27/06
WM052 Rev. 4	Pneumatic Brake Piping Clamps	372,525.00	374,918.00	250,000.00	1/26-27/06
WM053 Rev. 1	Truck Ground Lug	61,775.00	59,086.00	57,635.00	1/26-27/06
WM057 Rev. A	Zinc Epoxy Sealer	377,790.00	367,171.00	200,000.00	1/26-27/06
WM060	60 Hz Monitoring ( <b>Credit</b> )	(69,265.00)	(29,957.00)	(35,000.00)	1/26-27/06
WM061	Illustrated Parts Catalog Figures	17,824.00	17,887.00	17,824.00	1/26-27/06
WM065	#8 Vent Valve Mufflers	2,339.00	N/A	2,339.00	1/26-27/06
WM067 Rev. A	Rubber Flooring Upgrade	41,769.00	20,589.00	20,569.00	1/26-27/06
WM068 Rev. A	Additional Support for Existing Raceway	80,328.00	77,966.00	57,500.00	1/26-27/06
WM071 Rev. A	Knife Switch Hinge	36,408.00	34,495.00	28,000.00	3/22-23/06
WM078	Hand Brake Cabinet Window ( <b>Credit</b> )	(4,678.00)	N/A	(4,678.00)	1/26-27/06
WM086	Heater Guard Gaps	172,761.00	169,104.00	90,000.00	3/22-23/06
WM087 Rev. A	Additional Screws on Map Frames	43,146.00	N/A	43,146.00	1/26-27/06
WM090	Larger Capacity Electronics Manual Server	67,990.00	67,889.00	67,889.00	1/26-27/06

Attachment 2  
Change Orders Settled on Alstom Contract (FK0154)  
as of December 29, 2006

<b>Change Order Number</b>	<b>Subject</b>	<b>Proposal Amount</b>	<b>Audited Amount</b>	<b>Settlement Amount</b>	<b>Date Negotiated</b>
WM093	LVPS Circuit Breaker Box Coil Protective Cover	110,537.00	110,410.00	110,410.00	3/22-23/06
WM097	Knife Switch Test Plug II (was WM073)	10,319.00	N/A	10,319.00	1/26-27/06
WM098 Rev. C	Back to Back Seat Debris Guard	47,661.00	N/A	47,661.00	1/26-27/06
WM099	R-End Drawbar Cleat Block Spacer	109,463.00	106,998.00	106,514.00	1/26-27/06
WM100 Rev. 2	Priority Seating Sign	14,672.00	14,210.00	12,447.00	1/26-27/06
WM101	Heater Contactor Guard	174,792.00	172,996.00	172,996.00	3/22-23/06
WM104	Breaker Panel Terminal Board	15,174.00	15,930.00	15,174.00	1/26-27/06
WM108	Evaporator Coil Cleaning Access	532,372.00	351,117.00	120,000.00	3/22-23/06
WM110	End Door Locks	20,183.00	9,591.00	9,591.00	3/22-23/06
WM111 Rev. A	Vital Relay Bases	11,694.00	N/A	11,694.00	1/26-27/06
WM112 Rev. A	Valance Panel Latches	150,266.00	147,366.00	146,882.00	1/26-27/06
WM114	Removal of Knife Switch Safety Latches	14,668.00	14,951.00	5,000.00	3/22-23/06
WM115	CFM Heat Shield Stiffner	405,555.00	398,901.00	102,313.00	3/22-23/06
WM116	TB Bracket on Door Operator	49,750.00	48,507.00	48,507.00	3/22-23/06
WM121	Gear Unit Housing	301,689.00	287,939.00	287,455.00	1/26-27/06
WM123	Light Fixture Parts	80,873.00	34,331.00	10,000.00	1/26-27/06
WM124	Handicap Flip Seat Back	11,572.00	11,794.00	11,794.00	3/22-23/06
WM125	Handicap Flip Seat Rubber Bumper	36,488.00		36,488.00	1/26-27/06

Attachment 2  
Change Orders Settled on Alstom Contract (FK0154)  
as of December 29, 2006

<b>Change Order Number</b>	<b>Subject</b>	<b>Proposal Amount</b>	<b>Audited Amount</b>	<b>Settlement Amount</b>	<b>Date Negotiated</b>
WM127 Rev. B	Cab Air Diffusers	19,192.00	19,394.00	18,392.00	1/26-27/06
WM129 Rev. B	Manuals and Training Delays	503,508.00	93,125.00	93,125.00	3/22-23/06
WM130	Side Door Threshold Drain Pans	9,699.00	10,084.00	10,084.00	3/22-23/06
WM134	6" Range Present Platform Sensor Installation	12,687.00	12,966.00	12,966.00	3/22-23/06
WM135	Platform Indication Circuit Modification	551,960.00	510,550.00	450,000.00	3/22-23/06
WM136	Insulation Door Clips	46,810.00	52,436.00	30,000.00	3/22-23/06
WM137	Chicago Locks	4,859.00	N/A	4,859.00	1/26-27/06
WM139	Removal of Battery Box Microswitch	60,860.00	59,843.00	50,000.00	3/22-23/06
WM140	UF Raceway Notching	78,973.00	82,021.00	41,000.00	3/22-23/06
WM141	Cab Door Chicago Lock	11,843.00	11,376.00	11,376.00	3/22-23/06
WM143	Thumbscrews on Next Station Header	13,299.00	12,970.00	12,970.00	3/22-23/06
WM145	Seat Box Terminal Board	81,331.00	78,026.00	50,000.00	3/22-23/06
WM152	Switchguards on Operator's CB Panel	9,407.00	N/A	9,407.00	1/26-27/06
WM157	Valance Panel Enclosure	171,872.00	172,121.00	172,121.00	3/22-23/06
WM165 Rev. A	Compressor Heater on at all times	29,182.44	10,300.00	10,300.00	1/26-27/06
WM166	Back to Back Seat Flanges	192,231.00	196,189.00	75,000.00	3/22-23/06
WM172	Protect Door Pushbuttons	250,782.25	248,330.00	185,000.00	3/22-23/06
WM173	Low Ceiling Panel Blanks	17,601.00	N/A	17,601.00	1/26-27/06



Attachment 2  
Change Orders Settled on Alstom Contract (FK0154)  
as of December 29, 2006

<b>Change Order Number</b>	<b>Subject</b>	<b>Proposal Amount</b>	<b>Audited Amount</b>	<b>Settlement Amount</b>	<b>Date Negotiated</b>
WM175	Windshield Replacement Increase	154,405.00	149,470.00	149,604.00	1/26-27/06
WM176 Rev. 2	Brake Disc	421,805.25	420,284.00	420,284.00	1/26-27/06
WM177	Blue Light Relays	35,392.00	76,379.00	140,000.00	1/26-27/06
WM178	Tie Wraps on Evaporator Units	105,957.00	42,962.00	22,000.00	3/22-23/06
WM181	Contactoer Mounting Boards	51,824.00	42,485.00	42,485.00	3/22-23/06
WM185	Bench Test Equipment	28,576.99	N/A	28,577.00	1/26-27/06
WM186	Basic Overhaul of 176 Gear Units	790,920.22	751,660.00	751,660.00	1/26-27/06
WM187	Non-Destructive Tests	616,160.99	591,033.00	510,000.00	1/26-27/06
WM189	Wheel Replacement Percentage 75-100%	781,200.00	1,601,028.00	1,601,028.00	3/22-23/06 (a)
WM190	Jacking Pad - Car #3070	4,742.09	3,718.00	3,718.00	3/22-23/06
WM193	Broken Bases - Broken Status Unit	14,883.34	N/A	14,883.00	1/26-27/06
WM195	End Door Lock Hub Springs	16,112.19	14,867.00	11,972.00	3/22-23/06
WM196	Guage Brake Pipes	110,963.01	109,888.00	402,930.00	3/22-23/06
<b>Total Settled Change Orders</b>		<b>9,102,808.77</b>	<b>8,882,081.00</b>	<b>8,022,212.00</b>	

Notes:

N/A - Audit not Applicable

(a) Settlement Amount reflects a higher replacement percentage than in the original proposal amount

Attachment 3  
 Requests for Change on Alstom Contract (FK0154)  
 As of December 29, 2006

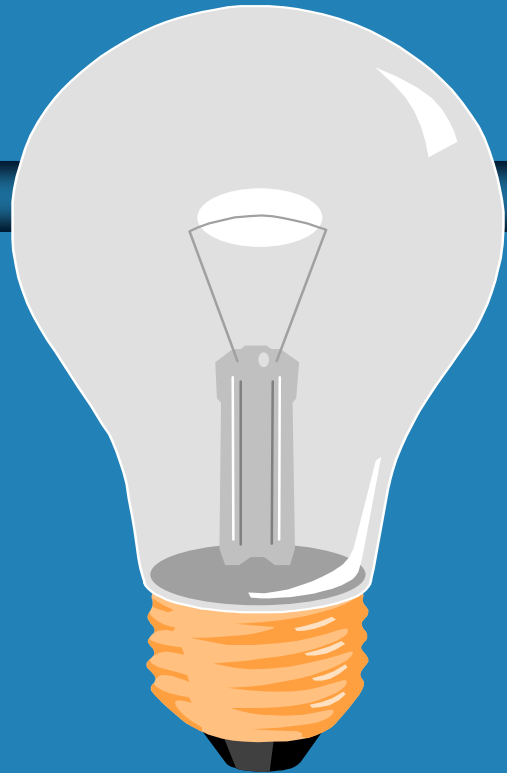
<b>Change Order Number</b>	<b>Subject</b>	<b>Proposal Amount</b>	<b>Audited Amount</b>	<b>Settlement Amount</b>	<b>Date Negotiated</b>
WM169	Glass Percentage Replacement	213,257.00	212,705.00	166,700.00	12/7/2006
WM197	New Trip Configuration Map DNSS	59,856.00	59,856.00	25,000.00	12/7/2006
WM198	HP-4 Actuator Replacement	472,093.00	464,235.00	464,235.00	12/7/2006 (a)
WM199	Move Site Work to Gblt & Branch Ave	61,654.00	In Process	40,000.00	12/7/2006
WM200	Cadmium Containment	173,537.00	In Process	173,537.00	12/7/2006 (a)
WM202	Replacement of Parking Brake Levers	23,463.00	18,986.00	18,986.00	12/7/2006 (a)
WM204	Door Auziliary Microswitch Adjustment	8,349.00	8,349.00	8,349.00	12/7/2006 (a)
WM205	Larson Guage Replacement	8,464.00	8,770.00	8,770.00	12/7/2006 (a)
WM206	Line Contactor Consumables	64,551.00	64,433.00	32,217.00	12/7/2006
WM208	Gearbox Material for Basic Overhaul	26,933.00	26,781.00	26,781.00	12/7/2006 (a)
WM210	Air Supply Reservoir % Increase	21,875.00	21,902.00	21,901.00	12/7/2006 (a)
WM211	Spare Electrical Coupler Head Asym	67,827.00		-	(b)
WM212	Seat Box Locks	40,064.00		-	(c)
WM213	Brake Gauge Replacements	287,635.00		-	(d)
WM215	Additional Gearbox Replacement	121,180.00	121,180.00	121,180.00	12/7/2006 (a)
WM216	Replace Windscreen Glass	188,087.00	187,972.00	187,972.00	12/7/2006 (a)
WM219	Supply Reservoir Additional % Increase	26,840.00	26,840.00	26,840.00	12/7/2006 (a)
WM220	Additional Wheels for Spare Trucks	41,790.00		-	12/7/2006 (c)
WM221	Wheel Price Increase to WM153	127,248.00		-	12/7/2006 (c)
WM222	Destination Sign Window % Replace	30,910.00	30,910.00	25,000.00	12/7/2006 (a)
WM224	Gearbox Material for Basic Overhaul	20,953.00	20,953.00	20,953.00	12/7/2006 (a)
WM225	Non-destructive Test to Spare Parts	11,963.00	In Process	11,963.00	12/7/2006 (a)
WM227	Glue Removal Cars 3127,3269 & 3268	2,335.00	N/A	-	12/7/2006
WM072	Window Percentage Replacement	461,236.00	458,205.00	461,236.00	12/7/2006
		<b>2,562,100.00</b>	<b>1,732,077.00</b>	<b>1,841,620.00</b>	

**Notes:**

- N/A - Audit Not Applicable*
- (a) Subject to Audit Adjustment*
- (b) Cancelled*
- (c) Alstom to Withdraw Proposal*
- (d) Resolved as part of WM196*

**Internal Audit Report  
No. AUD 07-076**

Ω **Questions**



Ω **If you have any questions or comments  
pertaining to this Internal Audit Report,  
please contact:**

Ω **James C.  
Stewart  
962-1008**