MBTA BUS EMISSIONS MONITORING AND CONTROL PROGRAM

Background

Over the past eight years the Authority has spent over one quarter of a billion dollars on new emissions friendly buses. These have included 40' and 60' Compressed Natural Gas (CNG) buses; 40' Electric Trolley buses, Silver Line Dual Mode buses; and Emissions Controlled Diesel buses. As each of these procurements was initiated, the Authority conducted an extensive review of the vehicle procurement options through vehicle evaluations, and consultation with outside vehicle and environmental experts to select the best vehicle technology available at the time.

With these investments the MBTA has modernized its bus fleet and dramatically reduced bus exhaust emissions resulting in an enormous positive impact to the region's air quality. The Authority's current bus fleet produces 92% less particulate matter and 54% less NOx than in 2000. This has been achieved through emissions control technologies, new fuels, and emissions monitoring and maintenance initiatives.

The entire diesel fleet now runs on a far more "environmentally friendly" ultra-low sulfur diesel fuel (ULSD), which reduces emissions by up to 30 percent over conventional diesel fuel. In addition, all active diesel buses are now equipped with diesel particulate filters (DPF's) that filter out diesel particulate matter.

Through this period the MBTA consulted the public and outside experts in how to address bus emissions. In 2001, when the MBTA was in process of selecting the vehicle technology for the Silver Line buses that would operate in the South Boston Piers Transitway, the MBTA established a peer review panel. The Panel was chaired by Prof. Nigel Wilson (MIT) and comprised of individuals nominated by the MBTA, the Massachusetts Environmental Policy Act (a part of the Massachusetts Executive Office of Environmental Affairs), and the Conservation Law Foundation. The Peer Review Report focused on ensuring that in the diesel mode the Silver Line vehicle used all of the current emission reduction technologies then available. The MBTA implemented these requirements into their vehicle specification to ensure that the buses diesel engine operated to the future 2004 EPA emissions regulations.

To help guide the MBTA in determining the best course of action for the Authority's procurement of buses in FY 2003, the MBTA again assembled a group of recognized experts in environmental and vehicle technologies - the "Expert Panel." The Panel was chaired by Prof. John Heywood (MIT) and comprised of experts with extensive experience in internal combustion engine technology, alternative fuels, clean propulsion and emission control technologies, environmental health, and financial management of public institutions. The Expert Panel evaluated the low emission engine and fuel technologies then available for transit applications. The expert panel focused on the clean engine technologies that would allow the MBTA to meet a Massachusetts Department of Environmental Protection (MDEP) Administrative Consent Order (ACO) that required the Authority replace their oldest high emissions buses.

Further establishing the Authority's commitment to environmentally clean buses, the MBTA Board of Directors, at the December 12, 2002, adopted a resolution that established precedents for bus procurements and facilities, emissions monitoring and the involvement of the "On the Move Coalition". The Board's objective was to ensure that the dramatic air quality improvements then being implemented would be sustainable over time and that community members and appropriate local, state and federal organizations were included in decision-making that had an impact on air quality. The resolution identified initiatives that MBTA management would undertake to ensure that all MBTA buses meet high standards for emissions. In addition, the Board authorized MBTA management to engage in further actions in order to reassure the community members and environmental advocates of the Authority's commitment to clean buses. Since then the Authority has actively implemented the Board's Resolution, including the investigation and selection of an Emissions Monitoring Program.

The Resolution required that a process be coordinated through which community members participate in developing the Emissions Monitoring Program and reviewing the results. An Advisory Committee (AC) was established to fulfill this commitment and to provide the MBTA with guidance, input and feedback for this emissions control initiative. The Committee was comprised of 15 individuals of diverse backgrounds representing public policy, public health, transit riders, academia, environmental organizations, community-based organizations, and government. Individuals were invited to participate in this volunteer, non-paid position. As well, the MBTA retained a specialized environmental consulting firm with expertise in monitoring and controlling bus emissions.

From the project's onset a representative from MassPirg and On The Move participated in all aspects of the project. She helped to develop, and ultimately approved the consultant study scope of work, which was based on the Resolution. She also sat on the consultant selection committee. Although note a voting member, she participated in the process and concurred with the selection of ESP.

As the Emissions Monitoring study progressed, five meetings were held with the 15-member AC to report on interim findings. The Committee made many recommendations that helped to reinforce the Study's results. Key AC members also reported to the public on a regular basis, through their organizations, that the MBTA was moving forward with this project.

With the help of the consultant, five different state-of-the art emissions testing technologies were demonstrated and evaluated during 2004-5. These options were considered as possible means of attaining more accurate and frequent emission performance data:

- Data Analysis
- Opacimeters
- On-Board Diagnostics (OBD)
- Portable Emissions Monitoring Systems (PEMS)
- Remote Sensing Devices (RSD)

The analysis revealed that three of the options (opacimeters, data analysis and OBD) would be unsuitable for use as a primary emission I/M screening tool in the enhanced I/M program, as they are unable to accurately detect or measure a broad enough range of pollutant emissions. While the MBTA continues to perform opacity tests in accordance with Massachusetts state law, all of the fleet's older 2-stroke diesels are slated for retirement, and the opacimeter devices lack the resolution necessary to detect malfunctions in modern diesel and CNG engines.

The remaining technologies, RSD and PEMS, were demonstrated by collecting emissions data on the MBTA fleet. In the case of PEMS, extensive emissions data was collected from fifteen buses over a nine-day period in November 2004. In the case of RSD, over 2,600 emissions "snapshots" were collected from 428 different buses, over two two-week test periods in June and September 2004.

The RSD and PEMS devices have advantages and disadvantages compared to each other. While PEMS provides the most detailed data on gaseous emissions, it requires significant time to set up the device on each bus and conduct the test. Testing is therefore costly, and requires significant bus out-of-service time. In addition, current PEMS devices can not collect information on PM emissions.

The RSD system, by contrast, collects emissions "snapshots" as vehicles drive by a fixed sensor. While each snapshot is less detailed than typical PEMS data, the MBTA deployment demonstrated that if collected under controlled conditions and interpreted properly, RSD data can provide an accurate means of identifying high emitting vehicles.

RSD can also measure Smoke Factor to identify buses with high PM emissions. As a drive-by testing technology, RSD can collect emissions data on hundreds of vehicles per day, if deployed in a high traffic area such as the entrance to a bus depot. In addition, buses do not need to be removed from service for testing, minimizing the impact on bus operations. While the capital cost of RSD equipment is high, incremental operating costs are low. Therefore, the technology can be used to cost-effectively collect fleet emissions data at a relatively high frequency (for example quarterly).

The report recommended RSD as the most appropriate technology to be used as the primary emissions screening tool for MBTA's enhanced I/M program. An analysis of the incremental costs and benefits of different testing frequencies found that RSD should be used to collect emissions data at each MBTA garage for one week each quarter. At the completion of each week's testing, the collected data would be used to identify high emitting buses, which would then be scheduled for maintenance.

There were multiple approaches that MBTA could take to procuring the necessary equipment and expertise to conduct both RSD and PEMS testing. The approaches ranged from the purchase of test equipment and conduct of testing with MBTA personnel, to the purchase of testing services from a third party. The report recommended that MBTA pursue a service contract for both RSD testing.

At the conclusion of the Study, the AC endorsed the final recommendations that called for the MBTA to proceed with the procurement of Remote Sensing Technology and a service contract.

The MBTA issued Request for Proposal Number 31-06 on May 6, 2006 to four potential bidders and advertised it the MBTA website. On Thursday, May 18, 2006, a Pre-Bid Conference was held followed by a System-wide Site Inspection. On July 11, 2006, only one company, ESP, submitted a pricing and technical proposal. A selection committee composed of contractual and technical teams reviewed the proposal. The technical team used criteria such as experience, past performance, service plan, installation plan and equipment solution. The contractual team performed a compliance review.

ESP's response included a comprehensive design, development, and fixed-installation plan for all eight MBTA bus garages. The remote sensing equipment would be operated two shifts per day, five days per week to provide quarterly reports for each garage. The total project cost for the equipment, labor and testing services over five years was originally valued at $2.56 million.

The MBTA entered into a series of negotiations with ESP to develop a less costly means of meeting the project goals. In subsequent proposals ESP reduced the testing frequency, combined fixed and mobile operations, and reduced labor. On December 18, 2006 ESP submitted its Best and Final Offer, for trimester testing utilizing a combination of fixed installations at the two primary garages and mobile deployments at the other six garages. ESP's BAFO was for $1,743,628 and found to be fair and reasonable by the selection committee. The MBTA subsequently entered into a contract with ESP.

The Emissions Monitoring Program is intended to provide trimester emissions screening for the MBTA's entire bus fleet. The scope of work is two-fold in nature:

> ESP provides the required equipment necessary to perform emissions testing on the MBTA's entire bus fleet housed at eight (8) garages. ESP operates and maintains this equipment in good working order, to ensure compliance with the emissions testing requirement of the entire bus fleet. ESP provides a trained, dedicated representative for this service; and
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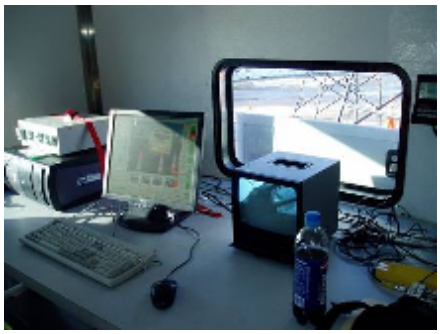
> ESP conducts an Enhanced Bus Emissions Testing Program, designed to measure and report the exhaust emissions of every diesel and natural gas bus in the MBTA fleet three times a year. The program identifies "high emitters" for the following criteria pollutants; carbon monoxide (CO), nitrous oxide (NO), gaseous hydrocarbons (HC) and particulate matter (PM).

ESP has been developing remote sensing technology for over fourteen years. It's systems are currently in use by state governments to supplement their existing light duty vehicle emissions Inspection and Maintenance programs, including the Texas Department of Safety, and the Arizona Department of Environmental Quality, as well as the Clean Air Strategic Alliance of Edmonton Alberta. The EPA has studied and approved remote sensing technology for use in emissions screening applications. As well, this same technology was extensively tested at the MBTA and proven effective in identifying high-emitting buses.

Previously, the MBTA did not have the capability to test or evaluate all critical bus fleet emissions characteristics. The new monitoring equipment allows each bus to be tested for a wide range of emissions including HC, NOX, PM and CO. The tests are conducted on each bus at least three times a year and the data is fed back into the MBTA's new maintenance control system which gives us the ability to immediately rectify any problem.

This program is a key piece of the MBTA's multi-year efforts to dramatically reduce bus emissions, while modernizing a critical component of its service fleet. The MBTA's achievements in rapidly converting to an environmentally friendly bus fleet are impressive. With this new RSD technology, the MBTA now has the necessary tools to identify high emission buses and ensure that appropriate maintenance action is taken. The RSD screenings provide data that enables more timely bus maintenance to be performed and also reduce the possibility of expensive repairs and/or in service failures.



ECD bus passing through sensors.