

Report on

Maintenance Practices Assessment

for the

The logo of the Boston Fire Department is a shield-shaped emblem. It features a central Maltese cross with a fire helmet on top. The word "BOSTON" is arched across the top, and "FIRE DEPARTMENT" is arched across the bottom. The shield is primarily red with gold and white accents.

**Boston
Fire Department**

March 2009

MERCURY ASSOCIATES, INC.

MERCURY

MERCURY

March 6, 2009

Mr. Roderick J. Fraser, Jr.
Commissioner
Boston Fire Department
115 Southampton Street
Boston, MA 02118

Dear Commissioner Fraser:

Mercury Associates, Inc. is pleased to submit this report on its assessment of the apparatus maintenance practices of the Boston Fire Department. We appreciate being given the opportunity to work with the Department on this endeavor, and look forward to the opportunity to assist your organization in implementing improvements in the maintenance – and overall – management of the fleet that will give BFD confidence that every apparatus in it is both safe to operate and safely operated.

Very truly yours,



Paul T. Lauria
President



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INTRODUCTION

This report presents the results of Mercury Associates, Inc.'s high-level assessment of the fire apparatus maintenance practices of the Boston Fire Department (BFD). This assessment was precipitated by an accident in January 2009 in which the brakes on a ladder truck reportedly failed. Tragically, a career firefighter with BFD, Lt. Kevin Kelley, was killed in this accident.

It is important to note that our assessment was not intended to investigate the direct or indirect causes of the crash of Ladder 26 or to ascertain whether any other pieces of apparatus in the BFD fleet are in danger of being involved in similar accidents. Rather, it was to examine the Department's general approach to apparatus maintenance and repair in recognition of the fact that no organization can have confidence in the safety of its fleet if it lacks confidence in the soundness of its fleet maintenance and repair practices.

We wish to point out that this report focuses more on negative than positive aspects of the maintenance of the fleet inasmuch as the Department's primary goal in commissioning our review was to identify weaknesses that it needs to overcome, not to get "attaboys" for things that it already does well, already is in the process of improving, or already recognizes need to be improved. The Department has, in fact, begun some important strategic initiatives aimed at improving the safety, reliability, and costs of the fleet, most notably replacing 11 pieces of apparatus in the last two years and developing and securing City Hall's support for a multi-year fleet replacement plan aimed at significantly reducing the age of the apparatus fleet over the next several years. The Department also has made sizable increases in funding for apparatus maintenance and repair (a four-fold increase from FY 2007 to 2008), and has devoted attention to improving budgeting and cost tracking for fleet maintenance so as to better get its arms around what types and quantities of resources BFD needs in order to care for the fleet properly. Readers should not lose sight of these accomplishments as they review our critique of fleet maintenance practices. It goes without saying that no amount of attention, expertise, or money can eliminate bad habits overnight that have developed over many years, but the Department has made a good start on reforming some long-standing practices that detracted from the safety and efficiency of its fleet.

This assessment was conducted by Paul Lauria, the President of Mercury Associates. Mercury is an employee-owned fleet management consulting firm that advises fleet owners of all types and sizes on ways to improve the management and operation of their fleets. The firm has no affiliation with any entity that sells vehicles or other products or services to fleet operators; it is a provider of independent, unbiased guidance to fleet operators. Mercury's experience advising large municipal and metro-area county agencies such as BFD on their fleet management practices is extensive. In the last three years alone, we have provided fleet management consulting services to the cities of Boston (Police Department), Charlotte, Houston, Las Vegas, Louisville, Oakland (CA), Orlando, Philadelphia, Salt Lake, San Antonio, San Francisco, Seattle, Tampa,



Vancouver (BC), and Washington, DC. Mr. Lauria has been a fleet management consultant for 25 years and has personally provided fleet management consulting services to more than half of the 50 largest cities in the United States, including the 10 largest.

The assessment consisted primarily of on-site interviews of an array of BFD officials and personnel over a period of two days during the week of February 16, 2009. We also reviewed some documents and cost data pertaining to fleet management and maintenance practices that were provided to us pursuant to an information request we made prior to this visit. The individuals interviewed included Commissioner Rod Fraser and Deputy Commissioner of Administration and Finance Kathleen Kirleis; Deputy Chief Peter Laizza and District Chief Mike Liotta who manage BFD's Fleet and Facilities Maintenance Division; Lieutenant Richard Cook and Firefighter Dan Moore, senior members of the BFD Motor Squad, who are responsible for overseeing, respectively, light-duty vehicle and apparatus maintenance and repair; Ed Kelly and Rich Paris, President and Vice President of Local 718 of the International Association of Firefighters; the BFD Joint Safety Committee; Mary Kane, who administers most materials procurement transactions for the Maintenance Division; John Perry and Bill Hackett of the Information Technology Division who support the Department's *Firehouse Software®* management information system; and several members of Engine Company 39.

Ideally, an assessment of this type would have included the review of policy and procedure statements and other documentation that specifies *how* all maintenance and repair activities are to be performed, and the calculation of a variety of key performance indicator statistics and their interpretation using suitable industry benchmarks so as to gauge *how well* they are being performed. However, as will become clear in this report, neither of these types of information are readily available in BFD because they are not used to any significant degree to manage the maintenance and repair of the fleet.



FINDINGS

FLEET MANAGEMENT ORGANIZATION AND STAFFING

BFD does not have a professional fleet manager or professional apparatus maintenance technicians, which is surprising given the size and costs of the fleet, the complexity of the vehicles and equipment comprising it, and the criticality of these assets to the Department's ability to fulfill its mission. The Department had civilian apparatus mechanics at one time, but these positions reportedly were eliminated for budgetary reasons in the early 1980s. The Department recognizes that the lack of such personnel is a problem, and currently is in the process of recruiting a fleet manager and three mechanics.

The maintenance of the fleet is overseen by a combination of career firefighters and civilians who are responsible for both facility and fleet maintenance. The Department has 35 fire houses, a training academy, a fire alarm building, and a 50 year-old headquarters complex on Southampton Road, so facility maintenance and repair demands occupy a sizable portion of the Maintenance Division's attention. This group includes firefighter superintendent and assistant superintendent positions, both of which are currently unfilled; a deputy chief and a district chief who currently act as the de facto managers of the unit, with one focusing on the fleet and the other on facilities; a Motor Squad comprised of eight firefighters who troubleshoot vehicle problems and perform a wide array of running repairs on vehicles; and six civilian garage attendants who perform some maintenance and repair work on light-duty vehicles but focus primarily on apparatus maintenance support activities such as shuttling vehicles between fire houses, the maintenance shop on Southampton Street, and vendor facilities.

While there is an organization chart for the Maintenance Division, the roles, responsibilities, and authority of the positions identified on it are not clearly defined. There are no formal position descriptions defining the day-to-day job duties – let alone career paths – of the firefighters or civilian employees that make up this organization. Some of the titles used for the civilian employees – Leather and Canvas Worker, Senior Sign Painter and Letterer, for instance – are clearly archaic. The fact that they are still used is reflective, in our opinion, of a general lack of appreciation (in the past, at any rate) of either facility or fleet management as important, professional activities requiring suitable titles and opportunities for career advancement, specialized expertise, formal training, or certification.

The firefighters who work in the Maintenance Division receive few incentives to do so. The chiefs who oversee the Division generally are close to retirement when they are assigned to it; have no particular background in the field of facility or fleet management or maintenance; and, due to their short time horizons, have little motivation to invest time in learning the finer points of these activities. The Motor Squad members receive negligible differentials in pay relative to their fellow firefighters. Since there is nothing preventing a Motor Squad member from leaving and rejoining an field company, the



Department has felt that it is difficult to justify spending much effort or money to ensure that these technicians are properly trained.

It seems to us that the principal implication of relying primarily on firefighters rather than civilian managers and technicians to oversee the management and maintenance of the fleet is that BFD has been reluctant to invest in the development of in-house fleet management expertise. We believe that this is the primary reason that the Department's fleet management practices are deficient in many areas.

The appropriateness of the Maintenance Division's current staffing level is difficult to gauge. Normally, a fleet maintenance organization requires its maintenance technicians to keep detailed records on how they spend their time and the resulting data can be used to measure, among other things, technician productivity (i.e., how much time is spent working on vehicles) and efficiency (i.e., what is accomplished in the amount of time spent). However, BFD does not maintain such records and therefore does not have data that would enable us to determine whether the Maintenance Division has too many, too few, or just the right number of mechanics and garage attendants.

As noted above, the Department is in the process of recruiting three mechanics. It is clear to us that BFD needs to increase the level of in-house technical expertise in apparatus maintenance, and hiring professional, journeyman mechanics seems like a logical and expeditious way to do this. However, a strategy for integrating such positions into the Maintenance Division has yet to be developed. It is our view that several questions about the Department's overarching approach to fleet maintenance should be addressed in conjunction with hiring these mechanics, in order to ensure that this investment yields the dividends that BFD expecting.

VEHICLE INSPECTION AND DEFECT REPORTING

An effective fleet maintenance and repair program has many different components, one of the most important of which is to inspect vehicles on a regular basis in order to identify defects that may impair their safe operation, and/or that may lead, if left unattended, to repair requirements that would be far more costly to undertake than would the preemptive correction of the defects identified. It is widely acknowledged by both senior management and firefighters we interviewed that BFD does not have an effective vehicle inspection program.

All fire apparatus receive annual safety inspections in accordance with Commonwealth of Massachusetts law. These inspections are performed by outside vendors. However, the Department was not conducting annual ladder and pump inspections and certifications until about one year ago. While both of these types of inspections obviously are valuable, they are performed only once a year and many things can go wrong with a vehicle over the course of a year. In other words, they are only two components of an effective vehicle inspection program, and by their very nature, the



least likely to detect a defect in a vehicle that might impair its day-to-day readiness and safety.

The only documentation of daily vehicle inspection requirements with which we were provided was a description of the job duties of Apparatus Chauffeurs contained in the *Rules & Regulations of the Boston Fire Department* (dated June 8, 2006). The half a dozen or so apparatus inspection requirements identified in this document are fine for inclusion in a job description for *illustrative* purposes, but they fall far short of the detailed guidelines and checklists needed to ensure that apparatus pre and post-trip inspections are performed properly. If the Department has other written specifications for performing such inspections, we were not provided with copies of them. References in the minutes of a recent Joint Safety Committee Meeting to a daily “Check Off Sheet” suggest that some type of inspection checklist used to be employed but is no longer used. Even if such documentation exists, however, the general consensus of the cross section of BFD officials and employees we spoke with is that the day-to-day inspection of apparatus is inconsistent at best.

The failure to perform such inspections is emblematic of a larger problem with the Department’s overall approach to fleet maintenance: namely, that it traditionally has tended to *react* to problems with vehicles as they arose rather than trying to *prevent* them from arising in the first place. There seems to be a number of reasons for this:

- A lack of a sense of ownership of, and responsibility for, apparatus. Within a given field company, an engine or ladder truck typically is operated by as many as 16 different firefighters, so it “belongs” to everybody – and to nobody. Human nature being what it is, it is common for individual apparatus operators to assume under such circumstances that someone else will take care of any problem encountered with the performance of a vehicle.
- The uneven and unpredictable utilization of fire apparatus. The nature of the mission of any fire department is such that the need for and use of a fire apparatus is erratic. To a certain degree, this creates the mindset that any deficiencies that may exist with a vehicle can be taken care of “later,” when things are slow or before the vehicle is needed to respond to an emergency. In the absence of a steady, predictable demand for vehicle use and proper performance, it is difficult for users to remain vigilant about vehicle readiness.
- A lack of appreciation of the costs of repairing versus preventively maintaining vehicles. As will be discussed in greater detail below, there is no tradition in BFD of using cost or any other quantitative data to manage the fleet. Consequently, there is little or no recognition of the actual cost premium that the Department pays to fix vehicles rather than preventing them from needing to be fixed in the first place. Many people in the Department recognize that when a vehicle is taken to a vendor for an inspection or a repair that it may end up staying there for some time so that a host of defects that the vendor uncovers can be remedied, but



such recognition does not seem to have translated into a coherent strategy for looking for defects and nipping them in the bud.

Pre and post-trip inspections are important not only for ensuring that defects that can impair the safe operation of vehicles and/or lead to costly repairs are *detected*, but for ensuring that they are *communicated clearly and coherently* to someone who can ensure that they are corrected promptly and properly. Keeping in mind that pieces of fire apparatus are in the physical possession of the field companies most of the time, it is important that mechanisms exist to communicate vehicle repair needs to the Maintenance Division. No matter how motivated, well trained, or equipped it is, no fleet maintenance organization can maintain and repair a fleet effectively without the cooperation and active involvement of fleet users, and this begins with effective communication between the two entities.

BFD does have a procedure in place for communicating vehicle defects and service requests to the Maintenance Division: *Form 5A*. This form is supposed to be filled out by a company officer whenever a problem is found with a vehicle and forwarded to the Division. However, we noted instances in which this form has been used to report vehicle accident damage and to make recommendations regarding the retirement of an apparatus, so it appears to be more of a catch-all mechanism for communication about vehicles between fire companies and the Maintenance Division than a tool specifically designed for alerting the Division that an apparatus requires immediate attention. There is no place on the form to indicate that an apparatus is not mission capable or to recommend that it be taken out of service, although an officer could communicate this in narrative form.

Since the use of email within the Department has been widespread for only a year or so, requests for immediate attention usually are made via phone call or in person when a firefighter brings a vehicle into the main shop for inspection. In a well-designed fleet maintenance program, the vehicle operator would convey such requests via a written service request or defect reporting form and a service writer or maintenance supervisor would open an electronic work order when the request/report is received. This approach has the benefit of tracking vehicle downtime and ensuring that the shop has a record of the problems with the vehicle that the operator did (or did not) report. This second point is important, because maintenance organizations can waste a lot of time trying to diagnose problems with a vehicle due to the fact that they were reported inaccurately or incompletely. It should be noted that BFD has an enterprise-wide information system called *Firehouse Software®* that has the ability for individual firehouses to open requests for service to their vehicles and equipment that the Maintenance Division could then access at the main shop.

In spite of having a procedure for vehicle operators and maintainers to communicate with one another regarding vehicle defects, many firefighters reportedly are reluctant to report problems with their vehicles out of fear that they may be taken out of service for an extended period of time in order to address a backlog of defects that has developed due to poor preventive maintenance practices and – no surprise – the repeated failure



to report little problems that eventually snowball into bigger problems. Various anecdotes were shared with us during our visit about vehicles with obvious safety problems such as bad brakes and broken windows and mirrors being driven by firefighters. Needless to say, no fleet maintenance organization can fix vehicle defects of which is not aware. However, one way to detect such problems – in spite of vehicle operators if not with their assistance – is through the conduct of regular preventive maintenance inspections.

PREVENTIVE MAINTENANCE

BFD does not have a formally defined preventive maintenance (PM) program for fire apparatus. Annual inspections and oil changes reportedly are performed on all apparatus, but there is no document, checklist, or other written specification as to what activities are to be performed as part of such an inspection service or how they are to be performed. Such instructions are staples of all effective PM programs, as are inspections of vehicles at intervals of considerably less than one year. When we asked officials in the Maintenance Division about apparatus manufacturers' recommended engine oil change intervals, which usually are key determinant of PM service frequencies, they told us that they do not know what these recommendations are.

Maintenance officials were quick to point out that they typically see each apparatus "four to five" times a year in the course of addressing defects that have been brought to their attention or taking vehicles to vendors' shops for state safety inspections, and that they inspect critical components when vehicles are in the shop for these reasons. The implication of this explanation was that vehicles do not go uninspected or repair needs undetected. It goes without saying, however, that having repair needs or once-a-year inspection requirements dictate if and when vehicles are serviced is not an effective approach to preventing in-service breakdowns or costly repairs.

WORK ORDER PROCESSING

In well-designed fleet maintenance programs the processing of work orders (i.e., the performance of vehicle maintenance and repairs) involves the following key steps:

1. A supervisor opens a work order for *every* request for service to a vehicle when the request is received;
2. The supervisor prioritizes each work order for assignment to an in-house mechanic or an outside vendor based on his/her assessment of factors such as the mission criticality of the vehicle, the nature of the services required and their likely duration, and the availability of a reserve vehicle for the user of the unit to be taken out of service;
3. The supervisor assigns each work order to a mechanic or an outside vendor based primarily on considerations of availability and technical competency to (if necessary) further diagnose any problems with the vehicle and to effectively repair the vehicle;



4. The mechanic or vendor documents all work performed to complete the repair, including the amounts of time spent on, and the specific parts used to complete, the various activities that comprised the repair;
5. The supervisor inspects the completed work order to ensure that all necessary information has been recorded properly and that the time and parts charged to the work order are reasonable; and
6. Depending on the nature of the repair, the supervisor conducts an inspection of the vehicle (or designates someone else in the maintenance organization to do this) to ensure that the repair was performed properly.

Typically, the documentation of each work order is performed electronically using maintenance management software designed for this purpose. This includes entering details of services performed by vendors, which, in BFD's case, accounts for the lion's share of all fleet maintenance and repair work.

While the Maintenance Division employs elements of this process, it does not do so in nearly as structured a fashion as these steps suggest it should. It has no written policies or procedures to be followed in opening, prioritizing, or assigning work orders; monitoring their status; or ensuring that all maintenance and repair work is documented properly. Although the Department's *Firehouse Software* information system has an integrated fleet maintenance module that appears to have sound, if basic, work order functionality, it is not used on a real-time basis to process or manage work orders.

The Maintenance Division uses paper "Day Work" and "Night Work" recap sheets to summarize in narrative form the maintenance and repair activities performed in house on each shift. The Division also records information on maintenance and repair work performed on each apparatus on paper Work Repair Order forms. However, as was common in the pre-computerization days of fleet maintenance, these forms generally are filled out after the fact rather than as the work is being done, so the accuracy and completeness of the information captured on them is somewhat suspect. Since these forms do not include space for recording information on any parts consumed in performing a service, it also is unclear to us how parts costs are tracked and parts warranties are managed.

Information captured on the Work Repair Forms is eventually input to the *Firehouse* system by the two senior members of the Motor Squad. This is a laborious and time-consuming process that prevents BFD's two most experienced fleet maintenance technicians from spending time on those activities that they are best qualified to perform – troubleshooting problems, fixing vehicles, and managing the work performed by vendors. Information on repairs performed by vendors does not appear to be entered into the *Firehouse* system. The Deputy Fire Chief overseeing the maintenance of the fleet identified hiring a clerk to assist with maintenance and repair data entry chores as his number one priority. While we would not put it at the top of the list of priorities, we agree that an organization that may spend as much as \$2 million on vehicle



maintenance and repair services this fiscal year needs some dedicated administrative and analytical support.

The Maintenance Division's paper-based, largely narrative record keeping practices are emblematic, in our opinion, of an organization that has not embraced the use of computers or quantitative information for the management of mechanics, parts, vendors, or vehicles. The Department was undoubtedly well served by first-hand observation, face-to-face communication, paper records and files, the institutional knowledge of key employees, and so forth, for many years, but the days of managing a large complex fleet and millions of dollars worth of expenditures *primarily* on the basis of such devices and techniques are long gone. They increase the likelihood that mistakes will be made in inspecting, maintaining, and repairing vehicles. They make it difficult for BFD to examine its fleet maintenance and repair activities and the performance of the individuals responsible for managing them objectively and critically. They make it virtually impossible for the Department to *prove* to anyone who might question the soundness of the management of the fleet or the safety of the vehicles and equipment that comprise it that the Department is a responsible steward of either these assets or of the taxpayers' money that pays for them.

Department management informed us that BFD has made significant strides recently in instituting up-to-date practices in areas such as cost forecasting and budgeting, human resources management, and the use of information technology. These advances are to be commended, and now need to be expanded to encompass the management of fleet resources and associated activities without which the Department literally could not fulfill its mission.

MANAGEMENT OF VENDOR-PERFORMED SERVICES

As has been discussed, BFD outsources virtually all major maintenance and repair work on its fire apparatus to commercial repair shops. Given the current limitations of those aspects of fleet management and maintenance that the Department does perform in house – a lack of defined policies and procedures, limited collaboration between vehicle users and maintainers, poor use of quantitative information, etc. – this is a good thing, and we do not recommend changing this practice to any significant degree any time soon. However, it has been our experience that organizations that outsource significant amounts of fleet maintenance and repair work to vendors or contractors often do not devote sufficient attention to managing the quality or costs of such work. They tend to assume that qualified service providers, precisely because they are qualified, have the best interests of their customers at heart. Far be it from us to impugn the motives or integrity of any vendor serving BFD, but such an assumption is, if not naïve, at least not a sound premise on which to base the management of millions of dollars per year worth of outsourced services.

Unfortunately, the Department's chief procurement official was ill during our two-day visit and we did not have an opportunity to review the procedures used to manage



vendor services in detail. From what we could glean from interviews with other Maintenance Division officials, however, it appears that, as in other areas, these procedures are not as robust as they should be. The primary goal of any procurement process is, of course, to obtain quality products and services at a reasonable (not necessarily the lowest) price. In the case of the vehicle maintenance and repair services that BFD routinely outsources to vendors, it is not clear to us that current practices are designed so as to achieve this goal.

The first step in the process is deciding who will perform the service. Ideally, a number of potential service providers have been “pre qualified” based on their relationship with the manufacturers of particular types of vehicles and equipment, their past performance, their billing rates, etc. and have blanket purchase agreements or standing purchase orders with not-to-exceed spending limits for individual transactions and for cumulative expenditures over the term of the contract (usually a period of one year, with renewal options). BFD does in fact have blanket purchase agreements with a large number of vendors. In the current fiscal year, it appears that the Department has procured vehicle maintenance and repair services from about 30 vendors. However, most apparatus maintenance and repair services appear to be performed by about half a dozen vendors, which simplifies the process of procuring bids and administering transactions.

The second step in the procurement process is specifying what services are to be performed. If the customer is not sure what services are needed, it should have a process for obtaining an inspection of a vehicle and an estimate from the service provider first. Service specifications should be detailed and they should be in writing. In the absence of an adequate paper trail that clearly indicates what a vendor was asked and authorized to do to a vehicle and what the vendor actually did, it becomes difficult if not impossible to establish responsibility (and liability) in the event that a vehicle component fails after it was purportedly inspected, serviced, and/or repaired by a vendor.

It appears that BFD does not routinely provide vendors with written service specifications or require that vendors provide detailed information on their invoices as to what services they performed on a vehicle. In view of how much the Department depends on vendors to perform all critical vehicle inspections and maintenance and repair services, we believe this is a serious deficiency in current practice. If a critical component on a vehicle fails, for instance, and the Department cannot demonstrate that the component has been inspected, serviced, and renewed properly by vendors whom it authorized and paid to perform such work, we believe this represents a potentially very costly liability for BFD.

Service specifications also should include a desired completion time. Vendors should not be given carte blanche to take as long as they like to return a vehicle to the customer. Again, BFD does not appear to do this, and repair turn-around times, which we were told average four months and have been as long as one year, are one of the biggest complaints firefighters have about apparatus maintenance. It is impossible for



us to know, barring further investigation, how much of this is vendors' fault versus the Department's fault. It goes without saying that firefighters allowing repair needs to go unattended, and the fleet aging to the degree that it had before efforts were undertaken recently to start renewing it, do nothing to shorten vehicle out of service time.

The third step in the process is to authorize the vendor to perform services. Just as few individuals accept at face value the services that auto dealership service departments, in particular, are notorious for trying to "up sell" to their customers, fleet owners should not necessarily authorize the performance of all services a vendor recommends for their vehicles. Procedures should be in place for consulting the repair history of the vehicle to see if any of the proposed services have been performed recently. For expensive repairs, procedures should exist for considering whether large expenditures are warranted given the current age and planned replacement date of the vehicle; the availability of an acceptable substitute vehicle; and the life expectancy of the vehicle if the recommended services are undertaken. The vehicle owner also should be clear on why the services are being recommended and what exactly they include.

It appears that BFD currently puts considerable trust in the vendors it uses to decide what services a vehicle needs. This is attributable, in no small part, to the Department's lack of in-house technical expertise in the more complicated aspects of apparatus testing, maintenance, and repair. We also think it is attributable, however, to the generally – to use a technical term – loosey-goosey approach the Department uses in virtually all areas of fleet management. As discussed earlier, the current business culture or philosophy in the Maintenance Division simply is not one that emphasizes objectivity, precision, thoroughness, accountability, economic efficiency, or myriad other goals or values that characterize a technically rigorous approach to management.

For instance, the Maintenance Division enters details of the running repairs the Motor Squad performs on vehicles into the *Firehouse* system, but not the details of the major inspections of, and maintenance and repair services on, these vehicles performed by vendors. Considering that the latter constitute the most important and expensive component of the maintenance and repair of the fleet, this practice is illogical. It suggests that the employees who are feeding data to this system view such efforts as nothing more than a bureaucratic exercise, and may have given little thought as to how this tool could help them improve their management of fleet maintenance and repair activities. Under the circumstances, it would not be surprising to find that vendors generally are given carte blanche to perform any repairs they deem appropriate – without any independent verification as to their need by the organization that ultimately pays their bills.

It is worth noting that some of the rank and file firefighters with whom we spoke are under the impression that BFD allows or perhaps even encourages vendors to use "inferior," after-market parts in repairing vehicles to save money. As the foregoing discussion should make clear, we think it unlikely that the thought of saving money by doing this has ever entered the Maintenance Division's mind. The organization's whole



approach to procuring maintenance and repair services is not geared toward optimizing the value of the services received, let alone cutting corners to shave a few dollars off the cost of a repair.

The next key step in the procurement process is to inspect the completed services and documentation. Procedures should be established for performing quality control inspections of completed work to ensure that it was done properly and completely. If the vehicle owner lacks the requisite technical expertise to determine this, it needs to have the vendor walk through the completed services and explain what was done and why. When vendors figure out that they are working for a customer who is interested in the details of their work and intends to hold them accountable for its quality and costs, they should be more than willing to help educate the customer as to the soundness value of their services. If a vendor does not appreciate the importance of, or is resistant to, doing this, they should not be used.

The senior members of the Motor Squad told us that they do not routinely conduct quality control inspections on vendor-performed services because they lack the technical expertise to do so. Enough said.

OTHER FLEET MANAGEMENT PRACTICES

Although the scope of our review was limited to apparatus maintenance and repair practices, a variety of other problems with BFD fleet management practices were brought to our attention during our visit. Many of these impact directly or indirectly on the overall safety, reliability, and costs of the fleet, so we would be remiss in not mentioning them here.

- *Driver training is inadequate.* There is a broad consensus that firefighters do not receive sufficient training in the operation of apparatus. Other than the training they receive at the Fire Academy when they first join the Department, several reported that the only training firefighters receive is on the job, usually while responding to or returning from a call. It goes without saying that this is not adequate.
- *Vehicle misuse and abuse are common.* We heard this from firefighters and maintainers alike. This probably stems, in part, from the lack of a sense of ownership of assets, noted earlier, that are shared among many people, as well as the lack of adequate driver training and the advanced age of the fleet. It was suggested to us that one truck has received more than \$100,000 worth of repairs directly as a result of operator abuse. Regardless of whether or not this is true, it seems clear to us that there is insufficient accountability and therefore concern in many different areas of Departmental operations for how resources are used and money is spent. Department management has made some progress in this area recently in terms of developing detailed budgets that force decision makers to pay more attention to resource requirements and costs, but there obviously is still a long way to go.



- *The vehicle specification process is weak.* Members of the Joint Safety Committee with whom we met pointed out that the specifications process does not adequately take into account the operational or maintenance experience of the Department with specific makes and models of vehicles. An example cited was the type of stabilizers on one particular make of trucks in the BFD fleet that is less suitable than another type when operating in some of Boston's older, narrow streets. The lack of in-house fleet management expertise also is felt to be a problem in this area in that the Department is too dependent on information furnished by manufacturers such as E-One in developing its purchase specifications. The implication is that there is insufficient competition among suppliers for BFD apparatus sales. However, Department management informed us that in the past vehicle purchases were being made without any competitive bidding and that this practice, at least, has been stopped.
- *The fleet replacement plan needs to be validated.* Many people we spoke with credited the current commissioner with tackling a major requirement for any fleet operator – the timely replacement of vehicles – that has been neglected by BFD for many years. Department management has developed and secured City Hall's support for implementing a fleet replacement plan aimed at reducing the current backlog of needs. However, replacement cycle guidelines for the different types of assets in the fleet, on which any long-term replacement plan should be based, have not been determined. Some firefighters we spoke with suggested that replacement cycles should be as little as 10 years – which would be very aggressive in our experience – but it is pointless to speculate about this. The best way to establish guidelines is to perform life cycle costs analyses for specific types of vehicles aimed at identifying the cycle that will result in the lowest total cost of ownership. Given the current fiscal challenges facing the City of Boston, the Department also probably would benefit from reviewing the periods of time over which it is financing the acquisition of new trucks. There could be significant opportunities to reduce near-term funding requirements in this area while continuing to renew the fleet.

RECOMMENDATIONS

Our preliminary recommendations for addressing the deficiencies identified in this report are outlined below. Given the limited scope of our contract, our primary goal is to identify *what* the Department should do and by *when*, not *how* it should do it.

WITHIN 3 MONTHS

1. **Develop and implement vehicle inspection procedures** using manufacturer and/or other suitable industry guidelines such as *NFPA 1911: Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, 2007 Edition* as a point of departure. These inspections should employ written checklists (samples are provided in the above-referenced document) for inspecting each vehicle component as appropriate (e.g., engine,



cab and chassis, aerial device, pump, communications equipment, etc.). The checklists should be accompanied by detailed instructions for their use. Explicit guidance should be provided for determining when a vehicle is not mission capable and should be taken out of service, by whom this should be determined, and how it should be accomplished.

The cost effectiveness of using computerized checklists and hand-held computers should be investigated. All firefighters who operate vehicles should be trained in the use of the inspection procedures. The use of the procedures should be incorporated in the driver training program for new firefighters used at the Fire Academy. Procedures also should specify who is responsible for performing inspections; how such responsibilities are to be shared among multiple firefighters; how inspection results are to be documented; how vehicle defects found during inspections are to be communicated to appropriate officials; and how compliance with all inspection procedures is to be measured, monitored, and enforced. Other BFD officials and personnel responsible for enforcing compliance with the inspection procedures should be trained in their use.

- 2. Develop and implement vehicle preventive maintenance (PM) programs** for each distinct type of apparatus in the fleet using manufacturer and other suitable industry guidelines such as *NFPA 1911: Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, 2007 Edition* as the point of departure. PM inspection and servicing activities should be described in writing in detail by vehicle component (e.g., engine, cab and chassis, aerial device, pump, communications equipment, etc.) and by service interval or frequency in elapsed days, engine hours, and/or miles of use. The replacement parts and other materials commonly used in performing each PM service should be identified. Each PM program specification should include estimates of the time required for completion. PM procedures should specify who is responsible for performing PM services, BFD or vendor personnel, and how such responsibilities are to be shared, if at all. They should specify how defects in a vehicle uncovered during a PM service should be handled (i.e., documented, reported, and rectified). They should specify the circumstances under which a vehicle shall be determined to be not mission capable and should be taken out of service, by whom such a determination should be made, and how it should be accomplished. The procedures should specify how individual vehicles are to be scheduled for PM services, how the field company in physical possession of the vehicles are to be notified of this, and how compliance with the schedules is to be measured, monitored, and enforced. Procedures for documenting all PM service activities and costs in the *Firehouse* system or another suitable fleet management information system should be defined. The feasibility of pre-defining all PM services in this or another system, so as to avoid having to enter all the labor and parts cost details of every PM service on every work order, should be explored.



3. **Develop and implement ladder and pump testing and certification programs** for each distinct type of apparatus in the fleet using manufacturer and other suitable industry guidelines such as *NFPA 1911: Standard for the Inspection, Maintenance, Testing, and Retirement of In-Service Automotive Fire Apparatus, 2007 Edition* as the point of departure. Since we presume that such testing will be outsourced for the foreseeable future, written procedures should focus on specifying the intervals at which tests will be conducted, the steps that will be taken to ensure vendor adherence to all testing specifications, the manner in which such compliance will be documented, and the manner in which Department compliance with these programs will be measured, monitored, and enforced.
4. **Hire a Fleet Safety Coordinator.** The skill level and experience, roles, responsibilities, and job duties of this position should be defined in detail before the recruitment process begins. Initially, the principal role of the Coordinator should be to oversee all maintenance and repair services performed on BFD apparatus by vendors, focusing on 1) developing specifications for all service requests; 2) authorizing all non-routine maintenance and repair services to apparatus; and 3) performing quality control inspections of all completed services and approving the return of vehicles to front-line service status. As the development and implementation of additional maintenance management policies and procedures and the hiring of appropriate staff permits, the focus of the Safety Coordinator should be broadened to encompass less oversight of individual maintenance and repair transactions and more strategic management and refinement of all fleet safety-related policies, programs, procedures, and practices, including those related to vehicle specification, operation (e.g., driver training), inspection, and maintenance and repair.

WITHIN 6 MONTHS

5. **Develop and implement comprehensive policies and procedures governing the management of vendor-performed maintenance and repair services.** The development of new policies and procedures in this area should be preceded by a thorough evaluation of current service procurement practices so as to ensure that new processes are compliant with City of Boston procurement regulations and processes; cognizant of the political and operational realities facing the Department (e.g., limited in-house technical expertise in apparatus maintenance and repair); sensitive to current and long-standing supplier relationships; and mindful of those aspects of current practice that work well and those that work poorly. Within the constraints, if any, imposed by the above factors, the new policies and procedures should be designed to maximize the value of the services procured from vendors. This means that, at a minimum, they should address key elements of the procurement process such as the following:
 - In-sourcing versus Outsourcing of Services Determination (i.e., making the decision to use a vendor to perform a maintenance service or repair);



- Establishment of Blanket Purchase Agreements;
- Vendor Selection;
- Service Specification;
- Service Authorization;
- Quality Control;
- Dispute Resolution;
- Vendor Payment; and
- Recordkeeping.

Policies and procedures should fully document what is to be done in each of these areas, how it should be done, and by whom it should be done, and also should spell out how and by whom compliance with the new processes will be enforced. Appropriate Department employees should be trained in the use of the new policies and procedures.

6. **Institute the use of *Firehouse Software (FHS)* or another suitable fleet management information system (FMIS)** to document and manage all vehicle maintenance and repair transactions. Review and evaluate the fleet management functionality of FHS relative to work order processing, parts management, fleet maintenance management, and associated data processing, management analysis, and reporting best practices. Determine whether or not the functionality of the system is adequate for meeting most FMIS needs on an interim basis if not permanently. If the conclusion is no, develop and issue an RFP for a suitable commercial off-the-shelf FMIS. If yes, develop a plan for properly configuring FHS and training all appropriate BFD employees in its use.

Part of the process of improving the use of FHS or implementing a replacement system should be to determine whether additional staff are required in the Maintenance Division to support data entry and management analysis activities. The alternative to this would be to train existing personnel in the Division in real-time entry of data, an approach which might or might not be cost effective.

Another key part of the process of implementing and using FHS or a stand-alone FMIS is to define key performance indicators (KPIs) that the Department should use in managing the maintenance and repair of the fleet. The definition process should specify 1) the attribute of performance being measured by each KPI; 2) the benchmark that will be used to interpret the KPI; 3) the source of data for computing KPI statistics and (if applicable) benchmarks; 4) the way data need to be coded in the system to facilitate the computation of KPI statistics; and 5) the manner in which KPIs will be reported (e.g., monthly or quarterly exception reports, dashboards, etc.).

7. **Validate and refine the fleet replacement plan.** This plan should identify future replacement dates and costs for each apparatus currently in the fleet based on replacing them in accordance with reasonable replacement cycle guidelines



expressed in years and accumulated miles. The plan recently developed by Department management should be used as the point of departure. Until such time as it can identify optimal replacement cycles for the specific types of assets in its fleet based on the empirical analysis of the life cycle costs of such assets (as is recommended in the next section of this report), BFD should use replacement cycle guidelines in line with those employed by other large cities with comparable operating environments and conditions. We anticipate that these will be in the range of 13-15 years for engines and 15-18 years for ladders.

The replacement plan should validate or revise, as necessary, the current strategy for eliminating the backlog of fleet replacement needs that exists over a reasonable period of time based on the prioritization of specific assets for replacement. This may require the conduct of physical condition assessments for specific vehicles in the fleet. The replacement plan should not only quantify future replacement *costs* (i.e., purchase prices less used vehicle sale proceeds), but *funding requirements* based on one or more assumed capital financing approaches such as outright purchase, lease purchase, and lease.

WITHIN 12 MONTHS

8. Evaluate the necessity of, and benefits and costs of expanding, reorganizing, and civilianizing the Maintenance Division. Conduct a thorough review of fleet management practices other than those addressed by previous recommendations aimed at identifying needed improvements to fleet management policies and procedures and associated organization structure, position descriptions, staffing levels, training programs, information systems, and facilities. Major questions that should be addressed by this evaluation include the following:

- Should the fleet-related mission of the *Maintenance* Division be redefined to encompass all aspects of fleet *management*?
- Should fleet and facility management functions be in separate organizational units?
- What types of fleet maintenance and repair activities should be performed in house and what types should be outsourced?
- What are the organizational structure and staffing requirements of a BFD fleet management organization and what should be the roles and responsibilities of the fleet manager and other positions comprising this organization?
- What are the facility requirements of a BFD fleet management and maintenance organization?
- Should a BFD fleet management organization be comprised of civilian employees, firefighters, or a combination of the two?



- Regardless of the makeup of a fleet management organization, how should fleet management responsibilities be shared between this organization and the fire companies that possess and use fleet assets day in and day out?

The initial output of this evaluation should be a strategic business plan for reengineering the Department's overall approach to fleet management over a period of two to three years, including, for each year, a manageable number of clearly defined improvement strategies, action plans, responsibility assignments, timelines, milestones, and end products. Each improvement strategy and action plan should produce its own set of outputs such as the recruitment of a fleet manager, the negotiation of fleet management-related roles and responsibilities with Local 718, and so forth.

- 9. Review and recommend improvements to the current apparatus operator training program.** The Joint Safety Committee should take the lead in reviewing current driver training practices with the assistance of qualified outside experts in fire apparatus operation and operator training, and make recommendations for improvement.
- 10. Develop vehicle specifications development and selection policies and procedures.** Review and evaluate current purchase specifications development and selection practices and identify opportunities for improvement. This evaluation should examine how the operational requirements of BFD, especially practices and/or conditions that are unique to Boston, and the maintenance and repair experience of the Department with specific makes and models of vehicles and with their authorized service providers are incorporated in the development of vehicle specifications. The findings of this evaluation should be used as the basis for developing and implementing formal vehicle specification and acquisition policies and procedures.

WITHIN 18 MONTHS

- 11. Determine optimal replacement cycles for apparatus.** Develop replacement cycle guidelines for each of the key types of apparatus in the fleet using recognized life cycle cost analysis techniques. The objective of such analyses should be to identify the replacement cycle in years or accumulated miles that will minimize the total cost of ownership of each type of asset. The optimal replacement cycles should then be used to update and execute the multi-year fleet replacement plan recommended above.
- 12. Develop an internal fleet cost distribution system.** Conduct an activity-based cost analysis of BFD fleet provision and management activities and develop a process for distributing the costs of the vehicles and services consumed to each company, district, and division that consumes them. The objective of this process should be to increase awareness of, and accountability for, the costs of the fleet resources fire companies consume. Current fleet operating and management practices clearly result in a fleet that is more costly and less safe and reliable than it could be. Shared ownership of this problem, through shared responsibility



for the fleet's costs, is essential for rectifying this situation. Upper management-driven business process reforms will not accomplish this by itself. The users of the fleet need to understand that every dollar wasted on the fleet as a result of less-than-optimal management and operating practices is a dollar taken away from the primary mission of BFD: fighting and preventing fires.