Conducting a Fire Apparatus Fleet Evaluation

BY MIKE WILBUR

EVERY FIRE DEPARTMENT HAS BEEN impacted by the rapidly escalating costs associated with new apparatus acquisitions as well as the increasing costs of fuel, insurance, inspections, maintenance, and repairs of existing apparatus. This has prompted many fire departments, fire districts, and municipalities to engage outside firms to conduct fire apparatus fleet evaluations.

The role of the fleet evaluation consultant is to provide recommendations on the best strategies and alternatives to ensure that the fire department will be able to perform its mission safely, efficiently, effectively, and at a reasonable cost. This begins with an assessment of the condition and operational capabilities of the fire department's existing vehicles. The second essential step is to identify the operational capabilities that are needed to protect the community. Based on this information, the consultant can begin to develop an apparatus plan for the fire department and provide important recommendations to guide decision making. The ultimate goal is to provide a blueprint that can be used to manage the apparatus fleet and plan future expenditures.

The costs associated with purchasing and maintaining fire apparatus have risen dramatically within the past decade. The purchase price for a new custom engine is often in the vicinity of $1 million, while the price of new aerial apparatus frequently surpasses $2 million. It is no wonder that fire apparatus fleets undergo more scrutiny now than at any previous point in our motorized history. It has become more important than ever to purchase wisely and ensure that new apparatus acquisitions meet the needs of the organization in an efficient manner. At the same time, it is a fundamental responsibility to ensure that the existing vehicles are in good condition and meet the operational needs of the department.

Many fire chiefs, administrators, and elected officials are faced with complex problems relating to their apparatus fleets, such as the following:

- Does it make sense to retain vehicles that are aging and require costly maintenance and repairs to keep them in service?
- Is replacement a better option?
- Do those vehicles still meet the needs of the department?
- If they are replaced, what should be purchased to meet those needs?
- Do we have more vehicles than we really need, given today's staffing, or do we need different types of vehicles to meet the changing needs of the community?

Departments should consider these essential questions before making important decisions that often involve large expenditures.

With so many rapidly rising costs, many fire departments are operating with reduced staffing. This is especially true for volunteer departments; for example, they may have more vehicles than they can effectively operate. In those cases, it might make sense to reduce the number of vehicles and replace them with a different combination of units. Mutual-aid partners may be able to plan together to complement each other's functional capabilities. Each of these factors deserves close examination.

It has become more important than ever to purchase wisely and ensure that new apparatus acquisitions meet the needs of the organization.

A professional fleet evaluation should provide a comprehensive analysis to determine the best combination of apparatus and capabilities going forward, beginning with looking at which vehicles should be retained; which should be replaced in the near future; and, in some cases, which are no longer needed. The projected dates and costs for future vehicle replacements should be identified. At the same time, the consultant should identify problems with existing vehicles that require immediate attention, taking into consideration the cost of repairs and ongoing maintenance vs. the cost of replacement. If new vehicles are recommended, the consultant should be able to recommend the appropriate requirements and capabilities, based on an accurate and factual assessment of the situation.

This replacement plan should encompass all units in the department's fleet. It will identify at least one complete cycle of the units operated with justifications as to when each individual vehicle should be slated for replacement. The decision-making process here is based on facts and having the vehicle fleet mirror the department's mission statement. This approach will minimize outside influences, which are often based on emotions or personnel preferences.

Getting Started

To begin the evaluation process with accurate and factual information, several documents need to be reviewed. These include the following:

1. Insurance Services Office (ISO) fire department grading report and recommendations.
2. Listing of all department-owned fire apparatus including spare and reserve apparatus as well as utility vehicles.
3. Specifications for all apparatus in the current fleet.
4. All maintenance and repair records and costs, including preventive maintenance and apparatus testing (pump and aerial). This should include

all reports and any repairs that have been recommended. The information should be provided for each vehicle to determine the cost of ownership of each apparatus in the fleet.
5. Weight of each apparatus from a certified scale.
6. Equipment inventories for each apparatus.
7. Listing of responses for each apparatus during the past year (or longer).
8. Unit staffing for each listed response.
9. Department staffing roster, including the following:
- Qualified approved drivers for each apparatus in the fleet.
- Firefighters qualified for interior structural firefighting.
- Members not qualified as driver/operators and interior structural firefighters.
10. A map of the first-due area indicating primary response routes and restrictions, areas with and without hydrants, and existing or planned risks that would affect the operational requirements for apparatus.

ISO Grading Report

A recent ISO grading report should be very helpful in giving the situation context. The ISO is an independent organization that provides information to insurance companies. This information is used to set fire insurance rates for specific properties and geographic areas.

The ISO periodically evaluates the capabilities of each fire department in relation to the risks that are present in the area it serves and provides a public protection grading for homes and commercial properties. The grading scale goes from Class 1, for the best-protected areas, to Class 10, which indicates that an area is basically unprotected.

The ISO evaluation process includes water supply, dispatching, and fire department capabilities. Within the analysis of fire department capabilities, there is an overview assessment of the apparatus fleet and how well it corresponds to the risk profile of the community from an insurer's perspective.

This assessment is based on a determination of the needed fire flow for each area and the engine and ladder company capabilities that should be available to combat structural fires. In some cases, it will provide recommendations for additional capabilities. This information provides a good starting point for fire departments and municipalities to assess their resources and capabilities in relation to the risks present in each first-due area.

(1) Photos by author.

Geographic Risk Analysis

The fundamental reason for having a fleet of fire apparatus is to provide protection for and deliver emergency services to a particular geographic area. The operational capabilities of the fleet should be matched to the types of properties that require protection and the specific characteristics of the community. The detailed fleet evaluation should examine the suitability of the existing apparatus fleet in relation to the functions that are expected to be performed and the capabilities that should be provided in that area.

The fleet evaluator should begin by developing an understanding of the area where the fire department operates and the challenges the department faces. This often begins with a map and aerial photographs of the service area, which develop a basic familiarity with the geography and its basic characteristics. The next step is to conduct a visual survey by touring the area to identify all the essential factors that need to be considered. This is often done with a local fire department guide who knows the area.

The apparatus fleet should be designed and configured to suit the area where it will operate. Does the community have a crowded core with narrow streets lined by multistory buildings, or is it a semirural area with large single-family homes surrounded by acres of woods and landscaping? Are there major industries, rail lines, or interstate highways?

Water supply is always an important consideration. Are there hydrants throughout the community, or does the department make extensive use of tankers? Are there drafting sites that require additional hard suction sleeves? Does the fire department use large-diameter hose to deliver water over long distances?

Are there areas with difficult access? What kinds of buildings are in the community? Is there good access to the front and rear? Can aerial apparatus be positioned where it is likely to be needed? Will long hose stretches be necessary to reach buildings with limited access?

These characteristics can only be determined by surveying the community, preferably in the company of a local firefighter or officer who can serve as a guide. In some cases, fire departments are unaware as to what is being built around them. In photo 1, we see a large, three-story home off the roadway. It's almost totally obscured, with only limited access for some fire department apparatus. Having private dwellings like this would have a dramatic impact on what kind of aerial apparatus you would buy and what portable ladder

complement is needed to be successful in the first-due response area.

The fleet evaluator needs to develop a thorough understanding of the fire department's operational environment, requirements, constraints, and capabilities. The analysis must be tailored to the particular circumstances of each community, and it should take advantage of the skills and experience of an evaluator who has conducted the same type of study for many other communities.

Evaluating Each Apparatus in the Fleet

The fleet evaluation process begins with a listing of all current apparatus, including the date of manufacture, pump size, tank size, aerial type, and length and equipment inventories. Support units and spare and reserve apparatus should be listed as well. If possible, the evaluator should become familiar with this information before conducting the detailed examination of each vehicle.

Evaluating each vehicle in the fleet is an essential and time-consuming process. The evaluator needs to spend a minimum of two hours per apparatus to conduct a detailed visual inspection, which includes underneath, on top, and every space inside the vehicle. The examination must be thorough and meticulous, addressing anything that could affect the serviceability and safety of the apparatus and the firefighters onboard.

NFPA 1910, *Standard for the Inspection, Maintenance, Refurbishment, Testing, and Retirement of In-Service Emergency Vehicles and Marine Firefighting Vessels,* provides very specific criteria for the inspection of apparatus. This includes, but is not limited to, checking for the following:

1. Worn, damaged, defective, or out-of-date tires; tire sizes other than what appears on the manufacturer's data plate.
2. Rust or corrosion, especially underneath the vehicle.
3. Broken springs.
4. Fluid leaks of any kind.
5. Loose wiring, especially on the underside of the chassis.
6. Corroded fuel tanks, air tanks, and straps.
7. Moisture in the air brake system.
8. Frayed or cut seat belts.
9. Loose equipment in the cab; not secured in 9g-rated brackets.
10. The safety of the hose loads and personnel stretching hoselines.
11. Expired extinguishers, ladder belts, harnesses, ropes, and other equipment.
12. Overall cleanliness of the apparatus.
13. Rubber gaskets worn out on roll-up doors.
14. Rub rails against roll-up door handles.
15. All pertinent information and dimensions of the vehicle.
16. Mileage, engine hours, pump hours, and aerial hours.

It is likely that the mandatory annual testing of pumps and aerial devices will have been conducted and those records will be made available to the evaluator. If this has not been done, the annual service tests will have to be conducted as part of the fleet evaluation.

The same situation applies with respect to the nondestructive testing of aerial devices that is required at least every five years. This testing involves special equipment and qualified personnel. If the required testing has not been done and the report is not provided, the evaluator will indicate that there is a serious deficiency. If the testing is seriously beyond the due date, the vehicle should be taken out of service until the aerial device has been certified.

Common Problems

Some of the most noted problems from the visual inspections are overweight vehicles, outdated or excessively worn tires, and serious corrosion on the underside of apparatus.

It is dangerous and illegal in almost every jurisdiction to operate a vehicle that exceeds the manufacturer's weight limits. Every apparatus should be weighed annually on a certified truck scale in accordance with NFPA 1910, Section 20.2 (photo 2). If this has not been done, it will be included in the evaluator's examination.

The overall weight and the loading on each axle must be compared to the ratings on the manufacturer's data label. The vehicle should be weighed with all fuel, water, and foam tanks full and with all equipment in place. An additional allowance of 250 pounds should be included for each seat.

Around one-third of all fire apparatus that I weigh each year are determined to be overweight. Often, they have been loaded up with more equipment than they were designed to carry, and the problem can be solved by offloading some of that excess weight. In some cases, they were already overweight when they were delivered from the

2

factory, because the weight requirements were underestimated and key components such as axles and brakes had insufficient capacity. You should weigh every new apparatus before you pay for it. Always remember: "Weigh before you pay!"

One recent fleet review revealed that three out of the department's four newest trucks were overweight. The same department had four other trucks that were more than 20 years old. That creates a dilemma when determining which units should be replaced first.

Tires are the second most common problem. In addition to running on worn and damaged tires, many fire apparatus are found to be operating with out-of-date tires. Rubber tires deteriorate with age and the problems they develop on the inside may not be visible to the naked eye. NFPA 1910 Section 8.3.6 requires tires to be replaced after a maximum of seven years, even if the tire tread looks like new. Most tire manufacturers recommend replacement after six years. Some states have similar requirements.

The date of manufacture of each tire is indicated on the sidewall (photo 3). The marking "4905" indicates that this tire was manufactured during the 49th week of 2005. It should have been replaced in 2011 or 2012.

Rust and corrosion were big issues at one time, due to the quality of steel that was used in the manufacturing of fire apparatus. As time progressed, rust became less of an issue, thanks to newer materials and manufacturing processes, such as aluminum or stainless-steel cabs and bodies, galvanized frame rails, and stainless-steel sub frames and other components.

More recently, it appears that some of the chemicals used for snow removal and ice mitigation have created a major resurgence in rust and corrosion problems, especially with regard to frame rails and underbody components. In some cases, this has required costly repairs. Some fire departments retire and replace certain vehicles ahead of schedule, while older units that are in better condition are kept in service beyond their planned replacement dates. This puts additional stress on the whole fleet.

For instance, this 2009 engine (photo 4) was evaluated in 2014 and unexpectedly required approximately $15,800 in rust and corrosion mitigation. It was within only the first five years of the engine's expected 20-year life cycle.

Cost of Ownership

Determining the cost of ownership of each fire apparatus in the fleet is one of the most important objectives of a fleet evaluation. The cost of ownership begins with the initial cost of acquiring a new or used vehicle minus the value when it is sold or traded in at the end of its life. The annual cost associated with this component decreases with each additional year the vehicle is kept in service.

The second cost component, which is critical for most fire departments, is the annual cost of owning and operating each vehicle in the fleet. This refers to the sum of all the expenses for fuel, preventive maintenance, repairs, insurance, annual testing, and whatever else is necessary to operate and keep the vehicle in service each year.

Experience has shown that maintenance and repair costs, as well as time in the repair shop, typically increase with the age of a vehicle. Ideally, a large fleet operator wants to replace vehicles before the cost to maintain them becomes excessive—and while they still have some trade-in value. There are methods of calculating this so-called "sweet spot" in relation to cost, reliability, and replacement schedule. This type of calculation has prompted many large fire departments to reduce the projected life cycle of their apparatus and budget for replacements every 10 to 15 years.

Smaller fire departments are generally more concerned with the costs related to individual vehicles to help them determine whether it would be better to replace an apparatus or keep on paying for excessive maintenance and repairs to keep it in service. Keeping track of those costs requires maintaining good records.

It has been my experience that deficient record keeping often makes it difficult to track the annual cost of ownership of fire apparatus. Fire departments should invest in simple computer programs that can keep track of all the costs associated with each vehicle as well as problems and out-of-service time. This will allow them to recognize when it is costing a small fortune to keep an unreliable unit in service.

From work that I have done in the past, I know that the annual cost for an engine in a small fire department typically averages around $7,000, unless major repairs are required. If the records indicate that the cost to maintain a

3

4

particular engine consistently exceeds that benchmark over several years, it should be a cause for concern. This could be a red flag indicating that the unit should be rotated out of the fleet early, even if it is the newest apparatus in the fleet. Of course, the benchmark figures need to be adjusted for the type of apparatus, the amount of usage, and other factors that move the cost expectations up or down the scale.

One of the outputs of the evaluation process will be an apparatus replacement plan that projects the date by which each vehicle in the fleet should be retired and replaced. This assumes that the operating costs are reasonable and that the vehicle continues to perform well for its anticipated lifespan.

Reserve and Spare Apparatus

The requirements for reserve and spare apparatus are an important consideration in most fleet evaluations. By definition, a reserve apparatus is fully equipped and ready to be placed in service whenever it is needed for a major incident or high activity period. Spare apparatus refers to vehicles that are used to replace frontline units when they are out of service for maintenance or repairs.

Smaller departments often combine these two classifications by having a reserve unit that can also be placed in service when one of their frontline units is out of service. A small department might have two frontline engines and a third in reserve. The third engine is ready to be used for major incidents and high-demand situations and it can also be used to replace either of the frontline units, as necessary. They might also have a backup ambulance that functions as both a reserve and a spare.

Very few small departments can afford to maintain a reserve aerial unit or heavy rescue. In many cases they must depend on mutual aid for coverage if vehicles are out of service.

One of the major challenges for large fire departments is determining the numbers of reserve and spare apparatus that are needed. A predetermined number of designated reserve units should be maintained in a state of readiness, while the spare engines and aerial apparatus are moved continually from one firehouse to another to replace frontline units that are out of service. While it is important for a fire department to have enough spares, it's very costly to maintain an excessive number.

For many years, the recommended guideline was to provide a ratio of one spare apparatus for every eight frontline units, assuming that one-eighth of the fleet was likely to be out of service for maintenance, repairs, or inspections at any given time. This has evolved to the point where many large fire departments maintain ratios of one spare for every three or four frontline units, simply to ensure that they will be able to meet their daily requirements. As companies have become busier and fire apparatus has become more complex and challenging to maintain and repair, the frontline units tend to be out of service more of the time, creating the need for more spares.

The spare and reserve units also must be maintained. If a spare engine or ladder is in service every day replacing other units, it is going to have the same wear and tear as a first-line unit. And it will require the same amount of maintenance and repairs. If it is an older vehicle that has been reassigned from frontline to spare status, it is likely to spend even more time in the repair shop and cost more to maintain.

This is a very important cost consideration for many larger fire departments. If the life cycle is shortened and the average age of apparatus in the fleet is reduced, it could allow for a reduction in the number of spare vehicles needed. All of these considerations need to be factored into the replacement schedule.

Staffing Considerations

Almost every fire department has challenges ensuring adequate staffing for fire apparatus every day. This is a rapidly increasing problem for many volunteer departments that used to have plenty of members to respond to calls but that today have difficulty assembling minimum crews.

It could be that a department is maintaining a fleet that includes more apparatus than it can operate. It is not unusual to encounter a small fire department that has two frontline engines in service plus a third reserve engine. The records may show that the staffing is very seldom available to respond with more than one engine. In the past, it may have been a regular occurrence for two or possibly all three engines to respond to calls with full crews, but that is no longer realistic. It could be that in these times the department can operate effectively with just two engines and save the maintenance and replacement costs for the third.

That same small fire department might also have an aerial tower, a heavy rescue, a light rescue, two front-line ambulances and a reserve, plus a water tender (tanker). While the fleet is impressive, it could be that on a good day it can only muster eight firefighters to respond to a call and only two of them are qualified drivers. That would suggest that the fire department is paying to maintain more apparatus than it can operate and when it is time to replace them the cost could be astronomical. Part of the fleet evaluation should be a realistic analysis of the number and types of apparatus that the fire department really needs and can be expected to operate.

This component of the analysis requires good records to determine how many members are responding to calls at different times of the day and how the units are staffed. Experience has shown that this data is often difficult to assemble because it is not being properly recorded and tracked. Every apparatus response should be documented, including the number and names of the personnel who responded, who was driving, and who was in charge. Once again, simple computer programs are available to manage this information.

The staffing and response data is another important metric in formulating the blueprint for acquiring and replacing apparatus. It doesn't make sense to purchase and maintain more apparatus than the fire department can operate. Does it make sense to replace a 20-year-old reserve/spare engine when the department doesn't really need it? Is it necessary to have both an aerial tower and a heavy rescue when the neighboring departments have the same types of apparatus? Each of these questions must be addressed on a case-by-case basis.

It doesn't make a lot of sense to spend more than $1 million of the taxpayers' money to buy a new engine that will sit in the fire station due to a lack of staffing. In the same sense, why would a fire department pay more to purchase a vehicle with an extended wheelbase and eight-person cab when the records indicate that it responds with an average of 4.2 firefighters and the maximum number within the past three years was six firefighters? It is illogical and probably unethical to pay more for extra seating space, based on the dream that more members will suddenly appear.

Maintain essential records to support thorough analysis and logical decision making, not memories and dreams.

Creating an Apparatus Replacement Plan

After impartially evaluating the situation, looking at the community, inspecting the existing fleet, talking to key individuals, and mining and evaluating all the data, the fleet evaluation consultant will be ready to put pen to paper (or, preferably, fingers to keyboard) to create the blueprint for a long-term apparatus fleet replacement program, based on the facts derived from a thorough, meticulous fire apparatus fleet evaluation—no emotion, no politics, just the facts.

The plan begins with the immediate future. In fact, a situation requiring immediate attention may have prompted the responsible officials to call for a fleet evaluation. If serious problems are revealed, the first objective must be to determine the best actions to solve them. Sometimes that is a serious and complex endeavor, which is where the expertise of an experienced apparatus consultant can be invaluable.

Once immediate problems are addressed, it is much easier to develop a logical fleet replacement plan for the following years. Given the rising cost of new apparatus and extended delivery dates, that plan could involve a combination of buying new, buying used, and rehabilitating some existing apparatus. It makes no sense to develop a fleet replacement that will require funding that does not exist or will not exist in the future. On the other hand, a good plan is invaluable when it is time to seek funding.

MIKE WILBUR was a volunteer firefighter for more than 40 years and a career firefighter with the Fire Department of New York for 32 years, retiring in 2013. He spent 15 years, including eight as an apparatus operator, with Ladder Company 56 before being assigned to Ladder Company 27 in the Bronx. He served on the FDNY apparatus purchasing committee and has given state certification to the FDNY Chauffeur Training School. Wilbur has served on the IFSTA validation committees for the Apparatus Operator and Aerial Operator Manuals. He has also served on the United States Fire Administration Committees on Safe Operation of Fire Tankers and Emergency Vehicle Safety Initiative. Nationally recognized in emergency vehicle operations, apparatus placement, consulting, and purchasing. Wilbur runs Emergency Vehicle Response, an apparatus training and consulting company.

@6.txt@ - 1/2 hor