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ACKNOWLEDGEMENTS

We wish to thank Don Hollingsworth, Senior Executive Assistant to the Mayor for Public Safety, for his guidance, facilitation, and coordination of this complex study. Dennis Thompson and Christina Garibay coordinated the project for the City in its later phase, and Mary Eversole in the early phase.

Fire Chief Lester Tyra, Chief Chris Connealy (then Acting Chief), and the many other chiefs, managers, and firefighters of the Houston Fire Department were extremely cooperative and afforded open access to data and people throughout the project. The Fire Department's cooperation was greatly appreciated. The Planning Department and Information Services Department also were very helpful.

While input was received from many people in the City, the evaluation and recommendations here were those of the TriData project staff. The principal project staff and their prime responsibilities were as follows:

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PREFACE

The initial version of this comprehensive review of the Houston Fire Department was presented to the City in October 2000. In September 2001, the City rehired TriData to assist with the implementation of some recommendations, and to issue this final revised report.

The primary purpose of the revision was to add comments to each recommendation that reflects the Houston Fire Department's acceptance or rejection of the recommendations and the status of implementation for those that were accepted. Of the 211 original recommendations evaluated, 203 were accepted, which is a phenomenally high degree of consensus between an independent third party evaluator and the department being evaluated.[1]

In the course of issuing this revised report, most of the original recommendations were left untouched. We dropped five recommendations either because events have overtaken the recommendations or to consolidate two recommendations. In several cases, we revised the wording of the recommendation to make it read more smoothly, more accurately, or to be more up to date. But in the vast majority of cases, the original recommendation text was left intact.

At the end of most recommendations in this revised report is a parenthetical remark as to the status of action on the recommendation. In a number of cases, the HFD administration agrees with the recommendation in principle but there are not yet resources to implement it or the implementation requires being phased in over time. Also, a number of the recommendations require agreement under the "meet and confer" contract, especially those dealing with personnel and training issues.

The recommendations were not meant to be taken as "gospel." They were a sincere attempt to address ways to improve virtually every area of the Department. It is unrealistic to expect that all of these could be implemented at once, nor is it advisable to do so; an organization can take just so much change at one time. We prioritized the recommendations, but it is ultimately up to the Department and the City to decide on the desirability, priority, and feasibility of achieving each recommendation. There is no fire

[1] Originally, there were 212 recommendations in the original report. One recommendation appeared alone on a page and may have been overlooked.

department in the United States that can afford the optimal level of fire protection nor can we even sensibly measure what is optimum. But we can make significant improvements in the vast array of emergency services provided by a modern fire department, and many of the improvements can be quantitatively measured.

In our opinion, the Houston Fire Department has made an astonishing number of improvements in the past year. Perhaps most noteworthy is a major change in the strategy for delivering emergency medical services, with the introduction of the paramedic squad concept, which in turn has led to a sharp improvement in response times of paramedics to critical patients and a corresponding increase in patient survival. That alone would have proven the cost effectiveness of the study, but there has been much more than that accomplished. The changes include significant consolidation of what had become a highly fractionated organization chart; more attention to prevention; more four-person fire units; improved labor-management relations; major progress toward developing a new communications center; introduction of people management courses for new supervisors; new fire vehicles; and many other changes.

On the other hand, there are many changes still needed that will have to be phased in over several years. These include a further overhaul of the employee and officer development programs, implementation of additional strategies for improving human relations in the Department, and increased staffing of some units. An area in which improvement has become even more critically in need of assistance than last year is information technology support, whose staff decreased from their already low level relative to need.

All in all, however, the Department and City are to be congratulated for the progress they have made. Revision of HFD's Strategic Plan to incorporate the accepted recommendations of this study, the work done to achieve accreditation of the Fire Department, and the results of the Red Ribbon Committee will assist in guiding the Department into the future.

A copy of this revised report that shows where every change was made from the previous version has been provided to the Department. Most changes were minor; the additions mainly reflect the current status of the recommendations. While we received comments from the Department on the various recommendations, the revisions here reflect the same independence of the TriData project team, as did the original report.

EXECUTIVE SUMMARY

A comprehensive independent study of the Houston Fire Department was chartered by Mayor Lee Brown in January 2000 to assess its efficiency and effectiveness. TriData Corporation of Arlington, Virginia, was competitively selected to undertake the study. TriData specializes in public safety issues and has undertaken studies of many other metro fire departments such as Chicago, Nashville, and Washington, D.C.

Overall, the HFD is doing a very good job in many aspects of its operations, including the quality of emergency medical care; firefighting; hazardous materials responses; airport operations; technical rescue; and fleet management. The headlines of recent months that have scandalized the Department unfairly portray the overall level of service being provided, and the care about service to the community we found among most employees interviewed, even some who are disgruntled. On the other hand, several important areas of the department have deteriorated, including EMS response times, the prevention program, management information, dispatch and communications, labor-management relations, and employee morale.

While this type of report devotes more space to problems than strengths, one should not forget in reading it that the citizens of Houston are being very well served by the Fire Department on the vast majority of emergency calls to which it responds. However, the current level of service is in jeopardy if a number of improvements are not made in almost every area of the Department, and especially in the strategy and resources for providing Emergency Medical Services. Overall the Department is not in crisis, but there are problems bubbling below the surface that could erupt into a crisis, and many resource deployment issues that could degrade services if they are not addressed.

Overview

The Houston Fire Department has been providing the citizens of Houston with an ever-increasing array of sophisticated emergency services. Besides the traditional basic fire fighting for which fire departments were originally founded, the HFD provides advanced Emergency Medical Services and enjoys a deserved reputation of medical excellence in Advanced Life Support. The Fire Department also protects three airports, provides a wide range of technical rescue services (such as high angle rescue, trench rescue, and water rescue), and participates in the outstanding area-wide mutual aid

system for hazardous materials incidents in this worldwide capital of the petrochemical industry. The Department also provides a wide range of prevention-related services that include public education, juvenile firesetter counseling, plans review, code enforcement, inspections, and, in cooperation with the police, arson investigation.

In the face of declining fires, this array of services is expected from a large professional department to increase productivity.

The study reviewed all of these services and the support services behind them, such as training, maintenance, dispatch and communications, and management information systems, using a team of over 20 specialists in different aspects of fire and EMS services. We interviewed over 100 members of the Department from all ranks and across all work groups. We analyzed much statistical data and observed operations first hand.

As is commonly found in virtually every large organization, let alone fire departments, there are many operational and support areas that need improvement to maintain or improve performance. There are also major workforce issues. In part, they reflect societal issues, such as equity across racial and ethnic groups, fair treatment of female firefighters and labor-management disagreements. Houston has less extreme versions of large organizational problems than fire departments in some other large cities, but some of the problems nevertheless are severe and must be dealt with to avert even worse problems.

There are too many incidents with long response times, and there has been some inexcusable handling of EMS requests for service, but that is not the norm. In responding to over 100,000 calls a year, all with potential life safety at stake and adrenaline flowing, with finite resources to deal with very high workloads, with many simultaneous calls, and with a large training burden to keep up with so many disciplines, it is to be expected that there will be a number of problem calls. Virtually every city has them. But there also is no question that more can be done to improve the level of services, quality of relations with the public, and the safety and work life of the firefighters.

The principal findings for each organizational area are summarized below. The text contains over 100 specific recommendations. The City plans to screen the recommendations and develop an implementation plan following up on this study.

Management and Organization

Strategic Plan – HFD Management developed a strategic plan intended to increase accountability, bring in fresh leadership at the top, and make many other changes. The concept of strategic planning is an excellent practice that should be encouraged, but the strategic plan omitted a crucial area: improving human relations.

Organization Chart – The structure of the Department has been radically altered by the current HFD leadership, with 14 Assistant Chiefs now reporting directly to the Fire Chief. All are appointed, not tested, positions. Many personnel were promoted two or three ranks to these positions. While no one organization chart has proven ideal for fire departments, this organization is overly flat, with a much larger direct span of control than one person can reasonably manage, and with fractionalization instead of concentration of logical functional groupings. For example, Prevention responsibilities are spread across three Assistant Chiefs; Training is spread across three; and Suppression is divided in two – an unheard of and not-well-justified innovation. While this organization may work under the current Chief, it is inherently unstable – a cause of great concern to many Department members. The organizational changes have provided a needed shock and clean break with the past, but the organization needs to be redesigned to a form that is more logical and likely to survive across future fire administrations. We recommend reorganizing the HFD under four or five Executive Assistant Chiefs rather than 14 top level appointed positions under the Chief. The subunits headed by Assistant Chiefs can mostly be retained.

Management Training and Education – Officers (firefighters of lieutenant rank and above) have been well trained in technical specialties and incident command, but most are under-educated and under-trained in the ability to manage human resources. College education is not a requirement for chief level officers, and many if not most senior chiefs do not have degrees. These have been common shortcomings across the fire service, but Houston is lagging behind other cities in remedying the situation, despite positive moves by the current fire management.

The lack of adequate supervisory training has led to many problems in work force dynamics that instead of being nipped in the bud are allowed to escalate, rise in the organization, and occupy too much of the senior chiefs' time. A much stronger program of teaching people how to manage, encouraging higher education, and preparing a deeper

leadership pool needs to be undertaken. (Specific program elements are proposed in Chapter IX, Personnel and Supervisory Issues.)

Leadership Style – While each leader must be given some leeway for style of leadership, the style needs to be professional. A wide cross-section of the Department membership at many ranks criticized the tone and manner of many internal communications as inappropriate. Firefighters readily risk their lives for each other and for people of every station of life and ethnic group. They truly act like a family when living together, with all the associated squabbling and resentment toward their "parents." The trick is to lead the "family" without it becoming dysfunctional, and it is borderline at present.

The tone and quality of work life in the Fire Department needs to be improved through the cooperative efforts of management and labor. We recommend use of peer mediation to resolve some interpersonal problems at their outset, at lower levels in the organization. We recommend developing a plan to improve skills at conflict resolution and people management starting with first level supervisors (lieutenants) and continuing throughout one's career. (Suggested elements of the plan are given in the report.)

Internal Communications – As in many other large fire departments, there are many issues and unnecessary hard feelings that come about from lack of understanding of the intent of management actions. The current leadership has made significant strides to improve internal communications. That effort should be built upon so the work force receives better communications on the rationale for decisions and policies. This can be accomplished through better use of newsletters, meetings, and visits from chiefs.

Prevention

The Houston code is quite clear in the responsibilities of the Fire Marshal and Fire Prevention Division, but these responsibilities have been scattered, in part because of professional disagreements between the Fire Chief and Fire Marshal. The management of the Prevention function is in disarray. It does not seem to have accurate data on the number of inspections the inspectors are doing, and it does not know the number of inspections they should be doing, both key management statistics. (There is data on inspections; if it is accurate, then there is very low productivity.) Lack of computer

support is a major reason for this problem, but good records were kept manually before computers existed.

The fire prevention function should be re-gathered and strengthened under an Executive Assistant Fire Chief.

Plans Review – The Fire Department should be playing a somewhat larger role in plans review than it is. While the Planning Department has prime responsibility for these reviews, the Fire Department needs to review plans for fire-related features from the beginning, to avoid having to make expensive corrections later in the life of the structure. With the large geographic area of Houston, it is critical to have safety built in, rather than depend on rapid response, which over the long term is a more expensive approach to safety.

Code Enforcement/Inspections – The inspection force needs more training. Inspectors should be certified in the codes they are implementing. They need more clerical support so that senior managers waste less time on paperwork and concentrate on management of the workforce and setting strategic and tactical objectives in prevention. The inspectors' productivity needs to be improved by giving them better access to vehicles and portable data terminals.

More inspections are needed; not all properties that should receive annual inspections are getting them. Without reliable data, it is difficult to quantify the shortfall, but there is no question that one exists. The inspections undertaken by the Prevention Division inspectors should be supplemented with inspections performed by line companies (at least the less busy units, such as most truck companies) and self-inspections performed by low-risk businesses.

The lack of adequate management information in Prevention needs to be addressed immediately. The Fire Prevention Division must figure out a way to keep accurate track of the number of inspections, time spent on inspections, percent of inspections completed, and compliance of buildings that have been inspected. The Division needs immediate assistance in information systems while awaiting the longer term improvement in information that will come from a new dispatch system with improved report-generating software. The Planning Department has software that can be

used in the interim. While it is not usually wise to invest much in an interim system when a better system is in the offing, in this case we feel the situation cannot wait.

Fire and Arson Investigation – The clearance rate for arson has dropped by 50 percent in the last few years. An extensive management analysis of the fire and arson investigation unit was undertaken in 1996, coincidentally by TriData, acting on behalf of the U.S. Fire Administration. Many recommendations are still valid and need to be implemented. In particular:

- The 10 investigators assigned to background checks and internal affairs need to be returned to investigations.
- The Arson Unit should acquire a canine for accelerant detection.
- Work schedules should be revised to facilitate continuity of investigations.

The Arson unit also needs a training coordinator, more office space, and an integrated arson information system.

Public Education – The public education program is generally well conceived but somewhat understaffed. Two or three public educators should be added, so that all of the schools can be reached annually with good prevention programs. The growing elderly population and other high-risk groups should receive programs, too.

Fire Operations

Response times are well below what they should be and getting worse. The underlying cause is a sharp growth in demand over the past six years, stemming more from an increase in calls per capita than from increased population. A combination of adding several stations, adding at least four to five fire units to existing stations, taking steps to curtail false alarms, educating the public on proper use of 911, speeding up call processing, and changing EMS response strategy to reduce engine company use as first responders together should help bring supply more in line with demand.

Engines and ladder trucks are nominally staffed with a crew of four, but in fact, two-thirds to three-fourths operate with crews of three each day. We recommend that all units, but at a minimum all ladder trucks, be staffed with four.

About 17 more ladder trucks and engines could run with a crew of four without adding any personnel by eliminating the single-person staffing of various auxiliary units and the booster units, and assigning their personnel to companies on a day-to-day basis. The specialty units could be cross-staffed by one firefighter from the four-person company complements when they are needed, which is infrequent.

As many as another 20 to 28 companies could be kept at four-person staffing if the recommendation for the redesigned EMS system (discussed below) is accepted. It will reduce the need to borrow company personnel to staff ambulances.

The above changes would allow two-thirds to three-quarters of all companies to have four-person staffing each day.

The plan to add five more stations over the next few years is generally fine. Three stations (24, 83, 84) should be added immediately (the planned stations at Reed Road, Breezewood, and Ella Boulevard). Adding units anywhere in the system will likely increase its robustness and ability to handle multiple simultaneous calls.

If Station 1 is closed as planned, its company needs to be added back elsewhere in the downtown area to handle the heavy demand.

In addition, three to five additional companies need to be added to existing stations over the next 10 years to keep up with demand and to implement the new approach to EMS.

The complement of vehicles and personnel that are sent to different levels of hazards seems appropriate. One more company should be added as a Rapid Intervention Team to structure fire calls for firefighter safety, as is planned. However, we do not concur with dropping an ambulance from structure fire responses, nor with adding a second company to each call, especially if the above recommendations are accepted, which will increase the number of four-person companies and hence the number of people on the fireground.

Special Operations

The Technical Rescue and hazardous materials services being provided are good. Most of our recommendations here are to fine tune these special operations.

There is an imbalance in workload across two heavy rescue units that reduces the level of experience of some personnel in this highly technical area. We recommend either rotation of personnel between the units, or co-locating them. The latter approach would facilitate training and not significantly affect their response time.

Overall, airport operations are being well handled and the level of protection is appropriate. Airport firefighting capability exceeds FAA minimum compliance levels. There is a good plan to add a third station to Bush Intercontinental Airport and to rebuild an older station there. The airport operations are large enough and complex enough that they merit a separate District Chief to supervise them, at least for the next two or three years, while a significant transition is being made and services are expanded to keep up with rapidly growing air traffic and airport facilities.

As new crash-rescue vehicles are purchased, their technology should be upgraded to include aircraft-piercing nozzles; improved infrared and other technology for seeing through fog and smoke; environmentally cleaner extinguishing agents (particularly for training); and better training through use of live burns. Rapidly improving virtual reality simulations may help in training, but the real thing is needed at least annually.

Emergency Medical Services

The HFD has enjoyed a well-deserved national reputation for excellence in the delivery of Emergency Medical Services. It has been a pioneer in the establishment and integration of the Dual Role/Cross Trained firefighter- paramedic model, proving that the merger of two different cultures, fire suppression and medical, can be a success.

The HFD continues to be an established leader in medical control innovations and EMS field research. The annual number of “saves” validates this finding. However, the reputation for EMS excellence is in jeopardy. Rising EMS call volume is creating a variety of problems that include:

- High ambulance utilization rates during certain hours of the day, in the more densely populated areas;
- Mediocre ambulance response time performance, especially Medic (ALS) ambulances;
- EMS staff shortages, particularly insufficient numbers of paramedics;
- Relation of medical authority to operational authority: there are some management problems, stemming from the bifurcated command system.

A major change in the approach to delivering EMS needs to be considered. While many of the EMS problems can be resolved by adding more 24-hour-a-day ambulances, there is an alternative approach that would use existing resources more efficiently and keep the system affordable while reducing demand on fire units.

The major organizational design modifications recommended are:

- Convert to an all-ALS initial response system. Put most of the ALS response personnel (paramedics) in new squad cars (SUVs) rather than ambulances; 50 squad cars and ALS engines would be used at peak hours, 30 at off-peak. The paramedics would treat the patient at the scene and only ride to the hospital with the patient when necessary for the most serious cases.
- Convert the ambulance fleet to all BLS (i.e., start with firefighter/EMTs instead of paramedics).
- Add 6 new ambulance vehicles, increasing the total to 68. Use part of the ambulance fleet to provide 28 "power shift" ambulances that would work 12-hour shifts and provide additional resources when they are most needed. The rest of the ambulance fleet (40 vehicles) would be staffed 24 hours a day. Only a small part of the operations force would need to be on a 12-hour shift.

At peak demand, there would be 68 ambulances and 50 squad cars in service, vs. 62 ambulances at present.

Implementing these recommendations will significantly improve ALS response times. They also will decrease the use of fire apparatus as first responders by about 50 to 75 percent, reducing their overload and helping to improve responses and staffing for fire calls.

Although a sizable investment is required to rectify current deficiencies – about $24 million for an initial year, declining to $19 million in subsequent years – the recommended system reconfiguration scenarios represent significant "opportunity" cost savings and should suffice for most of the next decade.

It will take some time to revamp the current system and to hire and train personnel to staff more ambulances and squad cars. We recommend adding 10 ambulance units – 5 BLS and 5 ALS – to the fleet immediately, at least at peak hours. This is critically important. A combination of 6 new and 4 reserve ambulance vehicles can be used for this purpose. The ambulances could be staffed by crews working 12-hour shifts to add 10 units at peak hours for the cost of five additional crews – about $3.0 to $3.5 million. Adding the units around the clock would cost about $6.0 million per year.

Support Services

The unglamorous support side of the Fire Department is critical for the delivery of services. As in most departments, it needs some additional attention.

Training – The HFD generally is doing an excellent job both in initial training and in on-the-job training in a wide variety of specialties, with the major exception being supervisory and management training in human relations and people management. A much stronger program is needed to train first-line supervisors and provide higher levels of management training as one gets promoted.

Physical Fitness and Health – While much time is spent maintaining vehicles and equipment, less attention is paid to maintaining the human bodies without which the equipment is useless. Fitness is key to firefighter health, productivity, and career longevity. The fitness program has recently improved, but a uniform set of workout equipment is needed and should be provided to the stations. Time should be provided each day on duty to maintain physical fitness.

Additional research is needed on the health of pregnant firefighters and their leave policy. The exposure to smoke and the physical demands of the job add to the usual workplace and legal concerns.

The present physical fitness criteria being used seem appropriate. The Department has wanted to change to a new testing approach being endorsed by the IAFC/IAFF. The project team expert in this area felt that the current process in Houston was satisfactory, and that changing to the new test would require a major validation effort without a clear gain in doing so.

Recruiting and Personnel Development – Stronger recruiting of minority candidates is needed. Consideration should be given to awarding extra points for residents of Houston. Potential recruits should be expected to come to their recruit test in better shape to pass the physical fitness test than is currently the case. Less time should be devoted in rookie school to getting recruits into necessary shape as opposed to attracting fit recruits who have been willing to train before coming to the test. The fitness standards are clear, especially for the one-and-a-half-mile run.

Reliance has been put on 100-question written tests to determine promotions. There is a question as to whether they adequately predict performance and whether the current testing procedure works against minorities. Many departments have changed to using assessment centers that more realistically reflect the types of thinking, decision making, and management ability actually needed by the job. We recommend that assessment centers be used in addition to the written tests.

Maintenance – Overall, the Department is doing a commendable job in maintaining the vehicle fleet, equipment, and stations. The vehicle replacement policy is almost too good: ladder trucks can be used for 12 to15 years, not just the 10 years currently planned. Vehicle replacement should be staged rather than waiting until a whole cohort of vehicles wears out at the same time, as has happened in Houston.

Information Systems – The state of information technology has, in some ways, taken a step backward in the Fire Department. For example, what once was a computerized building file system to assist in prevention has regressed to a collection of uncoordinated manual files and ad hoc computer programs that are not compatible.

A major increase is needed in the number of personnel who support information technology. Consideration should be given to having more of the hardware maintenance and infrastructure software handled by the centralized City Information Technology

Department, with the IT people in the HFD assigned to the tasks that require more understanding of fire-related uses.

Dispatch and Communications – The ability to properly and rapidly process emergency calls from the public and dispatch the appropriate units is the heart of any emergency operation. (Visualize the Johnson Space Center at the peak of the manned space program to get some idea of the complexity and real time information and competency needed.) The hardware, software, work practices, and labor-management relations in Dispatch and Communications all need drastic improvement. These problems are well known to the City and fire management. An excellent plan has been developed for a state-of-the-art combined Police-EMS-Fire dispatching communications system. It should be implemented as soon as possible.

The staff in Dispatch and Communications is demoralized but needs to hang in there and be given more considerate treatment to reduce tensions and maintain their service until transition is made to the new system, which will take several years. Emergency dispatch is too critical a function to let it fall into further disarray. Fire management needs to change its attitudes and relations towards this unit and help it perform through the transition period.

Emergency Management

Emergency Management is under the auspices of the Office of Public Safety and Drug Policy. On review, that seems to be a good organizational location and is similar to the majority practice in other large cities. Emergency Management has become an increasingly specialized and technical discipline to face terrorism threats as well as natural and man-made disasters. It needs leadership with specialization in emergency management.

The physical location of the Emergency Operations Center should be moved to an environment that is more secure from hazards and intrusion than the present site. One possibility is the planned, new Communications Center. The current facility needs better daytime security in the interim. The EOC needs improved logistics to sustain emergency staff independently for several days while isolated from the outside.

The Local Emergency Planning Committee Administrator, who is a gatekeeper and liaison for hazardous materials information, might better be assigned to the HFD Special Operations Division to ensure HazMat data sharing.

Cost of Implementation

A preliminary cost estimate for implementing the recommended EMS system changes is $24 million for the first full year of operation, dropping to $19 million in future years. The estimate depends not only on which recommendations are accepted but also the nature of the phase-in period and the extent to which existing firefighters are trained as paramedics and backfilled with overtime while training.

These costs include hiring enough firefighters to staff the ambulances, and not having to borrow personnel from engines and ladder companies. Thus the number of 4-person companies will increase by an average of about 20 to 28 units per day for the same investment.

Implementation of other recommendations will have additional costs that remain to be quantified, pending initial review of this report.

I. INTRODUCTION

Houston is facing a situation common to many large cities in the United States: a need to evaluate and rethink the management, organization, and delivery of the expanded and changing package of services provided by the Fire Department as it moves into the 21st century.

TriData Corporation of Arlington, Virginia, was competitively selected to undertake a comprehensive management review of the Department. The study started in January 2000 and ran until October 2000. TriData has undertaken many studies of Metro-sized fire departments, including Chicago, Jacksonville, Nashville, Seattle, Portland, and Washington, D.C. Houston has a combination of sheer physical size, a very large, diverse population, warm climate, many areas with high rises, and lack of zoning that makes it unique among cities in the United States.

The Department receives many more calls for emergency medical services than fire services. It responds to thousands of false alarms from automatic fire detection systems and responds to many non-fire service calls. It provides highly sophisticated hazardous materials responses and a broad range of advanced technical rescue services. It is part of one of the largest networks of mutual aid involving industry and fire departments in the world, guarding the petroleum industry and others.

Scope

This study examined all of the major functions of the Fire Department and many of its support services. Included in the scope were:

1. Management and Organization
2. Personnel Issues (including Physical Requirements)
3. Firefighting Operations
4. Emergency Medical Services
5. Fire and Injury Prevention
6. Special Operations (technical rescue, hazmat, anti-terrorism)
7. Support Services (including administrative services, training, maintenance, and MIS)

A major overhaul is planned for the Communications Center; we reviewed its current operations and plans for change, but without duplicating recent evaluations.

A related small study by TriData evaluated the Emergency Management function, which is now reporting to the Mayor's Office of Public Safety and Drug Policy, but was a Fire Department function at one time. Its organizational placement and approach were considered. The results of this mini-study are included in this report.

The scope of work included the management issues listed below, as articulated in the original RFP for this study. They were considered for the Department as a whole and as part of the review of various functions:

1. Effectiveness of the current organizational and management structure; whether functions can be consolidated; the basic physical requirements for personnel and whether the span of control and management staffing levels throughout the organization are appropriate to support the timely, effective, and efficient delivery of service to the public, as well as ensuring proper internal control.

2. Existence and/or adherence to documented policies, procedures, and management practices throughout the organization.

3. Adherence to sound personnel assignment, evaluation, and management practices, including performance assessment policies, procedures, and practices.

4. Benchmarks of the Department's organizational and management structure against peer organizations throughout the United States and "best practices" throughout the industry.

5. How information technology supports Department management and operations and how technology might be leveraged to improve management and operations.

6. Improvement opportunities in the Department's organizational structure, management processes, procedures, operational practices and technology

related to current service delivery. As part of this, the study reviewed recommendations from performance, management, and technology reviews completed by various consultants since 1986, noting recommendations that have been implemented or warrant implementation in the current environment.

7. Practical recommendations for improving the quality of the management processes and the overall efficiency and deployment of resources related to Department operations, taking into account Department constraints and potentially available resources.

General Background

The Fire Department is responsible for protecting life and property within the City of Houston and adjacent areas by providing fire protection and prevention services, arson investigation, emergency medical services, and hazardous material incidents response.

The Department operates 85 currently active fire stations (excluding the airport stations) in a service area of approximately 617 square miles with a population of 1.9 million. The Department has 83 engines, 37 aerial ladder truck companies (including quints), and 62 ambulances. The ambulances are divided into 26 basic life support units, 27 advanced life support units, and 9 dual units.[2] The Department had approximately 3,600 full-time equivalent employees and an operating budget of $218 million for the fiscal year ending June 30, 1999. Approximately 90 percent of the Department's full-time equivalent personnel (FTEs) are firefighters and emergency medical service providers.

The Department has increased the number of operating divisions under its current leadership to 14. It is one of the largest and most complex organizations in City government. The operating divisions include Emergency Medical Services Command, Public Relations/Community Outreach, Fire Prevention, Operations Command North, Operations Command South, Finance and Administration, Professional Development, Career Development, Planning and Research, Facility Management, Staff Services, Fleet

[2] A full listing of stations and apparatus is given in Appendix A.

Maintenance, Central Command (Communications and Records), and Special Operations.

Approach

The study started with a "triage" week during which members of the study team met with the Mayor, the City's project director (the Director of the Office of Public Safety and Drug Policy), the Fire Chief, several Assistant Chiefs, the union president and executive board, and the chiefs or directors of most major functions in the Fire Department. We visited a sample of stations and spoke with many employee groups and individuals of all ranks. (This process continued throughout the study.) At the end of the triage week the key issues to be addressed were identified and initial decisions made on the level of emphasis to be given to various functions and issues. As a result, the report varies in detail across the various issues and department functions. More attention was directed to some areas than others.

The overall approach included reviewing and analyzing records, data, and documents, including several developed in response to queries during the study; extensive observation of services, equipment, and personnel on site; comparative analysis with other large cities across the nation; and many discussions with personnel at all levels. Over 100 employees were interviewed in-depth to discuss personnel and supervisory issues. TriData paramedics and EMTs rode along with HFD paramedic supervisors, ALS and BLS ambulances, and engine company first responders. Many subject area experts on our large team visited the Fire Department to observe and discuss its specialties.

Further details of the approach are discussed where appropriate in the body of the report.

Report Organization

We first address in Chapter II the overall management and organization of the Department. Because of their sensitivity and importance, personnel and supervisory issues are addressed in a separate chapter, which was placed at the end of the report to avoid interrupting the discussion of line functions with the highly emotional issues.

The main functions of the Department are prevention, emergency medical services, and fire/rescue operations. Each is dealt with in a separate chapter. The Special Operations part of fire/rescue operations, which includes airport operations, hazardous materials operations, and technical rescue services, were split off into a separate chapter.

The Department could not deliver its main services without the help of a host of support services in its infrastructure. They are addressed in a chapter that includes training, management information systems, health and physical fitness programs, vehicle maintenance, and station maintenance.

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Note to the reader: In the course of making recommendations throughout the report, when we say "Consideration should be given to…," we mean just that — it is an alternative to be considered. When we feel more strongly, we use the imperative construction, "HFD should…" or "The City should…." or "Add three …," etc.

II. OVERALL MANAGEMENT AND ORGANIZATION

This chapter discusses the overall structure of the HFD and some of its broad management and organizational issues. It starts with a description of the city environment in which the HFD must operate. The last chapter in the report discusses detailed human relations issues and their related supervision and personnel issues

The City Environment

Houston is a large city, both in terms of area and population. Its approximately 1.9 million people are spread across approximately 617 square miles, which has profound implications for providing and managing fire services.[3] The City is experiencing population growth and is expected to continue to grow for the foreseeable future, which means demand is likely to keep increasing. The City completed annexation of the area known as Kingwood in the last five years, which increased the HFD service area. According to the City's Annexation Plan, no major annexations are planned in the next few years.

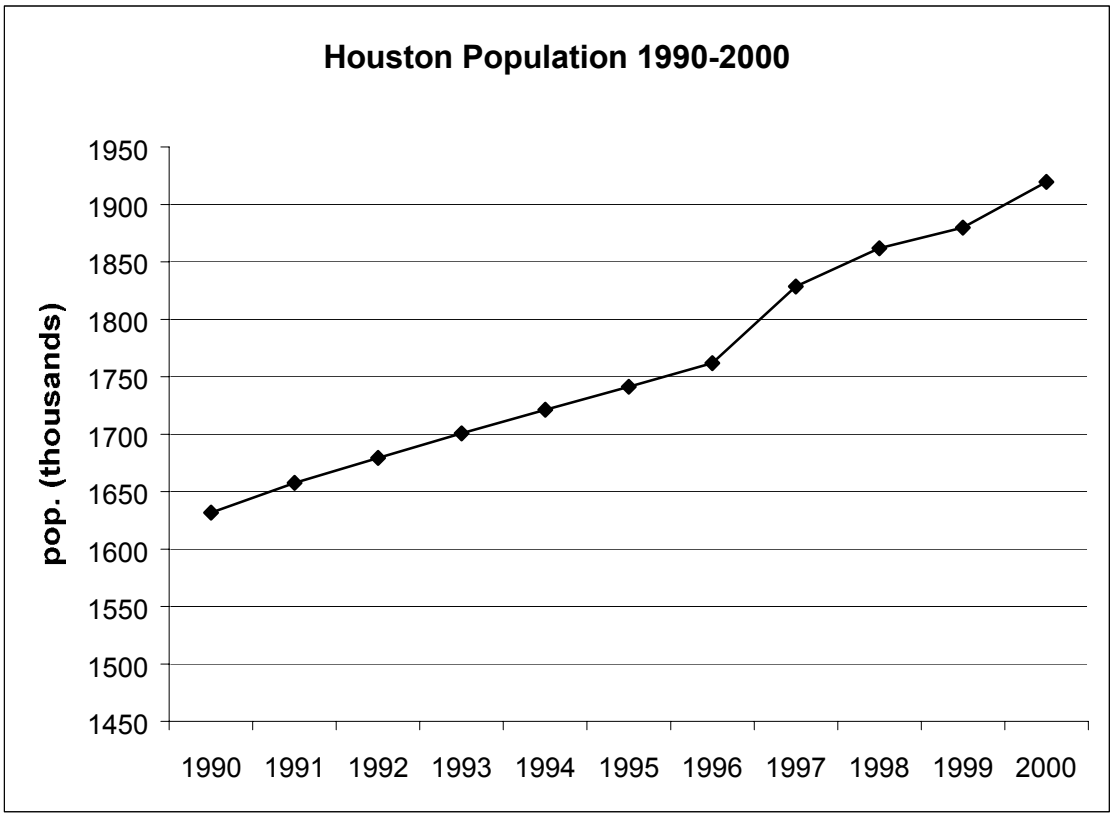
Since 1990, the City's population has increased from 1.6 to 1.9 million people. This includes some population from annexation. Figure 1 shows the population trend since 1990. The demographic make-up of the population is split among non-Hispanic whites (34.7 percent), Hispanics (32.2 percent), and African Americans (26.4 percent). The balance (6.7 percent) is composed of Asians, American Indians, and other ethnic groups. Only the Hispanic, American Indian, and Asian populations have increased since 1990. The diversity of the HFD does not yet match the City, but has improved.

The City serves as a regional finance, health care, and business center and as headquarters of a significant number of oil industry firms. There are many petrochemical plants in or near the City, which means there is potential for major hazardous materials incidents. The City's economy continues to diversify, and is undergoing a building boom, with considerable development taking place in both residential and commercial

[3] City population estimates differ slightly among sources. Also, some people quote the January 1, 1999 estimate and some the January 1, 2000 estimate, which vary from 1.88 to 1.92 million, respectively. Both round to 1.9 million.

areas. Much of this development is taking place in empty lots and revitalizing older neighborhoods, a factor toward reducing structural fires. The increasing population density in the inner city is helping to stabilize traditional population decline in the urban center, but increasing demand for EMS.

Figure 1



With over 55,000 new units, the net number of housing units in the City increased by 45,000 units in the 1990s (after deducting demolished properties). The percentage of vacant units declined to 9.6 percent, its lowest level of the decade.[4] These are indications of a healthy economy and a growing urban area.

Houston is well known for its "no-zoning" approach to land development. This policy, which has been in place for many years, has produced a unique urban landscape. Although the City has a traditional downtown core, there are several other centers of commercial activity, each with concentrations of employment, retail, and high-rise

[4] Source: Houston Department of Planning and Development.

development. In addition, there are numerous mid- and high-rise structures scattered throughout much of the City. This geography requires the HFD to cope with high risks and high-rises spread over a large area. Many cities can concentrate resources in a few key areas, but the risk profile in Houston is much more widely spread out. This negates much of the practical benefit of fire risk analysis, because a minimum level of resources must be maintained virtually all over the City to deal with the widespread higher than average level of risk.

Thus the HFD must operate in a variety of environments, including urban and wildland areas. It operates in weather conditions that range from freezing to hot and humid. In the past, major flooding and hurricanes have been experienced.

A wide range of potential risks must be faced, including the high-rise buildings, petroleum and chemical plants, airports, railroad lines, and major highways. This large array of considerations and responsibilities places a huge demand on the HFD operations and gives HFD management an enormous responsibility, which must be met adequately and in a timely manner on the street.

Scope of Services

Like other large municipal fire departments, the HFD provides emergency response to incidents requiring fire suppression, emergency medical services, hazardous materials mitigation, technical rescue operations, aircraft rescue/firefighting, and urban search and rescue. Technical rescue services are used to mitigate incidents involving rescue or extrication from high angles, tunnels, swift water, confined spaces, collapses, and cave-ins. The HFD also participates in the Houston Medical Strike Team, whose mission is to assist in the handling of emergencies involving weapons of mass destruction – actual or threatened nuclear, biological, and chemical incidents.

Overall, the HFD is doing a very good job in many aspects of its operations, including the quality of emergency medical care; firefighting; hazardous materials responses; airport operations; technical rescue; and fleet management. The headlines of recent months that have scandalized the Department unfairly portray the overall level of service being provided, and the care about service to the community we found among most employees interviewed, even some who are disgruntled. On the other hand, several important areas of the department have deteriorated, including EMS response times, the

prevention program, management information, dispatch and communications, labor-management relations, and employee morale.

The bulk of this chapter and the remainder of the report point out the strengths as well as problem areas. While this report dwells more on the problem areas, the public should not lose sight of the many successes and day-to-day strengths of the Department.

The current fire leadership to its credit is aware of the problems and has taken many steps to improve on the legacy it inherited. In an organization of this size, there are always things that might be done somewhat differently or approached in another manner. The remainder of this chapter and the rest of the report make suggestions and recommendations for improvements.

Mission Statement

The HFD's Mission Statement states that "The Houston Fire Department is a professional organization continually seeking opportunities to serve our community through fire prevention, emergency operations, patient care, and excellent customer service."

This is coupled with a "Vision Statement," which states that "We are committed to a superior emergency service organization which continually improves the quality of service delivered to our customers, the citizens of Houston."

The HFD also has adopted a series of "Organizational Values," which include customer and employee satisfaction; service excellence; training competency; professionalism; diversity; community service beyond expectations; safety for our members and community; leadership and teamwork; communication; accountability; loyalty, commitment, and trust; and innovation. The HFD's slogan is, "Seeking Opportunities to Serve."

All of these statements and values are appropriate. Adhering to this organizational philosophy would result in top-notch service to the community, and a safe, well-motivated and high-quality workforce. Many aspects of the Mission Statement and Organizational Values are demonstrated on a daily basis by the men and women of the HFD through their competent, excellent service to the City. Other aspects of the goals

are met only in part, such as workforce diversity, employee satisfaction, and an active fire prevention program.

Organization

The HFD consists of some 3,700 uniformed and civilian individuals housed in 87 fire stations and ancillary facilities. The operations forces are organized into 83 engine companies, 37 ladder companies, 27 advanced life support ambulances, 26 basic life support ambulances, 9 dual ambulances, and a variety of other special apparatus. In FY1999 the HFD was dispatched to about 74,000 "fire" incidents and 182,000 emergency medical incidents, which required about 435,600 unit responses.[5] (The fire calls include all non-EMS calls; they are all non-EMS calls to fire suppression units.)

The operational personnel work on one of four shifts, A, B, C, or D. Their shift schedule is 24-hours-on, 24-hours-off, 24-hours-on, 120-hours-off. The schedule equates to a 46.7-hour average workweek. This schedule is similar to those used in many cities. The shift schedule suffices for most purposes except ambulance staffing, as will be discussed in Chapter VI.

Organizational Chart – The HFD organizational chart is continually changing, which makes it difficult to analyze, and creates problems in and of itself. The organizational chart is different in many respects from those found in the majority of American fire departments. This is not to say that the current system does not function well and adequately serve the needs of both the HFD management and the community of Houston. No single fire department organizational chart has proven optimal; many variations are workable. However, the flatness of the organizational chart and the huge span of control of the Chief are unique and problematic, although deliberately designed.

One of the project team concerns – shared by many in the Department – is that the organization is highly personal in design and unlikely to be used by the next Fire Chief. There are too many Assistant Chiefs and too much spreading out of functions that usually are logically grouped in most departments. The large number of Assistant Chief positions has made it possible to elevate many talented people to high command

[5] The "fire incidents" here do not include fire unit responses to EMS incidents, to avoid double counting. Sources within HFD differed slightly on the count of the number of incidents and units.

positions, and to have adequate diversity at the top if not the middle of the organization. It also has allowed the Chief to develop a loyal cadre committed to his vision of change. But it is likely to be unstable.

Historically, each time a new Mayor assumes office, an almost clean sweep is made at the highest levels of HFD management. Members of the HFD have come to expect this change, but the concept does not lend itself to continuity. While change is inherent in municipal fire departments, few change so fast so often as the HFD. There is nothing inherently wrong with allowing new Chiefs to appoint and surround themselves with a cadre of individuals in whom they have trust and confidence, if they are fully qualified to fill their designated positions. However, it is the extent and scope of these changes that causes concern.

Most of the present department hierarchy was put in place between March and June of 1998. The number of Assistant Chief positions has grown to where there are now 14 separate and distinct entities or functions reporting directly to the Fire Chief, each headed by an Assistant Chief. (The Medical Director is another senior manager.) The top positions are listed in Table 1. This span of control would be deemed extremely large by any standard, particularly when the size and complexity of the HFD are considered. This comment is not meant to demean or question this particular style/philosophy of management or those who practice it. However, the project team doubts that succeeding Fire Chiefs would keep an organizational structure of this nature. Rather, most will likely opt for the more conventional structure, as will be recommended below.

There are no apparent reasons why Houston needed a radically different organization than that used elsewhere in the fire service. It is much healthier for the organization in the long run if the structure of the organization is generally stable across fire administrations. This allows senior management to focus more on operational matters rather than organizational, political, and human relations issues. Unfortunately, this is not the case in the HFD. While the current HFD leadership has been trying to correct many problems, the strong dose of medicine given to cure the patient may be making it sicker instead of better.

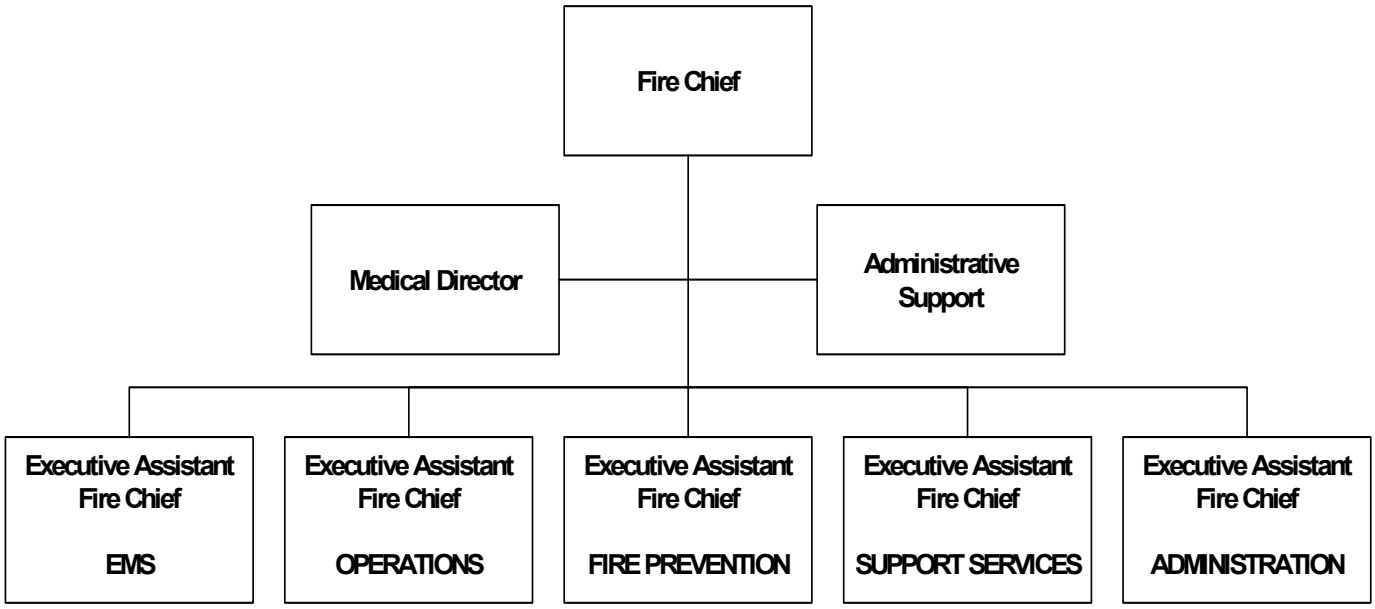
Table 1: Present HFD Command Staff

Title	Function
Assistant Fire Chief	Emergency Medical Services
Assistant Fire Chief	Public relations (and public education)
Fire Marshal	Fire Prevention Division (less several prevention functions)
Assistant Fire Chief	Operations command, North division
Assistant Fire Chief	Operations command, South division
Deputy Director	Finance and administration
Assistant Fire Chief	Professional development
Assistant Fire Chief	Career development
Assistant Fire Chief	Planning and research
Assistant Director	Facility management
Assistant Fire Chief	Staff services
Assistant Director	Fleet Management
Assistant Fire Chief	Central command (includes dispatch and communications)
Assistant Fire Chief	Special Operations

Executive Assistant Chiefs – A note attached to the HFD organizational chart dated January 4, 2000 raised the concept of having three Executive Assistant Fire Chiefs, which would reduce the direct reporting chain of command to the Fire Chief from 14 to 3. We agree with this concept, but would modify it slightly to have five rather than three appointed Executive Assistant Fire Chiefs who would report directly to the Fire Chief. These would include Operations, EMS, Fire Prevention, Support Services, and Administration. All of the activities and functions on the present organizational chart can be folded into this more streamlined structure. A proposed organizational structure is shown in Figure 2.[6] One alternative is to combine Support Services and Administration into one Support Services group. Another alternative is for the head of Administration to be a civilian position.

[6] Consideration will need to be given to the parity of ranks between Police and Fire Departments for establishing pay levels and competitive requirements of all positions.

Figure 2: Proposed Top Tier of the HFD Organizational Chart



Recommendation 1: Organize the HFD under five major commands, each headed by a new rank, Executive Assistant Fire Chief. These positions would report directly to the Fire Chief. The Fire Chief and each Executive Assistant Fire Chief would them have a reasonable span of control. All of the responsibilities displayed on the current HFD chart could be absorbed under one of the five major headings. Possible groupings are shown in Table 2, Table 3, Table 4, Table 5, and Table 6; other reasonable groupings are feasible, too. The key point is to gather like functions under five vs. the current 14 top appointed positions. (To update: as of January 2002, approval for the Executive Assistant Chief position is still being sought. There has been some re-consolidation of the Department into fewer divisions. Of particular importance is the consolidation of the fire operations functions and the prevention functions, each under one assistant chief-level position.)

Recommendation 2: Reduce the number of senior positions appointed by the Chief and increase requirements for Executive Assistant Fire Chiefs. The above organization would reduce the number of senior positions appointed by the Chief. Only the Executive Assistant Fire Chiefs and their civilian equivalents would be appointed. There should be some specified requirements, e.g., minimum education and time in grade, and interview screening that are considered as part of the selection process. The eligibility requirements for Fire Chief and Executive Assistant Fire Chief should be raised, which may require a change in state law.

Table 2: Executive Assistant Fire Chief of Operations – Proposed Responsibilities

AC South Side Deputy Chief	Fire and Rescue Operations
AC North Side Deputy Chief	Fire and Rescue Operations
Staffing Office	
Safety Office	
AC Special Operations – (New)	HazMat, ARFF, Rescue, Emergency Management

Table 3: Executive Assistant Fire Chief, Fire Prevention – Proposed Responsibilities

AC Fire Prevention (Fire Marshal)	Code Enforcement and Inspections; Plans Review
AC Community Relations and Public Education	Fire and Injury Education Fire Museum HFD Website Public Information Office Permits/Licenses
Fire and Arson Investigation	Investigations; Lab

Table 4: Executive Assistant Fire Chief, EMS – Proposed Responsibilities

EMS Operations	EMS Training Liaison
EMS Quality Control	EMS Education and Research Liaison

Table 5: Executive Assistant Fire Chief of Support Services – Proposed Responsibilities

Training *	Fire, EMS, and Technical Rescue Training Career/Professional Development Continuing Education, Certifications, Industrial Fire Fighting Training
Fleet Management	All Aspects
Communications	All Aspects (until new center built)
Research and Planning	Policies and Guidelines, Data Analysis, Strategic Planning, Special Events, District Chief's Technical Advisory Committee, HFD Committee Rep.
Air Pak (SCBA)	Specification and Maintenance
District Chief Tech. Advisory Committee	
Systems Development	
Management Information Systems*	

* One or both of these functions could be put under the Administration Command

Table 6: Executive Assistant Fire Chief of Administration – Proposed Responsibilities

Human Resources	Assignments, Benefits, Recruiting, Drug Testing, Pensions, Worker's Compensation, Language Assessment
Finance	Payroll, Budget, Procurement, Grants
Quartermaster/EMS Supply	
Legal Services	
Discipline/Grievance Administration	
Government Liaison	
Facility Management	

The current organizational chart contains several closely related activities that could benefit by combining them, and the proposed organization reflects this. For instance, both Professional Development and Career Development address the education and training of HFD personnel, albeit with a somewhat different focus. Both of their ultimate goals, however, are a more enlightened individual, bringing enhanced personal skills to the job he or she is tasked to perform within the HFD. As a result, both fit well as components of the Department's training office.

Similarly, Special Tactics is an operational arm of the HFD and all those activities presently listed under this function fit well under the umbrella of Operations.

The Public Information Office is frequently co-located organizationally with fire safety education activities in other cities. Sometimes it is under Fire Prevention, and sometimes it is a separate community relations function. As public educators are usually trained in public presentations, it is a short leap to incorporating public information into their responsibility. This function then could be readily absorbed under the Executive Assistant Fire Chief for Prevention's area of responsibility.

Activities such as finance, personnel, facility management, and quartermaster are often found under the auspices of a single Administrator. There is no reason this approach would not work in Houston. In addition, all those activities now shown under the Assistant Fire Chief of for Staff Services could be under the Executive Assistant Fire Chief of Administration. The administrative head could be a civilian, in which case the title should be changed to Executive Director.

Support Services under our recommended organizational structure would include Training, Fleet Management, Communications (now Central Command), and Planning and Research. All of these are technical functions that provide direct and vital support for the operational side of the house. MIS could fit here or under Administration.

Selection of Assistant Chiefs – In the selection of unit or function heads, the HFD Fire Chief has a great deal of latitude. None of those holding the rank of Deputy Chief, the highest competitive rank achieved by competitive examination in the Department (except the Fire Marshal) were chosen to fill any of these important Assistant Chief positions. In at least four cases the individuals selected were jumped three promotional ranks to attain their Assistant Fire Chief position. We are not singling out or finding fault with these individuals but rather focusing on the process that led to their promotions, and the liabilities inherent in this system.

The very concept of ranking positions is designed to provide development, education and experience for individuals that will better position them to advance to higher levels in the command structure. The degree of responsibility and supervisory involvement typically increases as one ascends the career ladder. There is a learning curve related to every position within any large organization, and if that curve is interrupted or circumvented an individual's job knowledge could suffer. For purposes of this discussion we will not address the degree of widespread resentment that occurs when others are passed over using this type of promotional process. Rather, it is sufficient to say that it does not bode well for departmental morale.

Organizational Exceptions – During the on-site interview process, one organizational unit, the Hazmat Warehouse team, appeared to be unusually placed on the organizational chart. The individuals assigned this role reportedly were re-assigned to their current organizational position because of their differences with the Fire Marshal. This function should reside either where the departmental inspection activity is taking place, or with the hazmat response teams; a case can be made for either location. As a general principle, the quality or status of interpersonal relationships should not dictate organizational structure. If differences cannot be resolved through mediation with the individuals involved, one or more of the personnel should be changed, not the organizational structure, unless there is an equally sensible alternative.

Another example of a misplaced unit is the five classified mechanics. Their basic function is to test ladders and they work under the Fleet Management Director, a civilian. However, they officially report to the Assistant Fire Chief for Professional Development because, according to Civil Service regulations, classified personnel cannot report to a civilian. Some action should be considered to change this arrangement. One alternative is to "redline" or eliminate these uniformed positions as each of the incumbents retire. Using this process, the job will eventually be eliminated without harm to anyone. If the job is deemed necessary, the Department should fill these positions with civilian employees, which might result in a small cost reduction. Another alternative is to change the Civil Service rules, which are much more restrictive in Houston than in other cities; having uniformed personnel report to a civilian for specialties such as prevention, management information services, and many others is commonplace elsewhere.

Fire Chief – The position of Fire Chief can change every two years or even more frequently, and is appointed. An alternative to consider is to conduct a nationwide search for a Fire Chief that also includes internal candidates. Upon selection, the new Chief would sign a contract for a specified term, typically five years. This process reduces the politics and stabilizes the position. Simultaneously, new and fresh ideas could be tapped and brought to the HFD.

Rank Structure

Table 7 displays the present and proposed rank structure for the Department. They are identical except for the added Executive level. The other ranks are appropriate, but several changes should be considered in their areas and responsibilities.

Senior Chiefs – The HFD should consider revising the system used to develop the Department's rank structure by adopting a method likely to reinforce command stability as well as continuity. That system could be designed around the four appointed Executive Assistant Fire Chiefs suggested above. In practice, the Mayor would appoint the Fire Chief and he or she would, in turn, select the four Executive Assistant Fire Chiefs. Below those five appointed positions (vs. the 15 appointed at present), the rank of Assistant Fire Chief and all other levels of supervision within the Department would be attained through a competitive process. The process would have assessment center and written examination components and would require a minimum time in grade in the presently held rank, and some consideration of seniority.

Table 7: HFD Rank Structure

Present	Proposed
Fire Chief	Fire Chief
	Executive Assistant Fire Chief
Assistant Fire Chief	Assistant Fire Chief
Deputy Chief	Deputy Chief
District Chief	District Chief
Senior Captain	Senior Captain
Captain	Captain
Engineer/Operator	Engineer/Operator
Firefighter	Firefighter

Using a process of this nature, anyone reaching the level of Executive Assistant Fire Chief would have served at all levels of the Department and most likely have a broad-based understanding of both the HFD's standard operating procedures and a wealth of experience to draw from. When City administrations or Fire Chiefs change, the HFD will still have a cadre of informed leaders to oversee the day-to-day operations of the Department under the new top level of leadership. Fewer positions would change when the Fire Chief changes. This would be a major change, but it is an approach that works well in many jurisdictions across the country. It does not preclude the selection of individuals from lower in the command structure to be Executive Assistant Fire Chiefs. Were that to happen, a solid core of experienced individuals would still be in place to support and guide the new top fire leadership.

Deputy Chiefs – Based on observation, it appears that the Deputy Chief positions in Operations are not being fully utilized to the Department's best advantage. Although their title is "Shift Commander," most of their workday is spent dealing with staffing matters, and they have little interplay with the troops they command. This rank is the highest attained by competitive examination. Some of the most experienced individuals in the department hold this rank. Their talents and operational experience are valuable assets to the HFD and they should be utilized more fully. A close look should be taken at the way the Deputy Chiefs are utilized.

District Chiefs – Currently there are 20 fire districts, with a District Chief in command of each. On the organizational chart these District Chiefs all report to one of the two Deputy Chiefs – north side or south side. In practice, there is one District Chief in each of the City's four quadrants who is the "Lead Chief" and who coordinates

activities in the five fire districts in his or her quadrant. This is an additional duty with no additional compensation.

A suggestion surfaced during on-site interviews that the Deputy Chiefs be eliminated and one District Chief be designated "Shift Commander" and compensated at a rate to be determined. TriData does not support this proposal. Compensation not withstanding, this would create a situation where District Chiefs are under the direction of and responsible to another District Chief. The process by which a "Lead Chief" is identified and designated would likely cause hard feelings and ill will. In another section of this report, a modified chain of command is proposed that shows a pattern of advancement from District Chief to Deputy Chief (north or south sides) to Executive Assistant Fire Chief for Operations. Though Assistant Chiefs could be selected from ranks lower than Deputy Chiefs that should be the exception.

Union Membership – Another issue relating to the District Chiefs as well as the Deputy Chiefs is their membership in Local 341 of the International Association of Fire Fighters. There also was indication that some Assistant Chiefs retain their membership in the Union. All three of these ranks must be regarded as HFD management as it is they who see that departmental policies and procedures, rules and regulations and other orders and guidelines are carried out and/or adhered to. These chief officers are responsible for discipline and contribute the most in the research and development of policy. Frequently, in the day-to-day administration of departmental policy, conflict arises between labor and management. In those conflicts, issues may be compounded when both sides belong to the same bargaining unit.

Recommendation 3: All Chief-level officers (those above the rank of Senior Captain) should be considered members of management, and removed from the firefighters union. If this is implemented, a process should be put in place that ensures maintenance of benefits and wage parity for Chief officers. Alternatively, or in addition, the upper level managers could form their own bargaining unit. (This recommendation might need to be accomplished under the auspices of a "Meet and Confer" agreement.)

Internal Communications

Critical to the functioning of the HFD is the transmission of timely, accurate information about the Department to its members and the passing of information and perceptions from members up the line. The current leadership has adopted many

mechanisms to promote good communications. Regularly scheduled meetings include monthly Command Staff and General Staff meetings, quarterly Deputy and District Chief meetings, and periodic informational sessions. In at least one case pre-meeting questions are submitted by participants and are addressed at the actual meeting. These meetings generate written notes useful for reference purposes.

There is a District Chief Technical Advisory Committee located in the organizational structure under the Assistant Fire Chief for Planning and Research. Participation in this committee is voluntary and the group meets monthly, with meeting minutes distributed. Their agenda includes nearly every aspect of the HFD. District Chiefs oversee adherence to departmental policy and are closely attuned to what is and is not working in the operational setting. This committee is a valuable asset and should be utilized as fully as possible.

The present HFD leadership elected to discard all written departmental guidelines upon assuming command in March of 1998. Based on a review of existing documents, all significant areas are adequately covered. A series of guidelines, effective September 1999, cover emergency operations, administration, and emergency medical services. Included in departmental written guidelines are numbered orders and bulletins detailing changes to these rules, regulations, guidelines, training bulletins, and inter-office memos.

Despite all of the above, there still is a need to further improve informal communications, such as expanded use of Q&A columns in a periodically published newsletter. Some other suggestions are given in Chapter IX.

Affirmative Action/Consent Decrees

The HFD is not currently under any kind of Affirmative Action orders or consent decrees, and has significant numbers of minorities, but not to the extent desirable or reflected in the City's population. There are non-trivial numbers of female firefighters, but again there is under-participation. These issues, too, are discussed in Chapter IX, Personnel and Supervisory Issues.

Rotating Assignments

There is no structured officer rotation program within the department involving company officers or District Chiefs. A city as diverse as Houston offers a tremendous opportunity for the practical education and development of its officers as a result of the variety of types of buildings and occupancies. Within the boundaries of Houston there is an almost unlimited array of fire service challenges. These challenges run from high-rise buildings to commercial and industrial activities to refineries to chemical plants and to transportation facilities among other challenges. Assigning an officer or District Chief to one area of the city and leaving him or her there for extended periods of his or her career precludes the opportunity for that individual to gain the job knowledge offered in other parts of Houston. In addition, a familiarity is likely to develop over time between the supervisor and those he or she supervises that can cause administrative and disciplinary problems. When individuals are on a first name basis it is difficult for one to effectively discipline the other. By establishing a rotation policy whereby a company officer or District Chief is moved to a new assignment every three or four years, the Department can reduce the familiarity issue and, at the same time, enhance the career development of the officers and chiefs.

Recommendation 4: A Company Officer and District Chief assignment rotation policy be developed and instituted. The typical period of assignment for this type program is three or four years. At present, transfers are covered by state statutes.[7] This recommendation, like some others, may have to be negotiated as part of a new Meet and Confer contract. (See the more detailed discussion of rotation policy in Chapter IX, Personnel and Supervisory Issues.)

Other organization and management issues pertinent to each sub-function are discussed in the chapters on the various functions.

[7] Texas Local Government Code 143.351 – 143-363.

III. FIRE PREVENTION

The Fire Prevention Division's responsibilities are outlined in the Houston Code as follows:

> The Fire Prevention division and its personnel shall be charged with the primary duty of conducting inspections, reviewing plans for construction and conducting public information campaigns to reduce the loss of life and property by fire.[8]

More specifically, the Division enforces the State laws and City ordinances in the following areas:

- Prevention of fires;
- Storage and use of explosives and inflammables;
- Installation and maintenance of automatic and other fire alarm systems and protection systems, fire extinguishers and equipment;
- Maintenance and regulation of fire escapes;
- Means and adequacy of exits in cases of fires from ... places where numbers of persons work, live, or congregate;
- Investigation of cause(s), origin and circumstances of fire; and
- Conduction of fire prevention campaigns and the circulation of fire prevention literature ... in the interest of fire prevention and public safety.[9]

The Fire Prevention Division had a national reputation in the past for some aspects of its program, such as its juvenile fire setter program. The prevention program (in year 2000) was not adequate and not as efficient as it needs to be. The responsibilities were spread over several divisions (Prevention, Public Information, and Planning and Research), and the Division is understaffed for its remaining duties.

Part of the problem was professional differences between Chief Tyra and the Fire Marshal, but that was not the only problem. (The human relations aspects of the problem and recommended solutions are discussed later in Chapter VIII, Personnel and Supervisory Issues.) This chapter discusses what the project team thought was best for

[8] Houston Code Supp. No. 22, p. 2360.1, Section 34-50.e.
[9] Houston Code Supp. No. 22, p. 2360, Section 34.48.

Houston independent of the personalities involved. The set of recommendations here would improve the productivity and responsiveness of the Prevention Division, as well as provide clear feedback to the Chief without the need for micromanagement. The prevention program needs to be consolidated and strengthened, not dissipated. It was (in 2000) going counter to practice in most other large city departments.

Organization and Management

The Fire Prevention Division is headed by the Fire Marshal, who reports directly to the Fire Chief and is equivalent to an Assistant Chief, as specified in the Houston code.[10] The organization chart for the Division is shown in Figure 3. Along with other Division personnel, the Code specifies that "he shall perform or cause to be performed all the duties required of such division." At present, some prevention responsibilities are not under the Fire Marshal.

Current Staffing – The number of budgeted positions for fire prevention functions in the HFD has increased slightly over the past decade from 168 positions in FY 1992 to 178.5 positions for FY 2000. The number of inspectors increased 24 percent, from 79 to 98. Much of the increase, 12 new inspector positions, was added just in FY2000. The increase in positions was in part to provide services to Kingwood when it was annexed. Included in the 178.5 positions are 64.5 positions in arson, public education, and hazardous material inspections that do not currently report to the Fire Marshal. Table 8 shows the trends in budgeted prevention positions since 1993. Table 9 shows how the positions are currently assigned by rank and function. This is a moving target: the numbers and assignments are almost continuously changing.

[10] Houston Code Supp. No. 25, p 2362, Section 35-56.

Figure 3: Current Organizational Chart – Inspections (2000)

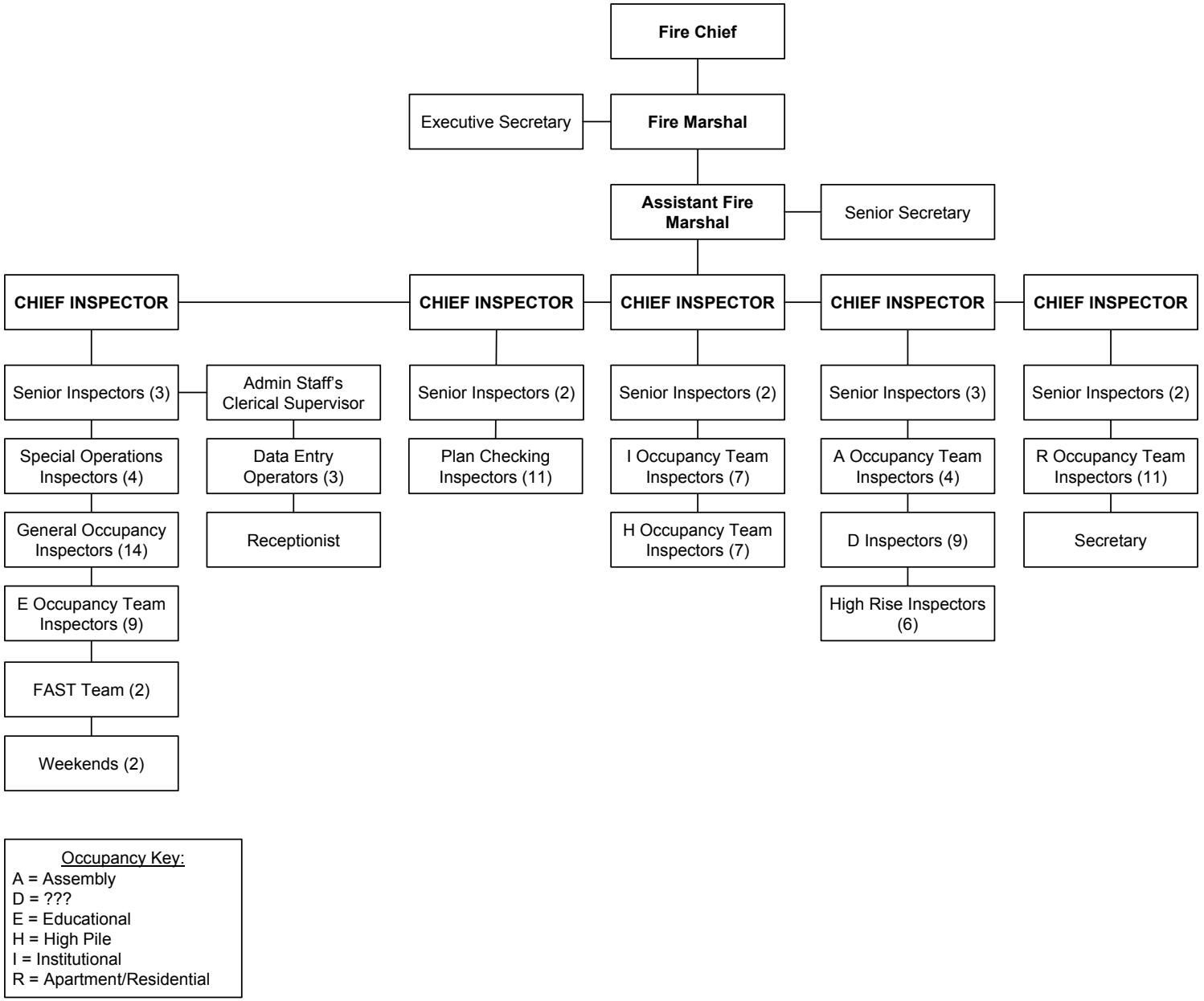


Table 8: Number of Budgeted Positions in Fire Prevention Activities

Position Title	1993	1994	1995	1996	1997	1998	1999	2000
Fire Marshal	1	1	1	1	1	1	1	1
Asst. Fire Marshal	1	1	1	1	1	1	1	1
Chief Inspectors	6	6	6	7	7	7	7	5
Senior Inspectors	14	14	14	14	14	14	14	14
Inspectors	79	79	79	79	86	86	86	98
Support Staff	11	10	16	18	17	16	18.2	13.5
Sub-Total*	**112**	**111**	**117**	**120**	**126**	**125**	**127.2**	**132.5**
Total**	**176**	**166**	**173**	**184**	**186**	**180**	**179.2**	**178.5**

* Total budgeted prevention positions inside the Prevention Bureau. **[Reviewer: Breakout by position does not quite jibe with numbers below – reason?]**

** Total budgeted prevention positions including those outside the Prevention Bureau.

Table 9: Positions by Assignment within the Prevention Division

Organizational Unit	Fire Marshal	Asst. Fire Marshal	Chief Inspectors	Senior Inspectors	Inspectors	Support Staff	Total Positions
Management							
Fire Marshal	1					1	2
Asst. Fire Marshal		1				1	2
Chief Inspector			5				5
Citizens Assistance				1	4		5
Administrative Staff						5	5
General Occupancy				2	14		16
Subtotal	**1**	**1**	**5**	**3**	**18**	**7**	**35**
Inspectors							
Fast Team					2		2
Weekends Team					2		2
Educational Occupancy				1	9		10
Plan Checking				2	11		13
Institutional Occupancy				1	7		8
High Pile Storage				1	7		8
Assembly Occupancy				1	4		5
D Occupancy				1	9		10
High Rise Occupancy				1	6		7
Apartment Occupancy				2	11	1	14
Total	**1**	**1**	**5**	**13**	**86**	**8**	**114**

Executive Assistant Fire Chief – As recommended earlier, an appointed Executive Assistant Fire Chief should be placed over all fire prevention functions. This would include plans review, code enforcement, public education, and arson investigation. The title "Fire Marshal" could be used for that position or for just the code enforcement function as it is now. The Fire Marshal would also have Public Information and the Museum. This position might also be called Chief Fire Marshal or Executive Fire Marshal.

Fire Marshal – The Fire Marshal currently is a 'tested' position subject to Civil Service rules. Opinions in the Department and elsewhere differ on whether this position should be appointed like the other Assistant Chiefs or remain a Civil Service position. There are valid arguments on both sides. The primary argument for making it appointed is to ensure that the Fire Marshal is a trusted member of the Chief's management team, and to treat all assistant chiefs uniformly. The primary argument for having it be a tested civil service position is that it requires high technical competence that an appointee may not have, and that this position must be independent of politics in enforcing code – the very reason for the existence of a civil service.

Recommendation 5: The Fire Marshal should remain a Civil Service position. The Fire Marshal should be the ranking fire safety professional free from political influence to advocate the strongest possible fire safety standards and precise enforcement. Program and enforcement continuity as well as independence is difficult to achieve if the Fire Marshal is appointed. The Fire Marshal would report to the previously mentioned Executive Assistant Chief – Prevention. (Since the initial report, the position has remained civil service.)

The Fire Marshal has two direct subordinates, the Assistant Fire Marshal (currently vacant) and an Executive Secretary. Within the past two years, a second Assistant Fire Marshal position was eliminated. In July 1999, a Chief Inspector was appointed Acting Assistant Fire Marshal and was assigned the responsibility for all administrative functions of the Division. An indirect reporting relationship was established between the Assistant Fire Marshal and the Fire Chief, bypassing the Fire Marshal. This is not a healthy arrangement.

The Assistant Fire Marshal functions as the personnel director for the division and is responsible for disciplinary actions. The Assistant Fire Marshal also manages staff services, responds to complaints and supervises the Chief Inspectors. However, the

Assistant Fire Marshal does not have authority to act as the Fire Code Official in the absence of the Fire Marshal. This organization is problematic. At the highest levels, it splits the Division's reporting hierarchy into two, negating the chain of command. This structure is not found in other municipal Fire Marshal organizations of which we are aware.

Recommendation 6: The Fire Marshal and Assistant Fire Chief Prevention should be responsible for all the functions of the Prevention Division. The indirect reporting relationship between the Assistant Fire Marshal and the Fire Chief should be ended and replaced by operational reports on prevention produced as frequently as the Fire Chief desires. The Fire Chief should indeed track prevention and expects high performance, but should not micromanage the unit. (This recommendation was subsequently implemented.)

The present structure of the Division insulates the Fire Marshal from the organization because all units report to the Assistant Fire Marshal. It separates the inspectors responsible for operational code enforcement from the fire code official that recommends codes, enacts code policy, and resolves interpretation issues.

Recommendation 7: Consideration should be given to eliminating one level of Prevention Division management, and establishing a new position of shift Deputy Fire Marshal. The Deputy Fire Marshal position would combine the responsibilities of the current Assistant Fire Marshal and the Chief Inspector. The Deputy Fire Marshals would be empowered with official fire code authority in the absence of the Fire Marshal. By having multiple Deputy Fire Marshals, supervisory coverage could be provided 24 hours a day seven days a week. Hopefully, this change would create a stronger connection between the inspectors and the Fire Marshal. It might also sharpen the focus of Division management on the Fire Code rather than administrative matters, and on how to achieve the best life safety programs, education, enforcement, and codes possible for the City of Houston. (Legal and civil service issues must be resolved before this recommendation could be implemented.)

If the above recommendation is accepted, an Office of the Deputy Fire Marshal should be created for each Deputy Fire Marshal. This office should be staffed with a secretary to provide clerical support and a staff inspector(s) to provide training as recommended below.

Despite the number of supervisors, prevention management is not available on a 24 hour, seven days a week basis to support the Weekend Team, the Fire Watch inspectors and other inspectors that are required to respond during off duty hours. There

are no inspection personnel available Monday through Friday from 0200 to 0700 hours. An emergency response reporting structure is not in place

The Deputy Fire Marshal or a Senior Inspector should be available, at least on-call, to approve decisions and actions of inspectors working on off duty hours. This responsibility could be rotated.

Recommendation 8: An emergency response command structure should be established in Prevention and used for on-call situations, special events, and emergency situations. (Subsequent to the initial report, a plan was developed to achieve 24-hour coverage by inspectors by splitting the night shift into two shifts. One crew with three Inspectors worked from 1600 until 0200 hours Monday through Friday. Three Inspectors begin their duty at 2100 hours and 0200 hours during the busiest duty hours. Between 0200 and 0700 hours, Inspectors answer complaints and monitor assembly occupancies.)

Chief Inspectors – At present, five Chief Inspectors manage the various administrative and code enforcement inspection teams in the division. They report through the Assistant Fire Marshal to the Fire Marshal for life safety program issues. They report directly to the Assistant Fire Marshal for administrative issues.

The five Chief Inspectors are assigned as follows:

- **PLANS REVIEW:** One Chief is responsible for 13 employees, including the Plan Checking Inspectors. Two senior inspectors report to him. Under them are 11 inspectors, split almost evenly. They review new building plans.

- **ADMINISTRATIVE STAFF AND SPECIAL INSPECTIONS: One** Chief is responsible for a total of 39 employees, including the Administration Staff, Special Operations Inspectors, the General Occupancy Inspectors, Educational (E) Occupancy Inspectors, the Fast Team, and the Weekends Team. Eight people report directly to him: three senior fire inspectors, one clerical supervisor, and four inspectors. One senior inspector supervises 14 inspectors, another supervises nine inspectors, and one supervises four inspectors. (The four remaining inspectors are assigned to special teams that do not report through Senior Inspectors.) There are a total of 31

inspectors in this section. The clerical Supervisor manages three data entry operators and one receptionist.

- **INSTITUTIONS AND STORAGE:** A third Chief position (currently vacant) is responsible for 16 employees in the Institutional (I) Occupancy Inspection Team and the High Pile (H) Occupancy Team. There are two Senior Inspectors under the chief, each with responsibility for seven inspectors.

- **PUBLIC ASSEMBLY/HIGH RISE/D INSPECTIONS:** One Chief Inspector is responsible for 22 employees in the Assembly (A) Occupancy Inspection Team, the (D) Occupancy Team, and the High Rise Occupancy Team each headed by a Senior Inspector. The teams have four, nine, and six inspectors, respectively.

- **RESIDENTIAL INSPECTIONS:** One Chief is responsible for 14 employees on the Apartments ("R" for Residential) Occupancy Team. It is comprised of two Senior Inspectors who supervise 11 inspectors and one secretary. One of these inspectors inspects "911 gates" and another responds primarily to complaints.

The Chief Inspectors function as mid-level supervisors. Most manage from two to three Senior Inspectors directly. One Chief manages six functional units while the others manage from one to three functional units. They manage sections ranging in size from 39 employees down to 12.

The Senior Inspectors are the first-line supervisors. They make work assignments, schedule, and monitor fieldwork. They train inspectors, perform quality assurance reviews, function as technical experts, and interpret the Fire Code as the need arises. They also prepare monthly reports, resolve conflicts with citizens, participate in court cases, and are sometimes called by the Chief Inspector to draft policy and procedures for code revisions.

Some of the Chief Inspector duties seem to be identical to those performed by the Senior Inspector. These may include supervising field inspections, assigning daily work, and resolving complaints.

This organization begs the question of whether so many senior positions need to be devoted to people management vs. spending more management time on the higher-level prevention issues. The higher-level prevention issues include developing policies for emerging risks, analyzing and prioritizing risks, building alliances with developers and other community groups, writing code revisions and interpretations, determining training needs, and looking for ways to improve methods and procedures. If inspectors are well trained, have clear assignments, and have their authority backed up; they should be able to function well in a flatter organization chart.

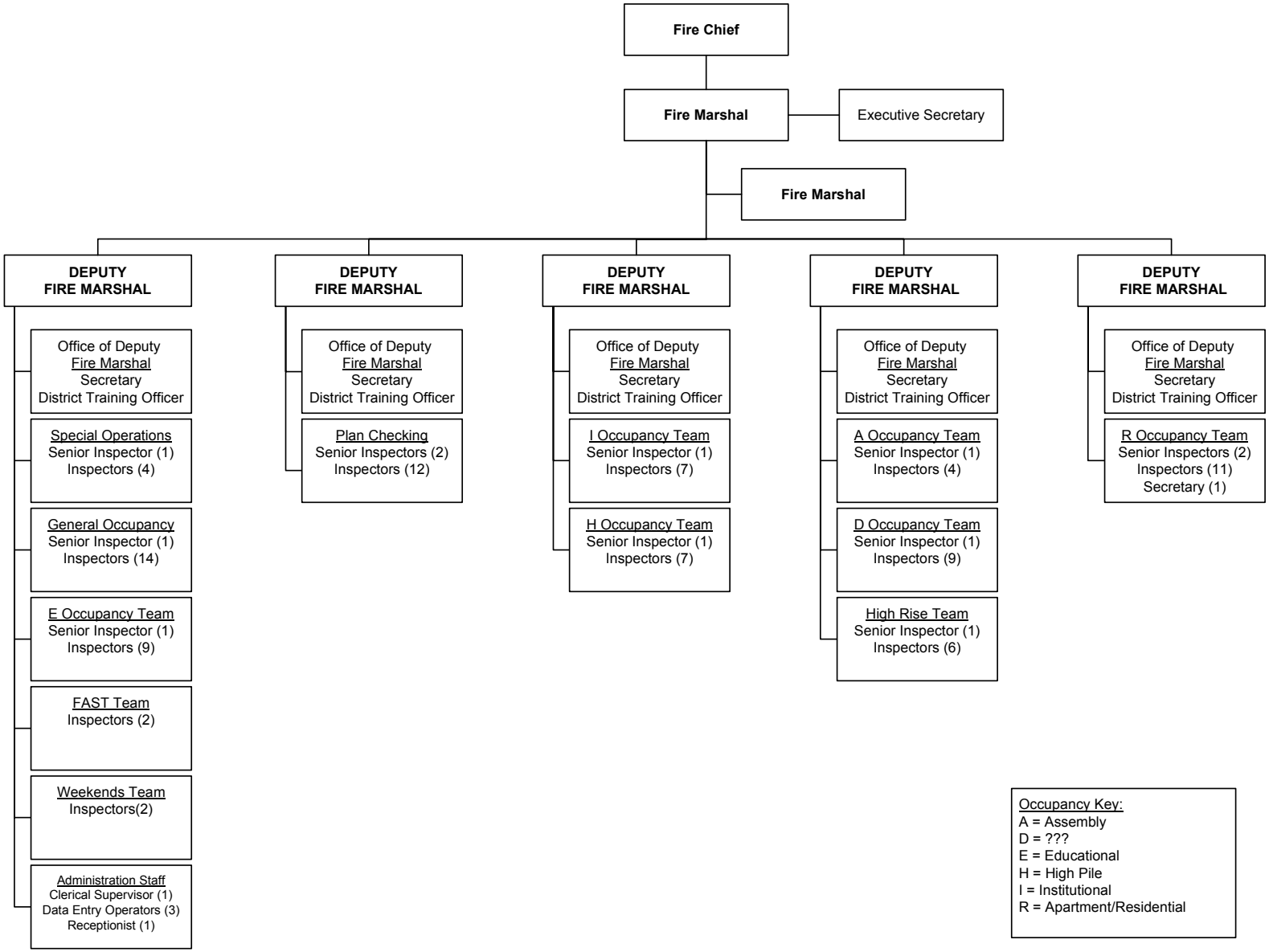
The small number of direct reports to the Chief Inspectors, and similarity of functions managed, do not warrant a second level of supervision above the Senior Inspector. Combining the positions of Chief Inspector with the Assistant Fire Marshal, as recommended above, should clearly separate the management duties performed at the Deputy Fire Marshal level from the supervision duties performed at the Senior Inspector level.

Figure 4 shows the proposed revised organization chart for prevention.

Training – The Prevention Division does not have District Training Officers (DTOs) or Field Training Officers (FTOs), unlike Fire Operations and the Houston Police Department. Senior inspectors are required to perform field training along with their other duties, with no mechanism to ensure the continuity or quality of training. It is standard practice for Prevention Divisions in large cities to have DTOs and FTOs.

Recommendation 9: The Prevention Division should make use of District Training Officers and Field Training Officers. Consideration should be given to staffing each Office of Deputy Fire Marshal with a DTO. Their duties would include developing and conducting training programs for prevention activities and maintaining quality control. A Field Training Officer – an inspector with a side job of field trainer and observer – should be assigned to each inspection team. It is standard practice to pay DTOs $250 per month extra pay incentive and to give FTOs an extra pay incentive. Pay incentives comparable to Fire Operations and HPD should be paid for these positions. (The Professional Development Command is planning to implement this program after a meet and confer agreement is reached.)

Figure 4: Recommended Organizational Chart – Inspections



Fire inspectors are required to know and apply the UFC and UBC dating from the current 1997 codes back to the 1973 UFC and 1972 UBC. This imposes an extraordinary demand on them. They are expected to know the many versions of the codes and to be capable of exercising a high degree of judgment to determine which code applies and how defects should be corrected. However, the fire inspectors in the Prevention Division are not routinely trained in either the UFC or the UBC. For the most part, training is left to the discretion of the Senior Inspectors. There is a wide disparity in the level of training. Few inspectors have been trained in the 1997 codes.

The training performed in the High Pile Occupancy Team is a good example and exception. It can be used as a model for the other teams. Once a month, the Senior Inspector conducts a training session of two hours or so. The training primarily covers code issues.

Recommendation 10: In addition to formal certification of inspectors in the UFC and UBC (recommended later in Recommendation 24), periodic training should be given to Inspectors that is tailored to the requirements of the particular occupancy and/or function assigned the Inspector. The Senior Inspectors could do this training (until DTOs are instituted). Ideally, training sessions should be conducted monthly. Training should include topics such as the administrative section of the codes, powers granted by the codes, how to fairly apply codes, how to handle immediate dangers to life, and dealing with various situational scenarios. (The HFD agreed.)

Cross-training of building and fire inspectors improves consistency of regulation and helps the two areas better support one another. The Plan Checking Division and Building Inspectors already have some cross-training. Fire Inspector certification school already has a Building Inspector teaching the Building Code. To accomplish further cross-training will require consultation with the Building Code official.

Recommendation 11: Cross-train Fire Inspectors in the Uniform Building Code and cross-train Building Inspectors in the Uniform Fire Code and in fire fighting considerations. The Fire Chief, Building Official, and Fire Marshal favorably received this recommendation in concept to help the two departments work better together and to raise the sensitivity of employees to detecting problems in each other's area. (The HFD is planning further cross-training in 2002.)

Internal Communications – The Prevention Division is large and communication between its groups is difficult. Communication with prevention elements outside the division is problematic. There are no formal mechanisms to exchange ideas,

report achievements, discuss plans or establish priorities. Senior Inspectors are called upon to perform most of the management reporting, code interpretation and supervisory duties without a forum to pass on concerns, accolades, desires and needs.

Recommendation 12: The Fire Marshal should conduct a monthly Management Meeting including all division management from Senior Inspectors and up. The primary focus of this management meeting should be to establish standards for management and supervisory practices in the division. It should also address inspection practices, code interpretation practices, career development issues, organizational issues, productivity issues, cooperative efforts with other divisions and departments, etc. (Meetings were held "as needed" before; the policy has now changed to holding monthly meetings.)

Communication between Prevention and other HFD divisions seems to be rare, according to the prevention staff. Prevention does not receive fire incident data from Central Command to analyze trends or identify problems. There is little interaction or exchange of ideas or joint program efforts between Prevention and Fire Suppression. The Fire Marshal and other upper management in Prevention are not involved in top department management activities such as the development of the strategic plan and the accreditation project. Historically, there has been a solid demarcation between suppression and prevention. This occurs despite the fact that all prevention personnel came through the firefighting ranks. Efforts need to be made to reestablish exchange of ideas and information with other divisions. Prevention should not be viewed as a step-child off on the side; it should be a major function integrated across divisions and in which Suppression should participate.

Recommendation 13: The Fire Marshal should meet at least monthly with the senior staff group comprised of Chief Inspectors and Chief Investigators. The primary focus of the Fire Marshal's Staff Group would be to develop forward-looking direction and goals to improve life safety for the citizens of Houston. It should work hand in hand with the Building Official to develop more cooperative ventures and approaches. It should develop strategic plans to fit into and augment the Department's strategic plan and goals. It should work with each of the fire divisions to open communication and develop ways to jointly support divisional and departmental goals. It should seek participation in all HFD top management initiatives and participation of the rest of the Department in Prevention. It should decide issues that are unresolved at the Management Group level and keep the Management Group informed on community and departmental issues. (This is being done.)

Use of Computer Systems – There is a lack of adequate computer support for the Prevention Division. Activity reporting is done manually. In October 1999, the responsibility for manual compilation of data was shifted from a central unit to the Senior Inspectors. Some of the senior inspectors have developed their own stand-alone databases in MS Access to track permit and reporting activities. Most also maintain manual files of permits and inspection reports.

The administrative staff in Prevention maintains the master building files. These are manual records and not entered into a computer system. Building floor plans are not part of these files. Most inspection reports and permits are not part of the files. Inspection teams maintain these records in various locations to use as management tools for reporting and monitoring inspections.

This lack of a good prevention MIS is particularly troublesome because Prevention once had a computer system on the BULL mainframe that met their basic reporting needs. Prevention was ahead of other divisions in the use of computer systems. It was the first division in the department to have e-mail capability. Hand-held devices were purchased in preparation for a new system, but have been warehoused for a couple of years. Unfortunately, the BULL system was scrapped about three years ago during preparations for implementing a new system. The historical data on the mainframe was not converted and is not available for analysis. The ability to track prevention information in the HFD now is much worse than it once was, despite the enormous advances in MIS technology.

Additionally, fire prevention does not now receive fire incident data from Central Command to analyze trends and identify emerging problems. Having this analysis is needed to target inspections both by occupancy class and within a class to particular problems that cause fires or contribute to loss.

Ultimately, the Record Management System associated with the new CAD can help provide a database usable by the inspectors. Before that, an interim system should be considered. Ordinarily, the effort required to implement an interim solution is so substantial that it is better to direct those resources to new systems. However, the implementation of the Records Management System (RMS) of the new CAD system is probably two or more years off, too long to wait.

Recommendation 14: Consideration should be given to using the Planning Department computer system as an interim solution for prevention inspection reporting. The Building Official is amenable to this approach. Precedence has been established: the Plan Checking function in prevention enters notes and results in the Planning Department computer system. In implementing this interim solution, the Division must ensure that the interim database will be readable or readily convertible to the planned RMS.

(The HFD concurred with the above recommendation, and plans to begin use of the same Integrated Land Management System that Planning and Development uses. The system can access information on buildings permitted by the City of Houston and would greatly enhance the HFD's ability to track and sort inspection data. Plans are to provide each Inspector with a portable computer that can dock at work stations provided at Stations #70, 75, Braesmont, and West 12th. Each laptop can be connected to a monitor. All reports will be standardized. Permits not approved can be flagged both from the Building Department and the HFD. The Permit Office will process all permit renewals, and renewals can be faxed or mailed to the business owner. The Permit Office will also have the ability to electronically send permit billing to the business owner and expired permit information will be electronically forwarded to each substation daily. The plan is to implement this program in January 2002, at a cost of about $100,000. In the meantime, the HFD will compile data by hand.)

Recommendation 15: Evaluate the feasibility of using the (available) hand-held devices for field capture of inspection data. One of the Senior Inspectors developed a proposal to do this in April 2000. With the installation of laser printers in all fire stations, the cost effectiveness and feasibility of using these devices may now be viable. The devices are in storage and do not have to be purchased. An alternative is the use of laptop computers, as noted above.

Recommendation 16: Eventually combine the prevention records management function with the Records Management System function of the new CAD. Fire operations as well as prevention need these records. The primary benefit of combining these functions is better control of the permanent records. The disadvantage may be more difficult access for prevention. However, a modern records management system should be able to accommodate both functions. (This recommendation is planned for implementation in 2002 when the new RMS is expected to be available.)

The Fire Department does not maintain a file of building plans, but it is becoming more and more important for prevention and suppression to have plans of buildings readily available.[11]

[11] The Worcester, MA fire that killed 6 firefighters probably would not have been as deadly if plans of the building had been readily available to the incident.

Civilianization – Part of the charter of this study was to examine opportunities for civilianization of functions. Many Metro-size fire departments use civilians for public education. Some use civilians for plan review and code enforcement. Fire investigation is virtually always performed by a uniformed position. However, the question of civilianization of HFD prevention is currently moot: Texas State law prohibits use of civilians in most positions in prevention. With the exception of clerical positions, all positions are filled through promotion from the rank of fire fighter. As a long-term proposition, the law should be relaxed to allow use of civilians in prevention, where appropriate, especially if qualified firefighters do not choose to apply for Prevention positions.

Clerical Support – There are eight clerical positions in Prevention for a division of over 113 employees. This is not adequate. There is one receptionist, three data entry operators, one clerical supervisor, one executive secretary and one senior secretary. There is one clerical position at the Station 75 sub-station. Inspectors are required to schedule inspections, receive complaints and answer incoming calls. This is an inefficient use of inspector time. For example, in Plan Checking, over 100 field inspections need to be scheduled each week. It does not take a highly trained firefighter/inspector to do that function.

Recommendation 17: Evaluate the use of the Planning Department's automated voice system for scheduling inspections to determine if it will suffice for scheduling field inspections. The HFD planned to consult with the Building Official to compare the systems' compatibility with HFD procedures. (This was reported to be in progress in 2001.) If it appears satisfactory, evaluate the remaining workload to determine if a clerical position also is needed for Plan Checking. It is likely that adding several clerks would free some inspector time and would be a lot less expensive than adding inspectors.

It is difficult to contact Prevention employees on duty by phone. There is one receptionist for the division. Often calls are placed on hold. It is also difficult to determine whom, if anyone, has the information you are seeking. This makes it difficult for businesses to get back to inspectors.

Recommendation 18: Create a centralized telephone information function. This function should receive complaints, schedule requested inspections and direct code information calls. (This exists now. A menu system allows calls to be automatically transmitted to an inspector.)

Another choice is where to put the hazardous materials investigations. They can benefit from being in the organization with the hazmat forces to keep information on existing hazards available during response to sites with hazards. The same could be accomplished with good information systems and common database that inspectors, line operations units, and investigators can share, but they do not exist in the HFD. We therefore recommended in the Special Operations chapter that the hazmat inspectors be assigned to the hazmat operations command.

Code Administration and Plans Review

In 1992, Houston changed from a Houston City Code to the Uniform Fire Code (UFC). The 1997 UFC was adopted in March 2000. Houston-specific amendments are being published and added to the UFC.

The 1997 Uniform Building Code is used for construction and renovation. Houston now is more consistent with nationally used codes than it had been a decade ago. A major advantage in being consistent is that the City benefits from the large effort that goes on nationally to keep codes current with technology.

Plan Review Authority – The basic concept of code administration in Houston is that the Building Official approves the fire safety and other aspects of a building and the Fire Marshal monitors the building once occupied. A Plan Checking Division was created in the Fire Department in 1967 to assist the Planning Department in building plans review and the field inspection of standpipe and automatic sprinkler systems. Responsibilities for inspection work, plan checking of fire alarm systems, and checking plans for flammable and combustible liquid tank installations subsequently were added. The plan-checking unit is physically located in the Building Code Enforcement facility. An Engineer in the Building Inspections department reviews sprinkler system shop drawings.

The Prevention Division only reviews the aspects of new building plans for which fire permits are required. This includes buildings in which hazardous materials are stored and those in which high pile storage is planned.

The Building Official is the final authority for approving plans, approving alternate methods and means, inspecting buildings during construction, and for approving

a building for final occupancy. Disputes go to the General Appeals Board. The Fire Marshal is not a member of this Board and has very limited authority for new construction and renovation in Houston. This situation is unusual compared to most other cities, where the fire departments at a minimum review new construction plans for fire department access and fire protection features even if the technical sprinkler computations are checked by the Planning Department. Most fire departments also play a role in inspecting buildings before they are certified for occupancy. Currently, plans are not reviewed by the Fire Department for such things as fire hydrants, flow and access roads.

Fire Prevention Inspectors do conduct inspections for hydrostatic tests, fire pumps, fire alarm systems, combustible liquid tank installations and final occupancy approval. Inspections of underground pipe installations for sprinkler systems are not performed. Fire Inspectors do not do inspections of methods used for mechanical and plumbing interruptions during construction. Inspections of fire accesses are not performed. Building inspectors perform the construction in progress inspections.

Under the current process, deficiencies that could be identified during the plan review and construction process are sometimes not discovered until after the building is completed and occupied. The deficiencies are much more expensive and difficult to correct after construction is completed.

Recommendation 19: Consideration should be given to having Fire Inspectors conduct more comprehensive progress inspections during construction. They would approve items such as underground pipe installation for sprinkler systems prior to covering, sealing of wall penetrations prior to wall surfacing, exit signage, hydrants, access roads, etc. These inspections could be limited to certain higher risk occupancies. Without progress inspections by fire inspectors throughout the construction process, expensive corrections may be required if Fire Code deficiencies are found after the fact. Worse, the problems may never be detected until they cause a catastrophe.[12] (The HFD estimated that it would take an additional four inspectors to do more comprehensive inspections if the multi-billion dollar level of building construction continues. The additional $200,000 in salaries plus office expenses seems worthwhile to head off potentially expensive problems in these expensive, long-life structures while they are still correctable.)

[12] TriData has undertaken many major fire investigations for the U.S. Fire Administration. One dramatic example of inspectors not catching a problem during construction was the Schomberg Apartments fire in New York City, where it was discovered that the sprinkler system pipes had never been connected, contributing to a seven-fatality fire.

Over time, some aspects of plan reviews that were identified as problematic have been assigned to prevention for plan review. Currently, the Prevention Division's education inspection team is considering reviewing plans for schools because two new schools did not meet the hydrant and access requirements. The Building Official has been very supportive of involving Fire Prevention Inspectors in plan checking and field inspections of certain fire aspects of the UBC.

Recommendation 20: Consideration should be given to increasing the authority of the Fire Marshal in reviewing building plans to include: (1) joint approval with the Planning Department of alternate methods for meeting the safety requirements, (2) joint approval of Certificate of Occupancy, and (3) checking all plans for fire resistive construction methods and material, fire exit signage, hydrants, access roads, etc. Any change in authority will require discussion with many parties, including the City Council and the building community. The idea here is not to take away the prime review by the Building Department, but rather to have the Fire Department (or fire protection engineers in the Building Department) review fire protection features to whatever depth is thought necessary. (Again, this may require additional inspectors, but a greater investment in prevention is likely to be cost-effective.)

Recommendation 21: The Fire Marshal should have authority to approve building plans for certain types of construction techniques that could pose life safety threats to fire fighters and/or adjacent buildings. An example of the type of construction that should be approved only after review by the Fire Marshal is the three to four story wood truss construction in midtown. Along with this recommendation is the following:

Recommendation 22: The Fire Department should have the authority to declare a structure using potentially hazardous types of construction as a "defensive-response-only" structure, unless the structure is fully sprinklered. In case of fire in such a structure, the Fire Department's primary objective would be to protect the adjoining buildings and fight the fire from outside. Unless lives are at stake, the Fire Department would not use interior firefighting to save buildings identified as defense response only, because of the high risk to the fire fighters. This would be a rather drastic and dramatic declaration, but it may help persuade the owner to use a safer construction.

HazMat and High Pile Storage – Plan checking for hazardous materials started to be undertaken by the Fire Department after a fire/hazmat incident in 1994. The responsibility has been assigned to the Hazmat Inspection Team responsible for code enforcement of hazmat storage rather than to the plan-checking unit. The Hazardous Material Inspection Team reports to the Assistant Chief of Planning and Research. Two inspectors perform the Hazardous Material plan checking. No fee is charged for this service. Prior to issuing a permit, a list of materials to be stored is required. The plans

are checked for spill control, ventilation, sprinkler design and density, man access doors, storage common and arrangement, exits, and area separation walls.

Plan checking for high pile storage facilities also was assigned to the code enforcement team. High pile storage is defined as specified classes of commodities with a storage height of at least twelve feet. The plans reviewed are typically for storage and mercantile occupancies. Each of the seven inspectors on the high pile storage team is assigned a section of the city and performs all plan review and code enforcement activities for high pile storage in the assigned section, including plan reviews on new construction and fire inspections on existing structures. No fee is charged for this service. An inventory of materials to be stored is obtained. The plans are checked for compliance to UFC Articles 9 and 81.

Fire Inspectors in Plan Checking, Hazardous Material and High Pile Storage are trained to review plans by the Chief Inspectors and by on-the-job experience. The inspectors in Plan Checking have been trained in the UFC and the applicable portions of the 1997 UBC. However, professional certifications are not required.

The Hazardous Material Inspection Team could logically fit in wither of two places in the HFD. The team could be assigned to the Prevention Division and coupled with the warehousing occupancy team, the High Pile Team, or it can be assigned to the Hazmat Operations team. Prevention requires cross-checking of problems of various types, which is facilitated when all inspection and plan review units are organizationally and physically banded together. However, there also is merit to combining the Hazmat Inspection Team with the Hazmat Operations team, because of common subject matter and because operation needs the Inspection data, and can identify problems to inspect. We recommend the latter approach, in the Special Operations chapter.

Recommendation 23: Centralize all types of plan checking, including hazmat and high pile storage, under the single plan-checking unit of Prevention located at 3300 Main. Either transfer the plan checking inspectors from the Hazardous Material Inspection Team and the High Pile Inspection Team to the Plan Checking Team or locate all these groups at 3300 Main. This change would provide better access for the public and would be more efficient. The benefits of specialization would not necessarily be sacrificed. Inspectors can specialize in reviewing particular types of plans while being qualified to look at all types of plans. (The Prevention Division plans to house these two fire inspection teams together on the third floor of 3300 Main, a good idea.)

Certification: Certification of inspectors helps ensure their competency and consistency across inspections. It adds to their professionalism and self-esteem, and raises their image among the customers. The LPG Inspector responsible for plan checking and field inspections of LPG tank is certified in LPG by the State of Texas already. The certifications should become a minimum standard for all inspectors involved in plan checking. Consideration should be given to providing a pay incentive until the certification becomes part of the minimum qualifications for the job.

The certification process requires that Inspectors take an examination given by the certification agency at a cost of $140 per test. This is offered twice a year and recertification must occur every three years.

Recommendation 24: Fire Inspectors involved in plan checking should be certified by International Conference of Building Officials (ICBO) in the Uniform Building Code (UBC). They also should be certified in the Uniformed Fire Code (UFC). (The HFD plans to certify at least ten inspectors per year in order not to disrupt the inspection process, which only costs $1,400. The Building Official does not require certification of their Inspectors; however, if and Inspector is certified on his own time, he is paid an additional $100 per month. If this policy were adapted, it would cost $100 per month after the Inspector is certified. (If the training is on City time, the payment may not be necessary.) The process should be discussed during Meet and Confer negotiations. A certification test is being developed by the Houston Community College on the 1997 UFC with Houston amendments.)

Recommendation 25: Develop a digitized database of building plans. The Planning Department is in the process of procuring a method to digitize plans. Fire Prevention, Suppression, and MIS should work with the Planning Department to develop a plan to provide these digitized plans to the fire department. The plans can be updated by pre-fire planning.

Fire Protection Engineers – Fire protection systems are getting more technologically complex, and require more highly trained people to review them. The HFD has no fire protection engineers, either in-house or on contract, a major deficiency in capability for reviewing plans in a large, growing city.[13] The main reason for this deficiency is the inability to find an engineer who will work for city pay. There are several alternatives:

[13] Another client of ours, North Metro Fire Protection District, a suburb of Denver, Colorado serving 100,000 people, has *five* fire protection engineers because of rapid growth.

1. Do as some other nations and at least one U.S. City do, and require builders to obtain third party reviews of their plans. Both the builder and the third-party reviewer sign off and are liable should the plan prove defective.

2. Have fire protection engineers available on call, under contract;

3. Get a special exception category for paying a competitive salary for a fire protection engineer.

Recommendation 26: Obtain fire protection engineering capability for plans reviews, one way or another. It is imperative for a city of Houston's size and stature to have the technical ability to review modern fire protection plans. (The HFD has now established a contract for fire protection engineering services. If a salary near the competitive range can be offered, it would be preferable to provide this service in-house.)

Fire Inspections

The Fire Inspectors have the responsibility to periodically inspect buildings to ensure they continue to adhere to fire and building codes throughout their life. The Fire Inspectors review plans against the standards in the UFC and the UBC. Chapters 4 and 9 of the UBC, which address high-rise construction and fire protection systems, are used as the minimum standards for this review.

Focused Team Approach – As a result of the Abbey Group report written for the HFD in 1997, the fire inspection functions were reorganized from a geographic approach to a "focused team approach" organized by occupancy type. The focused teams included: Special Operations (now Citizen Assistance), General Occupancy, Fast Team, Weekends Team, Educational Occupancy, Plan Checking, Institutional Occupancy, High Pile Occupancy, Assembly Occupancy, 'D' Occupancy, High Rise Occupancy, Apartment Occupancy, and Hazardous Material.

This approach shifted inspector responsibilities from general comprehensive fire-code enforcement to occupancy specialization, which is preferable if two conditions are met. The conditions are 1) there is good tenure, so specialist holes are not being created continuously; and 2) the inspectors can group work by geographic area within a specialty,

so that travel time from widely distributed inspection sites do not reduce productivity more than specializing enhances productivity.

Part of the overall concept for this reorganization included a planned shift from a use-based permit fee structure that regulated certain activities to an occupancy-based permit fee structure based on the general elements of business. (This reduced the need for multiple permits for a single occupancy.) This comprehensive plan was well-conceived in theory, but was dependent upon many elements that were not in place, including: (1) a computer system to collect data from multiple City departments so that the inspector knew what to inspect in a given occupancy; (2) a new fee structure to finance the changes to the computer system; and (3) mechanisms to insure community participation from business and neighborhood representatives to assess risks and establish priorities for fire prevention activities. The above elements are not in place as yet. The focused team organization, as implemented, is a static organization based on 1997 historical fire risks. There are no internal or external mechanisms to continually assess risks and establish priorities for fire prevention activities within or across occupancies. Still, there are pluses and minuses inherent in the focused team concept as currently implemented. They are summarized in Table 10.

Table 10: Pros and Cons of Focused Team Organization for Inspections

Pros	Cons
• Specialized inspection skills and code knowledge are developed, which improves the quality of inspections for more complex occupancies	• Travel time and associated expenses are increased because several inspectors must drive the same area, covering different occupancy types.
• More proficiency is developed in the code knowledge and inspection skills needed for a specific occupancy type. Greater inspection coverage and individual inspection efficiency within a given class of occupancies should result.	• A high degree of specialization may lead to elite attitudes and less of a team concept. An ever-narrowing focus may lead to a reluctance to perform inspections outside the area of specialization, reducing staffing flexibility.
• It is clearer to the business owners and managers who to contact to register complaints or raise questions. This should result in expedited solutions to problems.	• Proficiency in all aspects of the fire and building codes is not developed, which hinders career progression to higher levels of management.

Pros	Cons
	• Some occupancies receive minimal, if any, inspections (e.g., manufacturing plants, mercantile, low rises) because they are not targeted by a specialized team.
	• The organization is more vulnerable to personnel turnover. A specialist who leaves carries more expertise away and may leave a hole not easily covered by redeploying other inspectors.

Some of the benefits of team specialization by occupancy type (vs. area of the City) are offset by some of the resulting costs. On-site inspection efficiency is offset by increased travel time and cost. Inspection expertise in a single occupancy is offset by decreased knowledge of the overall aspects of the codes. Alternative methods of professional development should be explored to broaden perspectives and knowledge.

Recommendation 27: An internal mechanism should be developed in the Prevention Division to annually reassess risk by occupancy type. Teams should be reorganized or redirected in emphasis based upon this assessment. With the large geographic area and lack of zoning, a hybrid between specialized inspection teams and geographical area assignments may be optimum. The risk analysis will be much easier to accomplish when the automated ILMS system is in place. Since the present CAD System has this information, the HFD will set up a system to insure it can access this information in a timely manner. (The system is funded and is planned to be in operation by January 2002.)

Recommendation 28: A career development plan should be developed for all promotional positions in Fire Prevention. This should include training and possible rotation through various occupancy inspection teams. For the higher levels of management, it also may include training and rotation through different prevention disciplines including administrative, analytical and educational positions.

Consideration should be given to developing proficiency criteria for each specialized team. Each team inspector should be evaluated against these criteria and required to pass the proficiency evaluation within a specified time frame. Inspectors should be encouraged to develop expertise in many occupancy types. This can be done through career development program and proficiency requirements in various occupancies for Inspector, Senior Inspector and Deputy Fire Marshal candidates. Incentive pay may be considered as encouragement for achieving and maintaining

proficiency in several occupancy types. Rotation of Senior Inspectors and Inspectors into various occupancies should be considered.

Civil Service Rules and State Law 143 narrowly define how promotions are to be made. The HFD plan is to increase prevention training functions through the training coordinator, and encourage Inspectors to stay current and compete for promotions when they become available. The HFD proposed the following reasonable eligibility requirements outline below. The same steps as promotions for suppression officers would apply for the Fire Prevention Division.

1. Promotion to Inspector – 60 hours and/or Associate Degree

2. Promotion to Senior Inspector – Certification in both codes and 90 hours of college.

3. Promotion to Chief Inspector – Bachelor Degree, Master Inspector 2 weeks/residential U.S. National Fire Academy Course, certification in both codes.

4. Promotion to Assistant Fire Marshal and Fire Marshal – Bachelor Degree or Masters Degree, Master Inspector, Certification in both codes. Currently enrolled or completion of the Executive Fire Officer Program at the National Fire Academy.

The above requirements could be phased in over a several-year period. (As of Fall 2001, a career development proposal was being negotiated with the employee groups for submission during meet and confer negotiations.)

Number of Inspectors Needed – The general approach that should be taken to establishing the number of inspectors needed by the HFD starts with estimating the number of annual inspections needed, by type of occupancy. Then divide the annual inspection workload by the annual number of inspections per inspector, by type of inspection, for the inspections to be undertaken by Prevention Division inspectors. Part of the inspection workload should be assigned to line companies, and part to self-inspections by building owners or managers. All types of inspections need to be considered. In computing of number of annual inspections per inspector, inspector days

should be reduced by the number of days needed for training, leave, and other non-inspection tasks.

The annual number of inspections needed should be computed based on (a) the number of occupancies (or buildings) to be inspected annually by type of building or occupancy, plus (b) the annual pro rata proportion of buildings to be inspected that are on a two or three year inspection cycle.

Houston does not require permits for every occupancy and needs to build up the database of occupancies "to be inspected." At present, it is not feasible to project the number of fire inspectors needed by the HFD from the data currently available, a major flaw in prevention management. Houston is one of very few cities we have worked with that cannot produce comprehensive, reliable data on its inspection program and the number of occupancies to be inspected annually. There are data on inspections of various types, and numbers of buildings, but neither was thought to be complete.

As noted above, the number of occupancies in the City in each occupancy class is a starting point for estimating inspection needs, but this information has been difficult to obtain, even approximately. The Planning Department provided some data on the number of structures in the building inventory as of the year 2000, but this lot was thought to be incomplete. Also, there is no count of the inspectable occupancies within the buildings. There may be multiple occupancies in a building; e.g., a mall may have 100 occupancies; a high-rise apartment building might have stores in the basement; etc., and these are not and do not have to be tracked by the Planning Department.

There does not seem to be reasonably reliable data available on the number of inspections per inspector-day or inspector-year. If the data we received on inspections per inspector is accurate, then productivity of inspectors is poor. Our impression is that productivity needs to be improved but the data systems are incomplete and do not represent total work by inspectors.

Typically, in other cities, one inspector can average about 3-4 primary inspections per day plus the reinspections generated by this activity. For a work year of about 200 days, this equates to 600-800 inspections per year per inspector. About 20 full-time inspectors devoted to the building inspections would suffice for the number of buildings shown in Table 11, but that is probably an underestimate, and the inspectors have other

duties, too. Of course, inspectors assigned to large occupancies can do fewer inspections than assigned to small occupancies, and that needs to be taken into account. (For example, the high-rise headquarters of an oil company may be one occupancy that could take a week or more to inspect.)

In addition to the difficulties in obtaining data on the number of occupancies, the present data system does not facilitate calculating the number of structures in each category to be inspected. For example, the number of warehouse and storage buildings in Houston was said to be 7,759. However, only a portion of these buildings is required to have permits, primarily those with hazardous material and high-piled combustible storage. Currently only about 700 have high pile permits. The only way Prevention has of identifying those buildings that should be permitted is to visually identify a potential warehouse and conduct a general inspection. This is a hit and misses approach that lends itself more to general inspections based on geographical areas rather than to specialized teams.

Table 11: Number of Major Inspectable Structures in Building Inventory (Partial Count of Total Inspectable)

Major Occupancy Classification	Number of Buildings
Apartment houses (with over 20 units)	1,641
High-rises (4 or more stories)	330
Educational	1,241
Hospitals and nursing homes	184
Retail (over 10,000 square feet)	737
Industrial	1,309
Warehouse and storage	7,759
Public assembly	134
Total	**13,336**

Source: Planning Department

The current number of inspectors apparently is able to handle the workload of inspecting those buildings in which the activities currently require permits. Because permits are based on activities performed rather than the occupancy classification of the building, some buildings are inspected multiple times by different inspectors while others go uninspected.

Recommendation 29: The Prevention Division should collect detailed management data, including the number of inspections performed by inspector and by type of inspection; inspection hours spent by type of inspection; and travel time and miles driven by inspectors. This should include the number of inspections performed by inspector and by type of inspection; inspection hours spent by type of inspection; and travel time and miles driven by inspectors. This is the basic data required to evaluate the number of inspectors needed, and the best inspector deployment strategy. (A new form for collecting this information was developed by the Prevention Division, and the recommendation has been implemented. The data is to be compiled daily and summarized monthly for the Fire Marshal and Fire Chief.)

Recommendation 30: Prevention should obtain or develop maps showing the location of buildings by type of occupancy. They can be used to evaluate the most efficient type of inspection organization, i.e., whether to group inspectors by geographic district or by type of occupancy, or a hybrid—by geographic district within a given type of occupancy. The Planning Department may be able to provide the maps, with customization for prevention needs. (The HFD expects to have the maps by January 2002.)

Recommendation 31: The Fire Department and City Administration should decide whether the occupancy-based permitting system previously proposed in the 1995 Abbey Group Report is to be enacted. If so, the current focused team inspection organization may work. If not, consideration should be given to reorganizing along geographical districts and return to block by block inspections. We recommend a hybrid, with teams for the most technical types of occupancies and the rest organized by area. (The HFD has found that occupancy-based permitting is not well received, and so has followed the latter alternative: the inspection unit is now organized by geographical districts, with teams for the technical types of occupancies.)

Use of Line Companies for Inspection – Line fire companies are not currently used to perform inspections in Houston. The line companies do participate in TEAP, the "Technical Evaluation Assessment Plan" for pre-fire planning, as is common in other cities, but this is not the same as doing prevention inspections. Back to 1997, line inspection programs like the Houston Safe Program were said to have been relatively unsuccessful by HFD personnel. However, many fire departments, from small cities to large metro departments, now use line companies to do a significant share of inspections. Unfortunately, without data on the number of inspectable properties and the numbers of annual inspections being accomplished, it is difficult to make a strong recommendation on use of line companies.

Recommendation 32: In devising an inspection strategy, consider using line companies to augment inspectors. Line companies in other cities typically average from

one inspection a day to one a week across all shifts. Companies with over 3,000 calls per year might be given fewer inspections to do than the lower workload companies. Major code violations found by line companies can be checked with a Prevention Inspector. (Line companies will do some inspections starting in 2002. Line company officers will be certified as inspectors to assist in inspecting low risk occupancies.)

Use of Self-Inspections – The Prevention Division has worked with the Apartment Association to develop a mechanism to assist owners and apartment managers with self-inspections. The Apartment Association posts a checklist on the Internet, which is used by members to perform self-inspections prior to the scheduled fire inspections. This allows them to correct any deficiencies prior to field inspections, which reduces the need for reinspections, a good practice. This example can be used as a model to create other self-inspection processes. (As of 2002, it is planned for expansion to other occupancy types.)

Some cities send a checklist to entire occupancy classes that have relatively low fire incidence and allow them to make self-inspections annually. Occupancies send the completed inspection forms to the fire department. These low risk occupancies are inspected by the Prevention Bureau or line companies once every four years or so to check on the validity of the self-inspections and keep properties from getting too far out of code if self-inspections are not done well. Failure to do a good job puts a particular occupancy on a faster track for inspections.

Recommendation 33: Consider expanded use of self-inspections for low risk properties. Self-inspection checklists should be sent to the building owners of selected properties or classes of properties that have low risk and good fire experience in the past. They help advise the owner on what hazards to look for, and contribute to efficient use of inspectors. (A fuller self-inspection program is planned to be started in January 2002, and phased in over a 3 to 5 year period, along with certifying line officers to assist in inspections.)

Quality Control of Inspections – Uniformity of inspections and the application of codes is crucial to maintaining a high degree of professionalism and to being perceived as fair by the customers – the building community. The quality of inspections currently is left to the discretion of the Senior Inspector. Few of the inspection teams have printed guidelines to use during field inspections, a major omission compared to many other fire departments. Few inspectors are trained on how to judge particular situations. Consistency is maintained in one inspection team by performing a postmortem inspection when fires occur. An inspector is sent (even if an arson

investigator already was sent) to determine how the fire occurred. Although this practice may improve inspection methods, it appears redundant and occurs after the fact. Fire investigation results that indicate problems involving code violations should be conveyed to the inspectors by the fire investigators.

Recommendation 34: Management practices should be instituted to improve uniformity of inspections and code interpretations. Uniformity of inspections can be improved during field training of inspectors and by developing inspection guidelines and checklists. Case training methods and periodic code interpretation discussions also should be used. Another way to improve consistency is to use portable computers that have built-in guidelines and logic checks in the software, like the Police Department is using for incident report entry. Grouping inspection team personnel at the same location with their supervisors will also help. There will always be some human judgment variations across inspectors, but the variance can be reduced by these practices. (This recommendation was implemented in January 2001, except for portable computers for inspectors, which is scheduled for early 2002.)

One of the inspection teams holds a weekly discussion meeting on code interpretation issues raised in the course of issuing notices and situations encountered in the field. This provides an excellent mechanism to keep inspectors involved, up-to-date and in sync on applying codes to different situations. The other teams should consider something similar.

Performance Measurement – Accountability has been less than needed in the Prevention Division. Monthly reports for some inspection teams were not produced until October 1999. In many cases, the number of occupancies to be inspected are not known and there is no method to routinely update this data. Apparently, reporting became lax when the planned computer system for prevention was not implemented.

Performance data are not reliably collected and analyzed. There are numbers of inspections but they are not complete. The most basic performance measures are the number of inspections completed vs. the target number. The number of violations found per inspection is of interest if it changes over time. The number of inspections per inspector should be monitored, and compared over time and to other large cities. The performance outcome measures would be the number and percent of fires where the causes or spread was preventable by inspection, but we know of only one fire department (St. Petersburg, Florida) that ever really used this measure beyond doing a special study.

Recommendation 35: Monthly inspection workload reports for each inspection section should be presented to Prevention management and the Fire Chief. Data should include items such as: the number of inspections performed compared to targets for inspections completed to date; number of re-inspections performed; number of notices and/or violations issued by type of violation; number of immediate dangers to life safety, and the number of court appearances and number of field inspections evaluated. Inspection hours, travel time, and training hours should be collected separately if possible. Inspections should also be listed by inspector and inspections per FTE. Some inspectors have other duties; only the hours assigned to inspectors should be counted here. (Monthly reporting has started.)

Use of Vehicles and Other Tools – A recent citywide effort to control the cost of vehicles has lead to a new policy on inspector vehicles taken home. Effective July 1, 2000, fire prevention inspectors were no longer able to drive their city vehicles home. This may have a negative impact on the number of inspections performed by each inspector. Since the City of Houston covers so many square miles, many inspectors perform inspections on their way into the office and/or on the way home. This new policy is likely to reduce the inspector's effective workday (i.e., time spent driving). This could translate into a reduction of between one and two inspections per day per inspector for at least the inspectors doing this and depending on the type on inspections performed.

Recommendation 36: Reconsider allowing inspectors to take their vehicles home. Giving inspectors better tools and even perks is to be encouraged for productivity and to attract personnel to serve in prevention vs. working the preferable shifts in Operations. However, this action probably should be delayed until there is reliable documentation of the current workload of the inspectors and analysis of the number and types of inspectors who would benefit from the take-home car. The latter should be based on their geographic inspection beats. Using the cars from home works better when daily assignments can be read on-line by portable or in-vehicle computers, before the inspectors leave for work. (A slightly modified version of the recommendation has been implemented: inspectors are now allowed to leave their official car at the station closest to their home.)

Currently, tools are not available to establish inspector accountability while performing field inspections. There were plans in 1997 to implement an Automatic Vehicle Locator (AVL) System to facilitate the dispatch of the nearest emergency vehicle. Prevention could have used this system to locate inspectors and monitor activities.

Recommendation 37: Consider using the Teletrack system used by the Planning Department to track inspector activity. This is a locator device placed in

vehicles that electrically records when the car is static and when it is in motion. It costs $200 initially plus $25 per month per vehicle. Vehicle locations can also be identified through a ping. The Building Official is amenable to HFD using this system. This recommendation will cost about $22,200 initially and $33,000 recurring cost per year for a fleet of 111 inspection vehicles. Note that this recommendation would not be necessary if the overall productivity of inspectors could be tracked through data on the number of inspections and results of the inspections, unless there is some special problem known about inspector behavior. (The overall productivity of inspectors is now being evaluated on a monthly basis. If this does not prove satisfactory, Teletrack will be considered.)

Public Education

The public education function is part of the Community Relations Division, which is headed by the Assistant Chief. Community Relations includes the Public Information Office function, which ties media contacts and media savviness to public education, enhancing the latter, though it is separated from the rest of the prevention function. The Community Relations Division also is responsible for volunteer relations, the fire museum, and the juvenile firesetter program (referred to as the Safety Program).

Overall, the public education program is well conceived and well led, but it does not have adequate resources to meet its goals.

Staffing – Besides the Assistant Chief, Community Relations has 16 personnel. Three are assigned to the juvenile firesetter program and 13 to public education. Two public educators are assigned to the elderly, three to schools, and one to the Safe Kids program. The rest are cross-trained and respond to requests for talks, installing detectors, or teaching other prevention seminars.

As a rule of thumb, there should be at least one public educator per 100,000 population served. By this guideline staffing is short at least four positions. The arson unit often handles juvenile firesetters counseling, so four is on the short side. Later we suggest that six be added, based on bottom-up analysis.

The Community Relations Division has a marketing strategy. They have tried to recruit people from the community to assist in going door-to-door, an excellent approach

that has been proven to work well elsewhere.[14] It not only supplements the staff time available for public education but also does it in a way likely to increase acceptance by the community. This effort should be encouraged and expanded.

Recommendation 38: Improve the public education program outreach by increasing its staff by four to six public educators and increasing emphasis on injury prevention. Four to six educators are the equivalent of about one on-duty shift positions. There is no shift position with equal leverage for saving lives and reducing injury. In our judgment, this staffing priority is far higher than for any fourth position on an engine company. This recommendation is equivalent to adding one position to one engine company! It should be given priority over staffing for four-person companies, even though the latter are important, too.

The goals of new programs and the unit as a whole should be revised to include the following:

- Annual provision of a fire and injury prevention program to every elementary school, one for grades K through 2 and a second for grade 3.

- Increased outreach to the elderly by direct and indirect means; e.g., by talks to elderly groups and piggybacking on social service programs that reach their homes. People over 70 are the prime target.

- Annually tracking the percentage of homes with working smoke detectors. Target programs to equip 100 percent of homes with at least one detector, and a 95 percent rate of working detectors. (This can be tracked through incident reports, the school homework assignment on detectors, and/or citizen surveys.)

Juvenile Firesetters – Misbehaving, disturbed, or simply unthinking children are a major cause of fire. For over a decade, the HFD has had a well-known program to deal with these children. A civilian counselor and two firefighter-counselors staff the program. Each year the HFD, other local fire departments, and many other agencies refer over 100 juveniles to them. These children generally are three to 15 years old.

[14] See, for example, *County-based Public Fire Education* by Rosamundo Associates, and its predecessor report by TriData.

The program seems to be very good. The program has achieved a low recidivism rate of one to two percent, i.e., the percent of juveniles they see a second time. But some juveniles who set fires again may not be referred to the program, so the true success rate is not known.

The HFD has attempted to track program participation within three to six months after counseling, but has only been able to find only 40 percent of them because of changes in phone numbers, relocations, unwillingness to participate, and other reasons. Nevertheless, the names of juveniles arrested or identified as firesetters can be matched against the list of those previously counseled. One can also use the 40 percent of juvenile referrals who can be subsequently found as a sample; even if not a total or random sample, it is better to use than not checking the recidivism at all.

Recommendation 39: Make a greater effort to track past juvenile firesetters; proactively check on them once a year for several years after counseling. This would provide data to better evaluate the effectiveness of the program. The percent of counseled juveniles who do not start fires again is the true measure of program success, not the percent of referrals who were seen before. Proactively checking on previously seen juvenile firesetters also may help reinforce efforts of parents and others who for one reason or another, including feelings of frustration or futility, do not refer juveniles a second time, even though they still need help.

Schools – As is the case with most public fire education programs, the focus of the HFD public education program has been on schoolchildren. The goal has been to visit each of the 192 elementary schools at least once per year. This has not quite been achieved.

Two mobile safety trailers are taken to the schools for use in a program focused primarily on third-graders, about eight years old. If one has to pick a grade for this activity, the HFD has picked the most appropriate one. The children are old enough to understand key elements of prevention and young enough for the program to make a major life-long impression. The program seems to have appropriate content, such as smoke detectors, exiting, stop/drop and roll, use of 9-1-1, basic cause of fire, etc.

Grades 4 or 5 and some high schools are reached with general fire education programs.

Video presentations are made on request to day care centers, reaching children 2 to 6.

Recommendation 40: With the cooperation of the school districts, institute an annual school homework assignment on smoke detectors. This is our "check-rated, best-buy" public fire safety program – the best we have identified in 20 years. It requires working with the management of the Houston school districts to get them to agree to this. It can be part of the "Adopt a School" program. (The latter program was piloted in the Kingwood area and in planned for expansion if the school district approves.)

The homework assignment would be given to every class of every school in the City during Fire Prevention Week in October. The students ask their parents to test each detector, and then report to the teacher the number of detectors and whether they were working. Next, the class or teacher summarizes the results: the number and percent of households with detectors and the number and percent of detectors that did not work. The HFD companies collect the results. The Community Relations Division tallies them. The local media publishes the results. If the entire school system cannot be reached, detector campaigns are focused on schools and areas with the worst record. A similar campaign can be launched for households of the elderly. (The "homework assignment" is planned to be tried in 2002, as part of the Adopt-a-School program.)

Elderly – The HFD has admirably tried to reach out to large numbers of elderly people. To do this, they have targeted family-assisted living and other elderly concentrations. The outreach is not easy because most elderly live at home and are scattered throughout the community. The public educators made a concerted effort to reach elderly in early 1999; about 18,000 contacts were estimated to have been made in January 1999 alone, about 12 percent of the estimated elderly population.

CPR and AED Training – Citizens applying CPR in the first few minutes of a cardiac arrest, drowning, electrocution, and many other traumas can make a large difference in survival. The HFD was a founding member of the Houston CPR Task Force. An estimated 20,000 people have been trained in CPR and use of AED, including a record-setting 1,100 on one day (September 19, 2000). CPR training is given by two members of the public education staff in coordination with churches. This all is a major step in the right direction. CPR and use of AED are life-saving skills. Having large numbers of citizens trained can dramatically improve defibrillator and CPR "response times." Seattle, a leader in this field, has tried to prepare about a fifth to a third of the adult population with CPR training on a massive scale. Houston should decide whether it would like to have a significant number of citizens trained in CPR, and if so, make CPR a broad outreach program.

A related skill is the use of automatic external defibrillators (AEDs). The HFD has them on its apparatus, but even with good vehicle response times, the large number of high-rises in Houston require considerable time to get to the side of the patient after arrival in the street outside the building. A similar problem exists for shopping malls, golf courses, airports, and other large facilities. Private industry and local government are often willing to buy and maintain AEDs for their employees, shoppers, and residents. The Fire Department's Community Relations Division and the EMS Division can work together to disseminate the idea and to train the trainers. The HFD should meet with the medical community in Houston to get its support in planning and conducting a broader program.

The new AED technology has enabled untrained citizens to grab an AED off a wall mount and defibrillate someone, following simple directions. It is as easy to use as a fire extinguisher. Like an extinguisher, it helps to have a minimum of an hour or two of training to maximize its potential. Details would need to be worked out, but there are few more worthwhile programs than citizen training in CPR and AED. They are proven to reduce deaths.

Recommendation 41: Consider a broader, more aggressive citizen CPR and AED citizen training program. The existing CPR program should be built upon. Offer CPR and AED training on a broader scale. Develop a strong media campaign to advertise the program and a cadre of instructors trained to implement it. Classes could be taught in fire stations, schools, libraries, and other places. Training on the use of AEDs can be tied to a CPR program, or vice versa. (The HFD is continuing the CPR program and planning to expand distribution of the AEDs to all city buildings. There is a plan for more instructors to further expand the citizen training. This is a budgeting issue. To leverage its existing resources, the HFD is planning to work with the Red Cross to train more citizens in CPR and AED.)

Smoke Detectors – Another appropriate part of the HFD public education program has been a strong focus on installation and maintenance of smoke detectors. In 1999, the Division spent two weekends on smoke detector installations for those in need. The fire stations also received some detectors to install. The two approaches have yielded about 1,600 detectors per year installed – a small number relative to the total population, but focused on the part of the population at highest risk of death or injury from fire. About 93 percent of households nationally have at least one detector – the number in Houston was not known. A random survey should be done.

There are currently six programs in the HFD that are dedicated to smoke detector installation. The first three have been in place since 1991; the Safekids program, Senior Citizens Program, and an annual Fire Prevention Week smoke detector installation program. The newly added programs include "Adopt a School," the "Safe Congregation, Safe Community," and the "Fire Station" smoke detector programs. All six detector programs that install detectors appropriately focus especially on senior citizens, persons with physical or mental disability, and families with young children that are on a fixed income. The detectors used in the programs are all donated to the Department. Also, the Fire Marshal's office enforces smoke detector regulations for hotels, apartment, houses, and rented homes. Lastly, the "Adopt-a-School" program will be utilized to survey children on prevalence of smoke detectors in student homes lacking a detector will be targeted for a free installation.

Recommendation 42: Make it a Fire Department goal to have a working smoke detector in 100 percent of the residences in the city of Houston. Give free detectors to needy households without them. (The current plan is to continue aggressively promote the need to maintain detectors.)

Line Fire Companies – Some line companies are participating in public education. About 25 to 30 schools were estimated by Community Relations to be served by the Adopt-A-School program implemented by line firefighters.

Fire/Arson Investigation

The Arson Division within the Prevention Division is charged with investigating all fires. Their primary responsibilities are (1) establishing the origin and cause of all fires within the City of Houston and (2) aggressively pursuing criminals when an investigation reveals a crime of arson has been committed. The State of Texas classifies the Division as a Criminal Justice Agency and all of the investigators are certified as Peace Officers. In many cases, the Division partners with federal, state, and local agencies, such as the Bureau of Alcohol, Tobacco, and Firearms (ATF), the Federal Bureau of Investigations (FBI), and the Houston Police Department (HPD). This authority and these partnerships are an excellent basis from which the Arson Unit can work.

Previous Study – The Arson Division received a comprehensive review in 1996 by a TriData consulting team operating under the auspices of the U.S. Fire

Administration technical assistance program. The study made 25 recommendations to enhance certain operations and to correct several deficiencies. The recommendations of that review are still generally valid. The chief arson investigators recently described the review as a "best asset," "fair," and having received adequate input from the investigation staff. The Strategic Plan elements that deal with arson were said to reflect the study's recommendations.

As part of the year 2000 study, TriData reviewed the 1996 recommendations with the Arson Division and the Chief Investigator, who supplied a status report of their progress. The Prevention Division is to be commended for moving forward on the majority of the 1996 arson recommendations. Some recommended improvements were not made, for a variety of reasons. The recommendations in this section reflect the earlier findings that remain unresolved as well as some new findings.

Staffing – In FY1996, the Arson Division had a complement of 72 personnel. The staffing level has remained relatively constant since then, with 71 personnel nominally assigned to arson in FY2000, distributed as follows:

Personnel Complement - Arson

Position Name	# Positions
Chief Investigator	1
Assistant Chief Investigators	2
Senior Investigators	8
Investigators	50
Civilians	7
Crime Lab/Photography	3
Total	**71**

The Chief Arson Investigator reports to the Fire Marshal and manages the Arson Division. Its 71 personnel are divided among six units:

1. Original investigation (origin and cause)
2. Follow-up investigations
3. Administrative
4. Polygraph
5. Crime Lab
6. Photography

Ten of the investigators have been detailed either to the Investigator General's office to work on internal investigations or to the Staff Services office to conduct background checks on new fire department recruits. Thus, the Arson Division now has ten fewer investigators available to conduct fire investigations than was the case in 1996, despite the fact that clearance rates have been falling. This seems a less than ideal use of their time so long as there are arson crimes going unsolved that are not considered hopeless cases after a solvability analysis. Arson investigators should focus on solving arson crimes. Police or civilian investigators with no specialized fire training can do background investigations. (This may require hiring additional people for those duties.)

Arson Lab – Houston's Arson Division was one of the first in the country to establish its own lab to analyze fingerprints and to conduct polygraphs. The Houston arson lab became one of the premier law enforcement labs in analyzing fire scene fingerprint evidence, including the successful identification of latent prints. This outstanding capability should be maintained.

Joint Task Force – Another notable accomplishment is the joint task force operation with ATF, established in 1993 to concentrate on arson-for-profit cases and those associated with organized crime and major fraud. The division benefits from the Department of Treasury Forfeiture Act of 1992, which allows ATF to reimburse the City's investigation overtime expenses that are incurred during joint operations with the Agency.

Clearance Rate – The clearance rate for incendiary fires has varied over the six-year period, from a high of 26 percent in 1996 to a projected low of 12 percent in 2000. It is reasonable to link the falling clearance rate to the reduction of investigation personnel. Further study on the causes behind the reduced rate of cleared cases is needed. It is not a good sign.

Workload – Over the past six years (1995-2000), the number of fires investigated per year has remained relatively constant, averaging about 2,100 cases annually, or 7 to 8 new ones per day. An overwhelming majority (84 percent) of the investigations result in a finding of incendiary. This high proportion of incendiary to accidental may indicate that company officers are making good calls as to the suspicious circumstances of fires and are following the guidelines for calling out the fire investigators, which is good. It also implies that suppression officers are determining the

cause of most of the accidental fires, which is a workable policy so long as they meet the necessary conditions. These conditions are that officers have received adequate training and refresher courses in origin and cause determination, and they call in the investigators for fatalities and large loss fires, as is usually done.

As a rough rule of thumb, having a caseload averaging one investigation per week results in minimally adequate time for investigation and follow-up. By this rule of thumb, an investigator could adequately handle about 40 cases a year. This requires about 50 investigators, so the number of investigators would be about right if the 10 were restored to doing fire investigations. Fifty was also the number of investigators used four years ago when the clearance note was higher and the workload the same.

Investigators Used for Internal Investigation – At one time it was fairly common for police-certified fire investigators to be given responsibility for internal investigations. This practice has largely been discontinued nationally and is one that we strongly discourage for the HFD for the following reasons:

- Fire investigators need the full cooperation of suppression personnel when they investigate the scene and circumstances of fires. First-due companies provide valuable information on smoke color, progression of fire, other observations at and near the scene, and data that contribute to the investigation. If fire investigators are known to have duties in internal investigations, on-scene cooperation may become compromised. It is not good policy to mix duties of investigators that require cooperation with duties that may involve potential punitive actions against the same personnel.

- Becoming a fire investigator involves a considerable amount of initial as well as on-going training. Public agencies invest in law enforcement training, basic and advanced fire investigation training, specialized courses (e.g. bombs and explosions, arson-for-profit, electrical fires), and so forth. The return on this investment for the jurisdiction should be personnel who successfully investigate fires, take evidence, conduct interviews, prepare cases, and testify in court. Taking one fifth of the available pool of investigators to work on internal investigations and do background checks is not an efficient use of their training.

- The clearance rate has fallen by nearly 50 percent. It appears as though there are not enough follow-up investigators to develop the cases.

Recommendation 43: The City should reassign the fire investigators doing background investigations and internal investigations back to fire investigation work. Either contract out the background investigator service or hire less experienced people to do them. The fire investigators could assist in special background investigation cases and if there happens to be a lull in fire investigations, but that should not be their prime assignment. (Since the original report was issued, the Fire Chief directed three of about 10 investigators doing background investigations to return to the Arson Division. An additional five are planned to be replaced by civilian Loss Prevention Specialists circa the second quarter of 2002.)

Space – There has been a problem over the years with insufficient office accommodations for the investigators. In some cases, three or more investigators have had to share one desk.

The Fire Department has now made sufficient space available, but the area has not been equipped with such basics as desks, phones, and computers. Thus, the Arson Division is unable to use the space at this time. This situation should be corrected as soon as possible.

Recommendation 44: Finish setting up the office space for investigations. Delaying this impacts productivity and the morale of the Division. (The office space has been improved by moving into a new facility.)

Training – The Arson Division lacks a Training Coordinator to identify training opportunities, schedule in-service and outside classroom training, manage the training profile for all investigators, and establish a Certified Fire Investigator (CFI) program for the Division.

Training is vital to fire departments in all aspects of suppression, EMS, and prevention. Recent court rulings, advances in fire science research, and NFPA standards for investigators have created higher expectations and demand for fire investigation training, especially advanced and in-service training. In Houston and other cities where the fire investigators conduct both initial and follow-up investigation, training in law enforcement must be given, too. While a full-time investigation training coordinator can be justified and would be ideal, even a part-time (65-75 percent) assignment to training, with collateral duties, would net many positive benefits. The position should be at the

rank of Assistant Chief Investigator because the training officer needs the authority inherent in the higher ranks to effectively carry out the mission.

Establishing a training officer position in the Arson Division is especially critical given NFPA 921, the requirements to become nationally certified. The impact of recent court rulings such as the *Daubert* challenge on who is qualified to be an expert witness lend additional urgency to this matter. Case files and documentation on the investigation process are coming under greater scrutiny, as are the credentials of the investigator.

Recommendation 45: Establish a Training Coordinator position. It should be at the Assistant Chief Investigator level and would require 65 to 75 percent of the individual's time. (The plan is to create this position through the DTO/FTO program when it is approved, through the meet and confer contract. Each investigator will have a phone and a computer.)

Information Systems – The Division needs to establish an integrated arson information system that captures investigation and case data for overall case prioritization and management. It also needs to capture trend analyses on occupancies, victims, suspects, perpetrators, motive, time of day/day of week, modus operandi, and case outcomes.

The Division needs to use information technology to track suspicious and incendiary fire activity and to conduct predictive analysis. There are viable off-the-shelf programs designed to collect and report on investigation-related data from initial scene work through court decisions. Summary reports by month and by year would make it possible for the Division Commander and other senior investigators to manage caseloads, review case status and investigators' progress on closing cases, establish a profile of arson activity by neighborhood and citywide, and plan arson prevention initiatives.

Recommendation 46: Hire or assign an information technology systems analyst for the Division. The analyst should set up an arson information system, test it, monitor it, and train personnel on its use. The analyst preferably should be selected from within the Fire Department or the Police Department. Graduate students in computer science from local universities also can serve as resources to the Division. (The HFD IT section has committed to providing greater assistance to the Arson Division.)

Vehicles – Investigators are no longer permitted to keep their vehicles in "home storage," i.e., take them home. The Division should analyze the impact of this on efficiency, effectiveness, and costs. In particular, have investigator response times,

access to tools and equipment, overtime, and other indicators been measurably affected. Given the low clearance rate, one would tend to err on the side of increasing investigator efficiency *if* there are frequent instances where responding from home leads to more timely interviews or investigations that in fact make a difference.

Another vehicle-related issue is that the fire investigators' vehicles should be equipped with radios with police/fire frequencies, for reasons of both safety and efficiency. This is especially important when investigators are conducting undercover work, or are operating in high crime areas where they would need to be alerted to reports of gunfire, gang activity, and crimes in progress, among other communications priorities.

Recommendation 47: Arson Division vehicles should be equipped with police radio frequencies to facilitate communications with law enforcement. The Arson Division's hand-held radios are capable of communication over police radio frequencies. (The Arson Division has contacted the Communications Division with respect to the hand-held radios currently in inventory, and they are being reconfigured to fit in-car chargers. Additional radios will be requested in the in the FY2003 Budget Request.)

Canine Units – Canine units are widely regarded as an extremely valuable, almost standard tool for fire investigation units. Most large and many medium size U.S. cities have an accelerant detection canine to alert investigators about the presence of hydrocarbons at the scene. Canines lead their handler to the evidence where samples can be taken and sent to the lab for analysis. The dog's keen sense of smell far surpasses the capability of manmade "sniffers". Canines pick up clues that a piece of equipment might miss, and they work quickly to identify the areas where hydrocarbons are found. Time spent investigating a fire is thereby reduced. Canines, if well trained and handled professionally, are accurate and efficient. They contribute significantly to the identification of evidence that can lead to the proper determination of fire cause and the successful pursuit of an arsonist.

Borrowing a canine from another jurisdiction, as the Arson Division must do now, is not efficient. They cannot count on a borrowed dog and handler being available when needed. (The use of a hired dog and handler from the private side should be avoided, due to potential conflict of interest.)

Nationally, both State Farm insurance and ATF make canines and the associated training available to fire investigation units. They are a potential resource for Houston.

Given the Division's close working relationship with ATF, it would make sense to request an ATF-trained canine.

Recommendation 48: The Arson Division should acquire a canine as part of the unit assigned to one of the unit's trained fire investigators. The dog and the handler should be incorporated into the investigation protocols. Acquiring a canine involves the investment in training one investigator to become a handler. Other costs include veterinary bills and food, and some overtime. (The Arson Division is currently on the list to receive an accelerant-detecting K-9 from the ATF. The Arson Division included this unit in the FY2002 Budget Request.)

Name Change – The Houston Fire Department continues to call the investigation division an "Arson" Division. We suggest that this be changed to Fire Investigation Division or Fire and Arson Investigation Division. There also is a question of whether having a division within a division makes sense.

Technically and legally speaking, the term "arson" is applied to a fire after due process determines that the crime of arson was committed. During the origin and cause phase, investigators are seeking clues as to how the fire started. Sometimes the cause is accidental; sometimes it is incendiary. The investigation is a systematic, objective examination of the fire. It is not an investigation into a predetermined cause, which is implied by the designation "arson" investigator. While this may seem pedantic, defense attorneys have successfully challenged an investigator's objectivity and findings, arguing that since the investigator operated out of the "arson" division, the cause was a foregone conclusion.

Calling the Division the Arson Division also gives short shrift to the equally important work that investigators regularly carry out on non-incendiary cases, including fatal fires, fires with injuries, and large dollar loss fires that are not intentionally set.

Shifts – The current shift schedule of the fire investigators is not optimal. They would be more efficient if the work shifts were restructured to accomplish the following:

- More investigation hours for the time-consuming follow-up work on cases.
- Heavier coverage of origin and cause investigations during the time period when most of the incendiary fires are occurring.

- Adequate time before the end of the shifts to prepare investigation cover sheets without having to accrue overtime.
- Flexibility to rotate investigators, as necessary, depending upon caseload, special skills, etc.

Recommendation 49: The configuration of work shifts should be changed to make more investigators available for criminal investigation and case development. (New shifts were implemented in December 2000.)

Use of Funds Confiscated – A new issue is the disposition of drug funds confiscated by arson investigators. Police get to use confiscated property and the Fire Department should, too, if for nothing else than to help keep staff motivated. Funds or assets confiscated should first be considered for improving the arson program and juvenile firesetter program, and then the rest of the prevention and public education programs. Prevention generally gets less visibility and less support in a fire department than do line operations. The publicity and recognition attendant to using these funds will help. The HFD could use the windfall funds for unbudgeted "emergencies," but as a general plan, the money should first go to improving the prevention program.

Recommendation 50: Give first priority to bolstering arson investigation, the juvenile firesetting program, and fire prevention/public education with funds confiscated or raised by the Prevention Bureau or Community Relations. Historically, the funds go into the general HFD budget, but could help fund prevention and act as incentive to the Division, which gets less support and attention than they should (as in most cities.)

IV. FIRE OPERATIONS

This chapter discusses the original reason for existence of the fire department: fire operations. The size of the rest of this report relative to this chapter is indicative of how many other aspects there are to a modern fire department. The chapter includes an overview of operations, assessment of service levels, and comments on future needs. It also includes a forecast of demand for service and a review of the stations and unit deployment needed in the foreseeable future. A detailed station location analysis was not in the scope of this study, but the adequacy of the overall set of stations is assessed.

Special Operations and Airport Firefighting and Rescue, which are undertaken by the fire suppression forces, have become a major area of specialization and merit a separate chapter (Chapter V, Special Operations). Emergency Medical Services Operations are discussed in Chapter VI.

Overall Resources

The HFD is the third largest fire department in the United States. To deliver these services, it has an array of units and vehicles strategically situated throughout the city, each with its own dedicated response area. Table 12 summarizes the HFD's fire operations resources. A complete list of stations showing how the apparatus is deployed is given in Appendix A.

Table 12: Summary of Fire Operations Resources on Shift (As of 2000)

Description	Number	Nominal Unit Staffing	"Maximum" On-Duty Staffing
Engines	83	Officer + 3 FF = 4	332
Ladders	37	Officer + 3 FF = 4	148
Boosters	11	1 FF	11
Assistant Chief(s)	2	1	2
Deputy Chiefs	1	1	1
District Chiefs	20	1	20
Heavy Rescue	2	Officer + 3 FF = 4	8
Safety Officers	2	1 Officer	2
HazMat Units	2	Officer + 3 FF = 4	8
Cascade Units	3	1 FF	3
Foam Unit	1	1 FF	1
Comm Van	1	1 FF	1
Rehab Truck	1	1 FF	1

Note: Many Engines and Ladders ran with a staffing of 3 on any given day.

In 2000, Fire Operations was headed by two co-equal Assistant Chiefs under Chief Tyra, one for the north side, the other for the south. A Deputy Chief headed each shift for the whole city. Under him were 10 District Chiefs in the north and 10 in the south. Each District Chief headed a group of stations and an average of six companies, plus miscellaneous special units.

Unit Staffing

The desired daily staffing levels for fire apparatus with Houston's range and geographic spread of fire risks is four personnel per major apparatus. This is likely to be an NFPA standard within 12 months. While the HFD nominally staffs each unit with 4, leave and other time off result in many of the apparatus being staffed with three personnel on any given day. The prevailing practice had been to staff the majority of engine and ladder companies (all but 20 to 25 companies) with four personnel. This staffing was achieved through a dedicated fund known as the "extra board," used to pay for personnel to fill in for people on scheduled leave and other absences. This practice was discontinued with the expiration of the "meet and confer" agreement that authorized this program.

At present, 60 to 80 or more fire units out of 120 – a half to two-thirds – typically operate with three personnel on a given day. The City administration committed to trying to maintain 70 percent of fire suppression units with four-person staffing. Funding for this staffing initiative was planned for the next fiscal year.

Faced with a shortfall of personnel to achieve four-person staffing, most Deputy Chiefs (shift commanders) first reduce staffing to three personnel on engines. They try to preserve four-person staffing on the ladders. Some Deputies, though, cut staffing on some ladder companies as well. There is no reason for this variation from one 24-hour shift to another other than personal opinion of the Deputy Chief on duty that shift.

Ladder companies have a complex series of tasks on a fireground. They include forcible entry, search and rescue, ventilation, overhaul to prevent rekindles, salvage of the building's contents, and laddering of the building for rescue or to provide interior crews with a secondary means of exit. Most ladder companies carry portable ladders that are designed to be raised by four firefighters and some that require six. Engine company work, on the other hand, is more straightforward, and there are more engine companies to

assist each other, though the engines companies are sent to more calls than the ladder companies. After needed rescues are made, the engine companies are usually only required to stretch hose lines to suppress the fire and ensure a continuous water supply. This in no way is intended to demean or down play the value and importance of engine company work. Both engines and ladders have equally important tasks to perform in the successful mitigation of a fire. However, when it is necessary to allocate the fourth person staffing to one or the other, the ladders generally should be targeted first, except for engines that are relatively isolated from the next nearest unit, and need four-person staffing to meet the two-in/two-out rule when they arrive first at a structure fire.

Recommendation 51: For the immediate future, establish a uniform policy across shifts as to which specific units should receive priority to staff with four personnel. Isolated engines should be given first priority. Generally, ladders should be assigned four personnel before engines, except in low-rise areas or where there are other mitigating circumstances. (In 2002, all engines and ladders are staffed with four personnel.)

The HFD's nominal staffing levels of four personnel on engine and ladder companies conforms with the minimum recommendations of the National Fire Protection Association (NFPA) in their Standard 1500, *Fire Department Occupational Safety and Health Program.* NFPA 1500 reads, "It is recommended that a minimum acceptable fire company staffing level should be four members responding on or arriving with each engine and each ladder company responding to any type of fire." They stress that this is the minimum and that, "Overall, five-member crews were found to provide a more coordinated approach for search and rescue and fire suppression tasks."

Since there is no true standard, a decision on staffing levels for each fire apparatus must be made by the local jurisdiction. However, one must be cognizant that although NFPA standards are only recommendations and not obligatory, they have become the "standard of care" in the firefighting industry and are often considered in lawsuits.

The NFPA has a new Standard 1710 that sets staffing standards for career fire departments. It specifies a minimum of four-person staffing for engines and ladders.

Recommendation 52: Plan in the near future to staff all HFD engine and ladder units (as well as the heavy rescue units) with a minimum of four personnel, comprised of one officer and three firefighters. There is ample justification for using four-person staffing for a city with Houston's risks. Many units can be staffed with four

units from existing personnel and from the recommended staffing for EMS, which will free some personnel currently redeployed to ambulances. (The HFD is planning an aggressive hiring program with 265 new personnel per year for the next six years, to be able to staff all units with four personnel.)

Booster Units – Eleven "booster units" are staffed around the clock with one firefighter. These units are three-quarter-ton pick-up trucks with a pump, hose reel, small water tank, and hand tools. For the most part, they are used on minor fires such as brush or rubbish. When dispatched on a structure fire, the booster unit driver/operator is used as either additional staffing or as an aide to the Incident Commander. They are independently dispatched in most cases. Table 13 presents the year long activity of Houston's 11 booster units.

Table 13: Booster Unit Activity (1999)

Unit	Responses
B32	196
B47	232
B63	251
B65	62
B67	475
B68	681
B70	166
B77	236
B80	150
B101	172
B103	93
Total	**2,714**

These units each make an average of only 247 responses a year, with a range from 62 responses to 681 responses. B68 responds just short of twice a day and B65 about once every six days. This is very low usage. To use the personnel more efficiently, the booster units could be stored in the stations serving the areas that experience the most grass fires each year and only staffed upon receipt of an alarm. The personnel assigned to these units would be of greater use to the Department on a day-to-day basis in augmenting the staffing on engines and ladders, particularly under the present staffing constraints.

Recommendation 53: Remove full-time dedicated staffing from the 11 on-duty booster positions and use the 11 positions to be the fourth person on an additional 11 engines or ladders; when needed, cross-staff the booster units with a person from the company where they are stored. The booster units would be used as needed during times of high grass fire incidence. Since the booster units tend to be in the more rural, less busy areas (other than B68), their stations would tend not to be high priority for getting a fourth person assigned to the engine unless the station is far removed from others. Nevertheless, they can be staffed by one or two members of even a three-person engine company when occasionally needed. (The HFD decided to continue staffing booster units full-time, and to increase their productivity by using them more often on box alarms and other incidents, as well as for their specialized purpose.)

Special Apparatus – Another type of unit whose personnel might be better utilized is the Department's "special apparatus." These special units include three Cascade Units, the Foam Unit, the Communications Van, and the Rehab Truck. They are staffed 24-hours-a-day by the HFD, but infrequently used. In many fire departments units of this type remain without staffing until they are actually needed. When their presence is required on the fire ground, a unit housed with them or a nearby unit takes them to the scene. In the latter case, a member from the station in which the unit is housed operates it after it arrives. For the Cascade Units, a single firefighter could be assigned on day work to accomplish resupply of SCBA bottles throughout the city.

Recommendation 54: Personnel from the special (auxiliary) units should be reassigned to engine and ladder companies to augment staffing of those units. Like the booster units, the auxiliary units can be cross-staffed by one person to drive them to the scene when needed. The functions they provide are critical, but unless they can be shown to be used often, it is not efficient to staff them with dedicated personnel. Their staff do need special training, and that may merit a special pay premium, but they should be assigned to an engine or ladder co-located with the auxiliary unit for day-to-day operations.

The HFD disagreed with this view on staffing special purpose units for the following reasons:

> "The Cascade units and the Command Van E/Os require specialized training. The Command Van was designed to provide an Incident Command Vehicle that will be utilized during large-scale emergency incidents. It had the capability to provide communications to almost any entity during a major disaster or extended incident. It also serves as a Command Vehicle during large HFD incidents such as multiple alarm fires, hazmat incidents, and mass casualty incidents. While the number of Command Van responses is low, its function is critical to Houston and its surrounding neighbors. Cascade units are designed to refill self-contained

breathing apparatus bottles while at emergency incidents or at fire stations. These activities occur regularly during a 24-hour shift. The regular activities of these units would cause daily higher classification pay and would negate the value of removing E/Os from these units."

Recommendations for staffing special operations and EMS units are made in the separate chapters on those topics.

Demand for Service

By any standard the HFD is a busy fire department, with a heavy workload in terms of emergency medical services as well as fire and other emergency responses. Table 14 presents the recent incident history for the department in the two primary categories; fire and emergency medical services.

Table 14: Fire and EMS Incidents (FY 95-FY 99)

Category	FY 95	FY 96	FY 97	FY 98	FY 99
Fire	110,441	116,202	135,675	142,518	152,061
EMS	156,525	157,606	166,075	175,485	182,222

Source: Mayor's Monthly Management Report. These should not be totaled; there is some double counting.

The number of incidents is not to be confused with actual unit responses. An emergency call may require the response of more than one unit, but only one incident number is generated. However, the listing of incidents reported by the HFD can be misleading, in that essentially separate data systems are maintained for fire and EMS incidents. This results in "double counting" of incidents in which a fire unit responds to a medical emergency. The actual number of unique incidents responded to by the HFD is more accurately reflected by subtracting the "first responder" incidents from the count of fire incidents, as shown in the Table 15 totals.

Incidence by Type – Table 15 presents a breakdown of fire incidents by type. Fire incidents here are calls of any type responded to by a fire suppression unit. The most common "fire" incident is for medical first responder. This is now the trend in most fire departments. EMS incidents are for the most part also responded to by HFD ambulances.

The medical workload on fire units is borne primarily by engine companies. (Note that the totals for "fire" calls differ by about 10,000 with the data in Table 14, for reasons we could not determine.) While the EMS role has been an excellent way to improve EMS and increase productivity, the result has been that many fire units are overloaded. The pendulum may have swung too far, and it is now time to reevaluate EMS strategy.

Table 15: Houston Fire Incidents (1993-1999)

Incident Type	1993	1994	1995	1996	1997	1998	1999
Population (000's)	1,700	1,721	1,741	1,761	1,828	1,861	1,879
Structure Fire	5,251	4,624	4,442	4,058	3,857	3,467	3,473
Other Fire	7,755	7,266	7,265	7,983	6,190	6,452	7,017
Overheat	188	164	176	203	169	205	212
Medical	66,054	68,088	72,125	67,253	73,849	77,649	88,811
Hazardous Condition	3,609	3,658	4,126	4,312	4,670	4,651	4,872
Service	1,543	1,656	1,829	2,206	2,663	2,599	2,610
Good Intent and Other	4,562	4,784	6,891	19,121	26,573	28,351	27,050
False	15,607	17,203	18,863	23,154	26,971	27,550	28,820
Total Fire Incidents	88,962	107,443	115,717	128,290	144,942	150,924	162,865
Fire Incidents Less First Responder Calls	22,098	39,355	43,592	61,037	71,093	73,275	74,054

The second most common type of incident is false alarms, which includes system malfunctions, activations for environmental problems (such as dust or power surges), malicious false alarms, and the intentional activation of an alarm system when no fire or emergency exists. This category has increased by 85 percent since 1992, and now accounts for 29,000 calls, far too many. A similar situation is occurring in many other jurisdictions and has become a major concern for fire departments.

When units respond to a false or malfunctioning automatic alarm they are not available for other, perhaps more serious, incidents. They also increase the risk of vehicular accidents. Any effort made to reduce the false alarm percentage would be beneficial to the Department, and especially beneficial for the engine companies that made over 3,000 responses in FY 1999. In an attempt to lessen the overall impact of these dispatches, the HFD has made an adjustment in the initial dispatch to automatic alarms, sending only one engine company.

A common approach to mitigating this false alarm problem, one used in many jurisdictions, is a progressive penalty system. When a pattern of false responses to a particular property is established, a warning is issued that requires a remedy be found by the owner or occupant to bring the problem under control. After the warning phase has run its course and the problem continues, fines are levied in increasing amounts. A properly functioning alarm system is the common goal for all parties. Not only are the building's occupants and contents better protected, but fire suppression units are available more often to respond to true emergency incidents.

Recommendation 55: A process should be developed to address the large number of false alarms experienced from automatic alarm systems. A progressive fine system starting with the third alarm to an address in a 12-month period should be considered.[15] This would probably require a City ordinance. (The HFD has drafted a false alarm ordinance and is discussing it with BOMA and other stakeholders, as of January 2002.)

Nearly equal in number to false alarms are "good intent" calls, which include a situation where a report of fire or other emergency is made in good faith but determined not to be an emergency upon investigation. These types of incidents include steam mistaken for smoke and automobile accidents in which no one is injured (often reported by cell phone), among others. Good intent calls show an increase of over 500 percent since 1992. This increase may be partly attributable to changes in classification of calls, but it nevertheless comprises over a third of the non-EMS fire calls.

Structure fires have decreased by one-third since 1992, but there are still ten per day. This trend appears to be consistent, although the number of structure fires remained stable from 1998 to 1999 and may be leveling out. The reduction in structure fires is significant in that this is the most serious type of fire incident and requires the greatest amount of resources. Non-structural fires declined by 10 percent over this same period. Clearly a variety of prevention techniques are working.

Other call types include overpressure rupture (steam or gas); hazardous condition, which includes hazardous materials, wires down, and gas leaks; and service calls, which includes water removal, lock-outs, and other mainly non-emergency activities.

[15] For example, the city council of Schaumberg, IL, a suburb of Chicago that has a similar false alarm problem, double their fines, to $200 for three to five false alarms in a month, $400 for six to seven, and $600 for eight or more.

Incidents Per Capita – The population of Houston has been increasing, but it is only partly responsible for the increasing numbers of fire and EMS incidents. Increasing demand per capita also is increasing the total demand for service. Table 16 shows the trends in the number of incidents per capita by type of incident. There has been a 40 percent increase in calls to suppression units in just the last six years, while the population increased only 11 percent. Even with the annexed area, the per capita demand increase is huge.

The per capita rates for medical calls, hazardous conditions, service calls, good intent calls, and false calls all increased over the 1993 to 1999 time period. The increase was largest for good intent calls, which increased by over 11 calls per 1,000 population. While the number of medical calls increased by less, 8 calls per 1,000 population, their numbers are so much higher that they dominate the increase in demand for service.

Table 16: Incidents per 1,000 Population (1993-1999)

Incident Type	1993	1994	1995	1996	1997	1998	1999
Structure Fire	3.09	2.69	2.55	2.30	2.11	1.86	1.85
Other Fire	4.56	4.22	4.17	4.53	3.39	3.47	3.73
Overheat	0.11	0.10	0.10	0.12	0.09	0.11	0.11
Medical	38.84	39.56	41.42	38.17	40.39	41.71	47.24
Hazardous Condition	2.12	2.13	2.37	2.45	2.55	2.50	2.59
Service	0.91	0.96	1.05	1.25	1.46	1.40	1.39
Good Intent and Other	2.68	2.78	3.96	10.85	14.53	15.23	14.39
False	9.18	9.99	10.83	13.14	14.75	14.80	15.33
Total	**61.49**	**62.42**	**66.46**	**72.82**	**79.27**	**81.07**	**86.63**

Source: HFD CAD and incident reports.

The changes in per capita demand probably are caused by a combination of factors, including changes in public perceptions and awareness of services available, demographic changes, and socioeconomic changes in the community's composition. Many cities have increasing utilization of emergency medical services based in part on greater public awareness of their availability, the aging of the population, and the fact that many people do not have health insurance and may defer medical attention until a health emergency occurs.

Another possible reason for increasing incidence per capita is a larger increase in business and visitors than resident population. Incidence per capita includes non-resident calls in the numerator but only residents in the denominator.

Demand Forecasts

Future demand through 2010, the time horizon for this study, is a function of two factors – population increase and changing per capita demand.

Population estimates prepared by the Texas Water Resources Board were used as the first step in forecasting demand. Houston's population is projected to increase to 2.12 million by 2010 (Table 17). The increase will be fairly steady over the next few years. The official best estimates are listed in Table 17 and shown graphically in Figure 5. (These may be revised when the 2000 census results are reported.)

Table 17: Houston Population Projection (2000-2010)

Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Population (millions)	1.879	1.919	1.939	1.959	1.979	1.999	2.019	2.039	2.059	2.079	2.099	2.119

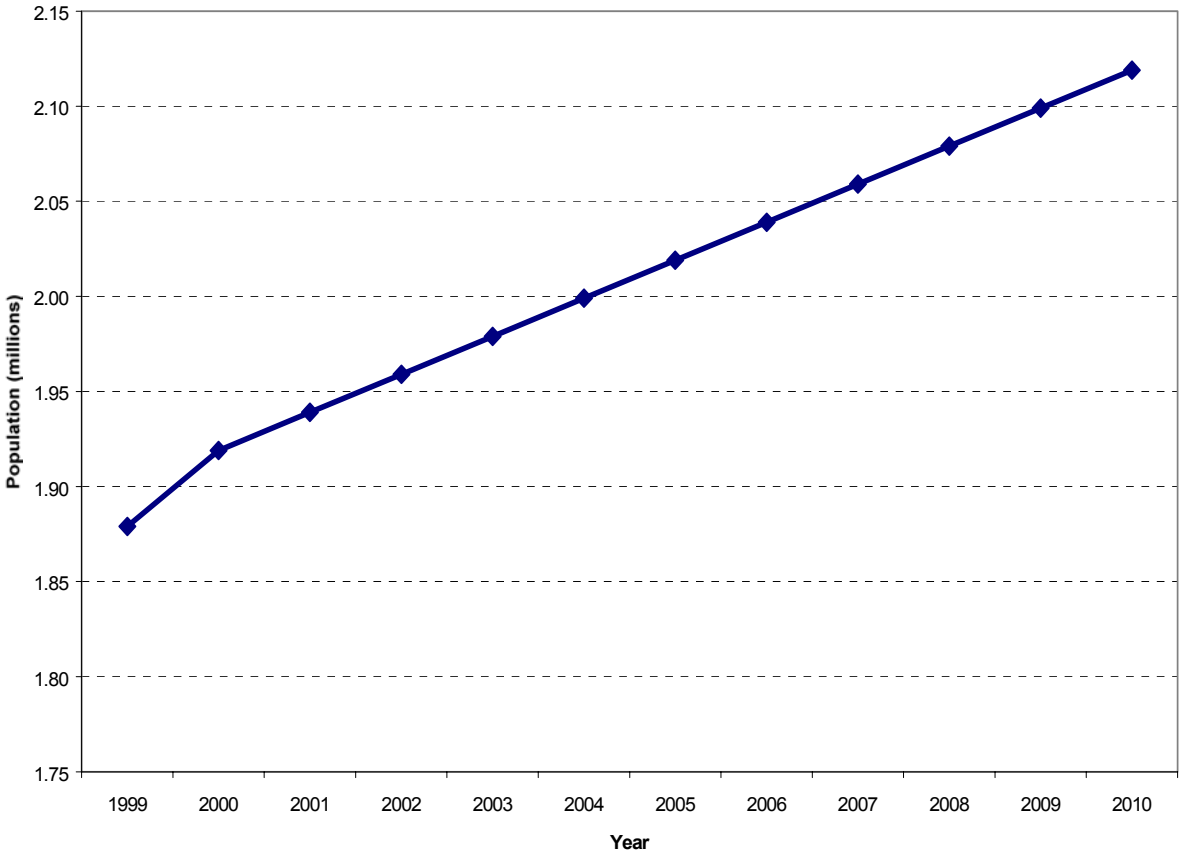
Source: Texas Water Resources Board

The trends in per capita demand for each type of incident were calculated using data provided by the HFD's computer aided dispatch and record keeping system. Forecasts of the per capita estimates were multiplied by forecasts of the future population to produce estimates of incidents.

Changes in policy can have a major impact on per capita demand. The policies might include filtering out non-emergency calls in the dispatch center, running public education campaigns to reduce EMS utilization rates, and increasing fines for false alarms.

Two forecasts of demand were made based on differing assumptions about the per capita demand. Both forecasts are conservative, and the actual demand is likely to fall somewhere between the two extremes. The two forecasts here are called "low growth" and "high growth."

Figure 5: Houston Population Projection (2000-2010)



Low Growth Forecast – The low growth forecast assumed that the demand per capita for fire services has peaked and will remain at its current level. Therefore, increases in the number of fire and EMS incidents will be attributable solely to increases in population protected.

The low growth forecast for 2000 to 2010 is shown in Table 18. If present policies continue, medical responses by fire units will likely exceed 100,000 by 2007, while the total number of incidents will reach 192,000 by 2010. This represents an increase of about 18,000 incidents, of which almost 10,000 are medical, with most of the remaining increase being in good intent and false alarms.

High Growth Forecast – In the high growth forecast, per capita demand was assumed to continue to rise for certain types of incidents. Based on the analysis of per capita demand by incident type over 1992 to 1999, a unique rate was selected for each incident type and a growth factor was applied based on the historic trends. Judgment was

used to adjust the growth rates where appropriate to account for the likelihood that growth rates would level off at some point in the future.

Structure fires and other fires actually declined per capita over the 1993 to 1999 period. Although it is likely that the rate will continue to decline, to be conservative, it was assumed that the rates for structure fires would remain fixed at their current levels. This is the same assumption used in the "low growth" forecast. For most other incident types, the high-growth forecast used the seven-year-average annual growth in per capita demand throughout the forecast period. The only exception was for service calls, which experienced rapid growth from 1995 to 1997, then leveled off. For service calls, a 3.8 percent annual growth was used. For overheat calls, a 1.0 percent growth was used; for medical, 3.0 percent; hazardous condition, 1.9 percent; service, 11.0 percent, and good intent, 1.9 percent. These growth rates were applied annually to the per capita demand, then multiplied by the population, to obtain the number of incidents.

The results of the "high growth" forecast are presented in Table 19. The proportion of incident types changes over the eleven years. Medical incidents increase dramatically, and reach 138,000 in 2010. The total incidents exceed 200,000 by 2003 and approach 300,000 by 2010.

When looking at the two forecasts together, the difference between the low and high scenarios is large, 105,000 incidents by 2010. In the short term, the "high growth" forecast will be the more likely of the two, but then the growth in per capita demand should slow, producing a final result somewhere between the two bounds presented here. Figure 6 graphically shows the total incidents under the low and high growth scenarios.

Under both scenarios, the HFD will be faced with an increasing number of emergency incidents. This will increase the burden placed on the units within the fire department in the future. Of particular concern is the medical aid responses, which are expected to continue their growth and increasingly dominate the workload of the Department. The effect of these incidents on individual units will be discussed later in the chapter. Policy changes for handling EMS calls, as will be proposed in Chapter VI on EMS, can keep the current trends from continuing and keep demand below the upper bound scenario.

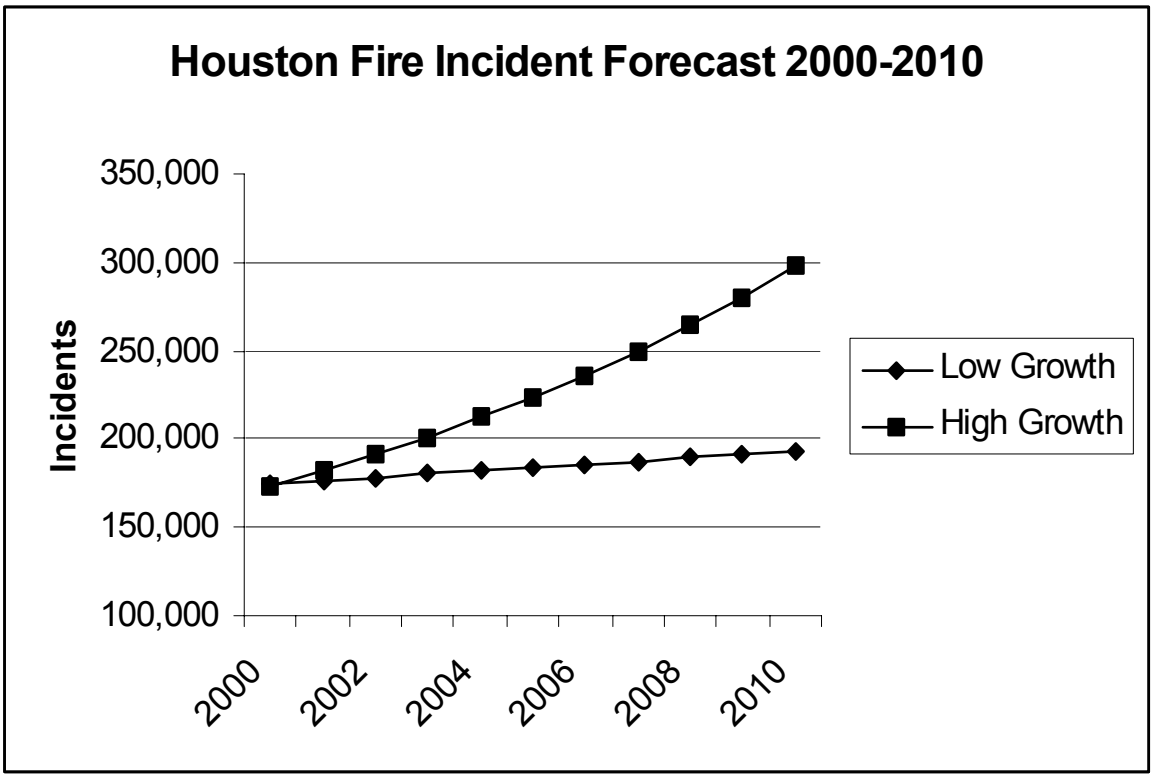
Table 18: Low-Growth Demand Forecast, Houston Fire Incidents

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Structure Fire	3,546	3,583	3,620	3,657	3,693	3,730	3,767	3,804	3,840	3,877	3,914
Other Fire	7,165	7,239	7,314	7,388	7,462	7,537	7,611	7,685	7,759	7,834	7,908
Overheat	219	221	223	225	228	230	232	235	237	239	241
Medical	93,405	94,374	95,343	96,311	97,280	98,249	99,217	100,186	101,155	102,123	103,092
Hazardous Condition	5,069	5,122	5,174	5,227	5,280	5,332	5,385	5,437	5,490	5,542	5,595
Service	2,766	2,795	2,824	2,852	2,881	2,910	2,938	2,967	2,996	3,025	3,053
Good Intent and Other	30,659	30,977	31,295	31,613	31,931	32,249	32,566	32,884	33,202	33,520	33,838
False	29,987	30,298	30,609	30,920	31,231	31,542	31,853	32,164	32,475	32,786	33,097
Total Fire Incidents	174,737	176,549	178,361	180,173	181,985	183,797	185,609	187,422	189,234	191,046	192,858

Table 19: High-Growth Demand Forecast, Houston Fire Incidents

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Structure Fire	3,546	3,583	3,620	3,657	3,693	3,730	3,767	3,804	3,840	3,877	3,914
Other Fire	7,165	7,239	7,314	7,388	7,462	7,537	7,611	7,685	7,759	7,834	7,908
Overheat	219	223	228	232	237	242	247	251	256	261	267
Medical	93,405	97,205	101,149	105,242	109,490	113,897	118,471	123,216	128,140	133,248	138,547
Hazardous Condition	5,069	5,219	5,373	5,531	5,692	5,858	6,029	6,203	6,382	6,566	6,754
Service	2,766	2,901	3,042	3,190	3,345	3,506	3,675	3,852	4,037	4,231	4,433
Good Intent and Other	30,659	34,384	38,558	43,234	48,472	54,340	60,912	68,272	76,515	85,745	96,079
False	29,987	30,874	31,783	32,716	33,673	34,655	35,661	36,694	37,752	38,838	39,951
Total Fire Incidents	172,817	181,629	191,067	201,190	212,065	223,765	236,372	249,978	264,683	280,600	297,854

Figure 6



Response Times

The primary service level measure used by the fire service is response time. It is easy to compute, clearly understood, and of concern to the citizens. Response time is not really a measure of the end result or quality of service, but rather addresses the timeliness of service. Nevertheless, it is an important consideration in evaluating fire services, since the intensity of a fire grows rapidly over time. We do not have the ability with current models to realistically assess the quality of fire services in terms of losses averted, the true measure of fire service but one that is not directly measurable. Response time is therefore often used as a proxy.

The HFD has good data on response times and utilizes the data to monitor system performance.

Response Time Definitions and Goals – Response times should be measured from the time a person calls the fire department or 9-1-1 center to the time when the first unit arrives on the scene. However, some jurisdictions, including the HFD, do not include the call processing time – the time from when a person dials 9-1-1 to when

units are dispatched – in assessing their response times, because the fire operations part of the Department only can affect the response time after they are dispatched. While this measurement practice is not uncommon, it should be corrected when the new CAD system is implemented.

Fire Operations can affect response times by assuring the rapid turnout of crews from the station after being dispatched, and by various strategic and tactical approaches to shortening drive times. Strategies include the number and placement of stations, control of traffic signals, and availability of an adequate number of units to handle simultaneous calls.

The HFD conducted a special study of call processing time within its dispatch center from August to December 1999. Call processing time was found to be 77 to 87 seconds for fire calls and 40 seconds for EMS calls. [NOTE that this does not include the time that it takes for the call to be answered at the 9-1-1 center and forwarded to the fire department.] The call processing times for fire calls are longer than desired; high-performing systems have call processing times in the 50 to 60 second range.[16] The reasons for the longer times are complex and attributable to a number of factors, including the organization and design of the computer aided dispatch system, turnover among dispatchers, and staffing limitations. In the short run, it is unlikely there will be significant improvements in call processing times.

The call processing time should be added to most presentations of response time information to obtain a "true" total response time. The inclusion or exclusion of this time should be clearly indicated on presentations of data to the public and elected officials.

Table 20 presents the current response times and the goals for response times for selected categories of incidents. This fractile presentation of data is very useful, and gives more reliable information than using average response times, which can be distorted by a few outliers. Having 63 percent of calls responded to in 6 minutes or less implies that for 37 percent of incidents, the first unit did not arrive until after 6 minutes.

[16] The new IAFC accreditation standards use 50 seconds as the time within which a dispatch should be made on the average.

Table 20: HFD Response Time Performance and Goals (Excluding Call Processing)

Milestone	Performance Criterion	Actual Performance	HFD Goal
First apparatus at fire scene	6 minutes or less	63 percent	80 percent
All apparatus at scene of a standard box alarm	10 minutes or less 12 minutes or less	71 percent 81 percent	80 percent 90 percent
First responder on EMS scene	6 minutes or less	53 percent	80 percent

Table 20 shows that the HFD is not meeting its fire unit response time goals for *any* category of incidents. (It also does not meet the response time goals for ambulances, as will be discussed in Chapter VI.) This is obviously an undesirable situation. The problems with fire response time were discovered only recently when a systematic study of response times was undertaken by the HFD administration as part of its IAFC accreditation effort.

Response time goals are a matter of local choice.[17] The HFD is proposing to revise its goals to be more reflective of reality, instead of improving response times to meet the goals. The revised goals, now including call processing, are presented in Table 21. Even with these revised goals, considerable improvement is needed.

Table 21: HFD Total Response Time Performance and Goals (including call processing)

Milestone	Actual Performance	Revised Goal
First apparatus at fire scene	8 minutes 30 seconds or less, 63 percent	7 minutes or less, 80 percent
First ALS ambulance on EMS scene	12 minutes 36 seconds or less, 62 percent	10 minutes or less, 70 percent

Any goals more stringent than current performance will help move the HFD in the right direction. But the proposed ALS goal is too lenient. It is well above the 90 percent in 8 minutes that is desired by the medical community and is achievable (see Chapter VI, EMS).

[17] The Insurance Services Office publishes standards for fire company location but does not explicitly address response times.

A realistic short-term objective would be to make improvements in response times subject to two criteria: maintaining service levels in high activity areas and targeting efforts at reducing call processing and station alerting delays. Station alerting and call processing can be reduced through one-time capital expenditures, as opposed to the more costly alternative of building and staffing more stations. Efforts must be made to assure that the planned improvements to the dispatch system will be effective and that reducing call processing time be the primary goal in all changes planned.

The Department, in its report, *Risk Hazard Assessment and Standard of Response Coverage,* which was being completed during our site visits, indicates that the long-range goal will be to meet the requirements in National Fire Protection Association 1710, Proposed Draft *Standard for the Organization and Deployment of Fire Suppression, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*.[18] Its response time standard calls for a first unit response in four minutes for 90 percent of all incidents, and an eight-minute response for the entire structural alarm assignment in 90 percent of all incidents. We do not believe there are realistic or desirable goals for the HFD at this time. The Department is so far from meeting these goals in the near future that they are likely to be ignored, and would be prohibitively expensive to meet.

Structure Response Times – Structure fires are usually the most serious and complex incidents faced by fire departments. They are incidents in which it is important to have multiple resources on scene as quickly as possible and therefore were given special attention.

Table 22 shows the average response times for three engines, two ladders, and the first District Chief on structural fire responses for 1995 to 1999. Table 23 shows the fractile response times. These response times do not include call processing, so total response time would be at least one minute longer.

By either measure, response times to structure fires have increased significantly over just the past five years. The increasing response times are a cause for concern, particularly in light of the fact that some new units have been added over this period.

[18] This document is still not approved, and is subject to revision or rejection by the NFPA membership.

The exact reasons for the increase could not be determined, but they may be caused at least in part by lower unit availability that results when the closest unit or units are often out on calls when the next call comes in. Another possibility is a change in the geographic distribution of structure fires. The increases may also be attributable in part to annexation of territory, indicating a change in the nature of the service area.

As shown in Table 23, the percent of units arriving within six minutes or less also declined over this period. The sharpest decline in response times was for second due ladder company coverage. However, only the first two to three units are reasonable to expect in six minutes; usually a full complement is expected in 10 to 12 minutes (with call processing). The good news here is that the first two engines and first ladder still are averaging less than 10 minutes, so at least 10 personnel are arriving in that time. With 4-person units, the first 3 units plus the district chief would bring 13 personnel, a significant addition since it would meet the NFPA guidelines. This reinforces the recommendation to increase staffing to 4 on all units; with less than satisfactory response times, it would ensure than an adequate complement is available in time to address at least light hazards, which include single-family homes.

Table 22: Average Response Times to Structure Fires, 1995-1999 (without call processing)

	1995	1996	1997	1998	1999
First Engine	4:43	4:36	5:20	5:33	5:27
Second Engine	6:49	6:41	7:18	7:47	7:34
Third Engine	8:53	8:38	9:31	9:37	9:44
First Ladder	6:35	6:29	7:13	7:21	7:20
Second Ladder	9:15	9:10	9:51	10:17	10:23
First District Chief	6:52	6:34	7:00	7:26	7:10

Table 23: Percentile Responses in Six Minutes or Less for Structure Fires, 1995-1999 (without call processing)

	Percentages				
	1995	1996	1997	1998	1999
First Engine	78	80	70	67	70
Second Engine	49	50	37	28	33
Third Engine	27	26	14	10	11
First Ladder	69	56	44	42	43
Second Ladder	38	22	13	9	8
First District Chief	65	55	47	42	46

Response Times by Area – While examining response time data on a citywide basis is useful, it is also important to examine response time and demand information by area of the City, especially with Houston's large land area. Figure 7 shows the fire incidents for 1999 in the City of Houston coded by Key Map® grid sections. Demand is concentrated in the center of the City inside the loop, and tends to decline out toward the periphery. Notable exceptions to this pattern are in southwest Houston and in the north. This map also shows existing fire stations (the crosses). In general, the density of stations tracks the density of calls very well. From this strategic viewpoint, the current deployment of resources makes good sense. Stations sometimes have to be located in low call volume areas to provide adequate response times throughout the area, and that is being done where appropriate, in general.

Figure 8 shows the average response time by area of the City. Most areas have averages within 3.6 to 6.5 minutes; with call processing added, the range is about 5.0 to 7.5 minutes. Response times get longer around the edges of the City where station density is lower. The largest area of poor response time coverage is near the western boundary of the City, where average response times are in excess of 10 minutes. However, the volume of responses for fire incidents along this boundary is low, with the affected map grids having less than one fire call per day.

Figure 9 shows the percentage of fire incidents responded to within 7 minutes (8 minutes with call processing) by grid area. While the average response time may be reasonable in most areas, there are still considerable percentages of incidents within large areas of the City that are not served within existing response time objectives.

The 80th percentile for the majority of the City's area is 9 minutes, which equates to 10 minutes when call processing is included or 20 percent of incidents have over 10 minutes response time, which is not desirable. The problem probably is due more to heavy workloads and low availability of units than to lack of stations.

Figure 7: Fire Responses by Area, 1999 (without call processing)

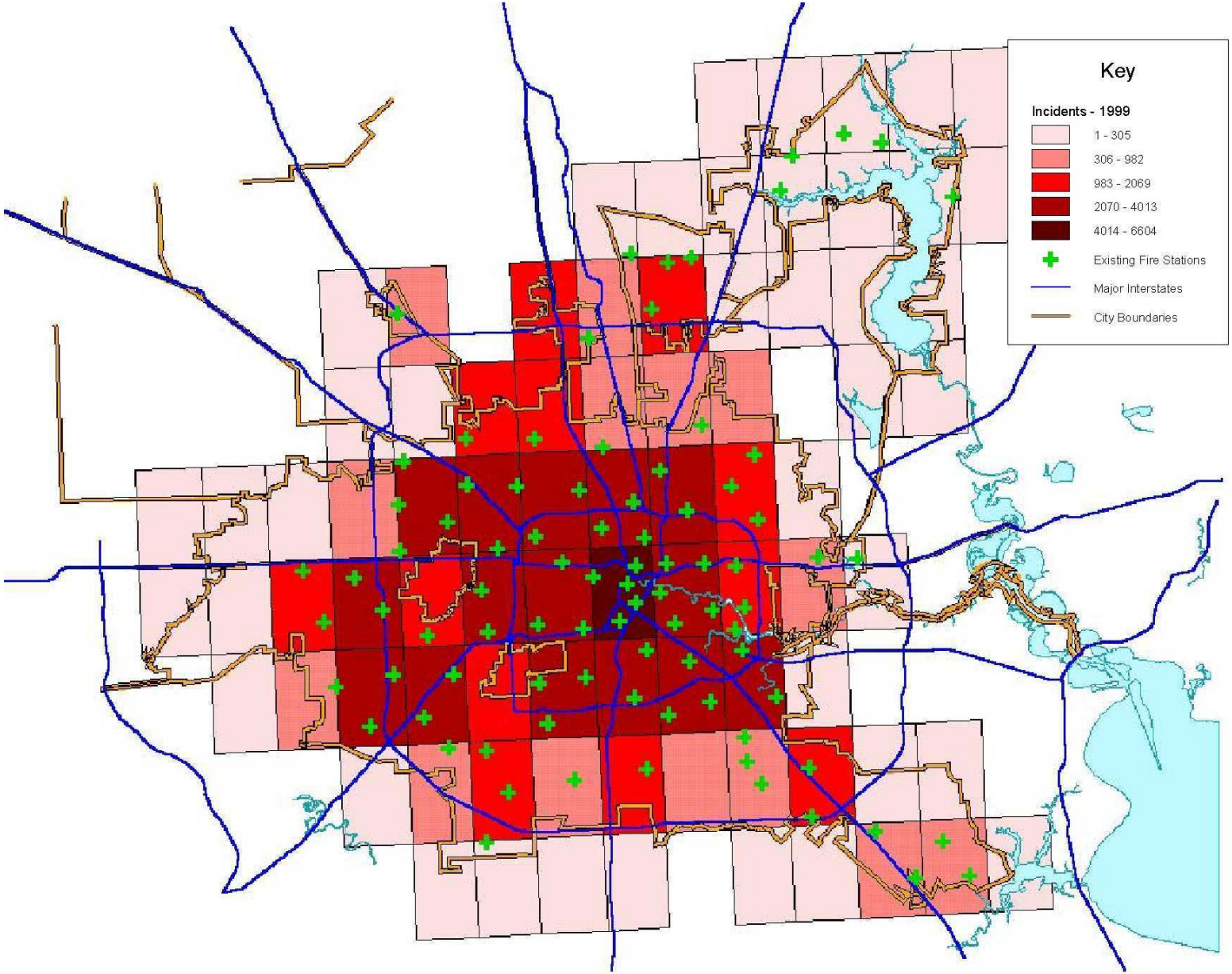


Figure 8: Average Response Time by Area, 1999 (without call processing)

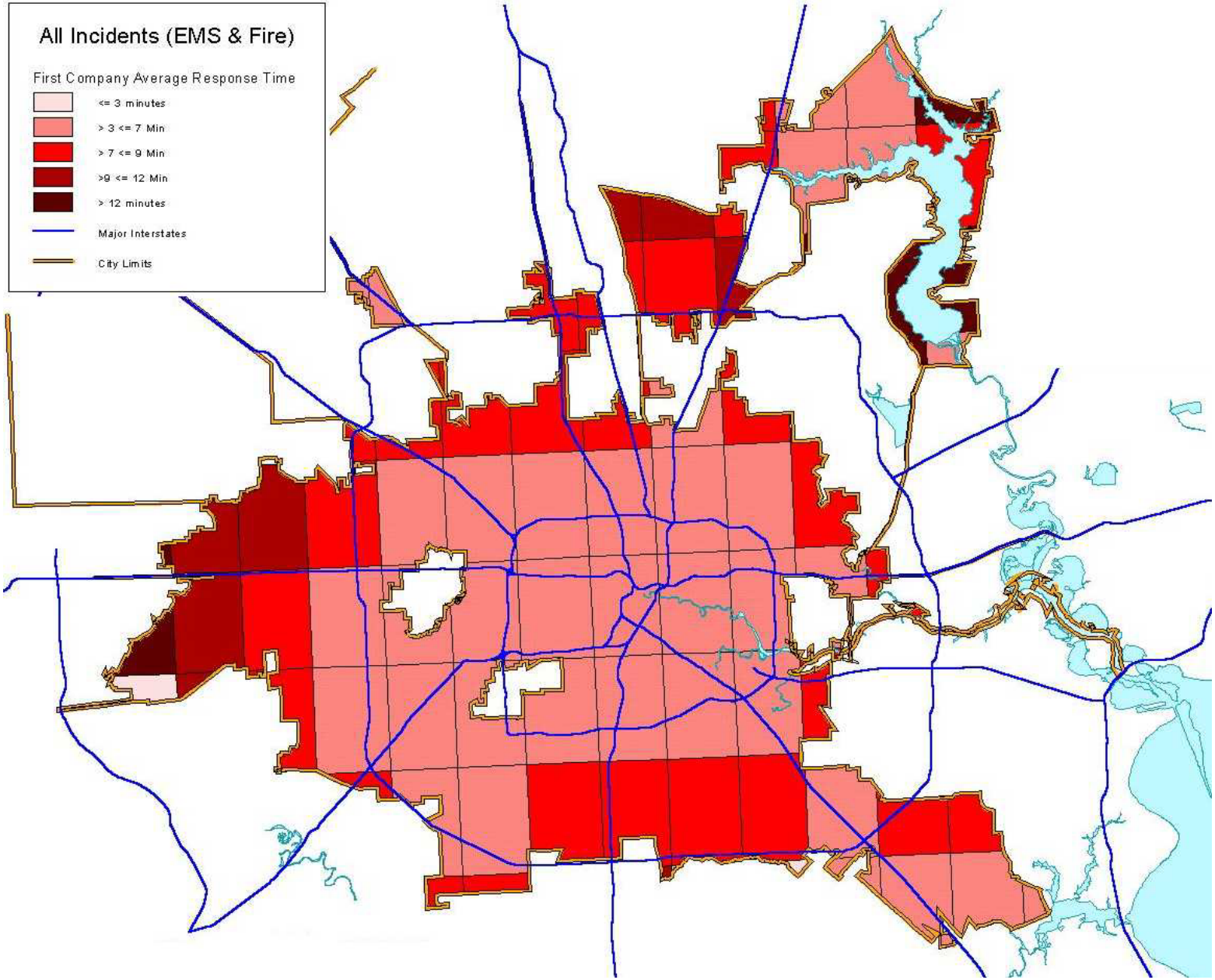
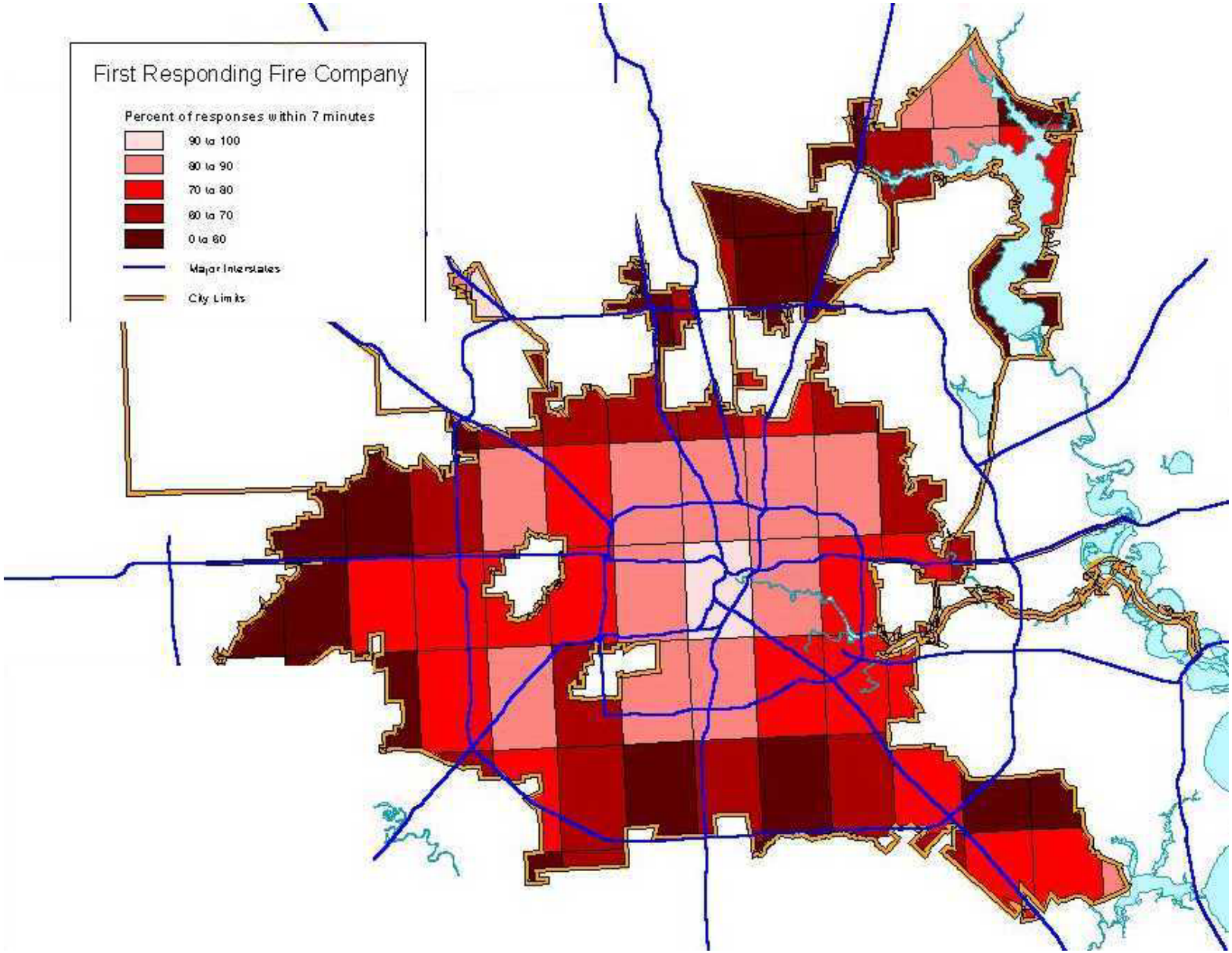


Figure 9: Response Percentiles by Area – Fire Responses, 1999 (without call processing)



Response Complements

The HFD has a predetermined dispatch complement sent to various levels of alarm, as do most other jurisdictions. Table 24 shows the dispatch complements by type of alarm. This dispatch protocol appears reasonable and reflects the risks in the City as identified by the Department.

Table 24: HFD Initial Fire Suppression Dispatch

Alarm Level	Units Dispatched	Remarks
Still Alarm	1 E	For automatic alarms, autos, grass, etc.
Standard Box Alarm	3 E, 1 L, 1 DC, EMS Unit, Amb. Super. & SO	1 B added if in the area of alarm
Heavy Box Alarm	4 E, 2 L, 2 DC, EMS Unit, Amb. Super & SO	Same as above
High Rise Response	5 E, 3 L, 3 DC, EMS Unit, Amb. Super & SO	Same as above
Second Alarm	4 E, 2 L, 1 DC, 1 B, 1 HR (RIT), EMS Unit, Amb. Super. & 2nd SO	
Third Alarm	4 E, 2 L, 1 DC & Deputy Chief	
Fourth Alarm	4 E & 2 L	
Subsequent Alarms	4 E & 2 L	

Note: E = Engine; L = Ladder; DC = District Chief; SO = Safety Officer; B = Booster Unit; RIT = Rapid Intervention Team; and HR = Heavy Rescue.

More important than even the number and types of units sent for a particular type of alarm is the number of personnel who are sent. Table 25 shows the number of firefighters responding on the initial alarm for staffing levels of three vs. four personnel per fire apparatus. Other apparatus is held constant – two per ambulance and EMS unit, and one per booster unit, District Chief, and Deputy Chief. If units were fully staffed, the HFD would exceed the NFPA recommendations in all three hazard categories. When two-thirds of HFD engine and ladders are at three-person staffing, as is common, the NFPA guidelines still would be met in most cases.

Table 25: Initial Response Comparisons

Type of Hazard	NFPA Guidelines	With All @ 4-person Staffing	With 2/3 @ 3-person Staffing*
High-hazard	24 FF + 2 C	Heavy Box Alarm = 28 FF + 2 C	Heavy Box Alarm = 24 + 2 C
Medium-hazard	16 FF + 1 C	Standard Box Alarm = 20 FF + 1 C	Standard Box Alarm = 17 + 1 C
Low-hazard	12 FF + 1 C	Standard Box Alarm = 20 FF + 1 C	Standard Box Alarm = 17 + 1 C

Note: FF = Firefighters and C = Chief Officers
* Also equivalent to having all ladders with minimum of four and engines with minimum of three.

However, it is not just the total number of firefighters, but also the time in which the minimum complement arrives that is critical. As shown earlier, four-person staffing of units allows more firefighters to arrive sooner. More units than the minimum necessary with four-person staffing still must be dispatched because (a) one cannot be sure which units will arrive first, given traffic conditions and units out on calls, and (b) if the fire already is large or gets larger because of the slow response, more units will be needed to deal with it. Because structure fires comprise only a few percent of the total workload, sending more units as insurance on a working fire is a good policy.

Because of the increased numbers of companies operating with three personnel, the HFD was adding an additional engine and ladder company to each box alarm and removing an ambulance and EMS supervisor; dispatch of the latter are now left to the discretion of the incident commander. This will have the net effect of increasing the total initial complement by at least three personnel. Adding one company to the alarm is appropriate in our judgment because it can serve as an RIT (rapid intervention team for firefighter safety) if needed before a second alarm is called. An ambulance, however, should be maintained on scene for all working fires. Although the ambulances are overloaded, there are a relatively small number of working structure fires (under 3,000 per year) and they should receive an ambulance because of the increased potential from a structure fire for injury to civilians or firefighters.

Recommendation 56: Add one additional engine company to the standard assignments for structural fires for use as a Rapid Intervention Team (RIT). And continue the dispatch of an ambulance and EMS supervisor to all working fires or sustained operations incidents involving a box alarm assignment or greater. (Since the original report, this recommendation was implemented to include an extra engine and ladder company. The ladder company will be deleted from a standard assignment when staffing is judged adequate by the incident commander. The addition of an EMS unit to standard assignments also will be left to the discretion of the incident commander.)

Station Locations

The HFD has been doing a good job in planning station locations. This study reviewed the rationale used for determining the station locations and the end results of the strategy.[19]

[19] Location of individual stations was outside the scope.

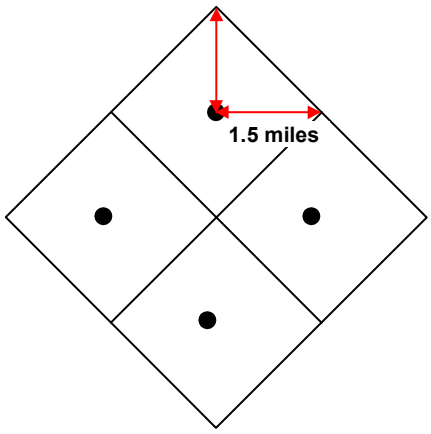
ISO Rating Schedule – The guiding philosophy of station location planning for the HFD has been the Insurance Services Office's (ISO) Fire Suppression Rating Schedule (FSRS), last revised in 1980. The rating schedule was developed in 1916 following a number of urban conflagrations at the turn of the 19th century and updated periodically ever since. The schedule is an insurance underwriting tool that evaluates a community's fire defenses, and in particular, its ability to avoid a conflagration or large scale fire. Communities receive a grade ranging from 10 to 1, with "10" meaning no recognized fire protection, and "1" meaning the department meets all ISO criteria. Few cities receive a "1." The rating of the fire department itself makes up 50 percent of the grade; the rating of the water supply is 40 percent; and the remaining 10 percent is based on handling of fire alarms.

The community's ISO grade is one factor in insurance underwriting. It is not the sole determinant of a property owner's insurance bill. The improvement of the ISO rating is viewed by some as an economic development tool, in that a potential business may evaluate insurance costs in competing locations, and factor the prospect of lower insurance costs into its decision on where to locate. Houston has tried to maintain a high ISO rating.

Although the ISO schedule states that it is not intended to be a guide to the management of fire departments, it remains highly influential because it has been the only "objective" standard for fire services, and it does impact the cost of insurance. The ISO schedule has come under criticism from several quarters as being biased in favor of property protection, since it measures only insured property losses as a basis for calibration. Communities often fail to assess the increased public costs of achieving a higher rating vs. the benefits of reduced private insurance expenditures while seeking to improve their rating. A numerical improvement in the ISO rating may not necessarily translate into lower insurance premiums, depending on the rating methods used by individual insurers.

The ISO rating schedule requires the location of engine companies at 1.5 miles from "built-up" areas and ladder companies 2.5 miles from "built-up" areas. This requires a network of fire stations located at 3-mile driving distance intervals, assuming a uniform grid street pattern. The stations ideally would be at the center of diamond-shaped areas, as shown below, if the north-south, east-west street grid were perfect,

which it rarely is. Any point on the periphery of a diamond is 1.5 miles or less from the station at the center.



Locally, the ISO's Fire Service Rating System (FSRS) is applied by the Texas branch of the ISO. They evaluate each large community on a ten-year schedule or earlier by request. As part of this evaluation, the ISO produces a list of station locations that would bring the City into compliance with their guidelines. The HFD receives regular reports from the ISO regarding its progress, and most recently reviewed proposed movement of ladder companies with the ISO in 1998.

The ISO schedule does not address the workload of the fire companies in the field, and tends to favor a uniform distribution of resources throughout a community. However, fire risk is often not uniformly distributed. While fire risks exist over a wide area, a few areas are responsible for a disproportionately high share of the workload.

While there are shortcomings of reliance on the ISO rating schedule for station locations, the decision to use it as a primary criterion for locating facilities is shared by many departments nationwide.[20] However, the ISO rating schedule should be incorporated into a more holistic agenda of management of the community's fire problem. Station locations should be based on the demand for service and the need to maintain response times. ISO implies importance of response times by specifying distances from "built up" areas, but this is not quantitatively defined and does not consider unit availability.

[20] See, for example, Toregas, Costis C. "Grading Schedule Blues or How I Learned To Be My Own Manager." *Fire Journal*, Vol. 75, No. 4, 73-75, July 1981.

Station Plans – The HFD plans to add several new stations over the next several years to the 87 stations that are strategically located throughout Houston's 617 square miles. Figure 10 shows the current and planned future station locations proposed by the HFD. These plans are under review and have changed during the course of this study. The newly-annexed Kingwood territory has been provided with four stations.

The Department provided a series of maps created by the Planning and Development Department Data Systems Division that display existing fire stations, relocated fire stations, new fire stations, and proposed fire stations. Seven proposed fire station locations were identified on these maps. Of these, five stations were identified as being funded as of July 2000. Table 26 outlines the five proposed new station locations. In our opinion, three are needed right away.

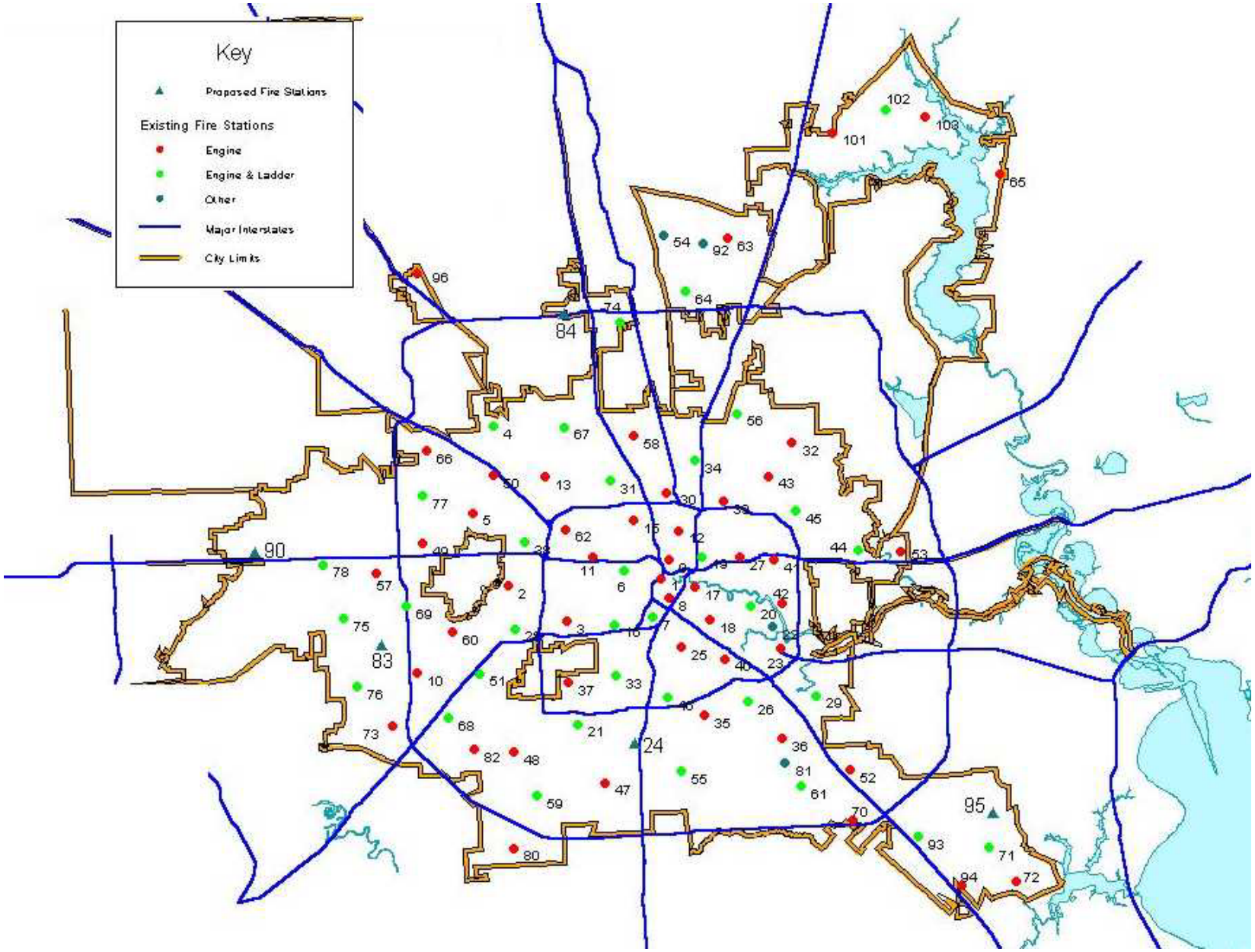
Table 26: Proposed HFD Fire Station Locations

Number	Location	TriData Comments
24	Reed Rd	Concur; proceed ASAP
83	Breezewood	Concur; proceed ASAP
84	Ella Blvd	Concur; proceed ASAP
95	El Dorado blvd.	Concur for longer run
90	Park Row and Langham Creek Dr.	Concur for near future

For any geographic area as large as the City of Houston, there will be areas where response times are not up to standards. Review of the present deployment of engine and ladder companies affirms that the HFD stations generally are strategically well located to address the majority of their current fire suppression and related emergency responsibilities. However, this deployment will not be adequate without additional changes in the future.

Of the five station sites currently under consideration for funding, three are urgently needed, while the other two could be made a lower priority at present, though it likely will be necessary they will be needed in the next five to 10 years, based on our demand projections. However, more critical needs may emerge elsewhere in the City before this time.

Figure 10: Existing and Proposed Fire Station Locations by Major Apparatus



Also included in the station location plans was the closure of Station 1, which is located in the downtown core. This former headquarters for the HFD now houses an engine, medic unit, Deputy Chief, and 2 EMS supervisors. The station is located in an area of very high activity, and its closure will have an impact on the workload of the surrounding stations (discussed later). We think the units need to be kept in the downtown area.

As noted earlier, the response times are suffering more from unit overload and hence unavailability than from absence of stations in some geographical areas. Station locations will be revisited later in this report after addressing unit activity and deployment. A continual review of resource deployment must be made in order for the department to stay abreast of changing conditions.

Unit Deployment

The City's deployment of resources has not been static over the past few years. In fact, there have been a relatively large number of unit and station moves undertaken. Table 27 lists these changes along with their effective dates and a brief rationale given for the change. Accounting for the impact of recent changes is difficult, as the system is arguably still "adjusting" to the new changes.

Table 27: Unit Deployment Changes (1998-Present)

Date	Change	Rationale
4-4-98	Add D 82 D 68 moved to Station 10 as D 10	
4-23-98	Re-Hab 1; Rescue Boat 1; Big blow moved to Station 17	
8-25-98	L 57 moved to Station 78	Enhance ladder coverage in Park 10 area
9-21-98	Add E 93, temporarily at Station 72	
1-12-99	Add MS-92 at Hobby Airport	Improve EMS first response
1-25-99	L 5 to Station 77	Improve coverage in NE; meet ISO Requirements
4-9-99	L 9 to Station 56	ISO Requirements
5-1-99	Add Booster 32 Move Evacuation Boat 56 to 32	
6-12-99	Move Booster 44 to 65	

Date	Change	Rationale
10-19-99	Move Booster 55 and Evacuation Boat 55 to Station 47	
12-2-99	Add M 65 (dual unit)	
12-8-99	Add M 96 (dual unit)	
1-14-00	Add Tower 96 at new location for Station 96. Formerly at 4780 W. Greens Rd. at Mills	
2-7-00	Move Booster 70 and evacuation boat 70 to Station 93 Reassign Station 93 from District 71 to 70 Reassign Station 40 from District 20 to District 26	Workload balancing
3-9-00	Add Station 104 (Kingwood) Move E 101 to 104; Move L 65 to Station 101	Improve coverage in annexed areas. New deployment: 65: E, M, B 101: L; M; B, RB 102: D, E, L, M 103: E, B, EB 104: E

Note: FF = Firefighters and C = Chief Officers

Unit Workloads

The current workloads for fire companies vary from a low of just over 200 responses for Ladder 71 to a high of over 4,700 responses for Engine 28, as shown in Figure 11. There are 20 companies that exceed 3,000 fire responses per year, the threshold above which a company is considered busy and possibly in need of added units nearby to share the load, depending on the nature and length of the calls. In urban areas, activity levels this high are not uncommon, but may mean that a company is so busy that the response times in its service area suffer because it is unavailable for some responses. That requires units located further away to answer the call, which in turn increases response times. Response times in Houston are indeed being heavily impacted by some very high unit workloads, in addition to the large area of the City.

The disparity between the busy and less busy companies reflects the differences in demand for service across the City and the desired objective to maintain response time performance even in areas with relatively light demand. This disparity is a normal phenomenon, but requires use of judgment as to when demand is sufficient to open a new

station or add a unit. There are no national standards for this. In general, we suggest that a new station be considered when it would have at least one call per day (300-400 per year) and would reduce excessive response times in its area.

Unit workloads may be significantly affected by changes in response protocols for fire units on medical first responder incidents, since 40 percent of all incidents are medical first responder calls.

Future Demand – To assess the impact of future demand on unit workloads, it is necessary to estimate how the growth in total demand will impact individual areas of the City. The first step is to convert the forecast of total incidents into a forecast of unit responses, using the recent ratio of unit responses per incident. We then used the historic percentage of responses made by each unit in the system to apportion the total forecast number of responses into the number of responses for each unit. Rather than using raw averages, the percentages of responses for each unit over the past three years was adjusted to account for units that had increasing workloads versus those that had relatively stable or even declining workloads. That is, some judgment was applied.

The emphasis was on identifying trends and relative changes in workload, rather than using the forecast as a prediction of a precise number of responses at a particular point in time. The unit response forecasts were made for both the low and high growth incident forecasts. These forecasts assume that no new units or stations are opened.

Low Growth Unit Forecast – Table 28 presents the forecast number of responses for each major fire unit in the HFD, based upon the low growth forecast. By the end of 2000, 20 engine companies are expected to exceed 3,000 annual responses. Another six engine companies would cross this threshold by 2005 and six more by 2010. None of the ladder companies should exceed 3,000 responses during the 10-year forecast; they are moderately loaded.

The engine company workloads by unit are shown graphically in Figure 11 and Figure 12 for the year 2000 and 2010 in the low forecast. These figures assume no station closures and no additional units. Even with the low growth forecast, many units would exceed 3,000 responses, several would exceed 4,000, and a few would even exceed 5,000 to 6,000 responses. Even worse, the highest workload units are in adjacent

areas, so that an entire region of the City might be overloaded at the same time, with units drawn from farther and farther away, causing a cascade of response time problems.

Table 28: Low Growth Forecast: Unit Responses (2000, 2005, 2010)

Units	2000	2005	2010
B32	221	271	325
B44	41	116	198
B47	49	137	234
B55	207	360	527
B63	91	68	41
B64	186	522	891
B65	26	73	125
B67	599	1,203	1,864
B68	806	2,260	3,854
B70	201	326	461
B77	271	761	1,297
B80	168	311	467
B101	264	460	674
B103	112	140	171
D5	881	927	972
D6	962	1,011	1,061
D8	1,045	1,100	1,154
D10	1,187	1,249	1,310
D19	687	723	758
D20	587	617	648
D21	872	917	963
D26	754	793	832
D28	946	995	1,044
D31	1,024	1,077	1,130
D34	773	813	853
D45	384	404	424
D46	927	975	1,023
D64	535	562	590
D69	932	980	1,029
D70	336	354	371
D71	188	198	208
D82	972	1,023	1,073
D96	195	205	215
D102	114	120	126
E1	2,800	3,081	3,376
E2	2,730	2,879	3,029
E3	3,120	3,181	3,233
E4	2,936	3,524	4,155
E5	2,332	2,479	2,630
E6	2,009	2,039	2,059
E7	4,555	5,208	5,903

Units	2000	2005	2010
E8	2,754	3,184	3,642
E9	2,045	2,104	2,159
E10	3,438	3,974	4,546
E11	1,785	1,829	1,868
E12	2,059	3,246	4,539
E13	2,087	2,144	2,196
E15	2,501	2,009	1,455
E16	3,397	3,222	3,013
E17	1,517	1,500	1,500
E18	2,376	2,565	2,760
E19	3,210	3,316	3,416
E20	2,174	2,219	2,258
E21	2,222	2,248	2,266
E23	2,645	2,836	3,033
E25	3,669	3,954	4,249
E26	3,306	4,010	4,767
E27	2,265	2,217	2,154
E28	4,768	4,836	4,887
E29	2,191	2,333	2,478
E30	2,243	2,294	2,340
E31	3,801	3,730	3,633
E32	1,808	1,831	1,847
E33	3,937	4,084	4,227
E34	3,043	2,870	2,665
E35	4,018	4,383	4,763
E36	1,899	1,998	2,096
E37	1,860	1,920	1,977
E38	2,361	2,450	2,534
E39	2,975	4,608	6,386
E40	2,362	2,582	2,811
E41	1,143	1,203	1,262
E42	855	893	932
E43	2,238	2,120	1,979
E44	1,649	1,904	2,175
E45	963	1,073	1,189
E46	4,030	4,406	4,798
E47	1,599	1,666	1,732
E48	2,948	2,827	2,679
E49	2,472	2,575	2,676
E50	2,533	2,776	3,029
E51	4,531	4,599	4,651

Units	2000	2005	2010
E52	1,996	2,079	2,161
E53	723	964	1,224
E55	3,842	4,566	5,342
E56	2,486	2,837	3,211
E57	1,678	1,598	1,598
E58	3,784	4,463	5,189
E59	2,092	1,545	933
E60	3,033	3,321	3,622
E61	1,476	1,895	2,347
E62	2,166	2,267	2,367
E63	1,416	2,142	2,933
E64	1,584	2,011	2,472
E65	286	411	546
E66	1,381	1,835	2,326
E67	4,113	4,609	5,132
E68	4,484	4,800	5,124
E69	2,862	3,778	4,770
E70	1,302	1,335	1,365
E71	759	783	805
E72	713	1,108	1,539
E73	3,129	3,117	3,089
E74	3,161	3,270	3,374
E75	2,282	2,812	3,382
E76	2,563	2,771	2,986
E77	1,910	2,252	2,619
E78	1,852	2,028	2,211
E80	1,559	1,600	1,600
E82	3,754	3,800	3,832
E93	443	466	489
E94	687	691	692
E96	843	886	929
E101	897	1,150	1,423
E102	787	980	1,188
E103	323	353	384
H1022	672	667	657
H2022	575	572	566
L4	701	804	913
L6	761	808	856

Units	2000	2005	2010
L7	1,497	1,662	1,835
L16	978	1,008	1,036
L19	820	835	846
L18	654	849	1,059
L20	624	715	812
L21	633	653	673
L26	911	1,001	1,094
L28	1,466	1,500	1,529
L29	517	500	500
L31	960	935	901
L33	946	1,025	1,107
L34	854	881	907
L38	738	753	765
L44	272	277	280
L45	298	301	302
L46	1,196	1,391	1,599
L51	1,589	1,653	1,715
L56	336	944	1,609
L59	605	637	668
L61	480	491	501
L64	492	480	464
L67	1,168	1,394	1,636
L68	1,501	1,486	1,462
L69	712	849	996
L71	215	219	222
L74	699	651	594
L75	575	645	719
L76	678	713	747
L77	478	1,341	2,286
L78	293	308	323
L93	124	348	594
L102	161	156	150
L301	252	706	1,203
R11	1,540	1,907	2,302
R23	633	1,775	3,026

Figure 11: Number of Responses by First Due Area: Existing Engine Stations, Year 2000 Low Estimate

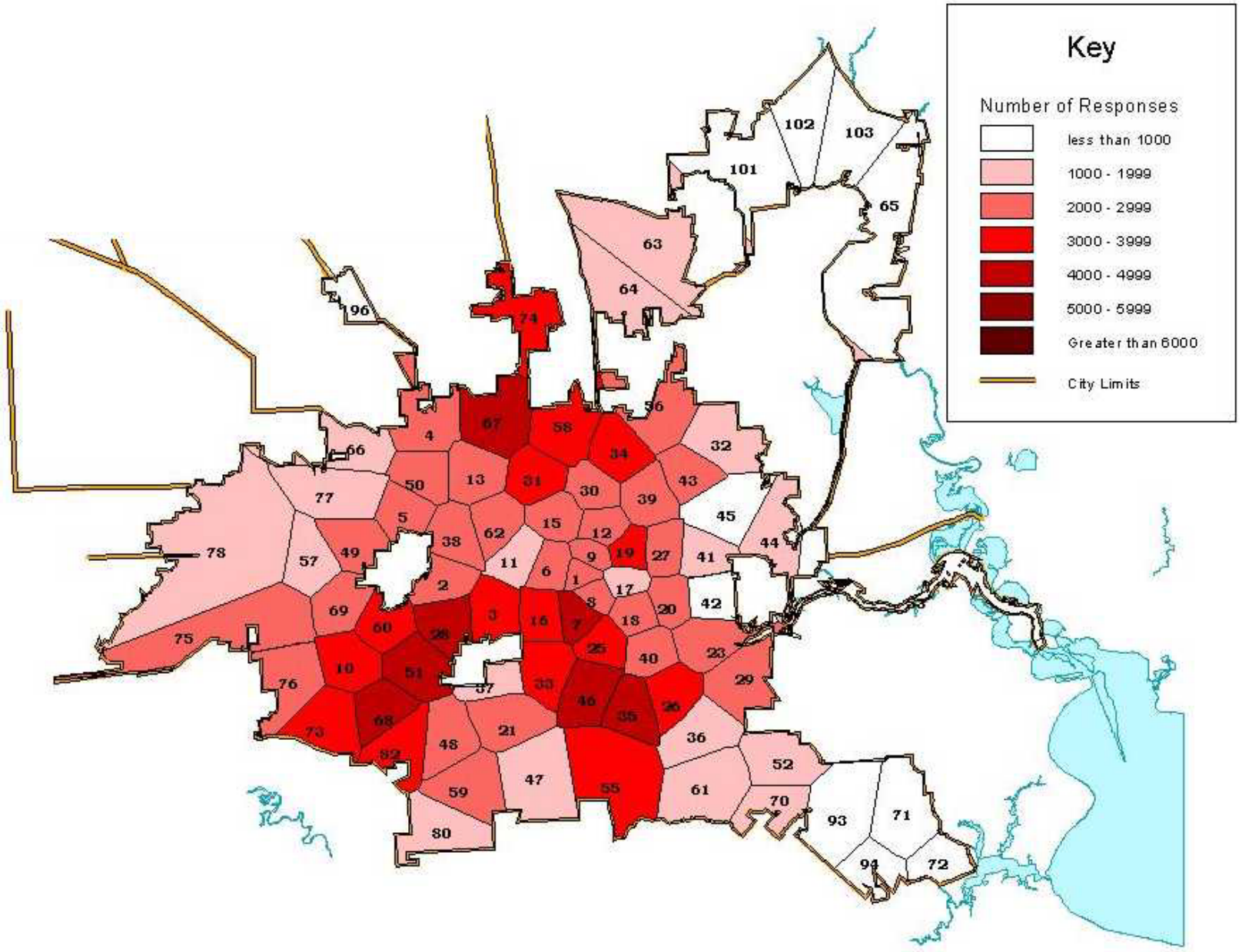
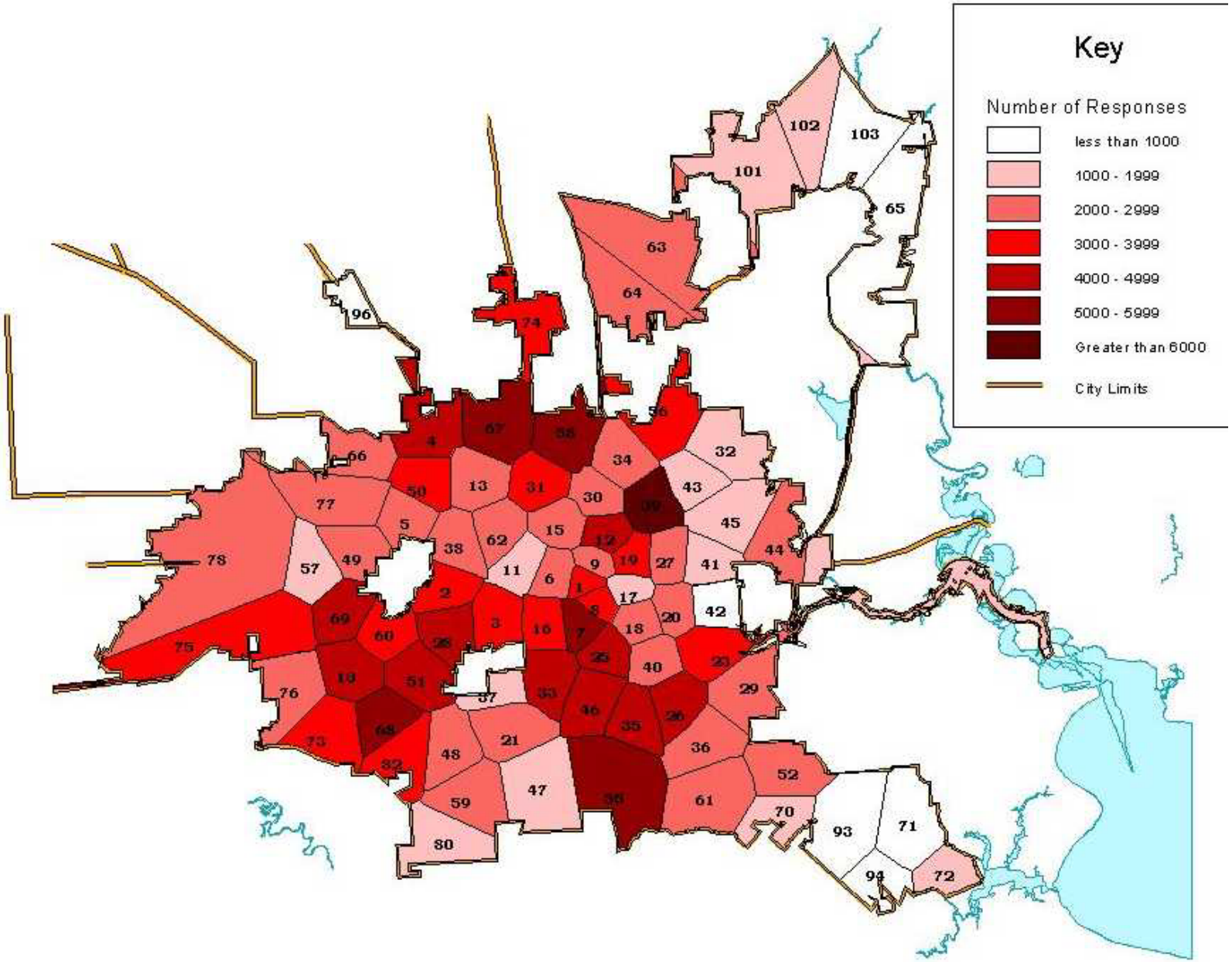


Figure 12: Number of Responses by First Due Area: Existing Engine Stations – Year 2010 Low Estimate



High Growth Unit Forecast – The results of the high growth forecast of incidents are presented in Table 29. They are worse news yet. Compared to the low growth forecast of incidents, the difference in activity level for units within the Department is striking. The number of engine companies that exceed the 3,000 response threshold grows from 21 to 43 by 2010, or half of the City's engine companies.

If no new units or stations are added, several companies will exceed 6,000 annual responses by 2010!

Table 29: High Growth Forecast: Unit Responses (2000, 2005, 2010)

Unit	2000	2005	2010
B32	240	325	431
B44	45	139	262
B47	53	165	310
B52	0	0	0
B55	225	432	698
B63	99	112	126
B64	202	626	1,179
B65	28	88	165
B67	651	1,443	2,468
B68	875	2,711	5,103
B70	219	391	611
B77	295	912	1,717
B80	182	373	619
B101	286	552	893
B103	122	168	226
D5	957	1,111	1,287
D6	1,044	1,213	1,405
D8	1,135	1,319	1,528
D10	1,289	1,497	1,735
D19	746	867	1,004
D20	638	740	858
D21	947	1,100	1,275
D26	818	951	1,101
D28	1,028	1,194	1,383
D31	1,112	1,291	1,496
D34	840	975	1,130
D45	418	485	562

Unit	2000	2005	2010
D46	1,007	1,169	1,354
D64	581	674	781
D69	1,012	1,176	1,362
D70	365	424	492
D71	205	238	275
D82	1,056	1,227	1,421
D96	212	246	285
D102	124	144	167
E1	3,041	3,695	4,469
E2	2,965	3,453	4,011
E3	3,389	3,815	4,280
E4	3,189	4,226	5,501
E5	2,532	2,973	3,482
E6	2,182	2,444	2,726
E7	4,948	6,246	7,815
E8	2,991	3,818	4,821
E9	2,221	2,524	2,859
E10	3,734	4,766	6,019
E11	1,940	2,194	2,473
E12	2,237	3,893	6,010
E13	2,267	2,572	2,908
E15	2,717	3,081	3,482
E16	3,689	3,864	3,990
E17	1,648	1,786	1,921
E18	2,581	3,075	3,654
E19	3,487	3,977	4,524
E20	2,361	2,661	2,989

Unit	2000	2005	2010
E21	2,413	2,696	3,000
E23	2,873	3,401	4,015
E25	3,985	4,742	5,626
E26	3,591	4,809	6,311
E27	2,460	2,659	2,852
E28	5,178	5,799	6,471
E29	2,380	2,798	3,281
E30	2,437	2,752	3,099
E31	4,128	4,473	4,810
E32	1,963	2,196	2,446
E33	4,276	4,898	5,596
E34	3,305	3,442	3,528
E35	4,364	5,256	6,306
E36	2,063	2,396	2,775
E37	2,020	2,303	2,619
E38	2,564	2,938	3,356
E39	3,231	5,526	8,456
E40	2,565	3,096	3,722
E41	1,242	1,442	1,671
E42	928	1,072	1,234
E43	2,431	2,542	2,620
E44	1,791	2,283	2,880
E45	1,046	1,287	1,575
E46	4,377	5,283	6,352
E47	1,736	1,998	2,293
E48	3,202	3,390	3,546
E49	2,685	3,088	3,543
E50	2,751	3,329	4,011
E51	4,922	5,516	6,158
E52	2,168	2,341	2,506
E53	785	1,156	1,621
E55	4,173	5,476	7,073
E56	2,700	3,403	4,251
E57	1,823	1,797	1,711
E58	4,110	5,352	6,871
E59	2,272	2,560	2,875
E60	3,294	3,983	4,796
E61	1,603	2,272	3,108

Unit	2000	2005	2010
E62	2,353	2,718	3,134
E63	1,538	2,569	3,883
E64	1,721	2,412	3,272
E65	311	493	723
E66	1,500	2,200	3,079
E67	4,467	5,527	6,795
E68	4,871	5,756	6,784
E69	3,108	4,530	6,315
E70	1,415	1,601	1,807
E71	824	939	1,066
E72	775	1,329	2,037
E73	3,398	3,738	4,090
E74	3,434	3,922	4,467
E75	2,479	3,372	4,478
E76	2,784	3,323	3,953
E77	2,075	2,701	3,467
E78	2,012	2,431	2,927
E80	1,694	1,793	1,876
E82	4,077	4,557	5,073
E93	481	559	648
E94	746	829	916
E96	915	1,063	1,231
E101	975	1,379	1,884
E102	855	1,175	1,573
E103	351	423	508
H1022	730	799	870
H2022	625	686	750
L4	762	964	1,209
L6	827	969	1,133
L7	1,626	1,993	2,429
L9	213	138	34
L16	1,062	1,209	1,372
L19	891	1,001	1,121
L18	711	1,018	1,403
L20	678	858	1,075
L21	687	784	891
L26	990	1,200	1,449
L28	1,592	1,798	2,025

Unit	2000	2005	2010
L29	562	608	653
L31	1,043	1,121	1,194
L33	1,028	1,229	1,466
L34	927	1,056	1,200
L38	802	902	1,012
L44	296	332	371
L45	324	361	400
L46	1,299	1,668	2,117
L51	1,726	1,982	2,271
L56	365	1,132	2,131
L59	658	764	885
L61	522	589	663
L64	535	576	614
L65	48	57	67

Unit	2000	2005	2010
L67	1,269	1,672	2,166
L68	1,630	1,782	1,936
L69	774	1,018	1,319
L71	233	262	294
L74	759	781	787
L75	625	773	952
L76	737	854	988
L77	519	1,608	3,027
L78	318	369	428
L93	135	418	786
L102	175	187	198
L301	273	846	1,593
R11	1,672	2,287	3,048
R23	687	2,128	4,006

Fire Station and Unit Location Recommendations

To summarize, Houston has several concentrated areas of high demand for fire service. The existing configuration of stations and units is achieving reasonable response times to much of the City when viewed on an average basis. However, when a more critical percentile basis is used for examining response time performance, and call processing time is added in, response times are longer than desirable in much of the City according to both HFD and nationally used response time goals. The situation is even worse for ambulances, as discussed in Chapter VI. The response time problem is not primarily due to lack of stations to deal with Houston's large area, but rather unavailability of units due to high demand, though some more stations are needed to service growth in new areas.

Given the heavy loading of units at present and the forecast of significantly increased demand through 2010, fire unit response times are likely to degrade further, even after the currently planned stations and their units are added. The response time situation is likely to become critical without additional resources or a major change in response policy. It is going to be difficult to impossible for the HFD to meet its response time objectives with just the planned additions to the stations and units. Barring major expenditures for new units and stations, it is not likely that the HFD will meet its response time objectives in the near future. Therefore, one way or another, there is a

clear need to reexamine the current paradigm for service delivery as the City goes into the future.

Recommendation 57: A combination of strategies should be considered for reducing response times, including adding units to improve unit availability; reducing or diverting some of the demand for service; providing adequate support resources to assure that existing resources are being utilized most efficiently; traffic light preemption; and having a different approach to service delivery, especially for EMS calls. The alternatives should include higher fines to reduce false alarms; providing non-emergency services for calls that are not emergencies; public education on appropriate use of 9-1-1; and, most of all, a revised approach to handling EMS calls. (In 2001, significant improvements in response times were achieved by increasing the number of EMS units, converting medic units to non-transportation squads, and re-defining the criteria for sending a First Responder response. Eleven squads were added in December 2000. Four additional squads and five BLS ambulances were added in April 2001. Four more BLS ambulances were added in May 2001. EMS dispatch screens were modified in February 2001 to accommodate the addition of paramedic squads. This reduced the number of fire apparatus dispatched as first responders by 28 percent in 2001, which increased their in-service time. Additional apparatus requirements will be evaluated for future budget years.)

Because EMS calls are so large a fraction of the business, any policies enacted to reduce the number of medical aid responses for fire companies would immediately improve the availability of units and their response times. Reducing medical aid responses should be undertaken along with enhanced prevention activity and more emphasis on built-in detection in the periphery of the City. As was previously mentioned, the design and implementation of the new dispatch system must be closely supervised to assure that the call processing times are also reduced.

Another approach to improving response times is to speed up emergency vehicle drive time. This can be done with traffic light preemption where traffic is light to moderate, and control of the lights can make a difference.

Recommendation 58: Give priority in traffic light preemption installation plans to thoroughfares in remote parts of the City where response times are significantly worse than average. This will improve response times in the more marginally served areas that do not yet merit an additional station. The particular intersections where traffic signal preemption can do the most good can be identified by the local first-responding fire companies.

Table 30 shows the effects of the planned new station openings on engine company workloads for the surrounding stations. These workloads are estimates, but give an indication of likely changes when contrasted with workloads in Table 28. The new stations reduce the workload of surrounding companies and improve response times. The impact on citywide response time performance will be proportional to the number of responses the unit makes. For example, new Station 95 probably will have little impact on overall response times in the City because it only will handle 400-500 calls, but it will have a positive effect on response times in its first-due area.

Table 30: Impact on Workload of New Stations (and their surrounding stations)

New Station (or Surrounding Stations)	Low			High		
	2000	2005	2010	2000	2005	2010
24	2,026	2,204	2,390	2,200	2,643	3,164
33	3,543	3,676	3,804	3,848	4,408	5,036
47	3,627	3,965	4,318	3,940	4,755	5,717
55	3,266	3,881	4,541	3,547	4,654	6,012
46	3,627	3,965	4,318	3,940	4,755	5,717
21	1,888	1,911	1,926	2,051	2,292	2,550
83	1,987	2,388	2,818	2,158	2,864	3,732
75	1,484	1,828	2,199	1,611	2,192	2,911
76	2,179	2,355	2,538	2,367	2,824	3,360
10	2,750	3,180	3,637	2,987	3,813	4,816
69	2,289	3,022	3,816	2,487	3,624	5,052
84	1,265	1,308	1,349	1,373	1,569	1,787
74	1,897	1,962	2,024	2,060	2,353	2,680
95	380	391	403	412	469	533
71	380	391	403	412	469	533
90	827	968	1,119	898	1,161	1,481
78	1,482	1,622	1,769	1,610	1,945	2,342

Closing a station will increase the workload on surrounding companies. The proximity of other stations will reduce the impact on first-due response times, but the effects of lower unit availability and drawing units from farther away will have a negative impact, too.

Table 31 presents an estimate of the effects of closing Station 1. This analysis probably overstates to some degree the impact on the immediately adjacent companies, as they would not be available for all responses and some of these responses would be taken by companies more distant. The analysis is nonetheless informative because it shows that several more companies will become overloaded during the forecast period. Because of the large number of responses in this part of the City, reductions in coverage response time here will influence citywide performance.

Table 31: Impact on Neighboring Station of Closing Station 1

Station	Low			High		
	2000	2005	2010	2000	2005	2010
6	2,848	2,962	3,071	3,094	3,552	4,067
8	3,593	4,107	4,654	3,903	4,926	6,162
9	2,884	3,028	3,172	3,133	3,632	4,200
7	4,835	5,516	6,240	5,251	6,615	8,262

Recommendation 59: The City either should not close Station 1 or should add a company in the downtown area to replace Engine 1 in the next five years. Replacement of Station 1 or addition of another company in the downtown area is needed to cope with demand. (Since the original report, downtown fire Stations 1 and 8 were closed, and their equipment relocated to a temporary superstation in downtown. A permanent eight-bay super station will be constructed in downtown, to be operational by 2004.)

Recommendation 60: Above and beyond the stations currently in the HFD plans, at least three to four additional units spread across two or three existing stations will be needed to meet demand between now and 2010. The response times are significantly affected by the high workloads and reduced availability of many units. Adding units virtually anywhere in the heart of the City will assist availability and response times throughout much of the system. The fine tuning of their placement can be made by the Operations Division. The highest workload stations or ones nearby in which there is room to add another unit are the prime contenders. (The HFD plans to seek budget approval for additional units after appropriate analysis.)

Plans to add fire units should be coordinated with the proposed change in dealing with EMS calls presented in Chapter VI.

V. SPECIAL OPERATIONS

"Special Operations" is a term used to refer to a variety of specialized services provided by modern fire departments. They include response to hazardous materials incidents and so-called "technical rescue" services such as high-angle, collapse, confined space, and water rescue. This chapter discusses these services and also the HFD Airport Operations. Special operations services generally make use of cross-trained firefighters and add to the productivity of the fire suppression forces.

The Houston Special Operations Division is responsible for all of these special services. It is headed by an Assistant Fire Chief who reports directly to the Fire Chief. This already is a leg up on other departments that have not recognized this as a new specialty and have their special operations scattered across commands.

The Special Operations Division is comprised of the Hazardous Materials Response Team (HMRT), Technical Rescue Command (TRC), Aircraft Rescue Fire Fighting (ARFF), Houston Medical Strike Team (HMST), and the Urban Search and Rescue Team (USRT). The Division has 176 personnel. A Senior Captain and Administrative Assistant II assist the Assistant Chief in day-to-day administration.

Hazardous Materials Response Team

The threat of a hazardous materials incident is higher in Houston than in most places in the nation because of the City's and surrounding region's enormous petrochemical industry. A first-rate hazmat response capability is crucial to the City's safety.

Houston is a worldwide leader in the handling of hazardous materials incidents. The management of the HMRT has been called upon to testify before Congress and to provide advice to various Federal and State agencies. The HMRT has built a strong relationship with local industry to the point that much of the training for hazmat personnel comes through industry efforts.

The HMRT also enjoys a close response relationship with the Channel Industries Mutual Aid (CIMA). There are approximately 120 Petrochemical companies organized through CIMA, one of the best regional systems in the world. The Phillips Petrochemical

fire in October 1989 demonstrated the power and ability of this outstanding mutual aid system.[21] The CIMA network is comprised of a large array of fire apparatus, including foam engines and industrial hazmat teams that can handle or assist the HFD in managing incidents at industrial facilities.

Staffing – The HMRT operates out of one station and is headed by a District Chief. Their apparatus includes two hazardous materials response vehicles, one foam pumper, and a utility vehicle used for support during hazmat operations. Staffing consists of four shifts, each with ten personnel including two captains, three Engineer/Operator/Emergency Operations (E/O/E) and five Firefighter/Emergency Operations (FF/E) personnel to operate the apparatus. A Senior Captain serves as the assistant HMRT Coordinator and assists the District Chief in the overall administrative and operational management of the HMRT.

Depending on a jurisdiction's risks and hazards, different configurations of personnel and apparatus may be assigned to the hazmat team. Given their outstanding response times, relatively low call volume, and strong mutual aid system, these staffing levels appear to be adequate for the HMRT for at least the near future.

Operations – The HMRT renders a variety of services for mitigating hazmat incidents, including: identification and analysis of hazardous materials; establishment of a safe working area for operations; sampling and monitoring of material(s) involved in an incident; site assessment; container evaluation; and a number of relatively sophisticated technical operations related to hazardous materials incident management. The HMRT responds to an average of 1,050 incidents each year. This number is much lower than might be expected because industry handles much of its hazmat needs without calling the HFD.

The task force usually sent to a hazardous materials incident consists of two hazmat units and a foam unit to support their operation. Because the HMRT has two primary hazmat response vehicles, the team has the ability to respond and operate at two separate incidents simultaneously. The HMRT operations seemed fine and were not explored in depth because of no apparent major issues. There was only one minor issue

[21] The USFA Major Fires Investigation Report 035, on the Phillips Petrochemical fire, by TriData Corporation, 1990, discusses the incident and the operation of mutual aid in more detail.

related to filling key HMRT leadership positions after hours. During business hours, the District Chief responds as the Hazardous Materials Sector Officer, and the Senior Captain functions as the Hazmat Safety Officer. After hours, there is a callback system to ensure that these two functions are filled. However, these procedures are not formally documented, which could lead to confusion in the event of a large or complex incident. All functions in the Hazardous Materials Incident Management System should be clearly defined to ensure that personnel from the HMRT, CIMA, and HFD suppression units understand their role in a hazmat incident. These Standard Operating Procedures (SOPs) should be written collaboratively and distributed to the organizations that would be involved in the mitigation and response of a hazmat incident.

Recommendation 61: The Standard Operating Procedures of the Hazardous Materials Incident Management System seems appropriate; they should be documented. This will better define roles and responsibilities at the scene. The Incident Command System should meet the requirements of National Fire Protection Association (NFPA) Standards1561, *Standard on Fire Department Incident Management Systems,* 1995 ed., and 1521, *Standard for Fire Department Safety Officer,* 1997 edition. (The Hazmat SOP's are now part of the HFD Guidelines.)

Response Time – A single hazmat team might be expected to have a long response time in a City as large in area as Houston, but the average HMRT response time over the last three years is 14.6 minutes. In many other municipalities hazmat team response times average between 30 minutes and one hour.

The average response time for the first due engine or truck company to the scene of a hazardous materials incident is 6.2 minutes, with the HMRT arriving an average of 8.4 minutes later. These times are calculated from the time that a call is dispatched, not from when it is received, so one minute should be added to them for call processing. Regardless, for a City this size, this hazmat response time is outstanding. The response time objectives of the HMRT are to arrive at an incident within 20 minutes 75 percent of the time and within 30 minutes 90 percent of the time. They easily achieve these goals.

The management of the Department has considered dividing the HMRT into two operational units, one on either side of the City to improve response times further. That is a reasonable option to consider, but there are some factors that suggest keeping the units together. In order to respond effectively to a hazardous materials incident, the HMRT requires an adequate number of trained technicians on-scene to fill all of the

identified functions in the hazardous materials incident management system. Dividing the team into two parts would require a larger pool of trained hazardous materials technicians dedicated to the HMRT.

Keeping the team together also makes it easier for personnel to train and fill in for one another. The total number of calls, approximately 1,000 per year, is generally considered a light load for a dedicated unit. (A reason for this light lead is that Houston's industry takes care of many incidents themselves.) Only 63 percent of the responses required the expertise of the team; the other 37 percent were handled by the first responders on the engine and truck companies. Over the past three years, the team spent an average of 78 to 80 minutes working each hazardous materials incident. This means the team is busy on calls 10 to 15 percent of the time.

Recommendation 62: The hazmat team (HMRT) should remain as one functional response district operating out of Station 22. The HMRT maintains acceptable response times, particularly considering that a full first alarm assignment is already on the scene, and can initiate basic functions of incident operations. The response time that might be saved by separating the team into two locations would be offset by increased costs, including additional staff and duplication of supplies. (The HFD agreed with this recommendation.)

Hazmat Station – The present HMRT quarters at Station 22 have been pieced together over the years through a series of renovations. As a result, the station is cramped, with inadequate living space for personnel, office space for inspectors, and storage facilities for equipment and apparatus. Rehabilitating the station is warranted. Any rehabilitation project should include additional space for a training room and drill yard so the HMRT has the facilities to do in-service training.

Recommendation 63: The rehabilitation of Station 22 for the HMRT should be added to the capital budget. They are severely cramped for space. It should be put in the category of Critical Needs and listed in the five-year capital plant forecast. (The HFD added this to the capital plan and requested that the renovation be expedited.)

Hazmat Training – The HMRT's current in-service training program appears more than adequate. As mentioned above, their solid relationship with the petrochemical industry serves their training needs well.

The HFD suppression personnel, however, are trained only to the hazmat first responder awareness level. This training is for people who could be the first on the scene of an emergency involving hazardous materials. First responders at the awareness level are expected to recognize the presence of hazardous materials, protect themselves, call for trained personnel, and secure the area. Since every company in the City has the potential to be the first to respond to a hazardous materials incident, the awareness level is essential. But a case can be made for continuing hazmat training of line companies to the Operations level.

The operational level of training is intended for those who are part of the initial response to a hazmat incident and who are expected to protect nearby persons, the environment, or property from the effects of the release. First responders at the operational level are expected to respond in a defensive fashion to control the release from a safe distance and keep it from spreading. Additional training would better prepare the line companies to secure the scene prior to HMRT arrival, identify the product(s) involved, request additional resources if needed, and assess wind direction and the characteristics of the surrounding area.

Recommendation 64: The Training Division, assisted by the HMRT, should provide training for all field personnel to the Hazmat Operations level of competency. This training should continue to meet the requirements of NFPA 472, *Standards on Professional Competence of Responders to Hazardous Materials Incidents,* 1997 edition. It is also required by federal regulations.[22] (Training now is being done to the first responder level, as of January 2002.)

Administration – Most, if not all, of the extensive administrative functions of the HMRT are performed by the District Chief and Senior Captain. These duties include general clerical and accounting activities, preparing public information releases, data processing functions, recording of training, and many other tasks. The vast majority of this administrative work is routine and repetitive, and should not be performed by officers, who would be better utilized by focusing more on operational, training, and logistical issues.

Recommendation 65: Create three full-time civilian Administrative Assistant positions to handle the administrative functions of the HMRT. An Administrative Assistant II position should be assigned to the District Chief. An Administrative

[22] 29CFR 1910.120

Assistant I position should be assigned to the Hazmat Operations Division, and an Administrative Assistant I position should be assigned to the Hazmat Inspections Division (see Figure 14). This would allow the District Chief to spend more time on the strategic role of interfacing with private industry, federal, state, and, local government agencies. This would also allow the District Chief to spend more time overseeing the operations of the HMRT and interacting with team members. The Senior Captain would be able to spend more time preparing training material and programs for the education of team members as well as other HFD personnel. (The HFD supports this recommendation. It has not been able to fund it yet, but plans to pursue it in the next budget.)

Figure 13 illustrates a proposed organizational chart for the Special Operations Division, with the main change being the addition of an ARFF District Chief, discussed later in this chapter. A proposed organizational chart for the HMRT follows in Figure 14; it shows the new administrative positions and the LEPC administrative position recommended to be added in the Emergency Management chapter at the end of this report.

Inspections – Elements of the Hazardous Materials Inspection Team are assigned to both the Fire Prevention Division and the Planning and Research Division. The Fire Prevention Division is responsible for tank truck inspections; Planning and Research is responsible for fixed facilities inspections. The inspectors' responsibilities include: plans review of new and existing H occupancies (locations of hazardous materials and/or high-piled combustible storage); field inspections of new and existing Group H1, H2, H3, and H7 occupancies; validation of hazardous materials inventory statements; hazardous materials management plans; and tank truck inspections. Information gained by this group of inspectors is not shared with the HMRT. One option is to improve the sharing of information across the various inspection units, which is easier said than done. Another option is to consolidate all hazmat functions.

Recommendation 66: The Hazardous Materials Inspection Team should be transferred to the HFD Special Operations Division and assigned to the HMRT. The team of inspectors should assist in developing the hazardous materials emergency preparedness plan with the HMRT and the Local Emergency Planning Committee (LEPC). Since the inspector records and other information would be part of HMRT and the LEPC would participate in the process, pre-planning for incidents in both fixed and mobile facilities would be facilitated. (Following the initial report, this transfer was made.)

Figure 13: Proposed Organizational Chart – Special Operations

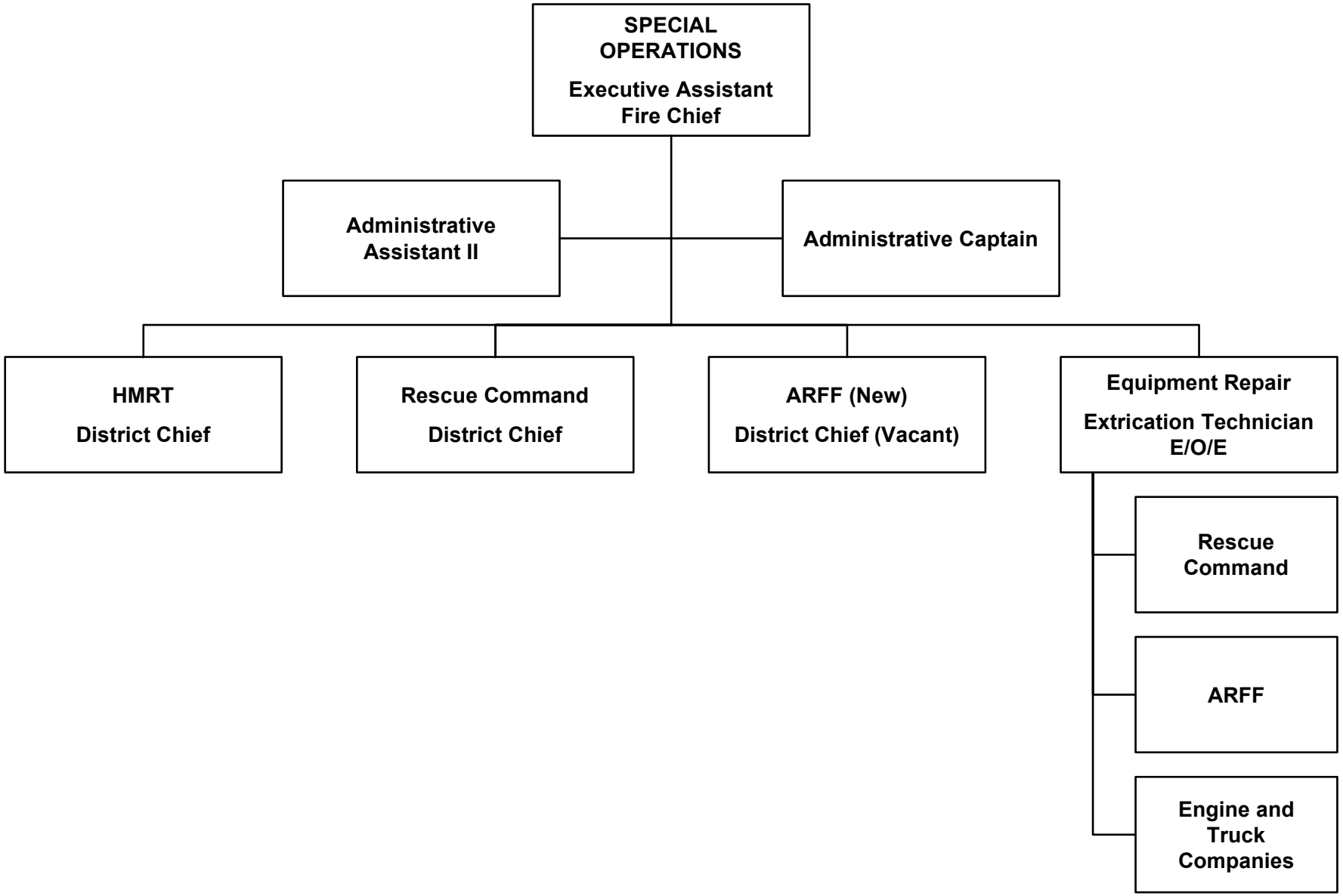
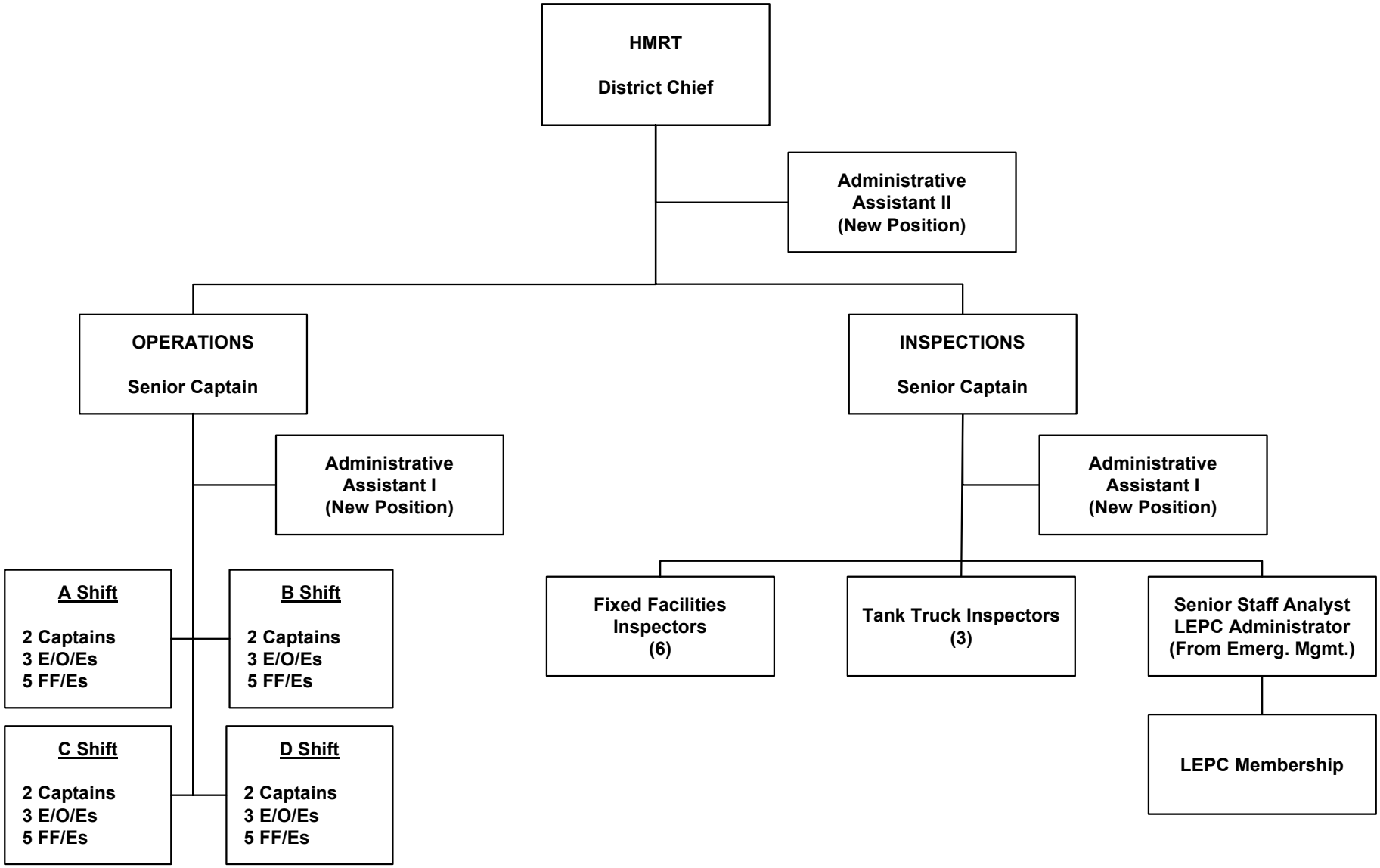


Figure 14: Proposed Organizational Chart – Hazardous Materials Response Team (HMRT)



Hazmat Management Information System – The current Management Information System (MIS) for HMRT is a stand-alone system. However, hazardous materials information needs to be accessed and updated by various elements of the Department including line companies, the Prevention Division, the HMRT, and the hazmat inspectors. Access to this information is crucial, particularly as the quantity of hazardous materials and the number of locations of hazardous materials increase. A new system should be designed that will interface with the CAD system in dispatch and the MIS in Emergency Management.

Recommendation 67: The HFD should develop a MIS that shares information among the HMRT, team management, and the Hazmat inspectors. This is another major IT shortfall in the HFD and needs to be developed. It may use off-the-shelf software. (Following the initial study, hazmat inspectors were reassigned to Special Operations, and monthly hazmat reports are being shared now.)

Hazmat Funding – Presently, the HMRT has only one source of funding, the Fire Department budget. The team, however, is responsible for the billing of Annual Voluntary Contributions. As the name implies, this is a voluntary program that allows any business or person to pay an annual contribution to the City and in return be exempt from having to pay any service charges stemming from incidents for which they are responsible. It is, in a sense, an insurance policy. It is not uncommon for local governments to return a percentage of collected revenue to the division that provided the service (e.g. for EMS transports, inspections, and fines). In Houston, to be fair across all services, funds raised by government units are returned to the general fund and re-allocated on the basis of Council-mandated priorities.

To operate in the most effective and safe manner possible and to keep pace with advances in technology, HMRT equipment must be upgraded and/or replaced often. Earmarking of the voluntary contribution fund might help ensure that this replacement is accomplished. Ultimately, however, the source of these funds is not as important as their availability in the first place.

Recommendation 68: Develop an apparatus and equipment replacement plan for the HMRT. The City Council might consider using a percentage of the collected revenue from hazardous materials operations to form a Capital Equipment and Apparatus replacement program for the HMRT, or simply fund by regular means. One way or another, the HFD should plan upgrades and replacements of key hazardous materials

response equipment and apparatus in a more timely manner. (The HFD agrees and says that a replacement plan will be developed this fiscal year.)

Local Emergency Planning Committee – The Houston Local Emergency Planning Committee (LEPC) was established in 1987 to improve the community's ability to prevent and respond to hazardous chemical emergencies. This is a requirement of the *Superfund Amendments and Reauthorization Act of 1986 (SARA), Title III*. The LEPC develops training; tests the hazardous substances emergency response plan for the City; develops procedures for regulated facilities to provide notification about what is stored, used, and transported from their facilities to the LEPC; develops procedures for receiving and processing requests from the public under the community right-to-know provisions of the Act; and implements other related activities as may be required by the federal, state, or local government.

The LEPC has a full-time administrator to assist the Executive Committee in accomplishing the goals of the LEPC. In most cities the LEPC operates either under the auspices of the Fire Department or the Office of Emergency Management. In Houston, The LEPC Administrator is a senior staff analyst assigned to the Division of Emergency Management.

Recommendation 69: The LEPC Administrator should be transferred to the HFD Special Operations Division. Since the primary response to a hazmat incident is by the Fire Department, this transfer would provide a better framework to prepare for and perform emergency response functions during a hazardous materials incident. The LEPC Administrator would also assist the hazmat inspection unit in the collection of data on fixed facilities and transportation planning (See the proposed Special Operations organizational chart in Figure 13).

Technical Rescue

The Technical Rescue Command (TRC) is headed by a District Chief and consists of two stations, two heavy rescue units, and two rescue trailer units outfitted for structural collapse and trench rescue. It also has 10 evacuation boats and five rescue boats, of which two are housed with the heavy rescue units. The other boats are assigned to fire stations throughout the City. The TRC also interacts with the State of Texas Urban Search and Rescue Team (USRT) for training and response issues that affect the HFD.

Staffing – Each of the four shifts has two Captains, two E/O/Es, and six FF/Es to staff the two heavy rescue units with a crew of five personnel each. A Senior Captain, not on shift, assists the District Chief with the administrative and operational management of the team and serves as the TRC Coordinator. A non-shift Extrication Technician (E/O/E) is responsible for the repair and maintenance of all hydraulic rescue equipment assigned to the TRC, ARFF, and the truck and engine companies throughout the department. These staffing levels are sufficient for the TRC.

Operations – The two heavy rescue companies responded to 1,995 emergency incidents during 1999. The responses ranged from structural collapse to high angle rope rescue and below grade trench incidents. Almost all rescue calls are first assigned standard fire units who can initiate basic operations and solve many problems without the specialty units. The specialized TRC units usually are needed only for the larger and/or more complex incidents.

The TRC workload is not evenly split: Rescue 11 responded to 1,414 incidents (71 percent) while Rescue 42 responded to only 581 (29 percent). Of these incidents, motor vehicle accidents accounted for 54 percent. Rescue 11 responded to 715 accidents and Rescue 42 to 363. The second most common TRC response was to elevator rescues, which comprise 18 percent of their responses. Rescue 11 responded to 320 elevator rescues and Rescue 42 to 32. These discrepancies in workload result from Rescue 42's location in an industrial section of the City, where there has been a relatively low demand for TRC service over the last 5 years. Rescue 11, on the other hand, is located in an area that has the greatest incidence of motor vehicle accidents and also other TRC service requests.

Recommendation 70: Relocate Rescue 42 to Station 11. This would allow the TRC to operate out of a single, central station, which would become the coordinating center for all HFD Rescue operations. This is analogous to the similar recommendation for the HMRT. The relocation would facilitate the development and delivery of training in the highly technical disciplines of structural collapse, rope rescue, confined space, vehicle and machinery rescue, and, trench and excavation rescue. It would allow members of the team to achieve higher technical excellence and competence in each of these disciplines. It would also better balance the workload across the rescue team. (As of 2002, there is no empty bay space in Station 11 because of the creation of an EMS Chief position assigned to that station. The Rescue unit may be relocated to the new downtown superstation when it is completed.)

The first-due responses would be rotated on a monthly basis. Each rescue company then would handle approximately 50 percent of TRC requests for service. This would function as hands-on skills maintenance and provide a morale booster for the underused staff of Rescue 42.

An alternative to this recommendation is to rotate the crews between rescue units periodically, e.g., every one to six months. This would balance their workload, but would not facilitate training.

Ladder Trucks – The HFD has equipped 19 of its 36 ladder trucks with the hydraulic rescue tools and equipment necessary to begin extrication operations while the Heavy Rescue unit is en route to the scene. By equipping all of the ladder trucks, a second set of extrication equipment would be available on-scene in case of multiple entrapments or other unforeseen circumstances without requiring the staffing of additional rescue units.

Recommendation 71: Plan for the expansion of rescue services by equipping the rest of the ladder trucks with extrication tools and equipment. There are 17 trucks needing equipment. (The HFD agrees, but the funds have not yet been budgeted.)

Assignment Pay – To remain a member of the TRC, personnel are required to maintain EMT certification and pass a competency-based skill test. Other specialty personnel (e.g., the HMRT, Emergency Medical Technicians, and Paramedics) receive assignment pay for the advanced training and professional competency required to perform their duty assignments. Despite similar training and certification requirements, TRC staff receive no assignment pay. While it is not uncommon in other cities for technical rescue personnel not to receive assignment pay, the practice does not seem fair or consistent with respect to other HFD services.

Recommendation 72: While they are assigned to the TRC, personnel should receive assignment pay. The advanced training and extra risk justifies the additional pay and would encourage personnel to increase their tenure with the unit. Experience is important for their specialty. Of course, the recommendation would also increase the morale of TRC personnel. (This concept has been included in the latest contract proposal.)

Rapid Intervention Rescue Team – A Rapid Intervention Team (RIT) is an extra unit sent to incidents to rescue firefighters when needed. The RIT is assigned the

task of locating and rescuing trapped, missing, or lost firefighters. In some jurisdictions this task is assigned to an engine company, in others to a heavy rescue unit. Use of these teams is a form of risk management that is a relatively new practice in the fire service.

HFD policy is to assign the RIT function to an engine company for responses to occupancies designated as high- or medium-risk hazards (including high rises). Assigning this task to one of the TRC units would augment compliance with the "Two-in/Two-out" Rule, an Occupational Safety and Health Administration regulation requiring two firefighters, one of whom can be a command officer, to stand by outside of a structure ready to enter in the event that firefighters inside the structure are injured or become trapped. The rescue unit would also allow engine company personnel to concentrate on fire suppression, and bring highly trained technicians to the scene along with the specialized equipment they carry should they be needed. As an incident expands in size or complexity, including requests for additional resources, the TRC unit would remain designated as the RIT, leaving suppression apparatus and personnel available for assignment wherever necessary. One TRC unit would remain in-service to respond to Rescue incidents in the city.

Recommendation 73: A Technical Rescue Command (TRC) unit should be designated as the Rapid Intervention Rescue Team for working commercial, industrial, and multi-alarm structural fires. (The HFD disagreed; it felt that use of TRC units as RITs should be restricted to multiple alarm fires, because there are only two TRCs in the city; an engine company can be assigned instead. The counter argument is that the rescues have far fewer calls than most engines, and are better equipped and trained for extrication. We do agree that one TRC should be left in service; i.e., both should not be assigned as RITs simultaneously.)

Medical Exams – At the present time the only medical examination for a member of the TRC is the pre-employment medical examination, if one was required at the time the individual was hired. HMRT members, a similar specialty team, receive annual examinations. Given the mental and physical demands of Rescue operations and the TRC's function as "back-up" to the HMRT, the TRC team members also need to be examined annually.

Recommendation 74: The Technical Rescue Command personnel should receive a baseline medical examinations and then annual medical examinations. The Department should review the current contract for occupational medicine consulting services to ensure that these examinations meet the needs of the TRC personnel. This review should meet the requirements of NFPA 1500, *Standard on Fire Department*

Occupational Safety and Health Program, 1997 edition. (The HFD agrees with the need, but funding has not yet been available to do the exams.)

Apparatus – The present TRC units have high mileage and are aging very quickly. They have little storage space available for specialized equipment. The design of the compartments causes personnel to strain to reach some of the rescue equipment.

Recommendation 75: Develop an apparatus replacement plan for the TRC units and equipment. Both TRC units, Rescue 11 and Rescue 42, need replacement. Their replacement might be staggered to spread cost and allow faster introduction of new technology in the future. Rescue 11 should be replaced first and their current vehicle rehabilitated for use as a reserve Rescue unit. Then replace Rescue 42, rehabilitate the current Rescue 42 and assign it as a reserve unit to the HMRT. Personnel assigned to both the TRC and HMRT should provide input into the design and rehabilitation of both units. (Replacement for both TRC units has been included in the FY02 budget.)

An Extrication Technician is responsible for the budgeting, repair, and maintenance of all hydraulic rescue equipment assigned to the TRC, ARFF, and truck companies throughout the City. This position reports to the TRC District Chief. Relocating the position on the organizational chart so it reports directly to the Assistant Chief might allow for better budgeting, operation, and communication between the divisions requiring repair/maintenance services, but it could also stay where it is. (This decision can be left to the HFD.)

Houston Medical Strike Team – The HMST is a specialized multidisciplinary response team whose mission is to assist local emergency responders in addressing responder safety issues, incident management, and public health consequences involving Weapons of Mass Destruction (WMD) of a nuclear, biological, or chemical (NBC) nature that result from accidental or deliberate acts. This support includes providing planning and training to response personnel prior to an NBC incident; identification of the offending substance or agent; safe extrication of victims from the contaminated area; triage, decontamination, and treatment of victims; and transportation of victims to medical facilities. The Team consists of paramedics, hazardous materials and medical specialists from the HFD; epidemiologists and physicians from the Houston Department of Health and Human Services; tactical unit personnel from the Houston Police Department; and private physicians and toxicologists. The Team's activities are conducted in collaboration with and supported by Federal, State, and Local authorities.

The HMST is a component of the larger Houston Medical Response System (HMRS), whose primary purpose is to augment local mass casualty response capabilities for NBC incidents in the City of Houston and, when possible, other jurisdictions. It also helps address time-critical public health and medical consequences of NBC incidents.

A secondary purpose of the HMRS is to facilitate the integration of State and Federal resources into local response operations. That integrating function is critical because any minor or major NBC incident could exhaust the available public health and medical response resources in Houston, necessitating a State and/or Federal response. State and Federal resources can then be accessed through the Texas Division of Emergency Management. Utilizing State channels is required. To ensure continuity with the City's Emergency Management Plan, the City's Division of Emergency Management is responsible for maintaining the HMRS Operational System Description. The Emergency Management Division also is responsible for coordinating other multi-department emergency operations. It would therefore seem that the Emergency Management Division is better suited to oversee the HMST.

Recommendation 76: Consider transferring oversight and organizational placement of the Houston Medical Strike Team from the HFD Special Operations Division to the Division of Emergency Management. The HFD would still oversee its medical and hazmat functions, and HFD personnel would be assigned to the team. (As of 2002, the City is leaving the Strike Team in the HFD, but administration and coordination with other agencies will be handled by Emergency Management.)

Urban Search and Rescue Team – Texas Task Force I (TX-TF1) is an Urban Search and Rescue response team designed to provide a coordinated response to disasters in urban environments. It is comprised of 186 personnel on three 64-person teams, which include two WMD technicians and represent 48 fire departments and organizations from throughout the State. 26 Team members are HFD firefighters. The Team is based out of College Station and trains at Texas A&M University. Recently, the Team was accepted into the National Urban Search and Rescue System that is coordinated and regulated by the Federal Emergency Management Agency (FEMA). However, the Team will not be FEMA-deployable for approximately one year.

Before and during deployments, an HFD coordinator on the Team ensures that the HFD command staff are apprised of the Team's whereabouts and the expected length of their deployment.

Largely, the Team's headquarters in College Station coordinates training and operational activities.

The current organizational structure for HFD personnel assigned to the Team appears adequate, and we have no recommendation to change it.

Airport Operations

Houston Airport Systems (HAS) operates three airports: George Bush Intercontinental Airport; William P. Hobby International Airport; and Ellington Field. The HFD provides personnel to serve as the Aircraft Rescue and Firefighting (ARFF) crews at Bush Intercontinental and Hobby International Airports. HFD also provides EMS and structural fire protection to the airports. Airport fire operations fall under the Assistant Chief, Emergency Special Operations Command.

Airport Levels – Bush Intercontinental Airport consists of more than 8,000 acres. The airport has four runways, four terminals, an airport hotel, an air cargo distribution center, and over 19,000 vehicle parking spaces. This airport is designated by the Federal Aviation Administration (FAA) as an Index "E" airport, which can accommodate the largest passenger carrying aircraft currently in service.[23]

Hobby International Airport has four runways and a main terminal building. It is a major regional center for corporate and private aviation aircraft. This airport is designated by the FAA as an Index "C" airport, which can accommodate all but the largest narrow body passenger-carrying aircraft currently in service.

Ellington Field is an FAA Index "C" airport that does not accommodate routine air-carrier operations. It has a unique client base that includes the military, the United States government, National Aeronautics and Space Administration (NASA) and the private sector. No permanent fulltime ARFF services are provided at Ellington Field and for that reason it was not included in the scope. Emergency response is provided by regular HFD units located in the vicinity of the airport.

[23] The assigned index of an airport also determines the minimum firefighting requirements, as will be discussed below.

Functioning as an enterprise fund, the HAS is financially self-sufficient with income from fees, rents and other charges to airport tenants and users. Surpluses are reinvested into capital development and bonding support programs. The HAS provides the ARFF stations, vehicles, equipment, and administrative support. All ARFF personnel are members of the HFD, but the HAS reimburses the City for their costs. Aviation activity within the system has increased significantly over the past several years in terms of aircraft operations, passenger enplanements and deplanements, and air cargo.

Growth in airport volume has been somewhat more dramatic at Bush Intercontinental then the other airports, but the entire airport system is projected to continue growing well into the future.[24]

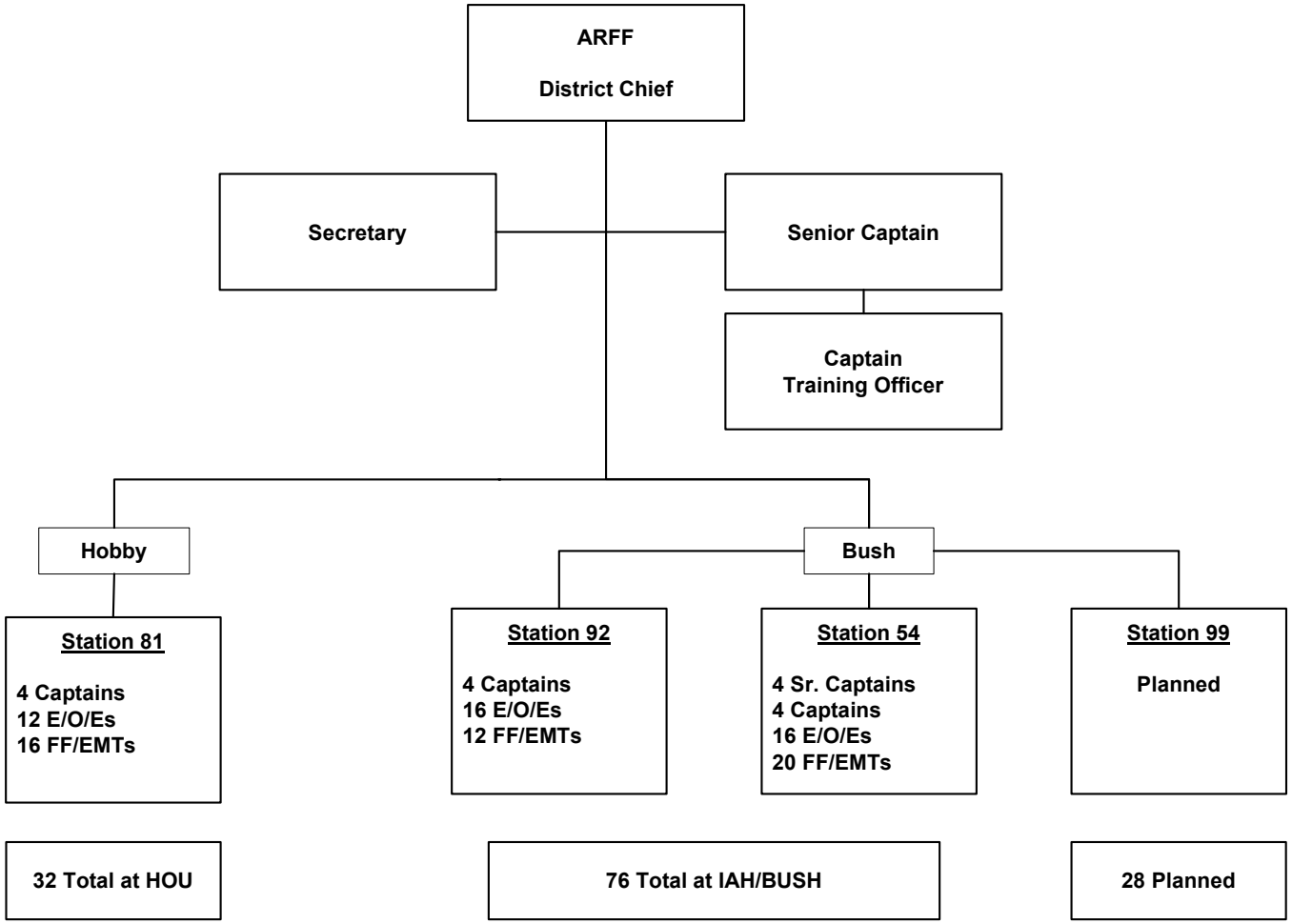
Organization and Staffing – The airport ARFF units are designated as District 54 within the HFD. They all are under the command of a District Chief who reports to the Assistant Chief for Special Operations. The same District Chief has responsibility for the HFD Rescue Team.

District 54 has 111 authorized FTEs. Like the rest of the department, they are staffed 24-hours a day using a four-shift system. Administrative and operational services are primarily based at Station 54 at Bush Intercontinental Airport. There are 76 firefighters and three administrative personnel at Bush Intercontinental Airport, and 32 at Hobby International Airport. The organization chart is shown in Figure 15. General administrative support is provided by an administrative secretary who is nominally assigned to the District Chief and works at Station 54. She supports much of the unit's clerical work and is an employee of the HAS, not the HFD.

There are two stations with 76 personnel assigned across four shifts at Bush, in Stations 54 and 92. Station 54 is planned for replacement. A third station, 99, is planned to be added, with an additional three vehicles and seven personnel per shift, 28 personnel in total. There is one station with 32 personnel assigned at Hobby. Table 32 shows the personnel assignments by shift.

[24] The HAS, "Preparing for the Millennium," Ricondo & Associates, Inc.

Figure 15: HFD Aircraft Fire Fighting Operations Organization



Totals reflect all four shifts

Legend:

Senior Captain = Assigned Captain in Charge

E/O/E = Cross-trained Engineer/ Operator/Emergency Medical Technician

FF/EMT = Cross-trained Firefighter/Emergency Medical Technician

Table 32: Current Airport Personnel Assignments

	Bush Airport		Hobby Airport
Station number	Station 54	Station 92	Station 81
Assigned crew per shift	11	8	8
Minimum crew per shift	10	7	7

While there are minimum staffing standards for ARFF, there are no adequate guidelines or data on the optimum, most cost-effective staffing (as is the case for structural firefighting, too). The military has stricter, better-documented staffing requirements for ARFF, but no published justification for them.

In general, the staffing at Bush Airport appears to be adequate for the range of incidents it handles. It exceeds the FAA minimum requirements and usually has two people per ARFF unit, versus the one used in some airports. We think the higher level of staffing per unit is safer and leads to more efficient operations when a critical emergency occurs. Adding a third station will help improve response times and adds to the resources available for a large incident or multiple simultaneous incidents.

Hobby Airport ARFF seems slightly understaffed. To maintain a minimum crew of seven requires about 8.75 personnel per shift, accounting for leave. In whole numbers, 9 firefighters are needed versus the 8 currently assigned to each shift. The single station there needs to be more self-sufficient, with ARFF trained personnel available to fill in. At a minimum, the staffing should be rounded up, not downwards. Traffic is growing there as well as at Bush.

Recommendation 77: Add one firefighter per shift at Hobby. This should provide enough people to handle leave and reduce staffing shortages or need for overtime. (As of January 2002, this is not yet done due to budget limitations.)

The ARFF organization is large enough and specialized enough to merit its own chief. The ARFF operation should be organized as a new division with its own District Chief in command.

With the planned expansion of resources and the increase of personnel at Bush Intercontinental Airport, a District Chief is needed full-time to manage all ARFF related operations at both airports, and 14 other personnel. The airport operations are large enough and specialized enough to warrant this position. The next two years are critical to

manage well as the ARFF organization expands. Although most of the planning has been finalized, a full time manager should be responsible to monitor the progress of the construction of the two new stations and the purchase of several new specialized vehicles, as well as all fire department operations at the airports. Selection and training of new personnel to be assigned to this unit is highly important. All aspects of ARFF emergency response at Bush Intercontinental must be reviewed, and a number of revisions made, as discussed below.

Recommendation 78: Create a new position of Airport Operations District Chief. A dedicated, full-time District Chief who has direct and constant communications with the HAS airport management would be in the best interest of both the HFD and the HAS, at least for the next two years. (An equivalent ARFF Coordinator position was created and filled in 2001. A Training Coordinator position was also staffed.)

Assignment of Personnel – The department-wide practice of "bidding" for station assignments is not the best way to select personnel for the airport units, nor other specialized units. The practice can result in an imbalance of personnel qualifications and service experience at the airports, e.g., too many relatively young and aggressive firefighters in some locations and too many relatively senior and perhaps less aggressive firefighters in other locations.

In the airport emergency response environment, perhaps more so than other emergency response environments, there is potential for responders to be confronted with a nearly overwhelming situation immediately upon arrival at the emergency scene. Additional support units may be more than several minutes away. The initial responders must be prepared and capable of engaging in a highly stressful situation and possibly extended physical exertion beyond what is normally anticipated in other assignments.

A secondary impact of the "bidding" system for personnel assignments is that it may limit the pool of qualified and desirable personnel with airport experience from remaining within the unit after seeking promotional opportunity.

Recommendation 79: Revise the District 54 personnel assignment procedures (and preferably procedures for all specialized units and functions). More flexibility is needed in selecting personnel for the ARFF units. Greater flexibility would be appropriate for all specialized units. A minimum two-year commitment should be requested for all Special Operations assignments. (The HFD is planning to change the Guidelines to allow this.)

Response Procedures – The ARFF units at Bush Intercontinental Airport responded to 1,566 incidents in 1999, of which 109 were aircraft-related and 1457 were emergency medical calls. Station 81 at Hobby International Airport responded to 350 incidents in 1999, of which 26 were aircraft-related and 324 were emergency medical calls. Though statistics for responses to structural and vehicle fires and miscellaneous services unfortunately are not tracked separately for the ARFF units, it is clear that the EMS calls dominate the emergency workload at the airport by far.

The airport units are self-sufficient for the majority of incidents to which they are called. Most are small fires or individuals needing medical assistance. They rely on automatic response or response upon request from surrounding HFD department units for larger events and when multiple events occur simultaneously.

Recommendation 80: Initiate statistical tracking of the various types of emergency service responses by District 54 units, and by other units to the airport. Data on the total set of calls by type of call and unit needs to be available for management purposes. Internal "mutual aid" should also be tracked to get a better quantitative picture of total fire department support to the airport. (The HFD has begun this task.)

ARFF response times seem satisfactory and are meeting FAA minimum requirements. However, at both airports the current practice is for Airport Operations personnel to investigate initial requests for emergency services that are not aircraft-related before notifying and dispatching the ARFF units. This is an unsafe practice that could result in a substantial time delay in the arrival of appropriate emergency units at a serious incident.

Recommendation 81: The practice of having airport operations personnel investigate requests for emergency services before notifying the fire department should be discontinued. This process should be replaced with a system that provides an initial simultaneous dispatch of ARFF and Airport Operations units to all requests for emergency assistance. This change should be discussed with the FAA Regional Certification Inspector. (The HFD agreed, and the practice was changed.)

Regulatory Considerations – Airport fire units are subject to a wide variety of federal regulations. Some of the key regulations, briefly summarized, are as follows:

VEHICLE INDEX REQUIREMENTS: The minimum FAA requirement for serving an Index "E" airport (Bush Intercontinental Airport) is three ARFF vehicles and the

minimum for an Index "C" airport (Hobby International Airport) is two ARFF vehicles.[25] The standards do not speak to vehicle staffing; each required vehicle could be staffed by as few as one driver/operator. However, this is not a viable level of staffing given the need to respond to structural fires, EMS calls, and other miscellaneous events.

RESPONSE TIME STANDARDS: Federal Airport Regulation (FAR) 139.319 mandates that the ARFF unit "must have the ability to respond within three minutes from the time of the alarm with at least one vehicle to the midpoint of the farthest runway serving air carrier aircraft … and begin application of agent."[26] Within four minutes from the time of the alarm, all other required vehicles must be able to do the same.

RESPIRATORY PROTECTION REQUIREMENT AND THE TWO-IN/TWO-OUT RULE: The Occupational, Safety and Health Administration (OSHA) consider aircraft cabins to be "confined spaces" and therefore subject to the "Two-In/Two-Out" requirements. OSHA defines interior structural fire fighting as "the act of providing fire suppression or rescue inside of a building or other enclosed structure." "Two-in/Two-out" is defined as having a two-person team outside a confined space and available to rescue firefighters inside, starting with the first two person team. The teams must be in direct voice or visual contact at all times.[27]

The NFPA 1500, Fire Department Occupational Safety and Health Program defines structural firefighting as "the activities of rescue, fire suppression, and property conservation in buildings, enclosed structures, aircraft interiors, vehicles, vessels, or like properties that are involved in a fire or emergency situation."[28] Thus NFPA as well as OSHA safety regulations and guidelines for firefighting have been interpreted to apply to airport fire units, including specifically aircraft crash and rescue units. While not a legal requirement unless locally adopted, the NFPA standards tend to be considered good practice.

[25] Federal Aviation Regulation, (FAR) Part 139.315 "Certification and Operations: Land Airports Serving Certain Air Carriers"
[26] FAR Part 139.317
[27] 29 CFR 1910.134 Occupational Safety and Health Administration.
[28] National Fire Protection Association Standard 1500, Fire Department Occupational Safety and Health Program, Chapter 1 (1997 Edition).

The recommendations in this study considered these NFPA standards as well as FAA regulations and other national standards and practices.

Mission Identification – Airports are vulnerable to a multitude of emergency and disaster situations. When an emergency occurs, there is the potential to create widespread disruption to the operation of the airport, affecting many lives and resulting in an adverse impact on the airport related economy. Consequently, the aviation community must apply a broad vision toward safety and protection of the infrastructure. All-hazard rapid intervention elements are established as a first wave response to assess, control and abate emergency conditions.

The mission of the airport units is described in Federal Aviation Regulation (FAR) Part 139, the Airport Certification Manual, and the Airport Emergency Plans at each airport.[29] The aircraft rescue units are tasked with primary emergency response to incidents involving: aircraft emergencies and accidents; structural, and other fires; emergency medical service requests; and hazardous materials incidents. Additionally, the units are tasked with responding to natural disasters and terrorist related incidents including bomb threats, aircraft hi-jacking, and hostage situations. Such a broad mission requires special resources and fleet flexibility.

For the primary mission of aircraft-related incidents and accidents, three basic operational areas are identified: external firefighting operations to establish and maintain evacuation and rescue paths; internal firefighting operations to assist in evacuation and initiate rescue activities; and firefighting support operations that allow uninterrupted initial operations. Directly associated with this mission, and critical to its success, is the need for rapid initial EMS interventions, followed by a potentially large scale EMS operation involving massive resources from within and outside the Department.

The secondary mission of the District, response to and support of EMS calls at the airport, is assigned primarily to a small fraction of the on-duty shift assignment, but they handle a high percentage of the emergency response calls.

[29] HOU and IAH Airport Certification Manuals, Airport Emergency Plans.

For the third mission, responding to on-site structural incidents, the on-site units should be self-sufficient and self-contained as much as practical to avoid initial dependence on off-site, automatic response by other HFD units with longer response times. They can be multi-purpose units that also serve as the initial interior firefighting and rescue teams at aircraft related incidents.

Equipment and Supplies – A variety of special equipment and supplies are needed to support the airport fire operations missions described above. Generally the amount and type of uniforms, PPE, tools, and equipment being used by the HFD are satisfactory. The exception is the EMS equipment designated for use at a mass casualty aircraft crash site.

MASS CASUALTY SUPPLIES: Mass casualty supplies are stored in enclosed mobile trailers at a designated ARFF station at each airport. In the event of an aircraft crash these trailers are to be towed to the incident site by airport personnel other than the ARFF units.

The supplies on hand at each airport to cope with a mass casualty incident are very limited. The FAA requires that the Airport Emergency Plan address or include "to the extent practical, provisions for medical services, including transportation and medical assistance for the maximum number of persons that can be carried on the largest air carrier that the airport reasonably can be expected to serve."[30] At Hobby International Airport (Index "C") this equates to a Boeing 757 aircraft that can carry approximately 270 passengers and crew, and at Bush Intercontinental Airport (Index "E") this equates to a Boeing 747 that can carry approximately 500 passengers and crew. Many FAA regional certification inspectors use a rule of thumb of having an amount of medical supplies on hand to accommodate one-half of the passenger and crew total. The requirements should be discussed with the regional certification inspector for each of the two airports.

Recommendation 82: Upgrade and increase the mass casualty supplies on hand. The amount should be consistent with at least the probable number of surviving casualties to be encountered at each airport in the event of a crash. Additionally, the supply delivery system at each location should be reviewed. When the systems are upgraded, the supply trailers must not exceed the towable weight of the assigned

[30] FAR Part 139.325

vehicles, a mistake that has been made elsewhere and often not discovered because of the infrequency of use of the trailers. This change, too, should be discussed with the FAA Regional Certification Inspector. (Not yet done, but still important for disaster preparedness.)

PERSONAL PROTECTIVE EQUIPMENT (PPE): The FAA identifies minimum standards for design, performance, testing, and safety of personnel protective equipment (PPE) for airport firefighting. To limit duplication of work product, national consensus standards have been carefully reviewed and incorporated, as appropriate, with the resulting recommendations and modifications. NFPA 1971, Protective Clothing, Proximity Fire Fighting addresses this issue.

Components making up the ARFF user's PPE include coat, pants, flash hood, helmet, gloves, and boots. Proximity suits have an aluminized outer shell and insulated inner layers. The proximity suit ensemble should withstand occasional short-duration flame contact but is not designed for fire entry. Personnel assigned to Division 54 are provided appropriately with ARFF-related Personal Protection Equipment (PPE) by HAS. The PPE seems satisfactory.

Stations – At Bush Intercontinental Airport, the design of the planned new station (99) and the replacement station (54) are well underway, with construction bids expected to be announced in the Fall of this year. Construction is expected to take approximately eighteen months. The stations will be built simultaneously. Demolition of the existing Station 54 will not take place until ARFF operations are moved into the new facilities. The current station at Hobby International Airport is satisfactory.

Vehicles – The airport fleet consists of a variety of standard and specialized emergency response apparatus and equipment, each designed and equipped to support a specific primary mission. The fleet is generally satisfactory.

The HAS-ARFF units currently exceed the FAA minimum requirements. The ARFF vehicles approaching the 12-year FAA recognized fleet life expectancy should be scheduled for replacement and included in the Capital Budget process.

The next set of replacement vehicles should include the most current technologically advanced equipment, especially the latest generation of elevated turrets with piercing devices; driver enhanced vision; and environmentally clean extinguishing

agents. The vehicles will need to serve for more than a decade, and should not be technologically obsolete before their time.

Requests for proposals to provide new vehicles were planned for Summer 2000. The vehicles were to include two major ARFF vehicles each with 3000 gallons of water, and one rapid intervention ARFF vehicle with between 100 and 1500 gallons of water. The ARFF may include one new structural firefighting vehicle for the new Station 99, and one structural vehicle to replace the current one at Station 54. Delivery of these vehicles is expected to be in time for completion of the two new fire stations.[31]

There are a number of technological advancements now available that can enhance emergency response for the HFD District 54 units. The following features should be considered when developing specifications for new ARFF vehicles:

ELEVATED AIRCRAFT SKIN-PENETRATING DEVICES: These are like large hypodermic needles with holes along their length to release extinguishing agent after penetrating the skin of an aircraft. An analysis of aircraft accidents involving external fuel fires shows that the penetrating devices are needed for fighting fires within the aircraft fuselage, which are difficult to extinguish with conventional interior fire attack equipment. The conventional equipment does a good job on exterior fires but not interior ones, including the passenger department. Recent full scale testing of skin-penetrating devices have demonstrated that using an application rate of 375 gpm for less than two minutes, a severe interior fire in a commercial air carrier can be successfully controlled. Positioning of the attack vehicle, making the aircraft skin penetration and applying water took less than 40 seconds from time of vehicle arrival at the aircraft. Interior thermocouple profiles recorded that the injection of water provided immediate results in lowering the interior temperatures.

POOR VISIBILITY RESPONSE: Emergency response during daylight hours with clear and dry road conditions is, at best, a difficult task. Compound this by changing conditions to nighttime hours with heavy rain and/or fog conditions, and/or the smoke accompanying a fire, and the difficulty of the task is magnified many times.

[31] District 54 leadership did not have the specs nor know whether the new technology was to be incorporated in the vehicles. There seems to be a gap that needs closing; the operational personnel should know the specs of specialty vehicles being ordered for them and participate in their development.

The new technology to cope with these conditions is the Driver's Enhanced Vision System (DEVS), an integrated system of sensors, computers and navigational equipment that permits response under conditions of fog, rain, snow, sleet and smoke. A Forward Looking Infrared (FLIR) system is a key component of this system. The FLIR technology is most effective when combined with a Global Positioning System (GPS) with moving map capability, to show the driver exactly where he is. The system should also include a central data command radio frequency link that allows direct communications and vehicle tracking capability between vehicles and a central communication base. All of these elements can be integrated into a single relatively low-cost functional system. A fully functional system in currently in place in a major northeast corridor airport, and other installations are being planned.

CLEAN FIREFIGHTING AGENTS: Following the 1992 Montreal Protocol, the US Environmental Protection Agency developed a program to phase out the production and use of chlorofluorocarbon chemicals, including those used for firefighting. At that time, the FAA began testing and evaluating a number of Halon 1211 alternatives that could be used on airports. One alternative agent, Halotron-I, has been approved for use at FAA certified airports. While the FAA does not require the use of any particular clean agent, Halotron-I can be used as an economic alternative to dry chemicals in certain aircraft-related fire scenarios.

Clean agents are being used not only for ARFF applications, but also for a wide range of firefighting scenarios where collateral damage that normally occurs in the act of extinguishment must be kept to a minimum due to the sensitivity of the equipment involved in the fire. The use of the appropriate extinguishment agent can greatly reduce the amount of time later required to repair and or restore fire-damaged equipment in many scenarios.

Recommendation 83: New ARFF vehicles should include the most current technologically advanced equipment, including elevated turrets with piercing devices, aerial ladders or platforms, halon alternative clean firefighting agent, and Driver's Enhanced Vision Systems (DEVs). This upgrade should be coordinated with Houston Airport Systems. (The next new ARFF unit, AR7, is scheduled for 2002.)

Radio Communications – FAA Advisory Circular No.150/5210-7C, *Aircraft Rescue and Firefighting Communications*, recommends communications capabilities and protocols for airport emergency use. One is the Discrete Emergency Frequency (DEF),

which establishes a direct link between the emergency aircraft flight crew and the ARFF Incident Commander.[32] This allows for the exchange of critical information regarding the emergency aircraft status. The DEF capability should be used selectively at the direction of the air traffic controller. This capability already has been implemented at the HAS airports, a good idea. However, while there is a protocol in place to use the DEF, not everyone knew it existed let alone the protocol for its use.

More broadly, there are some aspects of ARFF training on communications that are a problem at both airports. During emergency responses, units are required to monitor and/or communicate on three separate frequencies: airport ground control; airport operations; and Houston Fire Department. There seems to be a policy problem concerning assignment of units and the frequencies each unit must monitor during various phases of an alarm. An HFD memorandum addresses this situation, but the Training Officer has identified several modifications needed to the current procedures. With some minor changes in procedures and equipment location, and reinforced with training, this situation can be improved.

Recommendation 84: A review of airport radio communications procedures should be initiated to eliminate the procedural problems involving multiple frequencies. The HFD was working with Airport Operations and its own Communications Command to eliminate this problem. Consideration also should be given to relocation of specific frequency speakers within vehicles. Training should be given on the communications protocols so that all are using them consistently. (According to the HFD leadership in 2002, the problem is being addressed.)

Training – There are two levels of training for ARFF personnel. They participate in the HFD mandated program and they have a separate ARFF program that complies with FAA and State of Texas requirements. Recent FAA inspections noted deficiencies in the training program and required improvements. The training programs at both airports are being restructured and appear to be consistent with the FAA requested improvement. However, implementation of the new programs may present some challenges.

The FAA has many training requirements for ARFF firefighters. FAA Part 139, section 319(j) requires that "each holder of an airport operating certificate shall ensure

[32] Section 6 (Overview of Airport Emergency Communications), paragraph (e)(1).

that firefighting personnel are properly trained to perform their duties.[33] The training curriculum shall include initial and recurrent instruction." There are eleven basic topics prescribed. Included is the requirement that all rescue and firefighting personnel participate in at least one live-fire drill every 12 months. The objectives of this training are: to enhance firefighter confidence in his/her ability and equipment; to provide firefighting experience commensurate with the level of public protection indicated by the ARFF Index of the airport; and to develop effective firefighter tactics, strategies and procedures. The FAA strongly encourages that all firefighting personnel meet the requirement for the annual fire training with a ground fire exercise and augment or supplement the training with interior and exterior simulations.

Realizing that many ARFF crews may not have access to live-fire drills more than once a year, and that there is a benefit for crews to have experience in simulations and ground/pit fires, the FAA has allowed Index "C," "D," and "E" airport firefighters to substitute an interior/exterior fire simulation for a live fire every other year. Two interior/exterior fire simulator-training exercises in two consecutive years cannot be used to count as the annual training requirement. The interior/exterior fire-training simulator may be stationary or mobile and must be a size commensurate with the airport's index.[34] And, while the substitution of an interior/exterior fire simulation is optional, the ground fire pit exercise is not.

INITIAL TRAINING: Candidates for vacant positions within the ARFF unit come from other units of the Houston Fire Department and all are already certified to State of Texas Firefighter Level I and II. Prior to assignment at District 54 they must be trained to meet minimum FAA requirements (approximately 40 hours of ARFF specialty subjects). Prior to assignment and working without supervision, all new ARFF candidates also receive approximately 200 additional hours of airport-related training. The training includes the 120-hour Texas State Certification ARFF Course and an 80-hour Airport familiarization course. It includes communications, operation of ARFF vehicles, tools and equipment, airport and aircraft familiarization, responsibilities under the Airport Emergency Plan and other specific items identified by the FAA. Members initially assigned to the Hobby International Airport receive an additional training course,

[33] Federal Aviation Regulation, (FAR) Part 139.315 "Certification and Operations: Land Airports Serving Certain Air Carriers"
[34] FAA-Advisory Circular-150/5210-17, Programs for Training of ARFF Personnel.

"Fuel Line Inspection Training" related to airport fuel handling safety inspections. The current HFD training program also calls for a minimum of three (3) hours of continuing education daily.

While not required by the FAA, a worthwhile goal of the training program would be to enable personnel to meet the proficiency criteria detailed in NFPA 1003, Standard for Professional Qualifications for Airport Fire Fighters. It specifies in terms of performance objectives the minimum requirements of professional competence required for service as an airport firefighter. A training program that fulfills the professional qualifications identified in NFPA 1003 is acceptable to the FAA Administrator as proof of adequate training. A training program that fulfills the criteria for the applicable state-level airport firefighter certification is also an acceptable means of meeting the requirement. The Texas Fire Training Commission curriculum meets or exceeds the training objectives of NFPA 1003.

RECURRENT TRAINING: The FAA minimum requirement for annual recurrent training is an eight hour refresher course covering the same topics as in the initial training course, and a series of aircraft-related simulations: Class B flammable liquid fire of an appropriate size for that airport Index; a wheel assembly fire; an engine nacelle fire; an auxiliary power unit fire; an interior cabin fire; and a baggage compartment fire. This training is reinforced with an annual review of the Airport Emergency Plan by all responding agencies.

As is true for Initial Training, a worthwhile goal of a recurrent training program is to meet the objectives offered in NFPA 405, Recommended Practice for the Recurring Proficiency Training of ARFF Services personnel.

TRAINING REQUIRED BY THE AIRPORT CERTIFICATION MANUAL/AIRPORT EMERGENCY PLAN: All persons having responsibilities designated in the Airport Emergency Plan (AEP) are required to be trained in the actions they are expected to perform during emergencies. The Airport Certification Manual/Airport Emergency Plan (ACM/AEP) identifies emergency response assignments to aircraft emergencies, fires, medical emergencies, hazardous materials incidents, natural disasters, hi-jack and terrorist actions, and off-airport responses. Training specific to each of these situations must be provided.

EVALUATION OF ARFF TRAINING: The current system of in-house ARFF training is not totally adequate and is being revised. There is a good basic structure in place, but it is not applied consistently after initial training and beyond the annual FAA-mandated subjects.

Perhaps the largest shortcoming is that there is little or no hands-on training being conducted at either airport. Some practical training is done annually at the HFD training facility located near Hobby International Airport, but this training is not consistent with the annual recurrent training required by the FAA. There also appears to be a lack of vehicle operations training, particularly firefighting evolutions using bumper- and roof-mounted turrets.

Aircraft rescue firefighters may have to be sent off-site for some of the regional training. There are several cost factors to be considered when sending members off-site for FAA mandated training, including registration; transportation; lodging; meals; crew coverage; and possibly overtime. The per member cost (excluding overtime and crew coverage) could vary from a little as $300 for a one-day, live fire training evolution only, to as much as $2,000 or more per member for a one-week, full ARFF annual refresher and re-certification course.[35] That would cost $200,000 per year, but live fire training is required. This makes developing HFD's own ARFF training facility more attractive for long-run cost savings as well as convenience and quality of the training.

FAA initial and recurrent training is available at the Dallas/Fort Worth International Airport Training Facility and the Texas A&M Training Facility. Both facilities conduct ARFF training that complies with the State of Texas ARFF requirements and that is acceptable to the FAA regional certification inspector. Visits to each facility confirmed their individual strengths. Based on the existing facilities and training staff experience, the Dallas/Fort Worth International Airport facility appears to be the better of the two off-site choices for the HFD to use, although use of Texas A&M is less expensive. Training also could alternate between these two sites.

Recommendation 85: All ARFF personnel should participate in full-scale fire training at a flammable liquid hydrocarbon facility at least in alternate years, as required by the FAA. This is already being done. Used in conjunction with on-site

[35] Phone survey conducted with various training facilities and course advertisement materials.

training and simulations, this optimizes training cost-effectiveness. The final decision as to which facility is used for a particular group or specific training requirements should be made by the HFD District 54 training staff.

ADDITIONAL LIVE FIRE TRAINING OPTIONS: An ARFF training facility is intended to provide personnel with realistic training in the application of extinguishing agents on an appropriately sized fire area using the ARFF vehicles. If training is to be meaningful, it must be a practical representation of the operational task. Ideally, a training facility for a given aircraft size should have a burn area structure that can simulate a fire extinguishing task that a trainee will perceive as an equal challenge. While this is not practical at either of the airports, the HFD training facility adjacent to Hobby International Airport could be modified to accommodate the FAA-identified training scenarios such as the following:

> ***Class A Fires*** – Baggage compartment and interior cabin fires, such as galleys, cockpit, lavatory, trash containers, that can be accessed through replaceable forced entry exterior panels or doors; and landing gear, brake/wheel fires by an under-the-wing landing gear device.
>
> ***Class B Fires*** – Pool fires, engine nacelle fires, and ruptured wing fuel fires. The last two shall provide cascading or three-dimensional fire training exercises.

For safety reasons, Class C (energized electrical) and Class D (combustible metal) fires are not to be part of the mockups. Separate stand-alone features would be needed for these scenarios.

For the long run, consideration should be given to the new technology of computerized virtual reality training simulators for incident command and control. These systems are safe, and the scenarios are flexible, repeatable and allow for non-biased scoring of performance. Currently available models range from fairly basic programs to multiple scenario programs involving multi-unit and multi-jurisdictional response. These systems meet the requirements of FAA Advisory Circular 150/5210-18 "Systems for Interactive Training of Airport Personnel." Several manufacturers have demonstrated computer systems that can simulate the incident command and control structure used at most airports. Each of the required pre-planned emergency situations required by FAA for inclusion in the Airport Emergency Plan can be developed to be site specific. Using these simulation systems, airport personnel will be able to work jointly with other

responders and organizations, from both on and off the airport, to practice team building and command and control skills.

Virtual reality vehicle drivers training models are also available. These systems need not be ARFF specific; they can be designed to include all units that function on the airport. The "driver" is able to see him/herself at the wheel of an assigned vehicle while responding with other vehicles in a coordinated manner. Driver actions and reactions influence the relationship with other vehicles and personnel. These systems provide ability to monitor and record the skill levels and progress of entry-level trainees, and to reinforce the skills of members involved in recurrent training.

While not intended to replace the required hands-on training of vehicle drivers, the great reduction in the use of front line response equipment for driver training tasks should translate into reduced vehicle maintenance and extended replacement times.

Recommendation 86: Consider obtaining virtual reality training simulators for ARFF units. They will improve skills and readiness using safe, objectively reasonable training. Staff visits to some of the leading simulator manufacturers and fire exhibitions are needed to evaluate the state of the art and its applicability and affordability for the HFD. (As of 2002, this was not yet done, but the HFD is working with HAS to upgrade the capability for in-house training.)

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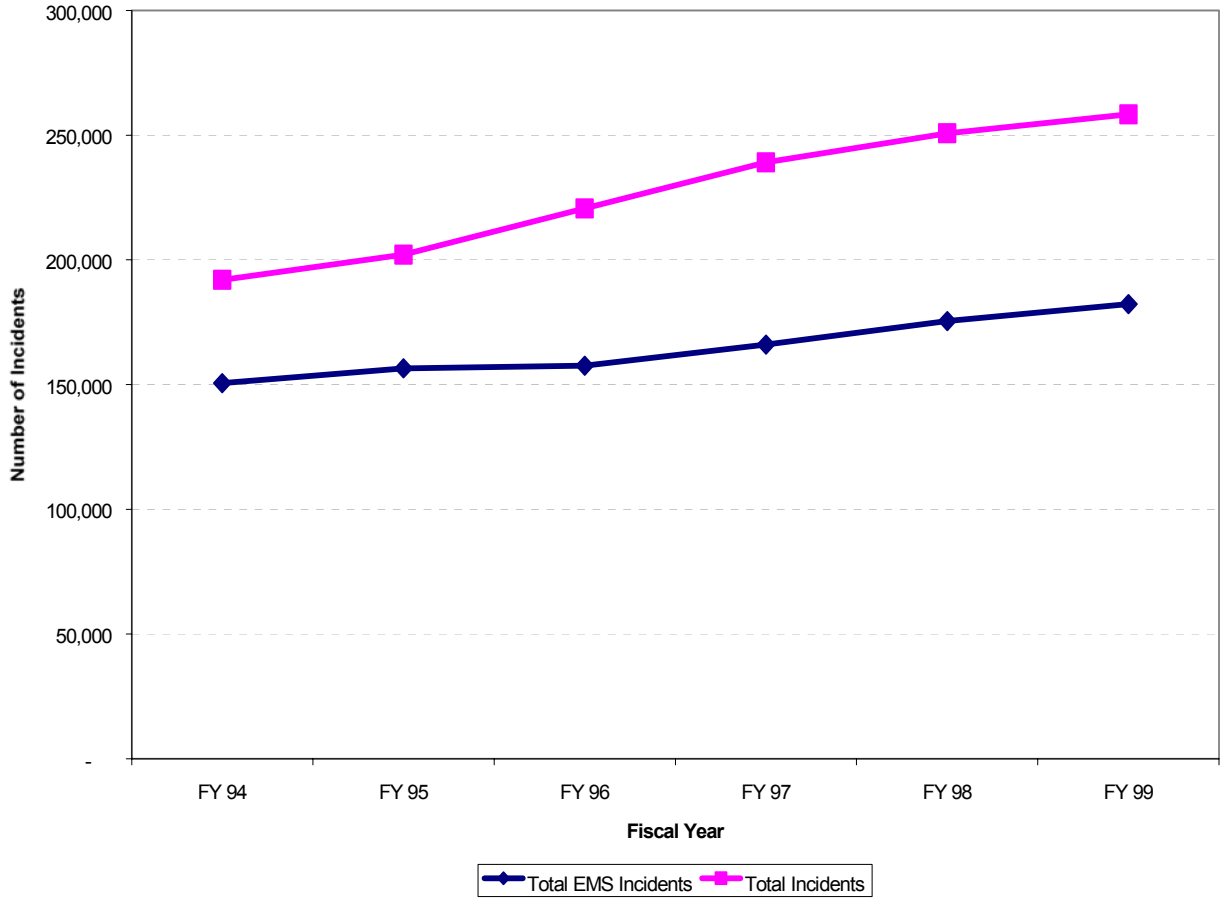
During the course of this study there was an aircraft accident at Hobby International Airport involving a Beechcraft Barron (BE-55) general aviation aircraft, that resulted in six civilian fatalities. A formal critique of the HFD response was conducted by the Houston Airports System (HAS), the HFD and the National Transportation Safety Board (NTSB). The overall ARFF response was determined to be very good, with the ARFF units arriving on the accident site in approximately one minute and ten seconds and the fire being extinguished shortly after that. The formal investigation of the cause of the accident is still being conducted by the NTSB, and could not be reflected here, but the initial conclusion reflected well on HFD Airport Operations.

VI. EMERGENCY MEDICAL SERVICES

EMS calls comprise the majority of emergency calls to the HFD and are trending upward as shown in Figure 16. Although some recent unfortunate incidents and related articles in the local media might indicate otherwise, the HFD has enjoyed a well-deserved national reputation for excellence in the delivery of emergency medical services, and especially in its medical direction and quality control. The HFD has been a pioneer in the establishment and integration of the dual-role, cross-trained firefighter/paramedic model, demonstrating that the merging of two different cultures, fire suppression and EMS, can be a success. The HFD continues to be a leader in emergency medical control innovations and EMS field research. The last few years' data on "saves" from cardiac arrests validate this view. As one firefighter/paramedic put it, "the rubber is meeting the road."

Figure 16: Incident Data (FY94-FY99)



Pressures on the System – The HFD reputation for medical excellence is in jeopardy. Rising EMS call volume is exerting a variety of pressures on the system, which include:

- High ambulance utilization rates in the more densely populated areas of the City during certain hours of the day
- Mediocre ambulance response time performance (in particular, Medic/ALS ambulances)
- Staff shortages (in particular firefighter/paramedics)

There is a mismatch between demand for services and the supply of responding apparatus and personnel. This mismatch is causing the occasional long response times that have been depicted in the media of late.

Future Alternatives – As will be discussed in detail later in this chapter, there are two distinct approaches the HFD could employ to alleviate these pressing problems. They are summarized below to help the reader keep in mind where we are headed, as the details of the complex EMS system are discussed. The two major options are:

1. Add more resources to the system within the current configured system design – about 15 additional ambulances (eight ALS and seven BLS), and 115 firefighter/paramedics and 170 firefighter/EMTs to both shore up staffing shortages and staff the new ambulances; or
2. Reconfigure the EMS deployment system to utilize existing resources more efficiently, plus add more resources. This option is more complex to implement and includes the following EMS system component changes, which will improve the quality as well as the efficiency of the EMS services:
    - Conversion to an all-ALS system (each call receives an ALS response)

- Basing the majority of the ALS response capability in squad cars with "one-plus-one" staffing[36] (firefighter/paramedic plus firefighter/EMT-I)
- Basing the remainder of the ALS response capability on "paramedic engines"
- Conversion of the ambulance fleet to all-BLS
- Converting 14 full-time ambulances to 28 12-hour, power shift ambulances, peak load scheduled
- Convert some of the ambulance staffing to 12-hour shifts

Of course there are many variations possible around each option, and various levels of added resources with corresponding changes in response times.

The major advantage to Option I is that it can be implemented in a relatively short period of time, with little to no disruption to current HFD deployment, staffing and work practices. The major disadvantage to Option I is more difficult to quantify: The current EMS practices have built-in inefficiencies that become more problematic as EMS call volume rises. Although Option I would immediately alleviate the stress the system is currently experiencing, it would not position the HFD for a more efficient operation that would serve the HFD well throughout this decade and beyond.

The major advantage to OPTION II is that the system would become all advanced life support (ALS) first responder. Not only is an all ALS system more capable of rendering the highest quality pre-hospital care, it also is more efficient in the sense that the HFD would no longer need to routinely send two ambulances to one call, nor will it have to send an engine company first response to calls where their presence is unwarranted. It would also better position the HFD to respond to future increases in demand by eliminating the inherent inefficiencies of the present static deployment scheme, using a more dynamic deployment scheme to better match supply of resources to demand.

[36] One-plus-one staffing is one firefighter/paramedic plus one firefighter EMT-I.

The major disadvantage to OPTION II is the complexity and magnitude of the change itself. It will be significantly more complex to implement and may require changes to existing labor contracts. TriData was encouraged to be innovative in developing options here, which we have done.

In addition to the selection and implementation of one of these two options, there are other important internal organizational design and technical deficiencies that should be addressed no matter which remedy to the response time problem is selected. They include:

- Further clarification of how medical authority relates to operational authority (the bifurcated command system), and how to rectify the "gray" area

- An organizational re-design of EMS administration to include enhanced Continuous Quality Improvement (CQI) capabilities

- Streamline the HFD dispatch deployment scheme (the protocol that governs the set of apparatus sent to each type of incident)

- A solution to the current inability to sufficiently query patient record and computer-aided dispatch data

- An upgrade of the HFD Medical Priority Dispatch (MPD) system, which will better match the resources sent to the pre-determined severity of a call

- A debugging and expansion of the HFD/Lockheed Martin portable, computer-based ALS patient record-keeping system

In order to understand the rationale for these recommendations, it is necessary first to understand the current system and to evaluate its components.

EMS System Overview and Description

The HFD employs the dual-role, cross-trained model of providing EMS. HFD personnel perform both fire suppression and EMS duties and can serve on any given day in either capacity.

The EMS system employs a tiered response in which the ambulances dispatched to an emergency may be staffed either at the basic life support (BLS) level of care or the ALS. A BLS ambulance is staffed by two firefighter emergency medical technicians (firefighter/EMTs). An ALS ambulance is generally staffed by two firefighter/ paramedics. EMTs receive about 110 hours of training and are proficient in basic first aid. Paramedics receive about 600 hours of training (as well as an extended field preceptorship) and perform skills that are by definition, the practice of medicine.

The HFD employs the now common practice of using fire suppression apparatus as first responders. About 96 percent of the largest 200 EMS systems in the country utilize a similar fire suppression-based first responder program.

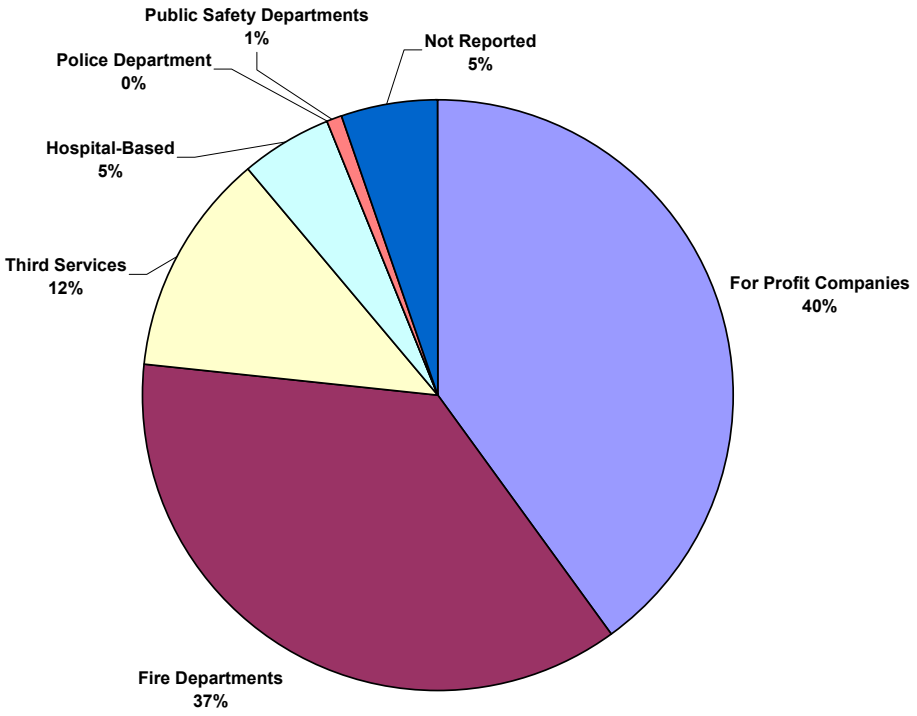
The "first response" concept evolved out of the need to get trained medical responders to the scene of emergencies within the first few minutes after a victim's heart stops beating. Initiating resuscitation efforts within this short four- to six-minute window of time with basic CPR and now automated external defibrillation gives the victim of cardiac arrest a greater chance of survival[37]. Fire suppression units frequently can arrive at the scene of emergencies several minutes before an ambulance simply because there are more of them, they are "out of service" on calls less often than ambulances, and they are better distributed within the service area than are the ambulances.

Municipal fire department-based EMS delivery models, where the ambulances are under the Fire Department, are one of the two predominant models employed by the largest 200 American cities. It is used in 74 (37 percent) of them, as shown in Figure 17. Its most desirable feature is the ability to use one workforce, one dispatch mechanism,

[37] The HFD first responder program is to be commended for the inclusion of an automated external defibrillation (AED) program to its first response capabilities. The firefighter/EMTs receive additional training in order to operate the AED. The AED is capable of detecting certain cardiac dysrythmias, while delivering a preset volume of electrical energy measured in Jules.

and one housing infrastructure to achieve the goals of two distinct services. Another 40 percent of the top 200 cities utilize a private contractor for patient transportation.

Figure 17: Who Provides EMS Patient Transportation



Source: The Journal of Emergency Medical Services (JEMS) 1999 200 City Survey

Disparities in workload, pay, educational, and career ladder opportunities often exist between the firefighter/EMTs whose primary business is fire suppression, and the firefighter/paramedics and firefighter/EMTs assigned to EMS. The paramedics and firefighter/EMTs assigned to the ambulances often perceive their relative status to be that of second-class citizens, known in the EMS industry as "the stepchild syndrome."

These differences are exacerbated by the fact that EMS has become the primary reason why citizens call the Fire Department through the 9-1-1 system. Although the field response workload of HFD is 72 percent EMS and 28 percent fire suppression, staffing assignments to apparatus are roughly 79 percent to fire suppression and 21

percent to ambulances.[38] To the HFD's credit, the cultural friction between paramedics and other firefighters is less than in many other departments.

The Greater EMS System – The HFD EMS is the centerpiece of a coordinated system of pre-hospital emergency care linked to the City's emergency departments, hospitals, and greater medical community. The paramedics, who also are called EMT-P's, are trained by the Houston Community College System and tested and certified by the Texas Health Department.

The paramedics practice medicine in the field under standing orders from their fire department-based Medical Director as well as from on-line verbal medical orders delivered by emergency medicine specialists from Houston's base station hospital, Ben Taub. This extension of the practice of emergency medicine by physician extenders in the field (paramedics) is defined by Texas general statute and regulated accordingly.

Houston Code (Code 1968, s5-2; Ord. No. 70-1580. Sec. 4-2) governs the formal mechanism by which the Harris County Medical establishment can offer EMS system design recommendations to the Houston City Council. The ordinance establishes an "Ambulance Advisory Committee" whose duties include direct recommendations regarding the numbers of ambulances operating in the system.

What differentiates the HFD EMS system from its counterparts across the country are the quality, vitality and thoroughness of its medical control. For a major metropolitan system, Houston has perhaps the most intense, aggressive, and sophisticated physician involvement in EMS in the nation. The now routine direct involvement by telephone of the Medical Director or an Assistant in all cardiac arrest cases is unequaled in any major municipality. By utilizing a small number of physicians in these scenarios, there is a level of consistency, predictability, and stability provided to these critically important encounters that is not achieved in most other systems.

Among the system's greatest assets are:

[38] This comparison is somewhat misleading by virtue of the fact that fire suppression apparatus require three- to four-person staffing while ambulances require two. Even adjusted for this difference, the HFD still experiences a substantial workload distribution inequity, a two to one ratio.

- The HFD practice of field EMS supervision has developed essentially "super-paramedics" who respond to many cardiac arrests and critical patient care scenarios each month. This type of experience on a regular basis develops a corps of personnel with a tremendous amount of medical skill and experience.

- The paramedic internship program is as well organized and well executed as any of its type. It can be the role model for any sophisticated metropolitan EMS system.

- Coordination with major manufacturers and the military is producing information on EMS practices that will be of benefit well beyond Houston's city limits.

- The public access defibrillation (PAD) initiative and civilian fire warden program are examples of a major public safety department's outreach to the community. It provides the citizens of Houston a means by which they can contribute to their own health and safety.

- And as noted above, the HFD has the most sophisticated system of physician medical direction perhaps in the world. It has brought excellence in the practice of emergency medical care through its many programs that begin with the paramedic just out of initial training and provides a significant amount of recurring educational opportunities.

The greatest threat to a continuation of superior medical control practices is related to the stress now placed on the HFD firefighter/paramedics. Not only is the HFD understaffed with regards to paramedics (currently running from 35 to 115 positions down), but the workload placed on each paramedic is such that "burnout," which invites high turnover, is compounding the problem.

Fire protection has always relied on the availability of firefighters to respond immediately to a call of fire. It is a long held tradition that firefighters must have significant "down time" to preserve their availability for that immediate and timely response. They are employed in numbers in excess of their daily need.

EMS is new to fire services. Without the centuries of tradition, it has arrived in more cost-conscious times when management concepts of unit-hour utilization are used to analyze EMS personnel productivity. Fire services thus far have escaped this analysis. The desirability, however, of EMS personnel to be available for immediate response to a medical emergency is as important if not more so than the availability of firefighters for fire suppression. Yet EMS personnel are not employed in numbers in excess of their anticipated need. The goal, almost universally, is to achieve an efficient use of personnel to match the work volume with personnel hours available. The goal is to *not* employ EMS personnel in excess of their anticipated need.

As EMS call volume increases, as it is in almost every city, and as fire call volume remains stable or even falls, EMS personnel bear an increasingly disproportionate burden of work responsibility. This is the great struggle that is being played out in most metropolitan fire-based EMS systems in this country

Operational Authority vs. Medical Control – Fire department-based EMS systems administer a public safety transportation system that delivers two products, fire suppression and medical care. This creates a situation where a management decision may legitimately appear operational to one professional, while appearing mostly medical to another.

Fire department-based EMS systems that have earned a first rate medical reputation are the ones that have either formally or informally solved this bifurcated command problem. When an operational decision has medical ramifications (or vice versa), an accommodation must be reached between the two principal decision-makers, medical and fire. In situations where a good, trusting working relationship exists between the Fire Chief and the Medical Director, these accommodations can be reached through an informal consultative process. When a good working relationship is lacking, the implementation of even the simplest of initiatives can be problematic. This is currently the case in Houston. Numerous interviews with senior HFD personnel and senior members of the greater EMS community (e.g., the Ambulance Advisory Committee, Medical Director, HCC paramedic training specialists, and Emergency Department Directors) underscored this situation.

Recommendation 87: The bifurcated EMS command problem needs to be solved so that other improvement initiatives can proceed unencumbered. A more

detailed recommendation for the fire/EMS bifurcated command-authority problem is given later, in the section titled Medical Control.

Specifically, the Medical Director of EMS should be given the authority to:

- Set the goals and objectives for EMS
- Have budgetary authority over all organizations related to medical control/direction, continuous quality management, and education functions.
- Approve operational guidelines and directives affecting clinical patient care as well as continue to dictate all aspects of medical care.
- Be directly involved in the process for selection and approval of the EMS Assistant Fire Chief. The EMS Assistant Fire Chief should have responsibility for all other operational issues.

(Subsequent to the initial report, this recommendation was implemented.)

Benchmarking/Performance Measures

This section analyzes the EMS demand, workload, response times, and utilization rates. This in turn allows comparison of Houston to other high population/high volume EMS systems. There are two disclaimers one should keep in mind while dealing with performance measures and benchmarking: First, most, if not all, performance measures (e.g., response times, utilization rates, and transport rates) need to be viewed relative to past performance, other systems, and local objectives. There are no absolute national standards.

Second, there are definitional problems in making comparisons, especially of response times. Some systems start measuring response when the call first arrives at the 9-1-1 center, which is the preferred standard definition. Houston and others measure response time from when the call is dispatched. When the HFD lists a response time of *x* minutes, to compare that figure with most other EMS systems, one should add approximately one minute (the average call processing time at dispatch) in order to make the comparison valid. Differences in city size and geography compound the comparison problem.

Workload – In fiscal year 1992, the HFD handled 138,699 discrete EMS incidents. This grew to 182,222 incidents by 1999, an increase of more than one-third. Demand for EMS services has been rising at about 4.5 percent per year, much faster than

population growth. The increases are consistent with what other U.S. based high volume systems have been experiencing. It is safe to assume that these increases will continue into the near future.

In these statistics, an EMS incident is defined as a call into the 9-1-1 center requesting medical or ambulance services to one address. Usually there is one potential patient, but sometimes more. The number of incidents is sometimes confused with the number of patients treated. There may be several people involved in an automobile accident, but it is one incident.

The number of ambulance responses are different again from the number of incidents or patients. Ambulance responses are the number of ambulance trips to EMS incidents. The number of ambulance responses usually is greater than the number of EMS incidents for the following reasons:

1. Sometimes here is more than one patient at a scene

2. In the tiered ambulance response system, ALS ambulances (Medic units) are equipped and staffed for the more serious emergencies, BLS units for less serious ones. There are some calls where it is difficult to determine before arrival of the first unit which class the emergency will fall into. To be safe, most systems dispatch both types of ambulances to these gray area calls, at least until they have received information confirming which level of service is required, when one may be canceled.

Busy high volume systems often must dispatch an ambulance from further away than they would prefer when the closer units are already on other calls. If the nearer unit subsequently becomes available, it will be dispatched, and the unit en route from further away will be cancelled. The computer aided dispatch system, however, will record two ambulance responses in this case.

The medical first response call volumes listed in Table 33 differ from the official HFD counting of fire suppression apparatus on medical calls because we separated out the calls where a fire suppression apparatus would be sent even if there were no medical emergency. The classic example is an auto accident where no one is injured. The HFD computer-aided dispatch system records this as a medical incident, although it is standard

operating procedure to dispatch an engine for fire safety reasons. The fire first response numbers in Table 33 have the dual role counting largely eliminated.

Table 33: Trend in EMS Call Volume

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999
Population	1,721,255	1,741,257	1,761,754	1,828,544	1,861,705	1,879,912
Total EMS incidents	150,611	156,525	157,896	166,045	175,485	182,222
Total ambulance responses	183,476	191,567	192,794	179,888	189,278	196,746
Medical first Responses by fire Suppression	68,088	72,125	67,253	73,849	77,649	88,811
Total patients transported	94,487	98,817	99,483	103,670	115,108	121,194

The number of patients transported is the number of patients taken to a hospital by the HFD ambulances. Some systems count "transport trips," because on rare occasions one ambulance will transport two patients.

Transport Rates – The percent of calls resulting in a transport is a general indicator of proper use of the EMS system for true emergencies. About two-thirds of Houston's calls result in patient transports to hospital, a reasonable rate.

A run in which an ambulance is dispatched but does not transport a patient is called a "no load." The two most common reasons for no loads are no patient being present on arrival of the ambulance, or the patient refused transport.

Table 34: EMS Transport Rates

	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999
Transport rate per EMS incidents	63%	63%	63%	62%	66%	67%
Transport rate per ambulance responses	52%	52%	52%	58%	61%	62%
Transport rate per all EMS responses*	38%	38%	38%	41%	43%	42%

* "All EMS Responses" includes fire suppression and EMS apparatus

Table 35: Transport Rates, 6-Year Average

	Average
Transport rate/EMS incident	64%
Transport rate/ambulance response	56%
Transport rate/all responses	40%

The transport rate indexed to incidents tells more about the patient population than it does about the efficiency of operations. The HFD transport rate averaged over the last six fiscal years was 64 percent; i.e., approximately one in every three requests for service resulted in no patient being transported. The fact that the transport rate is gradually trending upward over time, from 63 percent in 1994 to 67 percent in 1999, is an indication of increasingly appropriate use of the ambulance system by the public, but also an indication of further stress on the system.

A statistic that would be highly desirable but is not usually available is the percent of transports for which the patient could have just as safely taken an alternate form of transportation. National studies estimate that from 20 to 40 percent of all EMS transports could be safely diverted to an alternate transportation system. Interviews with medical personnel at HFD confirm that this probably holds true for Houston as well. That translates into 25,000 to 48,000 patient transports per year that might be diverted to an alternate transportation system. This "misuse" rate coupled with a 64 percent transport-to-incident-ratio, means that for every three calls the 9-1-1 system receives, approximately one is an emergency, one could have taken an alternate form of transportation to the hospital and one didn't result in a patient trip to the hospital at all.

Most traditional EMS systems were set up to assume that all calls had the potential of being life threatening. As call volume has increased and medical control has become more proficient in tracking patient outcomes, the industry has come to realize that it is very inefficient to respond to each and every call as if it were the "big one."

The transport rate indexed to responses gives a feel for the efficiency of the dispatch scheme – the pre-determined list of vehicle types (ALS ambulances, BLS ambulances, and engine companies) the dispatcher will routinely send to any given type of EMS call.

The transport rate indexed to ambulance responses is more indicative of system efficiency than is the rate indexed to incidents. The tiered HFD system results in a relatively low average transport rate per response of 56 percent. The fact that this index is trending up over the last six years is not necessarily an indication of better resource efficiencies. As the system grows busier it no longer can send two ambulances to the same incident, for lack of availability of vehicles. In this context, the ambulance response to transport rate is an indication that there are an insufficient number of ambulances deployed to meet demand, at least during certain hours and in certain sectors of the city. It also means that only one patient gets transported for every two ambulances dispatched.

When one considers the sum of engine company first response and ambulance responses per patient transports, the ratio hovers around 40 percent. This is not atypical for high volume EMS systems that utilize fire suppression apparatus as first responders. It does, however, indicate that five vehicle responses are made in order to transport two patients.[39]

The Role of Public Education – There are proven public education programs designed to slow the growth or even diminish EMS call volume. The more successful efforts have combined public education with well-coordinated alternatives to EMS. The successful approaches tend to have most if not all of the following characteristics:

- An effective alternate "medical" transportation system to which to refer non-emergency calls;
- Public access alternatives (i.e. instead of just 911, a 311 system to dial for cases deemed more chronic than acute);
- Medical control must be comfortable with the medical skills of the systems field providers (firefighter/EMTs and firefighter/paramedics);
- An effective quality assurance tracking system must be in place to verify that the public is appropriately accessing the correct level of medical

[39] Even if all calls required transportation, more than one vehicle often needs to be sent. For example, sending an engine crew is often necessary for assisting the ambulance crew in patient lifting, extraction and scene control, and often to provide a third ambulance crewmember when two in the rear are needed for patient care. Some EMS systems, including many in Florida, where large numbers of elderly patients are seen, routinely send one reserve unit, with three paramedics, instead of a two-person ambulance backed up by an engine.

transportation and that adverse outcomes are not occurring as a result; and, perhaps most importantly,

- Community involvement and buy-in supporting a well-coordinated public education program (e.g., "Make the Right Call").

The complexity and inherent dangers of efforts to curtail call volume – some emergencies may be misdirected – argue against Houston undertaking a public education project of this sort any time soon. The HFD should first address its current supply-side difficulties. Only then should it turn its attention to programs that might curtail call volume through public education.

Recommendation 88: In the near future (one to three years) the HFD should embark on a "Make the Right Call" program. But adding supply (ambulances) must be done first, as must establishing an alternative to emergency transport. Reducing call volume by as much as 20 percent over a two to three year period from program inception is potentially achievable, based on experience elsewhere. Materials related to the "Make the Right Call" program are available free of charge from the U.S. Fire Administration.[40] It is possible that this program could increase calls, by publicizing the services available and not getting across that they are for emergency use only. Any such public education program needs to be market tested to ensure that the correct message is understood by all, including immigrants and low-income households. An increase in reporting of true emergencies should not be considered a liability, but rather a necessity. (The HFD agreed with the desirability of this program after careful testing.)

Inter-City Comparisons – Table 36 depicts the number of ambulances in eight other high volume systems, and the ratio of ambulances per 1,000 population. Most high volume EMS cities such as Dallas and Los Angeles deploy different numbers of ambulances at various times during the day, as demand varies. This is the reason for the ranges shown in the table. Houston staffs the same number of EMS units 24 hours a day.

Table 36: Inter-City Comparison – Ambulances per 100,000 Population

City	Population	# of Ambulances	Ambulances per 100,000 Pop.
Washington, DC	523,124	26-36	4.97-6.88
Houston	**1,919,578**	**62**	**3.23**
New York	7,322,564	217	2.96

[40] As a side note, TriData, the study consultant, helped develop the "Make the Right Call" program, and know it has worked in many communities.

City	Population	# of Ambulances	Ambulances per 100,000 Pop.
Chicago	2,802,079	71	2.53
Dallas	1,075,894	27-35	2.51-3.25
Los Angeles	3,597,556	80	2.22
Phoenix	1,198,064	21	1.75
Philadelphia	1,436,287	25-37	1.74-2.58
San Diego	1,220,666	18-30	1.47-2.46

Source: TriData research; HFD; U.S. Census Bureau. Where a range is given, the higher figure applies to ambulances available in peak hours.

Houston has the second largest number of ambulances per 100,000 population (3.23) among the large cities surveyed. This is a direct result of the HFD practice of flat/static deployment, i.e., the same number of ambulances and EMS personnel are deployed throughout each day, despite large fluctuations in call volume by time of day.

Like Houston, Chicago and Los Angeles also staff the same number of units 24 hours a day. The difference is that both Chicago and Los Angeles have been able to maintain a relatively low demand per 100,000 population. Los Angeles is in the process of revising the delivery of EMS to incorporate the "squad car" concept for providing ALS care, which will be discussed later.[41]

The HFD uses 26 BLS units, 27 ALS units, and 9 dual units, for a total of 62 ambulances. One reason Houston needs proportionately more ambulances per capita than other cities is because the population is spread over 617 square miles, a larger land area than in Los Angeles. More ambulances are needed as the area served increases.

More ambulances also are needed to serve higher demand. Table 37 illustrates that Houston's EMS calls per 1,000 residents is in the middle of the inter-city comparison group. Some cities experience proportionately greater influxes of employees from neighboring jurisdictions. This phenomenon is more a function of political boundaries than it is a statement on the health status of the population. Still, the Houston usage rate is on the high side, which may indicate an EMS "misuse" problem.

[41] We did a study of the Chicago Fire Department in 1999 and recommended that they use peak-load ambulances. They added a large number of BLS ambulances but have not yet negotiated changes in shifts that would enable use of peak-load ambulances.

Table 37: Inter-City Comparison – EMS Demand per 1,000 Population (1999)

City	Population	# of EMS Calls	EMS Calls Per 1,000 Pop.
Washington, DC	523,124	121,486	232.2
New York	7,322,564	1,034,506	141.3
Dallas	1,075,894	127,000	118.0
Philadelphia	1,436,287	145,000	101.0
Houston	**1,919,578**[42]	**182,222**	**94.9**
Chicago	2,802,079	232,716	83.1
Phoenix	1,198,064	91,000	76.0
Los Angeles	3,597,556	237,734	66.1
San Diego	1,220,666	65,000	53.2

Source: TriData Research; HFD; U.S. Census Bureau
(Sorted by 1998 Population Size Rank in U.S.): July 1, 1998 (U.S. Census Bureau)

The number of EMS personnel per capita is shown in Table 38. Houston ranks third of eight, with a third less EMS personnel per capita than Dallas, in part because Dallas has a higher per capita EMS volume than Houston.

Unit Workload – The HFD operates 62 24-hour ambulances, with the following staffing:

- 27 Medic (ALS) units, staffed by two paramedics on a 24-hour shift;
- 26 Basic (BLS) units, staffed by two firefighter/EMTs on a 24-hour shift;
- 9 Dual ambulances, staffed by one firefighter/paramedic and one firefighter/EMT on a 24-hour shift.

Table 38: Number of Full Time EMS Personnel per 100,000 Population

City	Population	# EMS Personnel	# EMS Personnel per 100,000 pop.
New York	7,322,564	2,937	40.2
Dallas	1,075,894	462	45.2
Houston	**1,919,578**	**620**[43]	**30.1**

[42] Houston data and population here was for FY2000; others are FY1999 to keep their population and data self-consistent.
[43] This is the minimum number of HFD personnel required to fully staff 62 ambulance fleet 24 hours per day, based on a staffing factor of five per on-duty position.

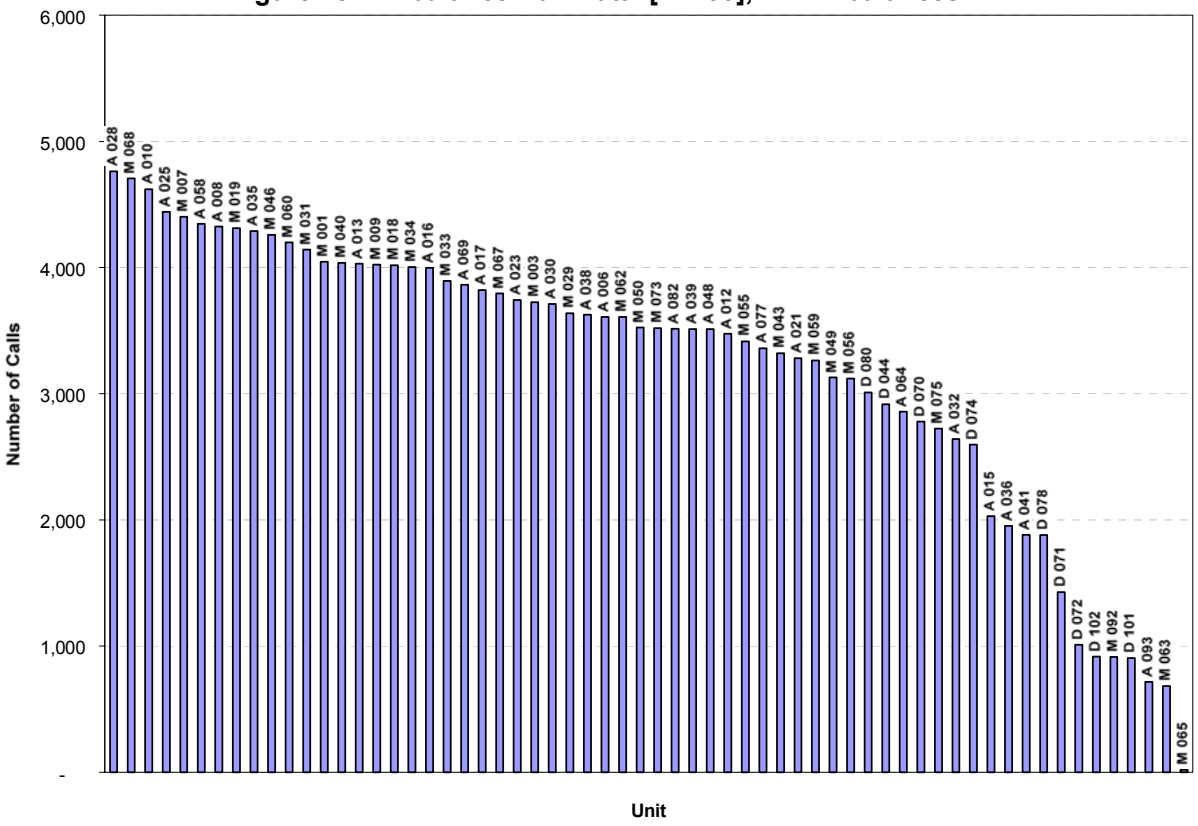
City	Population	# EMS Personnel	# EMS Personnel per 100,000 pop.
Phoenix	1,198,064	300	28.6
Chicago	2,802,079	631	23.1
Philadelphia	1,436,287	250	16.1
San Diego*	1,220,666	185	16.1
Los Angeles	3,597,556	434	12.6

* San Diego's EMS system includes a private transport provider, so this number may not be comparable.

Los Angeles and Houston provided numbers of EMS Field Personnel on a daily basis, which were extrapolated.

The EMS workload is unevenly distributed across ambulance units in Houston. As illustrated in Figure 18, there is a five-fold difference in workload between the most and least utilized ambulances. The lowest volume units are located at the airports; they are paid for by the airport, and generally unavailable for calls in the City. Putting the airport units aside, there still is a group of ambulances that have triple the workload of others.

Figure 18: Ambulance Run Data [FY '99], All Ambulances



As a general rule of thumb, any unit over 3,000 calls per year is considered very busy, and subject to consideration for relief. The majority of HFD ambulances are on the threshold. A very busy unit, staffed by the same two personnel for the entire 24-hour shift is a concern. The risk for "burn-out" and field fatigue is considerable; they cause paramedics to quit. On the other hand, and counter-intuitively, there are no studies that show that busy units or units late in their 24-hour shift provide worse care for patients.

Figure 19 and Figure 20 depict the workload for the HFD ALS and BLS ambulances separately. Fully 66 percent of the medic units and 77 percent of the BLS units receive in excess of 3000 calls per year. That is, both types of units are heavily loaded.

Figure 21 shows workloads for the dual units. A "Dual" ambulance is a hybrid between the ALS and BLS units.[44] The term "Dual" refers to the fact that the ambulance can be used for both ALS and BLS calls. Its ALS capabilities, however, are restricted to a one-paramedic staffing per ambulance as opposed to the medic units (ALS Units) two paramedic-staffing pattern. Dual ambulances were developed in response to the HFD paramedic shortage. There simply were not enough paramedics to staff all needed ALS units with two paramedics. The dual units are sent on ALS calls only when a medic unit with two paramedics is unavailable or considerably far away from the incident.

The Dual units have significantly fewer calls than the ALS and BLS units because they are stationed in the lower call volume areas of the city. The presumption is that because they are limited capacity ALS units, it is best to place them where they will be needed less often. Although Dual units evolved out of necessity, their existence compounds the complexity of HFD dispatch methodologies by adding more decision making criteria to an already complex scheme.

[44] "Dual" is the HFD name for these units; other systems call these units ALS units with one-plus-one staffing, where one-plus-one means one firefighter/paramedic plus one firefighter/EMT.

Figure 19: ALS Medic Unit Workloads

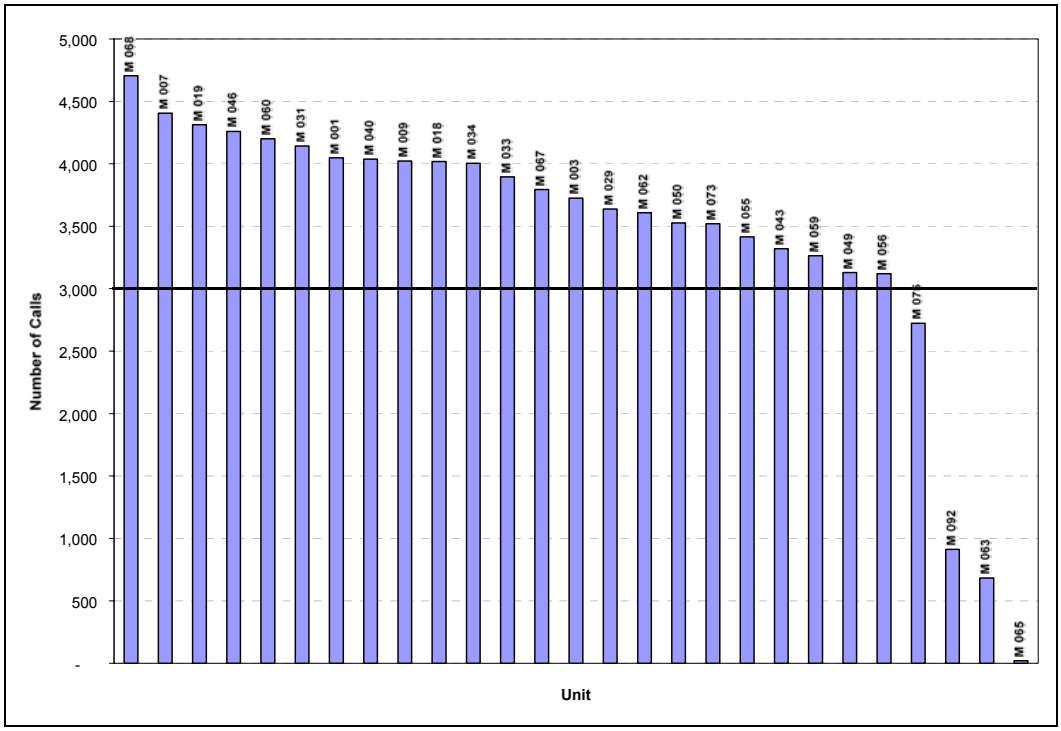


Figure 20: BLS Ambulance Workloads

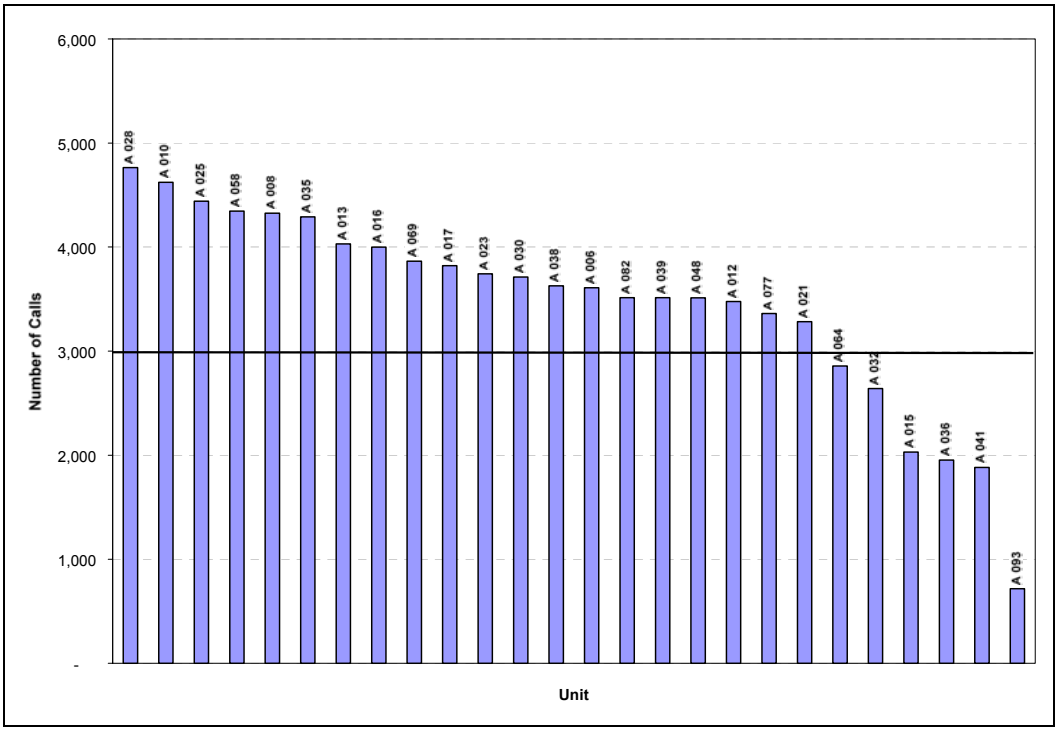
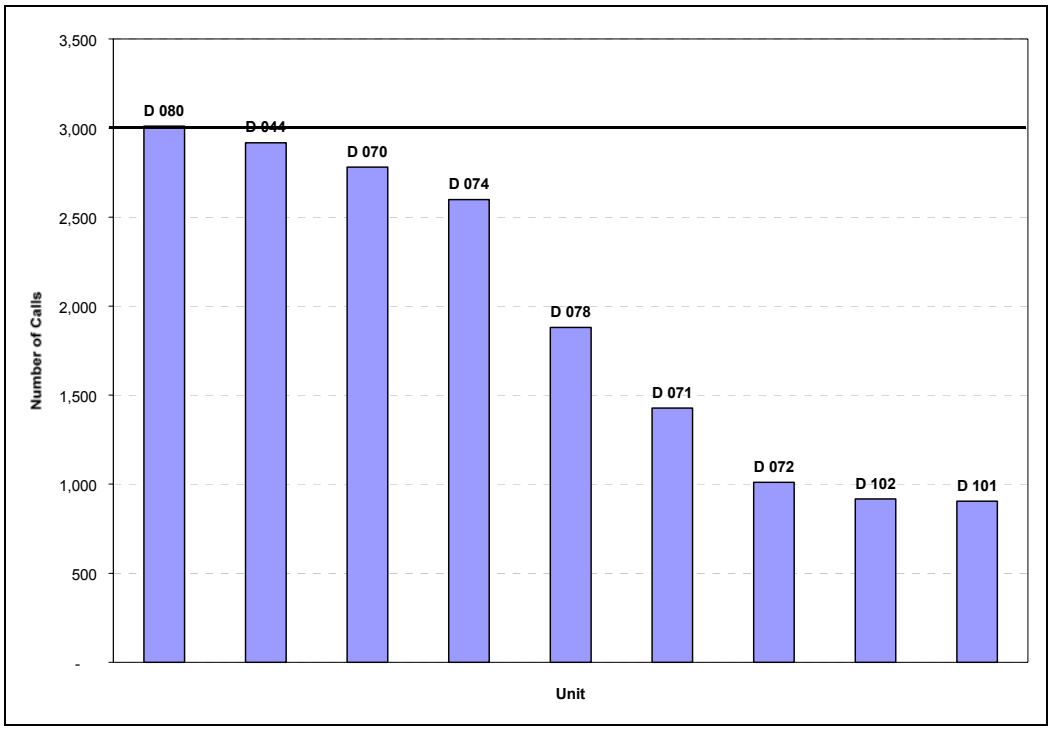


Figure 21: "Dual" Unit Run Data

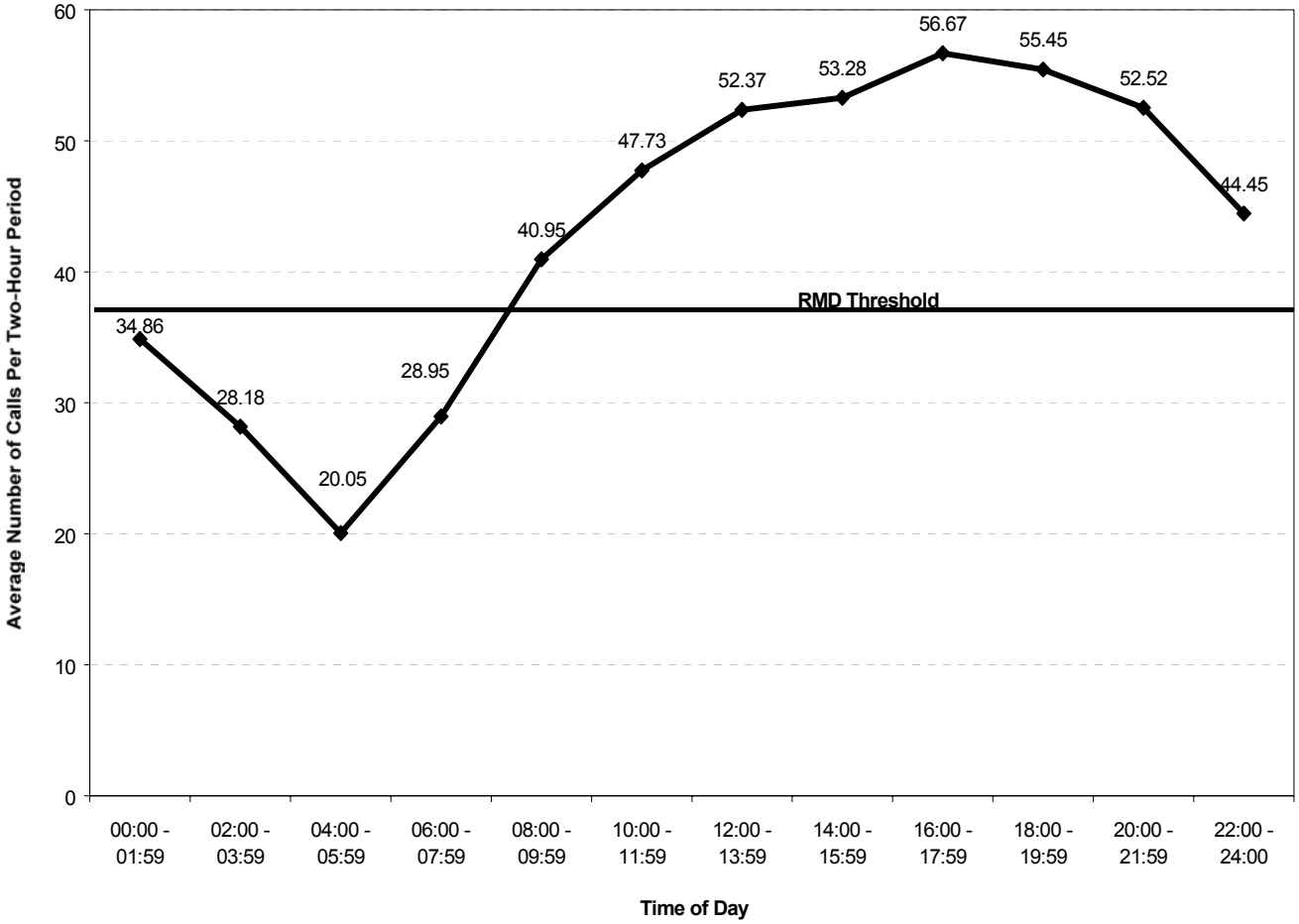


Recommendation 89: Consider converting each Dual Unit to either an ALS unit or BLS unit (5 ALS and 4 BLS). The Dual Units add complexity to the dispatch process. Unless it is clear that there is a significant improvement in response time in the targeted areas in which they are used, we suggest they be converted. (The HFD disagreed with this recommendation, stating the following:

The Dual Units are located in areas of the city with lower call volumes but are geographically remote from other resources. Converting their status to ALS or BLS will alter their assignments to incidents and probably result in prolonged response times. The Department should implement the other recommendations and see their effects before changing the status of the Dual Units.)

Workload Variations by Hour, Day, and Month – Call demand varies significantly by time of day, as shown in Figure 22. Volume peaks in late afternoon (4 p.m. to 6 p.m.), which is rush hour and dinner time. It is lowest in the early dawn hours (4 a.m. to 6 a.m.). There are almost three times as many calls during the peak load hours than there are during the minimum load hours. Figure 22 suggests the key reason why some EMS systems have chosen to vary the number of ambulances available by hour of day. **This is one of the most important findings in this study.** It has enormous implications on the efficiency of the entire HFD operations.

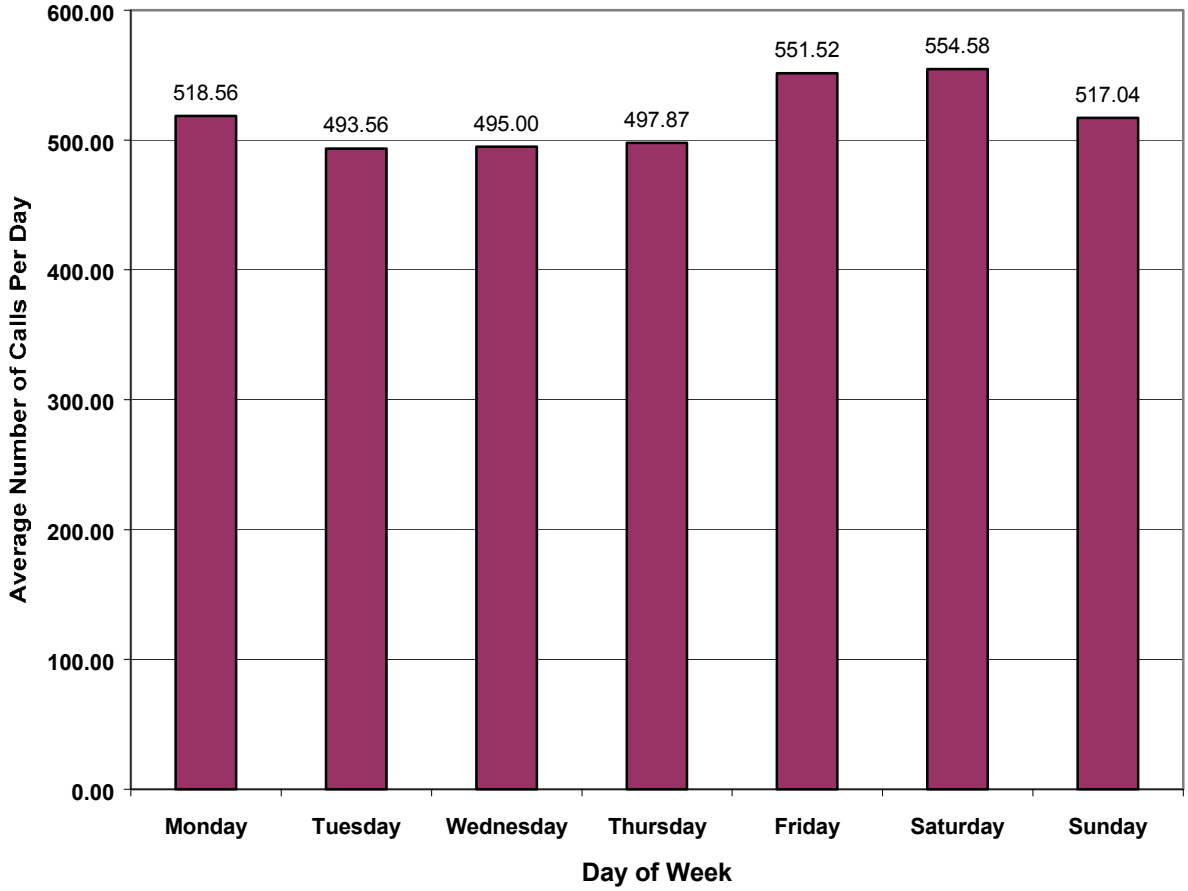
Figure 22: Call Volume Variation by Time of Day



The horizontal, bold line in Figure 22 depicts the level at which the HFD switches to "Resource Management Dispatch" (RMD). The trigger point comes when 37 ambulances are in use and only 25 of the 62 ambulances are left for any further calls in the City. At that juncture, the HFD dispatch starts to send only one ambulance per call rather than two or more units. For at least 12 hours of each day, and in some cases as many as 14 hours, call volume usually exceeds the RMD threshold.

Call volume varies only slightly by day of week, as shown in Figure 23. The weekend days of Friday and Saturday are about 10 percent higher than the midweek days, a phenomenon attributed in most cities to the "knife and gun club" and linked to drinking and recreational activities on Friday and Saturday nights.

Figure 23: EMS Call Volume by Day of Week

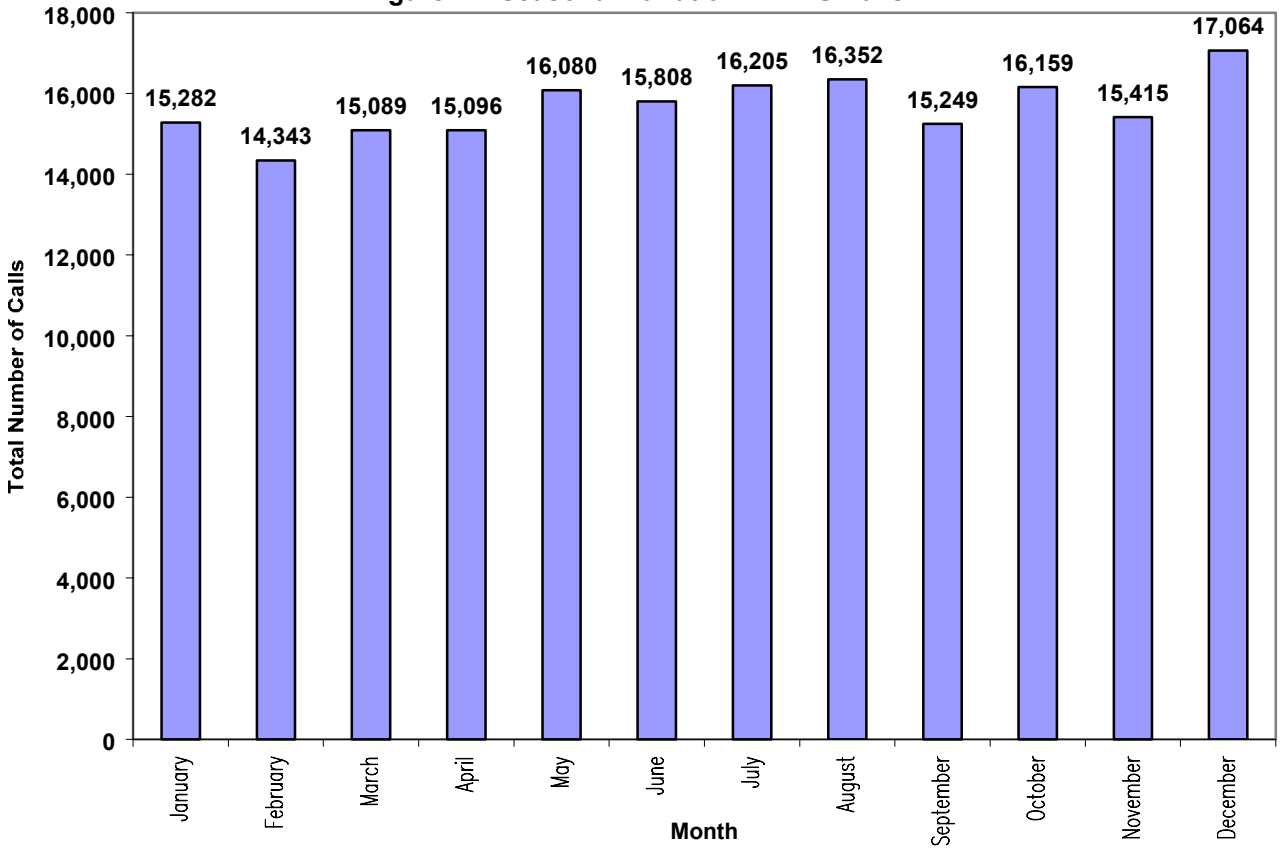


There is some monthly variation in EMS calls, as shown in Figure 24. December has the most calls, February the least. July and August are the second and third highest months. These variances are mostly due to the fact that the number of days in a month varies by month (February has two to three fewer days than the other months). The HFD experiences an average of 500 EMS calls per day, so February would be expected to have 1,000 calls fewer than other months. However, July, August, and December are peak months not just because they have 31 days in the month, but also because of traditional holiday and tourist activity, and children being out of school.

The HFD should match supply and demand more efficiently to optimize response time and reduce cost, especially by time of day. Sometimes all ambulances are busy when a call comes in, and sometimes many ambulances are idle. The traditional but costly solution to this problem is simply to add more units rather than to re-deploy unit hours. In Houston's case, it may be necessary both to add more units immediately due to the high-volume being handled by 71 percent of the ambulance fleet, and to re-deploy

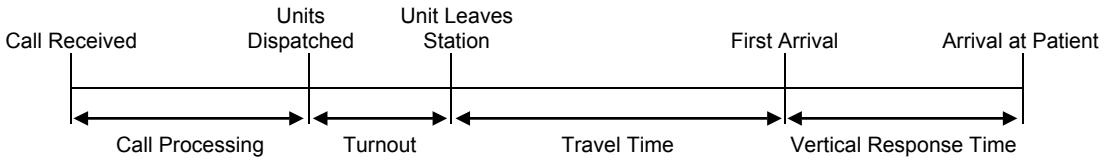
some units to deal with peak demand by time of day and in certain geographical areas. More will be said on this later.

Figure 24: Seasonal Variation in EMS Calls



Response Times – Response times are the most widely used measure of EMS system performance because of their importance, relative ease of measurement, and understandability. As noted earlier, the HFD does not include call processing time in its definition, and thus approximately one minute should be added to the HFD reported response times in order to make comparisons with systems that do include call processing time. Figure 25 shows the various components of response time. The most common definition is from call received to arrival in the street, leaving out "vertical response time" (from the street to the patient's side).

Figure 25: Response Time Components



The HFD fiscal year 1999 response time indicators, measured from dispatch to arrival at the scene, were as follows:

- Average engine company response time to all calls – 6.2 minutes;
- Average engine company response time to the calls deemed more urgent – 5.7 minutes;
- Average ALS ambulance response time to all calls – 10 minutes;
- Average ALS ambulance response time to calls deemed more urgent – 9.6 minutes;
- Average BLS capable ambulance response time to all calls – 8.5 minutes.

All of these averages are on the high end of the acceptable range.

Table 39 shows the trend in response times over the last six years. The averages for the more urgent calls and for the first ALS on the scene have increased, unfortunately.

Table 39: Trends in Response Times, Measured in Minutes

	FY 94	FY 95	FY 96	FY 97	FY 98	FY 99
EMS Average "Response Time" for calls deemed more urgent						
First Unit on Scene	4.7	4.8	4.8	5.1	5.5	5.7
First ALS on Scene	8.9	9.0	8.9	8.7	9.3	9.6
EMS Average "Response Time" for all responses						
First Unit on Scene	-	6.8	6.7	6.4	6.8	6.2
First ALS on Scene	-	9.3	9.1	9.1	8.8	10.0
First BLS on Scene	-	10.7	10.7	8.2	9.4	8.5

Received from dispatch, not call in-take. About one minute should be added.

There is no true national standard for ambulance response times; i.e., no standards-making consensus group has ever defined a definitive value for ambulance response times. The closest thing to a response time "standard" for EMS transport

vehicles is to arrive within eight minutes on 90 percent of the critical (i.e., life-threatening) calls. (This goal is for ALS units in urban areas.) An often-used goal for engine company first response with AED capability is six minutes, 90 percent of the time on life threatening calls. The eight-minute ALS goal was first proposed in a *Journal of American Medical Association* article. This form of measure is called a "fractal" measure because it is stated in terms of the fraction of calls responded to within a specified time.

Table 40 lists the HFD reported average response times for FY 1999, juxtaposing them against national figures as reported in JEMS 1999 200 City survey. The HFD response time fractiles are well below average. While these comparisons cannot be taken too literally because of variations in data collection procedures, the HFD performance is mediocre and well below desired levels relative o other cities and to its own goals.

Table 40: "Response Time" Fractiles (without call processing time)

	First Responder		ALS	
	Minutes	Percent	Minutes	Percent
National average	5	90	8.3	90
HFD FY99	5.7	49	9.6	62
HFD current goals	<6	80	<8	80

The fractal performance measures specifically acknowledge that there will be some response time outliers in even the best-performing EMS systems; 10 percent of calls can be over 8 minutes and still meet the standard. The standard does not use average response time because arithmetic averages can be distorted by a relatively small number of inordinately long response times. The average is much more sensitive to data errors for the same reason.

Figure 26 shows the GIS mapping of the 1999 HFD response time data by key-map location. It is plotted as fractal response times, using thresholds of less than 6-, 8-, 10-, and 12-minute responses. These fractal response times are for ambulance and medic unit response only. The mapping analysis verifies original contention that response times are mediocre. They also show the areas that have above or below average responses.

Figure 26: Fractile EMS Response Times

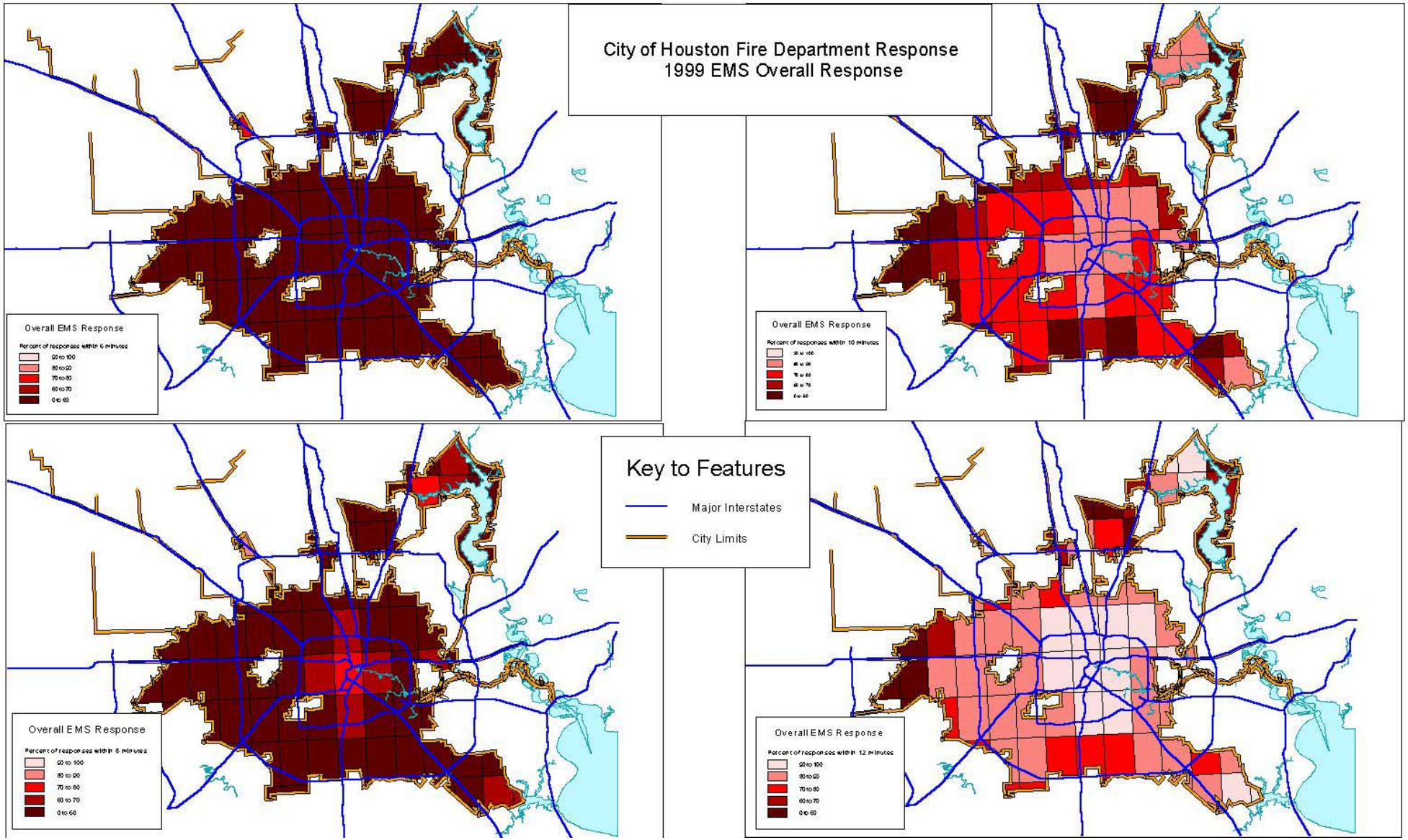


Table 41, Table 42, and Table 43 represent analyses of response times provided by the HFD for 1998. The information gives essentially similar results to Figure 26. Response time goals are not being met.

Table 41: 1998 Citywide Response Travel Time Analysis (Response Times for EMS Response First On Scene)

Average Response in Minutes	<4 Minutes	<6 Minutes	<8 Minutes	<10 Minutes
6.9	16%	49%	73%	86%

Table 42: 1998 Citywide Response Travel Time Analysis (Response Times for EMS BLS Units)

Average Response in Minutes	<6 Minutes	<8 Minutes	<10 Minutes	<12 Minutes
7.1	49%	73%	85%	91%

Table 43: 1998 Citywide Response Travel Time Analysis (Response Times for EMS ALS Units)

Average Response in Minutes	<6 Minutes	<8 Minutes	<10 Minutes	<12 Minutes
9.9	23%	43%	62%	75%

Response times can be further distorted by the fact that most systems record the time apparatus arrives "on-scene," not the time technicians arrive at the patient's side. Vertical response times (the time it takes for paramedics to exit their vehicles, get their equipment, and reach the patient's side). Most systems omit this component of response time; only about 10 percent of first response agencies keep the clock running until EMS personnel reach the patient's side. In a city with as many high-rise buildings as Houston, the vertical response times can be significant. An attempt should be made to measure the vertical component of response times, but not to use this more complete measurement for inter-city comparisons.

In summary:

- Actual response times are 10 to 20 percent longer than are currently published by the HFD due to the fact that call processing time is not included in the official measurement;

- HFD EMS response times are mediocre at best;

- Because they are reported as averages, response times during peak hours are probably significantly higher;

- Response times have deteriorated over the last six years as shown in Table 39, mainly because of rising call volume; and

- Response times will continue to deteriorate unless more resources are added to the fleet.

On the bright side, HFD medical control is to be commended for having segmented out its cardiac calls, (the calls which are the most time sensitive), tracking their response times separately. The average response times for cardiac calls are:

- 5.5 minutes for first fire unit on the scene (FF/EMTs with AED capability); and
- 9.3 minutes for first ALS unit on the scene (paramedic capabilities).

It is very difficult to state definitively just how the HFD stacks up against the rest of the nation as far as its save rate for cardiac arrest victims is concerned. There are too many measurement variables that are not standardized across all systems to make a good comparison. It is fair to say, however, that Houston enjoys a save rate that is among the top in the nation, despite its higher response times.

Unit Hour Utilization of Ambulances – The principal cause of the HFD poor response time performance is the high workload of the ambulances. Ambulance response time is directly correlated to their availability. The primary measure of ambulance usage is unit-hour utilization (UHU), the ratio of the number of unit-hours spent delivering EMS divided by the total number of unit hours that the system could possibly deliver. The UHU is computed as the number of calls times the average time per call (in this case 62.18 minutes) divided by the number of unit hours produced by the EMS system. [45] The

[45] Weighted average of turnaround times for both patient transports and "no-loads." A rough approximation for UHU in the HFD is the number of runs divided by 8,760, because the average run time happens to be about one hour (62.18 minutes).

unit-hours produced by the system are 8,760, which is the number of hours in a year times the 62 EMS units in service.

$$\text{UHU} \approx \frac{\text{\# of EMS runs x average number of hours per call}}{\text{\# EMS units x 8,760}}$$

A UHU of 0.5 therefore means that during any given hour of the day, one would expect to find 50 percent of the HFD ambulance fleet in service on some aspect of a call. This is an average across all hours of the day. It does not reflect the fact that call volume fluctuates dramatically by hour of the day. The HFD UHU is higher during certain hours of the day than the average.

As is the case with response times, there is no standardized UHU that all experts agree would be the definitive threshold. Public sector systems usually only respond to emergency calls, leaving the more routine inter-facility calls to the private providers. Private providers view UHU differently. For them, the higher the UHU the better; it means that their fleet is operating at maximum efficiency (the units are busier, they realize more revenue per unit). The opposite is true for the public sector. Here, ambulances cannot be scheduled for inter-facility transports; they must be stationed and prepared for the next call wherever and whenever that may be.

Public EMS Systems operating in the 0.33 to 0.42 range are generally perceived as reasonably balanced between cost-effectiveness and response times. (One must still analyze response times to be sure this is true.) High volume systems operating at 0.5 and above are generally perceived as running the risk of having frequent instances of lengthy response times.

Table 44 shows the two versions of the UHU calculations: one is based on 62 ambulance units, 24 hours per day; the other focuses on the busiest 14 hours of the day.

Table 44: Ambulance Unit-Hour Utilizations, FY 1999, (A/B = C)

	Factor	24 hour Average	14 Busiest Hours of the Day
A	Service Hours Delivered	188,843	152,074
B	Possible Service Hours	543,120	316,820
C	Unit-Hour Utilization	0.35	0.48

During the 14 busiest hours of the day, the UHU is 0.48, very high indeed. The UHU of the medic units (paramedic-capable ambulances) is about the same, 0.49. In any EMS system operating at about 0.5 or above, one would expect to find frequent instances of elongated response times.

Holding calls in queue occur when there is no unit within 20 minutes traveling distance of the patient's location. The call is then held until a nearer unit becomes available. Most systems will dispatch a further-away unit (greater than a 20-minute travel distance) as a stopgap measure. This is also the HFD practice.

Systems that keep their UHU at 0.42 or less, are usually able to meet their response time goals. They also keep the stresses on their personnel, equipment, and vehicles to a reasonable level. A UHU much lower than 0.33 would mean that there is relatively light EMS workload per unit; it is an indication of excess capacity.

The Houston UHU exceeds 0.42 regardless of whether the airport units are counted. In fact, over three-quarters of the ambulance fleet have a UHU in excess of the 0.42 target. Approximately a third of the fleet is significantly overloaded, with UHU over 0.55. That is, they are out on calls for more than 12 hours in a 24-hour period.

UHU rates computed by time of day and by sector of the city yield further insights, as shown in Table 45.

The medic units that are stationed in the higher population areas of Houston have a UHU of 0.58 during the busiest 14 hours of the day. This is the underlying cause for the HFD intermittently high response times.

Table 45: Average Unit Hour Utilization (UHU) Rates

Average Unit Hour Utilization	UHU
Entire ambulance fleet across *all* hours of the day for the entire service area	0.35
Entire ambulance fleet across the *busiest 14* hours of the day for the entire service area	0.48
Entire ambulance fleet across the least busy 10 hours of the day, entire service area	0.20
Entire ambulance fleet in the "major activity areas" of the City, 14 busiest hours	0.56
ALS ambulances in the "major activity areas" of the City, 14 busiest hours	0.58
UHU of BLS ambulances in the "major activity areas" of the City, the 14 busiest hours	0.54

To bring the UHU down to the acceptable range of 0.33 to 0.42, more unit hours must be added to the ambulance fleet. The question is, should the HFD add unit hours across all hours of the day to alleviate a problem that only exists for 14 hours of the day in certain sectors of the City, or should Houston add units only where and when they are needed? The latter is a far more efficient approach. The former is significantly easier to implement, mostly because labor contract issues do not come into play.

To bring ambulance utilization rates down to 0.42 overall requires adding 15 ambulances (e.g., 8 ALS and 7 BLS) to the current ambulance complement of 62.

The 15 additional units would cost approximately $10 million per year to operate.[46] However, the system does not require 15 additional units across all hours of the day; it requires 15 units during the highest activity 12 to 14 hours a day. Therefore, the HFD would be paying for coverage during 10 to 12 hours of the day where this would be excess coverage.

Further, continuing the existing static deployment scheme by adding 15 24-hour units is a temporary fix. The inefficiencies of static deployment schemes will recur as call volume increases. More and more units will be required in the future as call volume continues to rise.

There is an alternative – a system redesign using peak load units. Before discussing that option, it is necessary to discuss the likely range of demand over the next decade.

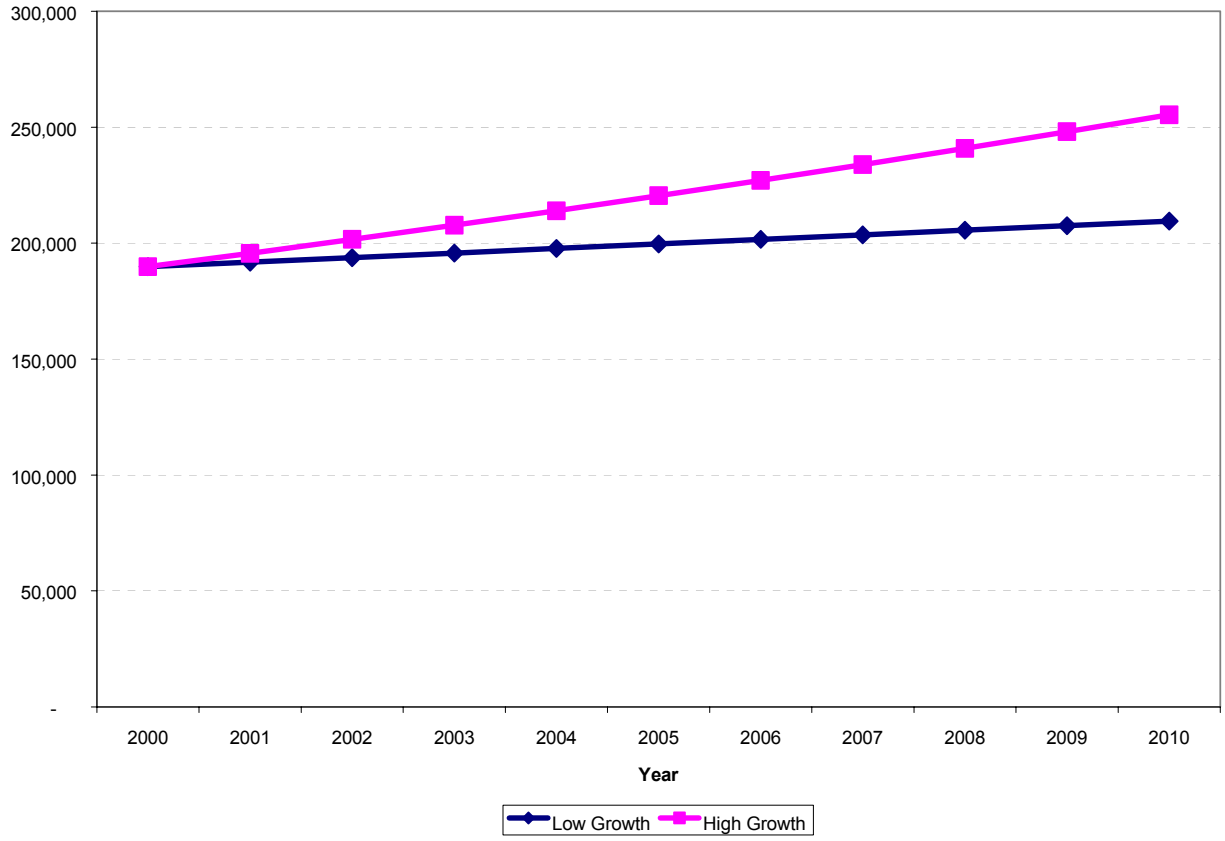
EMS Demand Forecast – The required number of transport units needed in the future to reduce or maintain a safe UHU can be computed given an estimate of future-expected call volume. EMS demand is most correlated with the population and median income of the community served. In general, EMS demand is directly proportional to population (the more, people, the more calls) and inversely proportional to median income (low-income households tend to be higher users of EMS for a variety of reasons).

[46] Estimate based on 150 new hires (80 FF/EMT-P and 70 FF/EMTs) each costing $55.3K and $52.0K respectively; plus 15 new ambulances (8 with ALS equipment and 7 with BLS).

There are many other factors that also influence demand, such as the self-reliance of the population (i.e., taking care of themselves or taking themselves to the hospital). EMS demand also is subject to external factors that cannot be anticipated or controlled, such as the heat wave of 2000.

Figure 27 shows two forecasts of expected future growth in EMS call volume. The high growth forecast (top curve) represents the more conservative, "worst case" scenarios. The lower curve is the lower bound. The methodology used to compute (estimate) future call volume was detailed in the Fire Operations, Chapter IV, under the heading, "Call Volume Forecasts."

Figure 27: HFD EMS Incidents Forecast (2000-2010)



The forecasts are plotted graphically in Figure 27 and are given numerically in Table 46.

Table 46: High and Low Growth Forecasts – Number of EMS Incidents

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Low Growth	189,788	191,756	193,725	195,693	197,661	199,629	201,597	203,566	205,534	207,502	209,470
High Growth	189,788	195,592	201,551	207,671	213,955	220,407	227,031	233,833	240,816	247,984	255,343

Analysis of EMS Operations by System Component

There are 16 aspects or components of EMS systems identified by the Federal Department of Transportation (DOT). They have been incorporated nationally through State regulatory agencies and are perceived as operational necessities.

The 16 component groupings are:

- Medical direction and clinical care;
- Manpower;
- Training;
- Transportation and apparatus;
- Public access, communications, and dispatch;
- Management and field supervision;
- Administration and MIS;
- Evaluation and CQI; and
- Facilities.

For purposes of discussion, some components have been grouped together. As stated earlier, the HFD EMS system is excellent; therefore, we focus more on the problems in each component area, and give briefer treatment to the strengths.

Most of the improvement initiatives are interrelated. Improving one or two while postponing work on others is likely to yield less than satisfactory results. For this reason, where improvement initiatives are closely interrelated, we include a cross-reference.

Two prominent EMS physicians, each with experience as a Fire Department Medical Director, were part of the TriData project team for this part of the analysis.[47]

[47] Fred Hagedorn MD, FACEP at University Medical Center, Lubbock, Texas; and Donald Blanton MD, MS, FACEP at Vanderbilt University, Nashville, Tennessee.

Most of the recommendations in this section should be undertaken by the HFD no matter which avenue is selected to solve the response time problems.

Medical Direction and Clinical Care – The HFD enjoys a well-deserved national reputation for excellence and innovation in the medical control of its EMS programs, both within the HFD and the greater emergency medical community (hospital emergency departments and trauma centers). The former Medical Director, Dr. Paul Pepe, put Houston EMS on the map by integrating EMS into a large, urban, municipal fire department. The current Medical Director, Dr. David Persse, has continued the tradition.

PUBLIC ACCESS DEFIBRILLATORS: An example of how medical control can impact the public health status of Houston beyond its immediate sphere of influence of the HFD is the City's recent decision to expand the use of automated external defibrillators (AEDs) above and beyond the HFD First Response program, called the Public Access Defibrillation, or PAD, program.

On May 15, 2000, there was a public announcement of the placement of automatic external cardiac defibrillators (AEDs) in city buildings for public access. Houston is on the leading edge of this proven initiative. Chicago's O'Hare airport was the first to install publicly available AEDs, and there have already been several lives saved with their use.

The State of Texas requires local EMS system involvement in public access AED programs. When a public access AED is pulled from its mount, an alarm is automatically tripped to notify building security, and the public safety answering point. EMS units are automatically sent in response.

The City of Houston also has a "Fire Warden" program developed for high-rise residential dwellings. One or more persons on each per floor are educated in fire prevention, safety, and escape tactics. The project has been supported via city ordinance, the office of Fire Inspection. There is consideration of teaching these Fire Wardens the operation of AEDs – a good idea.

Fifteen AEDs have been requested; five are in the process of being installed. In addition, there are now two AEDs at the Houston Hobby Airport and one at The George Bush Intercontinental Airport.

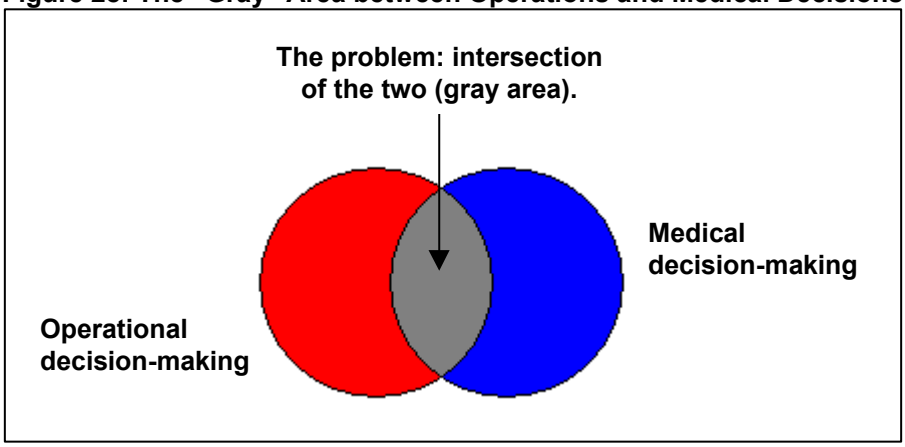
In addition to the public access AED project, HFD Medical Control has integrated an AED program into its fire suppression-based EMS first responder program. The system is acquiring Physio Control Lifepack 500 AEDs. They had been using Hewlett Packard and Marquette ECG machines but are unifying to a single brand. The system will have the capability of creating a manageable and analyzable record that will better serve the purposes of CQI and research.

All fire stations have an information transmission modem. Personnel can connect the AED and simply push a button to send data to a central processing point. The AEDs are programmed with the number to dial to relay information. The Telemetry Office is staffed at the Ben Taub Trauma Center with paramedics who coordinate communication between EMS field units and physician Medical Directors and less often, receiving hospitals. Physicians are paged for each cardiac arrest and assist in real-time.

Physio Control is beta testing various brands of ECG pads with their Lifepack 12 in Houston. It is another example of a benefit of Houston's organization and reliability in EMS medical direction.

ISSUES RELATED TO THE BIFURCATED COMMAND PROBLEM: The problem of bifurcated command arises when the line between medical and operational decisions is blurred; that is, when each views a decision as falling under his or her responsibility (see Figure 28). This creates a host of issues that affect personnel in the field as well as departmental management. Fire officers must have an understanding of both the medical and operational ramifications of their decisions. This requires communication and mutual respect between the principal decision-makers, generally the Fire Chief and Medical Director. In systems where these two functions coordinate well either formally or informally, the bifurcated command problem is mitigated. As noted earlier, this has not been the case in Houston.

Figure 28: The "Gray" Area between Operations and Medical Decisions



The City of Houston anticipated potential problems concerning the overlap of medical and operational authority in setting up legal authority for the EMS system. By one city ordinance, the Harris County Medical Society has an official voice in EMS policy matters. By another city ordinance, the Medical Director is under the auspices of the Executive Office of the Mayor and City Council, outside of the Fire Department's chain-of-command. This second city ordinance further defines the duties of the Medical Director to include responsibility "for medical oversight of the City's delivery of emergency medical services, including all aspects of … coordination, policies, procedures, research, and educational activities."

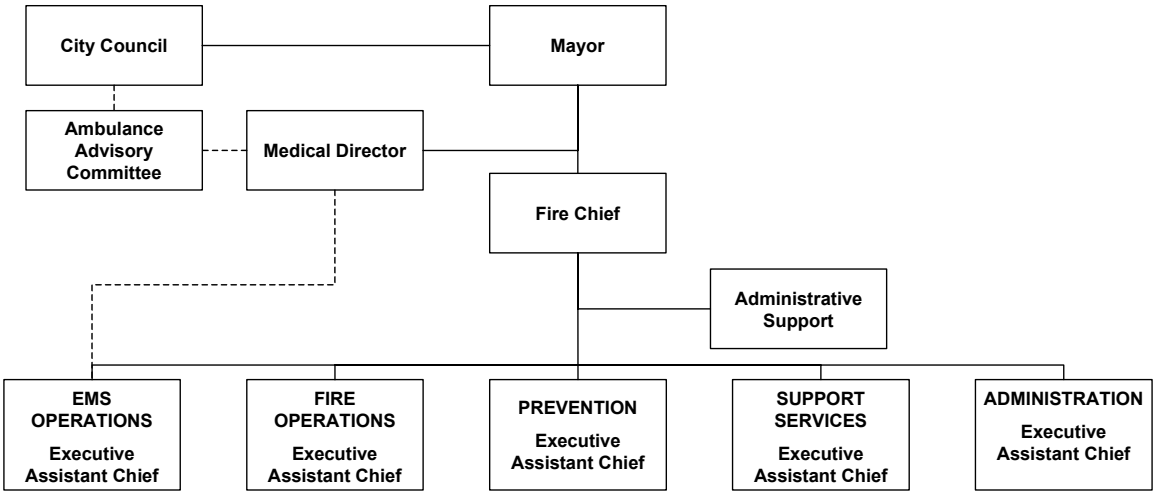
While these ordinances are farsighted, in and of themselves they cannot solve the bifurcated command problem. Therefore, we make the following recommendations:

Recommendation 90: In the future, the Fire Chief and the proposed Assistant Chief for EMS[48] preferably should have a sound background in EMS. Seventy-two percent of HFD calls for service are related to EMS. If possible, they should be drawn from current HFD ranks, otherwise, outside recruiting should be considered. The Medical Director and Ambulance Advisory Committee of the Harris County Medical Society should be consulted in the recruitment and selection process.

Recommendation 91: The position of the Medical Director should remain under the auspices of the Mayor's Office. This function should be afforded the technical and administrative support it requires, as will be discussed later in this section. Figure 29 shows the proposed top of the EMS hierarchy.

[48] A new position recommended in Chapter II.

Figure 29: Proposed EMS Organization



No matter what steps the City takes to reduce the bifurcated command problem, it will occasionally be necessary to involve a third party in differences of opinion on policy or specific issues. One way to accomplish this would be to have the Ambulance Advisory Committee's Executive Council review the opinions and make a recommendation to the Senior Executive Assistant to the Mayor for Public Safety.

ISSUES RELATED TO EMS FIELD RESEARCH: The HFD EMS system has an excellent reputation as a national leader in EMS field research. Approximately one-third of the Medical Director's compensation package is derived from simultaneous appointment as an Assistant Professor of Surgery at the Baylor College of Medicine.

The practice of EMS is constantly evolving as new techniques and equipment are introduced. A considerable amount of resources must be devoted to the study of patient outcomes to determine which practices yield the most satisfactory results.

Integration with the major medical centers, particularly the two level one trauma centers, provides an ideal research location. With the U.S. Army's interest and activity in training military field surgical units at Ben Taub and with their research interest in rapid and even remote evaluation of battlefield injuries, there is tremendous opportunity for the Houston EMS system to remain at the forefront of EMS research.

One of the most significant EMS studies of trauma was accomplished by Doctors Pepe and Mattux in Houston. The current medical director has guided the system to an

even higher level of professional medical sophistication, and subsequent studies are likely to be even more reliable and significant to the understanding of the physiology of acute trauma. There will be benefits to emergency medicine as a whole as well as to EMS systems worldwide.

Houston EMS physicians are at the forefront in national EMS activities. The Medical Director is part of the invitation-only EMS consensus group, the "Turtle Creek Conference." This group of EMS physicians, convene annually in the discussion of EMS topics. The results of these collaborations are published in an international journal to provide guidance to other EMS Medical Directors and administrators.

Physicians involved in HFD medical direction are routinely prominently featured on the National Association of EMS Physician's internet-based communication group. This continues the tradition of Houston EMS physicians being a resource of information and advise, nationally and internationally.

Sophisticated research projects in EMS do raise an issue, however. Municipal fire departments were not originally intended to accommodate academic medical practices and research. Although such research is vital, firefighters and field EMS providers can legitimately claim that capturing outcome data while experimenting with different field practices is not in their job description. Medical Directors, as a general rule, must become more sensitive to the demands research places on institutions such as the HFD.

Recommendation 92: The Ambulance Advisory Committee should officially recognize not just the contributions of the HFD physicians, but also the field providers and fire command personnel for their individual efforts in supporting EMS research. This may help increase acceptance of continued line firefighter participation in the research. (The HFD agreed.)

Recommendation 93: An internal analysis should be undertaken to identify and quantify the HFD resources directed towards research. If the amount is large, the Harris County Medical Society should be consulted to ascertain whether Federal, State, and institutional grant sources have been adequately tapped to offset the costs. (The HFD agreed.)

EMS Staffing and Shifts – Table 47 illustrates the breakdown of HFD personnel by several categories.

Table 47: Workforce Assignments (3,738 FTE Employees – 1999)

	Number	Percent
Class		
Classified/uniformed positions	3,313	87
Civilian positions	359	10
Firefighter/cadet positions	65	2
Primary Assignment		
Field operations	2,947	80
Dispatch/communications	144	4
Fire Marshal's Office	179	5
Fleet readiness and maintenance	163	4
Professional development/training	85	2
Administration (fire and EMS)	220	6
Upper Management vs. Rank and File		
Field operations (Fire and EMS) can be broken down by major function as follows (percentages below are based on the 2,947 personnel assigned to field operations):	2,947	80
Classified as field upper management, defined as senior captains and above;	260	9
Are assigned to frontline apparatus (Fire and EMS) defined as trainees through captains.	2,687	91
Primary Apparatus Assignment (Based on 2,687 FTE Field Personnel)		
Fire suppression	2,120	79
Ambulance	570	21
EMS Qualifications (based on 2,687 FTE Field Personnel)		
Firefighter/EMTs	Approx. 1,700	63
Firefighter/Paramedics	Approx. 350	13
Firefighters, not EMTs[49]	Approx. 640	24

There are two senior captain paramedics, North and South. There are six captain paramedics who function as EMS field supervisors, one each per central district and five quadrants.

[49] All HFD cadets now receive EMT training; firefighters who are not EMTs were "grand-fathered" in.

SHORTAGE OF PARAMEDICS: The HFD is currently experiencing a shortage of paramedics. It is difficult to determine the exact shortfall. An analysis was made of daily staffing shortages – the number of apparatus that had to be filled by overtime or personnel borrowed from fire companies. We estimate that the HFD is about 40 paramedics short for meeting current deployment. A staffing ratio of five was used when computing personnel needs.[50] That is, it takes 5 FTEs to staff one apparatus position 24 hours a day, 365 days per year.

Most EMS systems, as they grapple with lengthening response times, simply add additional resources to their existing deployment scheme. Earlier in this chapter the analysis showed that approximately 15 ambulances (eight ALS and seven BLS), would have to be added to the fleet to bring UHU rates down to obtain response time improvements. Table 48 shows the number of EMS personnel needed both to fill the existing paramedic shortages and to staff 15 additional ambulances. This analysis assumed retention of the present practice of a two-paramedic staffing pattern for ALS units, as well as converting the 9 dual units to medic units. Under this scenario neither staffing nor the number of units varies by time of day. (Peak-load staffing is examined later.)

Table 48: Future EMS Personnel Needs if 15 Full-Time Ambulances Added*

Position	HFD Current EMS Certified Personnel	Personnel Routinely Assigned to EMS Apparatus	Current Needs / Present Staffing Shortage	Future Needs with 15 Ambulances Added[51]	Additional Personnel Required for EMS Staffing**
Paramedics	350	275	315/40	440	165
Firefighter/EMTs	1,700	205	305/100	375	170
Total	**2,050**	**485**	**620/140**	**815**	**335**

* Based on TriData review of daily HFD staffing for 1999.
** Future Needs – Current Needs + Current Shortfall

The HFD is approximately 40 paramedics and 100 FF/EMTs short of fully staffing the current EMS deployment with two paramedics per ambulance/medic unit and two FF/EMTs per ambulance. Eight or nine medic units have to operate with one paramedic down each day (this is over and above the nine dual units). To ensure staffing

[50] A staffing ratio of 5 is conservative.
[51] Includes converting the nine dual units to medic units.

of BLS ambulances, many engine and ladder companies must also operate one person down (three personnel instead of the assigned four).

Later in this chapter we discuss two options for improving EMS service. Option I would require adding 15 EMS units to the number available (in year 2000). If the 9 dual units were converted to medic units (as recommended), then the staffing requirement would be 165 FF/paramedics and 170 FF/EMTs. To meet the Option I staffing would require either identifying 40 HFD FF/EMTs as candidates for a forthcoming paramedic training program or hiring 40 FF/paramedics outright. It also would require hiring an additional 100 to 170 FF/EMTs.[52] This would be a stopgap solution. The estimate for Option I does not factor in attrition from paramedic recertifications. Nationally, there is an annual field-provider turnover rate of roughly five percent. This, too, will have an effect on the future personnel needs of the HFD. Option II, a major system redesign, requires fewer paramedics and is preferable. [Option I was subsequently selected by the City.]

Another impact on EMS personnel numbers is the Deferred Retirement Option Plan ("The DROP"), under which one quarter to one third of the entire Department may be eligible to retire as soon as possible, possibly 1,000 classified employees over the next five years. The incentive to retire includes a large, cash payout at the time of retirement in addition to monthly retirement income. While mass retirement would bring numerous promotions and fresh minds into supervisory positions, there are inadequate numbers of personnel in training programs to take the place of field personnel.

To compensate for personnel lost through DROP, recertification failure, and annual turnover, *the HFD will have to recruit about 100 to 120 paramedics per year over the next five years*. This figure is over and above the current shortage of 40 paramedics and the additional 125 paramedics needed to improve response times under the current deployment scheme (the fifteen additional ambulances option).

SHIFTS: The HFD deploys its entire field workforce using 24-hour shifts, which has worked well for traditional fire suppression functions and is one of standard shifts used among municipal fire departments. (Others use a 10/14 shift.)

[52] Number is dependent upon paramedic training decision.

The 24-hour shift is conducive to departments with lower call volumes because providers can generally rely on having time during the shift to rest. However, as EMS call volume has continued to rise, HFD EMS field providers are increasingly finding themselves running back-to-back ambulance calls. The majority of these calls occur during a 14-hour period from 10 a.m. to 12 midnight.

This pattern of staffing, given the high workload, can be anticipated to produce fatigue at the end of shifts and the inherent products of fatigue in the work place: inattentiveness, cutting corners, an increase of errors in practice, and increased brusqueness in dealing with the public.

Many high-volume EMS systems are beginning to switch to 12-hour shifts for EMS personnel to reduce their stress and ensure good care of patients. Of the nine large cities surveyed in the benchmarking section, six use 12-hour shifts for EMS personnel. Another alternative, adopted by the Chicago Fire Department, is to lengthen the number of days off between shifts for paramedics using 24 hours on and 72 hours off, dropping Kelley days, and sometimes having "debit days" of extra work to make the average workweek come out with the right number of hours.

Most HFD field personnel prefer the 24-hour shift. This schedule allows personnel the time to pursue interests and opportunities outside of the HFD and the workforce have adapted their personal lives to this schedule. Any serious disruption to this schedule would likely cause morale to drop for a time. Further, the labor contracts would require renegotiations. Therefore, the support of HFD personnel will be essential to accomplishing any change in shifts. Due to the cross-trained, dual-role nature of the HFD, any change in shift for one group can be problematic and increase inter-group rivalry. Nevertheless, a different shift schedule for some or all personnel assigned to EMS units should be considered.

Several years ago the HFD experimented with an eight-hour shift for EMS personnel. Among the reasons for its failure was the need to change crews three times a day, which takes the unit out of service, often during the system's busiest hours. Tracking, assigning, and accounting of personnel are significantly more complicated when changing shifts three times a day versus twice a day. This makes the 12-hour shift a good compromise. Further, personnel remain fresh, ambulance turnaround times improve, and the 24-hour shift is mimicked in that field providers have several days off in

a row to pursue outside interests. In the next section, we recommend consideration of a shift schedule comprised of two 12-hour day shifts, followed by two 12-hour night shifts, and then four days off. Switching to 12-hour shifts would make it easier for the HFD to deploy its resources where and when they are most needed, rather than simply adding resources across the board.

A compromise that would affect fewer people is to staff only the newly added ambulances with 12-hour shift personnel (whether they be 15 ambulances added across the board or the power shifts outlined in the next section's re-design scenario). They could be volunteers from existing ranks and/or new hires not given a choice. It costs roughly the same to staff one 24-hour ambulance as it does two 12-hour ambulances. Earlier we computed that 15 additional ambulances would be required to solve current unit availability problems. However, these ambulances are actually only needed for 12 to 14 hours a day. Were the HFD to employ 12-hour shifts, the full-time equivalent of only 7.5 ambulances would be required, a savings of nearly half.

The next few years present an unusually good opportunity to change the EMS shifts. With an expected turnover of 25 to 33 percent over the next five years, the HFD has the option to deploy only new hires and volunteers to the 12-hour shift.

Recommendation 94: Work with Local 341 to poll EMS field providers to ascertain the number of current members who would be willing to have or prefer a 12-hour shift. (A survey of members will be undertaken in the first quarter of 2002.)

Training – As the HFD contemplates its future EMS staffing needs, the HFD must plan on how these personnel will be trained, certified, participate in continuing education, and be recertified.

Currently, new firefighters receive their EMT training from the fire academy, which works fine. The Houston Community College (HCC) at the Southeast Health Science Center has a contractual relationship with the HFD to provide paramedic training, continuing education, and testing. This is a first-rate training facility that is extremely well qualified to administer paramedic training.

In addition to the classroom training, the HCC participates with medical control in their "Paramedic Internship Program." The Internship program for paramedic firefighters is a superb continuation of formal supervised education for new paramedic graduates.

The education of any medical clinician is only in part achieved in the classroom. The concept of a supervised internship program as is practiced in Houston is actually quite a necessity. It is just not practiced in most locations. Paramedics completing their training are extremely inexperienced. Much of the learning of motor skills and implementation of what is taught in paramedic school is not fully internalized until experienced in actual practice. When a paramedic is thrust into that practice without continued oversight, attention, and "molding," the new paramedic runs a significant risk of committing errors to habit that will be difficult to correct, even if they can be identified later. The HFD internship program should be a role model to the EMS industry.

Continuing Medical Education (CME) requirements for paramedics is established and regulated by the Texas Department of Health. The CME requirement is eighty (80) hours over a four-year period, forty of which must be obtained, in the first year following graduation.

The HFD provides 80 hours of CME during the first two years following graduation and 160 hours over each four-year period. Each paramedic has one 40-hour week at Houston Community College. The last day of this week is at St. Luke's Medical Center reviewing assessment and management of Acute Coronary Syndromes.

A licensed examiner tests skills, including endotracheal intubation, IV access, megacode, dysrhythmia recognition, and drug therapy.

Houston's fine medical schools, trauma centers and hospitals also participate in paramedic training and CME. The Baylor Medical School Department of Anesthesia has a sophisticated computer controlled training mannequin used by HFD paramedics in airway-skills education and maintenance. The HFD EMS Fellow, an emergency medicine physician working under the HFD Medical Director, devised and administers this training component. This is an example of a benefit to the HFD EMS system that would not have occurred without significant physician involvement in the system. This level of integration does not occur in most EMS systems, where the degree of physician medical direction is only sufficient to attend to the "squeaky wheels," the items that reach the very top of the "must do" list.

ACLS (Advanced Cardiac Life Support) certification is accomplished through the Houston Community College.

Pediatric training is also significant. The State of Texas requires ten percent of EMS CME to be pediatrics. Paramedics in pediatric training spend two days in an Emergency Department (ED) and two days in an Operating Room (OR). Under the supervision of hospital anesthesiologists and with the approval and consent of the parents of the pediatric patients, the paramedics practice intubation skills on pediatric patients.

Paramedic personnel also take a short course called Pediatric Advanced Life Support (PALS) and Pediatric Education of Pre-hospital Providers (PEPP), sponsored by the American Academy of Pediatrics (AAP) and the American College of Emergency Physicians (ACEP).

A published Training Bulletin is routinely circulated to EMS personnel. On-line computer training is available. A pilot program was initiated 18 months ago and is scheduled to roll out this year. EMI net is an internet-based program of continuing education for physicians, nurses, and allied health personnel. Its cost is $102 per individual per annum. Computers at each of the fire halls are utilized for access.

While this overall EMS training is excellent, there are still some important training issues to be addressed. One is that much of the HFD's CME is conducted while personnel are on duty and their units are taken out of service for the training. This limits the availability of ambulances to the community, and requires that CME classes be frequently repeated to cover all personnel on all shifts. (Firefighter/EMTs require CME as well.)

Recommendation 95: There must be an organizational structure to plan and implement FF-EMT Continuing Medical Education on a routine and recurring basis. On-line FF-EMT continuing education program was started in 1999, after a pilot program in 1998. There also should be a plan for routine communication of changes in patient care practice and theory to field medical personnel addressed to their level of training and practice (EMTs vs. paramedics). For cost-effectiveness of training, the number of FF/EMTs routinely assigned to ambulances should be kept to a minimum and preferably remain a relatively stable group. (The HFD agrees with these recommendations.)

Recommendation 96: Also make continuing education available to the paramedics at their station houses to the extent possible. Consider innovative alternatives to having to repeat any given class four times in order to cover all platoons, e.g. on-line training for at least some material.

The contract with the HCC is subject to renewal in the near future. Another highly qualified institution has expressed interest in competing for the contract. Competition is a good thing, however, we do recommend that, should there be competition for the renewal of the HFD paramedic training contract, the positive experience and track record in the training of paramedics by the HCC should be recognized and continued.

Recommendation 97: Continue the current EMS training contract. The affiliation with Houston Community College is working well. It is one of the best programs of its type in the nation. There are too many other changes needed in EMS to entertain unnecessary changes.

There appears to be some controversy over what is considered an acceptable passing grade for paramedic training. Prior 1995, HCC required an 85 percent passing grade. Since then it has been changed several times, first to 70 percent, and now, 75 percent. This occurred because of fears regarding the ability to graduate a sufficient number of paramedics to meet HFD needs.

Should the HFD adopt one-plus-one staffing of squad cars (one EMT-P and one EMT-I), as recommended later, it will become even more important for paramedics to be proficient. A higher passing grade would help ensure their quality.

Utilizing EMT-I's has the added advantage of allowing for flexibility in the classroom. Should an instructor identify a student that might have difficulty successfully passing the EMT-P program, the student could be encouraged to complete only the first three modules of the program, "testing out" at the EMT-I level. (This option has been available since 1997.)

Recommendation 98: Re-establish a high passing grade requirement for paramedics. Each will be a precious resource expected to operate at a high level. (HCCS is planning to analyze data in 2002 to determine the correlation between grades and success on the TDH certifying exam, which should help establish a basis for setting a passing level.)

The final training issue is related to the forthcoming decisions on additional EMS resources and how they may be applied. Paramedics are a costly commodity that require constant training in order to maintain proficiency. The initial 600-hour training program costs approximately $1,200 per paramedic; when one adds backfill requirements for the

personnel that must operate the system while the paramedic is in training, the costs skyrocket.

It has proved difficult to attract paramedics to the Houston Fire Department and to retain them as practicing paramedics. As an acknowledgement of that reality, some new personnel over the past several years have been required to attend paramedic school as a condition of hire, and give a five-year commitment to serving as a paramedic. This has resulted in some personnel who want to be Houston firefighters being forced to practice emergency medicine for some period. To their credit, there does not seem to have been demonstrable patient care problems resulting from this practice. It must be noted, however, that subtle and occasional alterations in practice and outcome are almost impossible to identify in a large EMS system.

The state has no minimal test performance requirement. Any threshold for practice is at the Medical Director's discretion. Intentional poor performance on the paramedic test has been cited as a method of being excused from the practicing paramedic ranks.

Costs and personal commitment are, therefore, important factors to consider as Houston grapples with possible system re-design scenarios. A system re-design that requires fewer paramedics, while still providing superior care, is attractive for these same reasons. Therefore, as EMS System re-design scenarios are considered, appropriate attention should be given to system designs that use fewer paramedics than the alternatives. Also, in considering sources for additional providers, the pressuring of FF/EMTs to become paramedics should not be done. It can be counter-productive. Being a paramedic is a calling!

Patient Transportation and Apparatus

Vital statistics pertaining to the current EMS fleet are shown in Table 49.

Tiered fleets are economically desirable because they require fewer paramedics than all-ALS ambulance fleets. Tiered fleets are also attractive because only approximately 20 to 25 percent of EMS incidents actually require ALS skills. The inherent problem with tiered fleets lies in the matching of ambulances (ALS or BLS) to

calls. It is inevitable that both types of ambulances will be sent to calls that fall into the gray area between those calls that clearly are or not life threatening.

Table 49: Fleet Capabilities

85 fire stations house:
• 83 engine companies (also used for EMS 1st response)
• 37 ladder companies (also used for EMS 1st response)
• 52 special operations vehicles (includes 15 water craft)
• 29 command vehicles (which include 8 EMS supervisory squad cars)
62 ambulances in a tiered-response deployment scheme:
• 27 Medic Ambulances (ALS, staffed with 2 Paramedics)
• 26 Basic Ambulances (BLS, staffed with 2 firefighter/EMTs)
• 9 Dual Ambulances (ALS equipped, staffed with 1 Paramedic and 1 firefighter/EMT)

Given the high utilization rate of the HFD ambulance fleet, matching ambulance capabilities to the severity of calls is often difficult because the nearest preferred type of unit is often busy and unavailable to respond to calls. Two internal HFD committees are currently studying the efficacy of the "squad car" and paramedic engine concepts. Both of these modalities have worked well in other systems across the nation. Both should be considered, depending on the call volume in particular areas.

The primary advantage to paramedic engines is that incorporating ALS response into the existing first response program solves ALS response time problems. This concept, however, works well only in areas with low call volumes and minimal traffic congestion. Otherwise, it can be difficult to maneuver through traffic, and expensive equipment experiences unnecessary wear and tear.

The squad car concept has two major advantages. First and foremost, matching the presumed severity of any given call to the resources available is no longer an issue because the entire system is ALS-capable. Secondly, paramedics are no longer occupied with BLS transports and are more available for life threatening calls. Additionally, squad cars are more economical to operate and replace, and are more maneuverable in congested areas. Finally, using both modes of ALS transportation allows for the rotation

of paramedics from areas of high volume to areas of low volume, reducing personnel burnout.

Recommendation 99: Consider transitioning to an all-ALS system that is based on use of squad cars and paramedic engines. The next section discusses the particulars. (The HFD subsequently implemented the first step of a squad-car based program to send paramedics to ALS incidents as identified by Medical Priority Dispatch.)

The final issue with which to deal under the patient transportation component is when to run "hot," with red lights and sirens. As first responders are not required for every EMS request, neither is every call for EMS assistance a time-critical emergency. Criteria should be developed for determination of which calls are time-critical or patient care-critical and should be responded to with red lights and siren (RLS), and which are not. Reducing the incidence of RLS response would lower both personnel and equipment stress, reduce the incidence of emergency vehicles directly involved in collisions while responding with RLS, and reduce "wake-effect" collisions. The latter are collisions not involving the emergency vehicle itself but are caused by sudden stops or evasions resulting from the emergency vehicle's presence.

Recommendation 100: Consider modifying the response policy to permit non-emergency responses to selected calls. In other systems, approximately 18-20 percent of calls for EMS are not really emergencies. A similar proportion might be expected in Houston. The use of an alternative non-emergency response would take much planning to start up, but it has proven feasible and cost effective elsewhere.

Communications and Dispatch – Most issues regarding HFD communications and dispatch procedures are discussed in Chapter VII, Support Services. The planned improvements in the CAD and other aspects of communications will significantly improve EMS dispatch.

There are several areas of particular relevance to EMS in planning the new communications system. These include the conversion of call-taker and dispatcher positions from classified positions to civilian, the training of call-takers as Emergency Medical Dispatchers (EMDs), and ensuring access to dispatch data to augment the EMS quality assurance program.

MEDICAL PRIORITY DISPATCH: Proper Emergency Medical Dispatch (EMD) training and use of formal caller inquiry protocols assure information gathering from

emergency medical calls in a reliable and reproducible fashion. This helps reduce inter-dispatcher variation in response to calls. It has been well demonstrated that dispatcher "freelancing" – asking questions outside written protocols – delays dispatch and can lead to an inappropriate response.

Pre-arrival patient care instructions have become another indispensable part of EMD. Initial concerns about the legal liability of giving telephone instructions have given way to the more real concern in this age of EMS practice of not having them. Pre-arrival patient care instructions are available to dispatchers and are provided to callers as indicated.

Medical Priority Consultants is the industry leader in EMD and has the most medically sophisticated caller inquiry series, dispatch prioritization sequence, and continuing quality improvement program for EMD systems that exists. It is the only protocol currently available that is physician authored. It has undergone extensive review and refinement over the years by persons whose focus and attention have been dedicated to the dispatch process of emergency medical services. Its utilization can reduce the risk of errors of both commission and omission, direct ALS personnel when indicated and preserve them when BLS procedures are all that is indicated. The current incidence in HFD of ultimately needing a paramedic on a call to which only a BLS unit has been dispatched initially is almost zero. This may indicate some degree of over-triage to ALS personnel. Unrealized efficiencies may benefit the system if a reliable Medical Priority Dispatch system could more finely discriminate between ALS versus BLS-level requests for service.

A reliable protocol-driven system also would reduce stress of decision making on dispatch personnel. The dispatchers become facilitators of the process and do not have to use judgment to appropriately categorizing a call; the written protocol does that.

In a litigious society, the relatively small investment in the most complete EMD protocol available (the Medical Priority Dispatch system) is inexpensive insurance. Its cost-efficiency becomes rapidly apparent – it is used every time the telephone rings.

An extensive study of Houston emergency medical dispatch was published in October 1999. The report was detailed in its scope and its conclusions, and was reviewed by our project team. Our recommendation reflects our own observations and that report.

Recommendation 101: Use the call-screening system (ProQA) offered by Medical Priority Consultants of Salt Lake City, Utah, or something equivalent. It is the only medically validated product on the market, though that could change. Their system incorporates the following criteria:

- The medical protocols are developed by a consensus group of emergency medicine physicians;
- The protocols are available in software form and can be easily integrated into CAD systems;
- The protocols receive continuous professional reviews; revisions are automatically sent annually to the systems using the program; and
- The computerized protocols allow for an automated quality assurance process, where resources sent to a given incident are matched with what was called for by personnel arriving on the scene. This allows the Medical Director to fine-tune the dispatch deployment for optimum efficiency and medical outcomes.

(The ProQA system subsequently was selected for the new consolidated dispatch center. Unfortunately, there have been compatibility problems between the current dispatch computers that preclude full use of ProQA.)

Other issues/recommendations related to Emergency Medical Dispatch discussed listed below. They should be integrated into the Command Center planning process.

DISPATCH CERTIFICATION: Currently, the dispatch center of the HFD holds no nationally recognized accreditation.

Recommendation 102: Obtain certification and accreditation for the dispatch operation. (In 2001 the Department was in the process of establishing a dispatcher certification program that would meet the standards of the National Academy of Emergency Medical Dispatchers (NAEMD). The Department plans to apply for accreditation when the consolidated dispatch center is operational, since it is dependent upon utilizing ProQA software.) The certification can be accomplished easily with implementation of the MPDS.

TRACKING HOSPITAL DIVERSIONS: At present, ambulances are blocked from access to the Internet website used to track hospital diversions.

Recommendation 103: The Internet web site used to track hospital diversion status should be accessible from ambulances. This would allow ambulances to be apprised of the diversion status of area hospitals, and not have to be dependent upon the HFD EMS base station to relay that information.

RECORDING COMMUNICATIONS: Currently all radio communications are recorded at the Fire Alarm Building, but telemetry traffic is not.

Recommendation 104: Communications through the Telemetry Office should be recorded. Digital tape recording systems are available that would allow review of telemetry for purposes of CQI, education or legal processing in a cost-effective manner. (The HFD agrees, and the system will be implemented when funds are available.)

DISPATCH CQI: A routine and genuinely continuous quality improvement (CQI) program is needed to review reliability of the inquiry and dispatch processes (as well as the delivery of medical treatment). Evaluation of dispatch performance is particularly important in a tiered response system such as Houston's, where there is a level of sophistication in selecting the dispatch and response, and not every call is treated the same. CQI is less important in a system in which every call gets paramedics and firefighters running with red lights and siren. When dispatchers implement protocols that select which resources are to be utilized and which are denied, strict protocol adherence and the inter-dispatcher reliability of that implementation must be demonstrated on a recurring basis. This ensures protection of the public and medical-legal protection of the EMS system and its personnel.

The HFD established a management analyst IV position in HQ as a liaison with Dispatch for CQI. This position should help ensure the quality of dispatch and use of emergency medical dispatch. The liaison serves on the EMS continuous quality management team. This relatively new position is a good step toward genuinely continuous CQI. There were some problems under the previous fire administration with the adequacy of the liaison. If the situation does not improve, a uniformed fire medic should be considered for the liaison role. (Editor's Note: Twelve positions were subsequently added to EMS Administration for the CQI program.)

RESOURCE MANAGEMENT DISPATCH (RMD): Another symptom that the HFD EMS system is on the verge of being overwhelmed by rising call volume is the increasingly frequent need to use Resource Management Dispatch (RMD), formerly known as Critical Incident Dispatch (changed July 31, 2000). As noted earlier, RMD goes into effect in the HFD when there are 25 or fewer ambulances remain available for incoming calls. RMD data is entered on the Daily Activity Report. Over a period of 13 days, from July 20 to August 1, the HFD recorded 23 declared RMD conditions. The duration of these conditions ranged from a few minutes to as long as five or six hours.

The HFD CAD system is not programmed to automatically notify dispatch personnel when RMD is warranted. Consequently, the HFD may require RMD but may not be immediately aware of this situation. Also, this means that recorded occurrences of RMD reflect only those instances that were identified.

Recommendation 105: The new Command Center should incorporate automatic identification and notification of RMD status in the dispatch software. When RMD goes into effect, the automatic dispatches must change and the EMS operations management must be informed in real time that they are changing. (A dynamic software switch for implementation of Resource Management Dispatch (RMD) has been specified as part of the new dispatch software.)

Management and Field Supervision of EMS – EMS needs to have a separate senior command or Executive Assistant Fire Chief level. The system has become too complex to operate in its current bifurcated fashion. A separate EMS division also would demonstrate the importance of EMS to the HFD and affords EMS the recognition, support, and operational authority it deserves. The proposed top of the organization was shown in Figure 29. EMS Operations would be headed by an Executive Assistant Chief who receives medical protocol direction from the Medical Director and operations direction through the Fire Chief.

Field clinical supervisors should be considered the Medical Director's representatives and be a part of the CQI process. In Houston, they are on the scene of most serious medical emergencies and almost all cardiac arrests. They direct cellular telephone communication with the Medical Director or an assistant during the resuscitation process to help guide and direct care. The field EMS supervisors should not be misunderstood, as has been the case in some municipalities, as unnecessary "middle management." Their function might be better represented by the term "super-paramedic." Other cities should emulate Houston's use of the supervisors.

Particularly in dual-role, cross-trained fire departments, it is not uncommon to encounter the assumption that one field supervision structure can adequately oversee both fire suppression and EMS personnel. In fact, the main advantage of a dual-role, cross-trained system is the ability to alleviate redundancies through dual functioning positions.

This economic principal, however, does not function well when fire suppression field supervision personnel attempt to supervise an EMS incident. Primarily, this is

because EMS field supervision is medical in nature whereas fire suppression field supervision includes command and administrative duties. In an all-ALS system, EMS field supervisors must themselves be paramedics, preferably based in mobile units, which allow them to respond quickly to all areas of the City.

The present HFD practice of dividing Houston into two distinct districts (north and south), assigning EMS field supervision of the City between two District Chiefs, each assisted by three sector located senior captains is sound. It is our understanding that a sixth paramedic supervisor was added recently, which was a good addition.

However, the issue of whether eight or six paramedic field supervisors are sufficient must be explored. ALS field supervisors currently have a ratio of one supervisor to eight ambulances. Although this ratio is approaching the upper limits of a reasonable span-of-control, it is acceptable because there are only approximately 5,000 truly life-threatening calls each year, which translates to each paramedic supervisor covering two such calls per 24-hour period.

Administration and MIS Issues

Since EMS is a different field from fire suppression, attempts to co-locate certain EMS administrative functions with their fire suppression counterparts have sometimes led to frustration rather than economy.

EMS Supply – The HFD is attempting to consolidate EMS supply with the rest of Department in a section headed by civilian. Some problems have been noted in its execution. There is a lack of prioritizing the needs of EMS versus Fire. Actual needs and purchases have not been equivalent. For example, there was a need for 30 Stryker ambulance stretchers and 50 were bought. Fifty Physio Control Lifepack cardiac monitor/defibrillators were purchased, but more were needed. Batteries for the devices are in short supply. Purchase orders are not prioritized with respect to the timing of their processing. There does not seem to be an easy method to compare expressed supply needs with existing reserves to help make purchasing decisions.

Ambulance Billing – Billing for patient transport has been subcontracted to the Lockheed Martin Corporation's Houston office. The outsourcing of this function is quite common and recommended. The intricacies of ambulance billing and the multitude of

rules and regulations governing pricing and collections, argue favorably for using a subcontractor. Lockheed Martin provides this service to other high-volume systems across the U.S., but there have been on-going problems, and the software subcontractor to Lockheed will no longer support their product.

The current billing is collecting at a rate under 40 percent, which amounts to approximately $15 million per year. Compared to other jurisdictions, this collection rate is relatively poor, as shown in Table 50. (Some of the comparisons may be somewhat misleading, depending on whether the gross amount billed or the Medicare-approved amounts are used in the determination of the collection rate calculation, which is not always clear. But in any case, the HFD collection rate is clearly below what it could be.)

Table 50: Comparative EMS Collection Rates

City	Percent of Billings Collected
Phoenix, Arizona	70
Washington, D.C.	63
Los Angeles, California	60
Nashville, Tennessee	60
San Diego, California	56
San Jose, California	55
Indianapolis, Indiana	55
Chicago, Illinois	50
Philadelphia, Pennsylvania	48
El Paso, Texas	47
New Orleans, Louisiana	42
Houston, Texas	**40**[53]
Memphis, Tennessee	39
Detroit, Michigan	23
Baltimore, Maryland	20

One mitigating factor for the relatively low collection rate is that Texas leads the nation in the percentage of its population that is not medically insured.[54] Rural Metro, one of the largest private ambulance corporations in the country, plans to exit the Texas market because of the high rate of uninsured, citing that this fact has made it impossible for them to make a profit. Lockheed Martin estimated that future improvements in

[53] This was estimated to be in the 32 – 36 percent for 2000.
[54] The state of Texas experiences an uninsured rate of 24.4 percent (3-year Average); the national average is 16.3 (3-year Average 1996-1998). Source: U.S. Census Bureau.

collections could lead to a higher collection rate, about 45 percent, which would result in net collections of approximately $16 to $17 million per year, $1 to $2 million higher than in 2000, but still below average. These improvements would require implementation of a mobile EMS patient record keeping system, preferably compatible with the CAD and hospital data system.

COMPUTER-BASED PATIENT RECORD KEEPING SYSTEM: Having improved patient data is critical to improving the billing rate. We therefore discuss the system in detail below.

There is (in year 2000) a dual system for documenting patient care encounters. BLS units produce a written record and a dictated note that is forwarded to the central computer. Frequent receipt of this EMS medical record data is known to slow the function of the CAD.

ALS providers enter patient care data into a laptop computer. The ALS lap top computer has its own edit-check system that requires each appropriate field to be filled before the individual documenting patient care can proceed to the next field. This record is then sent to the CAD, which processes it through its own edit-check program. There are problems with this step of the process. It is said to be a far less sophisticated program than that in the laptops. On frequent occasions, the CAD cannot process the information received and the EMS medical record is held in "roam." Great effort in time and manpower is required to identify, retrieve, and repair each of these records to allow their ultimate entry into the permanent database.

The CAD, upon receipt and processing of an accessible record, forwards it to a "command computer" established and operated by Lockheed-Martin. From that computer, a copy of the EMS medical record is then forwarded via facsimile to the receiving hospital.

When the field laptop attempts to send information to the CAD, it has a five-second entry window to make the transfer or it is locked out for five minutes. The system in queried by the computer every two minutes to try to restore information flow.

There are docking stations in each ambulance that allow the EMS medical record to forwarded to the CAD computer via radio frequency (RF) transmission. There are no docking stations in the hospitals.

A variety of problems have seriously impaired the functioning of the system:

- An antiquated CAD system that cannot download incident data from dispatch to the portable computers in the field in real time. Out of fear of computer overload, the system has been set up to retrieve data from the CAD at less active times. As a result, paramedics receive dispatch data on their portable computers in a timely fashion only 30 to 40 percent of the time.

- Since the system cannot merge data in real-time, EMS users tend to open their own record for an incident, separate from the record eventually generated by the system. Matching the incident numbers for two records for the same call causes confusion, delay in processing, and delays in delivering patient records to the intended emergency departments.

- There are software glitches that have not been solvable by the HFD, Lockheed Martin, and the original software designer. All seem convinced the problem lies elsewhere than in their own shop. The solution to the problem would require all three parties to come to the table simultaneously. (Unfortunately, the software is no longer supported by the subcontractor.)

- A separate file server to allow CAD dispatch data to be retrieved in real-time, without, running the risk of crashing the system, has been ordered. This however, is only an interim solution.

The patient and treatment information created needs to be sent directly to a central computer with an advanced capability of receiving and storing data so that is can be available for subsequent analysis. Currently, significant information is lost because of the CAD's limited capabilities. Detailed information query of the EMS medical record is not currently possible.

The ideal system would allow a field user to access information discovered on previous interactions with the patient by being able to pull back remote EMS medical records.

The computer program also could track supply utilization, providing ease of control of restocking and rotating or replaced items with a definitive shelf life.

Firefighter-EMTs reassigned from fire suppression to the ambulance require about a day of training to acquaint them with computer documenting technique. The function of the computer program should be made more inherently obvious during its execution.

There are apparently two FTEs for record search and training. If all records were detailed and that information accessible for computer analysis, the efficiency of analysis would be greatly enhanced.

Those working within the Department on the laptop project should be encouraged to create a program that can be utilized by all who perform patient care. It should continue to be refined to a user-friendly format, the mechanism of which is obvious to the field user. This would minimize a training interval for new or infrequent EMS providers.

Lockheed Martin and the HFD in early 2000 had been in the process of converting the current handwritten patient record keeping system to a vehicle-based portable computer system. The new system was to have the capability to interface with the dispatch computer and communicate with receiving hospitals. The field-testing phase of this project began in 1996. Only ALS providers are presently utilizing the system. The system was designed to eventually expand and include BLS providers, which will also solve the problems associated with the collections, filing, and retrieval processes currently employed by the HFD. At present these functions are hand manipulated. They are slow, cumbersome, and require staffing.

Recommendation 106: As a stop gap measure to improve EMS data, purchase a file server that will allow promper access to CAD data than is possible at present. (As of 2001, a new database server is planned to be part of the new EMS mobile computing, reporting, and billing system to be developed. The database server is expected to be replaced by the new Records Management System as part of the consolidated CAD project.)

Recommendation 107: Develop a new mobile computer-based patient record keeping system to include ALS, BLS, and squad providers. (A new system is planned for mobile computer, reporting, and billing for all EMS units – ALS, BLS, and Squads. An RFP was issued in 2001. The system is expected to be implemented in 2002.)

Recommendation 108: Ensure that the new CAD system will have the capability of downloading patient dispatch information to an automatically generated patient record. This will improve the quality of the data and reduce paperwork for paramedics. (It is planned to be compatible with the new Mobile Computing system for EMS noted in the previous recommendation.)

FIREFIGHTER-EMT FIRST RESPONDER EMS DOCUMENTATION: The Houston EMS system has done a good job of developing a system to document information acquired at dispatch and make it part of the EMS medical record via radio frequency communication with the ambulance medical record computer. What needs to be accomplished is a mechanism for firefighter-EMTs to document their findings when providing patient care in advance of ambulance arrival. This also needs to become part of the permanent EMS medical record. Mechanisms need to be considered and developed.

Documentation by a member of the engine company, written and presented to the ambulance crew at the time of transport, would be of utility to subsequent caregivers. Such a form might not have to be utilized on every first response call. A threshold for its use would have to be determined. An alternative may be electronic documentation of the medical aspects of the call at the fire hall or hospital, for inclusion into the EMS medical record.

Recommendation 109: Consider further expansion of the EMS documentation system to include BLS first responders. This recommendation should be implemented as a third and final step, after all glitches are rectified and the system is working well for the ambulance based ALS and BLS providers. (As noted earlier, a new system for mobile reporting for all EMS units including BLS is now planned.)

DATA ACCESSIBILITY: Improving the EMS system design is dependent on the HFD's ability to obtain and properly analyze patient record and dispatch data. Integrating these two distinct systems would allow the HFD to monitor and track whether its new MPD system is operating effectively and efficiently. Further, these data will be invaluable in the event of a lawsuit.

With the antiquated CAD system it is difficult to manipulate, query, and format data. Presently, CAD data must be converted and analyzed using Microsoft Access, a time-consuming and often frustrating process. The data accessibility problem probably will be solved when the new CAD system is in place.

Evaluation and CQI

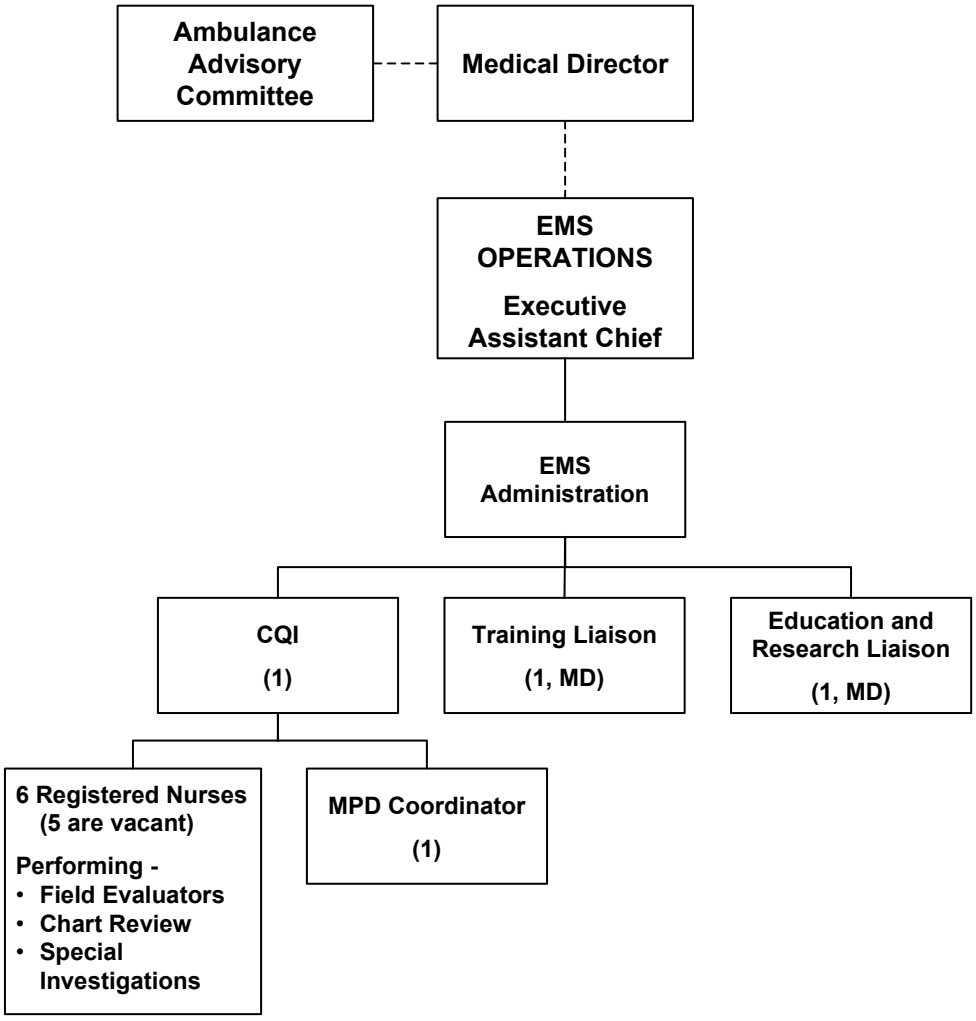
As is the case with other administrative functions, as well as paramedic supervision in the field, the merging of quality control functions under one departmental umbrella is ill-advised. Rather, the Medical Director and other key EMS administrative staff should have direct access to these vital functions. There needs to be a staff dedicated to the evaluation of field providers as they render street care, as well as a routine, systematic review of a random sample of all patient records. To achieve this, we recommend the changes illustrated in the more detailed proposed organizational chart (Figure 30).

FIELD EVALUATORS: The HFD currently has six positions for Registered Nurses (RNs) to provide field evaluation services for EMS field providers. Only one of these positions is currently filled. At current staffing levels, and assuming 15 FTE ambulances are added to the frontline fleet, each RN should be required to evaluate each paramedic and ambulance-based firefighter/EMT twice a year, or one evaluation per RN per day, excluding Saturday and Sundays.[55]

Registered Nurses are difficult to recruit and retain by the HFD because of the discrepancy between the salary and benefits available in the public verses private sectors. It is, however, imperative that these positions be filled, because of the importance of maintaining high-quality patient care. Options to accomplish this include raising the salary to be more competitive and/or utilizing veteran paramedics instead of RNs. (Most cities use paramedic officers as field supervisors.)

[55] If Houston accepts the recommended system redesign discussed later, the workload for the evaluation staff would increase only slightly to 1.3 evaluations per day per RN.

Figure 30: Proposed Organizational Chart (Second and Third Tier)



Recommendation 110: Staff the field evaluator positions for EMS. Do this either by recruiting nurses or hiring more paramedic officers. (The HFD is planning to hire civilians for this function. The local nursing shortage and TDH mandates have caused the HFD to utilize citizens with the necessary skills to handle this function.)

OTHER QUALITY ASSURANCE POSITIONS: In addition to the required field evaluator positions, a quality assurance dispatch liaison, training liaison, and a special EMS investigator are needed, at a minimum, for QA. (These are not shift positions.)

The QA dispatch liaison position is of vital importance because the Medical Priority Dispatch System, both the present one and the one on order, requires constant feedback from the field in order to fine tune and monitor the effectiveness of the resource dispatch policy – what units are sent to what types of incidents. Because dispatch is and

will be organizationally separate from EMS, a two-way information highway should be maintained to ensure optimal performance.

The same logic applies to a position that coordinates training matters between the Houston Community College System (paramedic training and CME), the fire training academy (EMT training) and the EMS field providers. The tracking and coordination of CME compliance by certification level, by training facility and by individual technician is cumbersome. The system currently lacks a centralized registry for both BLS and ALS personnel. This position would be responsible for the development of a centralized registry, the coordination of training facilities as well as the appropriateness of CME.

Finally, most high volume EMS systems assign one full time employee to investigate serious allegations regarding adverse medical field incidents. Paramedic supervisors usually initiate incident reports, however, they then go off duty, sometimes for days at a time. Without an office-located position to receive, track, investigate further and recommend actions, these incidents can and do fall through the cracks.

Recommendation 111: Add three EMS quality assurance positions. Two positions are needed to address liaison issues for dispatching and training, and one is needed for investigation of adverse EMS field incidents. There have been several incidents involving questionable EMS practices by a few EMS personnel; the investigator would investigate those types of situations.

(As of 2001, two of the quality assurance functions had people assigned to them. The dispatch liaison position is handled by the Management Analyst IV position described earlier. However, additional personnel are still needed in Central Command to perform continuous quality improvement tape review. The training liaison position is a classified firefighter/paramedic who oversees the tracking and scheduling of EMTs and paramedics. In addition, this position is responsible for ensuring the continuing medical education is implemented and completed in accordance with state and departmental mandates (through the Physical Director of EMS). In matters of curriculum design and appropriateness of CME, this position reports directly to the Medical Director of EMS. The volume of data to be monitored is constantly increasing and the training liaison is currently under-supported. An additional assistant to the training liaison is needed.

The responsibility of investigating adverse EMS field incidents is now performed on a part-time basis by the EMS Administrator position.

Twelve positions have been added to the CQI program for CQI and certification documentation. They have been funded and are currently being filled.)

Proposed EMS System Re-Design

In light of the various problems discussed above, especially the overload of calls per EMS unit, and the likelihood that demand will continue to increase, some major action is necessary if Houston is to reduce response times to acceptable levels and keep the quality of EMS high.

One can do this in a series of uncoordinated changes, or one can take a systems approach and redesign the whole system for the future. We have made many individual recommendations in the previous sections. In this section we discuss a redesign of the EMS resource deployment scheme utilizing proven state-of-the-art methodologies that incorporate most of the proposed improvements into one package. This is Option II, the recommended approach. It is contrasted with Option I, making the individual recommended changes above plus adding 15 ambulances to the current system.

Option I: Add 15 ambulances to the current System – To reduce UHU to 0.42, an additional 15 ambulances are needed. These units would be added 24 hours a day, 7 days a week. The 15 additional units would cost approximately $10 million per year to operate.

As noted earlier, the fifteen additional units are not really needed 24 hours a day. Assuming access to staffing on a 12-hour basis (there are several ways to accomplish this), these 15 units could be put into service for 12 hours only. Then instead of having to add 80 FF/paramedics and 70 FF/EMTs at a cost of $10 million, staffing requirements would be cut in half to 40 FF/paramedics and 35 FF/EMTs and the cost would be $6 million per year.

All 15 new units should be placed in the high activity areas of Houston. Consider assigning the eight additional medic units in the following areas:

- Central Business District
- Galleria – Uptown
- Greenpoint Crossing
- Greenway Plaza
- Medical center
- Memorial City

- I-10 Energy Corridor
- Westchase

The seven BLS units should be stationed around the I-610 Loop.

If the decision is to proceed with Option I and personnel are identified to put these units in service for 12 hours only, then the units should be separated into two power shifts, with start and stop times similar to those proposed in Option II.

The major advantage to Option I is that it can be implemented in a relatively short period of time, with little to no disruption to current HFD deployment, staffing and work practices.

The major disadvantage to Option I is more difficult to quantify: The current EMS practices have built-in inefficiencies that become more problematic as EMS call volume continues to rise. Although Option I would immediately alleviate the stress the system is currently experiencing, it would not position the HFD for a more efficient operation that would serve the HFD well throughout this decade and beyond.

Option II, Proposed HFD EMS System Re-design – The key features of the proposed system re-design are as follows:

- Conversion to an all-ALS system
- Basing the majority of the ALS response capability in squad cars with "one-plus-one" staffing (firefighter/paramedic plus EMT-I)
- Basing the remainder of the ALS response capability on "paramedic engines"
- Conversion of the ambulance fleet to all-BLS
- Converting 14 full-time equivalent (FTE) ambulances to 28 12-hour power shift ambulances, peak load scheduled
- Convert *some* of the ambulance staffing to 12-hour shift.

All "ingredients" in the proposed integrated new approach have been employed in other high volume systems throughout the country (e.g., Los Angeles, California, and Birmingham, Alabama). While the proposed design uses a unique combination of

alternatives, it is not radical, but rather incorporates accepted industry concepts in a new way.

The recommended redesign is not intended to represent an indictment of the present response modalities employed by the HFD. The current system epitomizes the prevailing model employed by high-volume systems for the last 20 years. However, high-volume systems are having to rethink their response/deployment systems because:

1. It is expensive, time-consuming, and difficult to recruit, train, and ensure the proficiency of an ever increasing number of paramedics;
2. Calls for service continue to increase;
3. Only 15 to 20 percent of the patient population requires ALS services to improve their outcome;
4. Twenty to 40 percent of the patients transported could be safely diverted to an alternate medical transportation system; and
5. Thirty-five percent of the EMS incidents the HFD responds to result in a "no-load."

The purpose of the recommended redesign is to better match resources with types of calls, so that the HFD does not have to treat each EMS incident as if it were the "big one." If implemented and operated properly, the recommended redesign will enable the HFD EMS system to:

- Better match demand for services by adjusting supply by hour of day as opposed to a flat deployment scheme that remains static over the 24-hour period;
- Meet and exceed response time goals;
- Reduce paramedic (ALS) utilization rates;
- Reduce ambulance utilization rates;
- Reduce utilization of fire suppression apparatus as first responders, thus reducing wear and tear on the most expensive apparatus; and
- Reduce the number of paramedics needed to staff system.

The major advantage to Option II is that the system would become all advanced life support (ALS) capable. Not only is an all ALS system more capable of rendering the highest quality pre-hospital care, it also is more efficient in the sense that the HFD would

no longer need to routinely send two ambulances to one call, nor send an engine company first response to calls where their presence is unwarranted.

For Houston to achieve an all ALS-capable response system using the present deployment scheme, a paramedic force of some 770 paramedics would be required, not counting paramedic supervision and other non-field assignments. The cost of maintaining a paramedic complement of this size is a persuasive argument for considering an alternative modality that will accomplish the same goals with fewer paramedics.

Another factor to consider is skill deterioration. Paramedics must use their skills frequently in order to remain sharp. The more paramedics in the field, the fewer ALS calls per paramedic. A liberal estimate of how many true ALS calls Houston experiences per year is approximately 25,000. A 770-paramedic force, therefore, could expect each paramedic to work on a truly skill-challenging call about 32 times per year, or less than once per week. Most EMS physicians and EMS providers would probably agree that this number is insufficient to maintain peak skill levels. A system that focuses paramedics on true ALS calls may increase the ratio from 32 per year to approximately 100 per year. Further, because fewer paramedics are required, the new system is considerably less expensive, allowing resources to be spent on the many other components that require improvements.

Another advantage of the redesign is that because paramedics will no longer be assigned to ambulances, their "turnaround" time will decrease significantly. Currently, HFD paramedics experience a turnaround time of approximately 81 minutes when tied up transporting BLS patients. Assigning paramedics to squad cars or engines (vs. ambulances) ensures that they are involved only in the transport of ALS patients, leaving them more available, and thus improving ALS response times.

Converting the ambulance fleet to all-BLS has certain advantages as well, particularly fiscally. EMTs are less expensive to hire, train, and maintain their skill level through continuing education. Eighty percent of all transports require only BLS service. On the 20 percent of calls that require ALS service, a paramedic can rendezvous with an ambulance and accompany them to the hospital.

The re-design also better positions the HFD to respond to future increases in demand by eliminating the inherent inefficiencies of the present static deployment scheme, using a more dynamic deployment scheme to better match supply of resources to demand.

The major disadvantage to Option II is the complexity and magnitude of change itself; it is significantly more complex to implement and may require changes to existing labor contracts.

Finally, it will cost Houston more in the short term to implement the system redesign than it would to simply put more units on the street. The redesign recommendations contain three staffing options, with a cost range of $7-$24 million per year. (Our recommended option would have a personnel cost $12.2 million, vs. the $10 million needed just to add 24-hour ambulances). The chief reason the re-design scenarios are more expensive than Option I is that the new system will be an all-ALS system. To convert the present system design to all ALS would have required an investment of $24 million above the $10 million required to add 15 ambulances.

One must be careful not to mix apples and oranges when comparing the system re-design to its alternative. The system re-design has significantly enhanced capabilities and represents a higher level of service.

The recommended system redesign introduces some new practices to the HFD. These are proven practices. While they represent a new approach for the HFD, they are not new to the U.S.

ALL ALS SQUADS + PARAMEDIC ENGINES: Perhaps the key advantage of the recommended system is that it will allow the HFD to become an all-ALS system. This means the system will deliver a paramedic to all EMS incidents while ensuring that the most life threatening incidents have excellent response times (i.e., meet the goal of eight minutes, 90 percent of the time).

Paramedics will be placed in either of two response modalities, squad cars, or paramedic engines. The squad concept is one that the HFD has been looking at for some time now. Paramedics would be in an SUV-type vehicle capable of housing two to four individuals and their ALS equipment, and capable of operating in all weather conditions.

Squad cars are less expensive to purchase, operate, and maintain than ambulances and/or fire engines. They maneuver better on congested downtown streets and through rush-hour traffic on the major thoroughfares. The squad car concept is especially suitable to the high-volume areas of the city.

Paramedic engines also have the ability to deliver ALS service quickly, while remaining cost-effective. They would help meet response time goals in the far reaches of Houston, where call volume is not as high as the rest of the City. An engine is often stationed without an ambulance in locations that do not have high call volume. A paramedic engine is a less expensive staffing option than adding an ambulance. One member of the crew would be a firefighter/paramedic. This is an upgrade of the fourth person on an engine, not an added position.

Another advantage to deploying paramedics on a combination of engines and squads is that it will allow Houston to rotate paramedics from areas of high-volume to areas of low call volume, and from all-EMS work to a mix of firefighting and EMS. High-volume systems can and do "burn out" paramedics. Rotating paramedics minimizes the risk of burnout and ensures that paramedics regularly practice their skills. At present, virtually all HFD ALS ambulances have very high workloads.

The disadvantages of paramedic engines are their lack of maneuverability relative to ambulances. For this reason we recommend that paramedic engines be utilized in the areas of Houston with larger expanses of territory and relatively low call volumes.

NUMBER OF ALS UNITS NEEDED: To compute the number of ALS response vehicles needed for the proposed system redesign, a baseline call volume estimate of 202,000 incidents in 2002 was used as a starting point. We chose a maximum target utilization rate of 0.33, the low end of the desired range, to achieve a significant improvement in ALS response times and to develop a system that could handle much of the expected growth in the next five years.

With these assumptions, the HFD would require 40 full-time-equivalent ALS-capable response vehicles (squad cars and paramedic engines), which could be split between 34 squad cars and six paramedic engines. This is based on an analysis of call volume by key map area, choosing ALS squads for the high volume sectors and paramedic engines for the lower call volume areas. These 40 ALS units are 24-hour

equivalents. At peak hours there would actually be 50 separate ALS-capable response vehicles on the street, dropping to 30 vehicles during off-peak hours. When one combines this capability with an all BLS ambulance fleet, HFD EMS apparatus would increase from its present 62 units (all ambulances) all the time, to 118 units (a mix of ambulances, squad cards, and paramedic engines) at peak and 70 at off peak. This is over and above fire suppression first responder support.

ONE-PLUS-ONE STAFFING: A paramedic unit, be it an ambulance or squad car, can be staffed with one EMT-P and one EMT-I instead of two paramedics. Some cities use one paramedic and one EMT-Basic on their ambulances, some use two paramedics as Houston does now, and some use three paramedics like many cities in Florida.

The EMT-Intermediate certification is recognized nationally and by the State of Texas as a level of pre-hospital care between the EMT-Basic and EMT-P. The EMT-I curriculum is standardized at the national level by the NHTSA. It encompasses approximately three modules of the EMT-P curriculum. One must complete approximately 140 hours of approved training and pass a written and practical exam to obtain EMT-I certification. EMT-Is are certified to perform several ALS skills, including intravenous therapies and advanced airway management techniques.

An advantage of one-plus-one staffing is that it allows the HFD to contract for one paramedic course and graduate both EMT-Is and EMT-Ps. Paramedic training represents the rough equivalent of a two-year community college experience. Early in the training process, EMT-P candidates that are identified as having difficulty in successfully completing the course but still competent for EMS can be encouraged to "test-out" at the EMT-I level. This would allow Houston's EMS system to raise the pass rate for paramedic training from its present 75 percent to the national standard of 80 to 85 percent.

The efficacy of one-plus-one staffing versus the two-paramedic model is a hotly debated issue in the EMS industry. Many EMS physicians and providers prefer the two-paramedic model, more from an intuitive sense that two heads and two pairs of hands are better than one. It also is helpful in breaking in new paramedics rather than leave them on their own. To our knowledge, however, there has not been a definitive study that demonstrates variations in patient outcomes as a result of utilizing either staffing scenario. Most of the "one plus one" discussions have assumed an EMT-B, not

an EMT-I as the second person, a major difference because the EMT-I is an ALS-provider and the other a BLS-provider. The EMT-I curriculum was specifically designed to develop a paramedic assistant.

During the course of this study, the project team discussed the proposed EMS system redesign with Houston Medical Control. They indicated a willingness to experiment with a new staffing configuration. As a result, we recommend a phased approach to one-plus-one staffing, from which the system can return the results are if not satisfactory. The objective is to help both the practitioners and the public by fielding more units within a reasonable budget, which will improve response times and reduce workload and stress on the EMS responders.

At first, no more than 20 of the 40 ALS squads, should be staffed with the one-plus-one option. The HFD could start with as few as 10 one-plus-one units. This will allow the HFD to document and compare patient outcomes. Even with this phased in approach, 100 fewer paramedics will be required at the 50 percent level for one-plus-one staffing than if all squads have two paramedics. The HFD is currently experiencing a serious paramedic shortage. This one deployment change could result in profound effects on HFD operations and finances. The effects include:

1. The HFD will become entirely ALS-capable approximately five years earlier than could have been possible under the present deployment scheme;

2. There will be an immediate cost savings in training as well as recurrent cost savings in personnel services, from the following factors:

    - Cost of paramedic course is approximately $1,200 per student;
    - Requires four to eight fewer classes for EMT-Ps;
    - Requires about 62 percent of the backfill requirements needed for an all paramedic system, a major expense that is often ignored;
    - Average salary and benefit package for a firefighter/paramedic is approximately $55,000 per year vs. $53,000 for a firefighter/EMT-I;
    - Pay scale differential – EMT-Is earn less than paramedics: using 100 firefighter/EMT-Is instead of 100 paramedics saves $200,000 per year; 200 saves $400,000 per year.

ALL-BLS AMBULANCE FLEET: Basing the HFD ALS response capability in squad cars or engines allows for the use of an all-BLS ambulance fleet. The main advantages of utilizing this modality in conjunction with the squad car concept are:

1. Instances will be avoided where an ALS and BLS ambulance are both dispatched to the same scene because of insufficient information obtained from the callers to make a reasonable assumption regarding the likely severity of a call. This appears to be happening about 55 times per day at present.

2. Paramedics will be more available because they will not have to transport BLS patients, which they do at present.

3. The advent of an all BLS ambulance fleet allows for ambulance staffing options that are more economical than present practices. Conceivably, the fleet could be staffed by either two Firefighter/EMTs, two HFD "civilian" EMTs, or by subcontracting-out patient transportation entirely to a private firm. All three of these staffing options are presently being successfully utilized in various cities. The relative merits and downsides of each of these options are discussed later in this section.

Estimating BLS ambulance staffing needs under the proposed system redesign was accomplished in much the same manner as were ALS response needs, except that we used the upper end of the utilization rate spectrum, 0.42. Unlike ALS response, BLS ambulance response would not be as time sensitive as it is under present response modalities. It is also a recognition that 80 percent of incidents will result in either a "no load" or require BLS services only. We again used a target volume based on the high growth option, year 2002.

Utilizing these assumptions, the ambulance fleet needs to have the full time equivalent of 54 ambulances. These ambulances would be peak-load scheduled. Forty ambulances would be in service 24 hours a day, with two 12-hour power shifts of 14 units each, the overlapping 12-hour schedules as discussed next.

PEAK LOAD SCHEDULING: There are nearly three times the calls for service between 4 p.m. and 6 p.m. as between 4 a.m. and 6 a.m. This is an ideal situation to use

peak load scheduling, where units are added to particular areas during the hours with higher call volumes rather than adding a fixed number of units at all hours of the day. Two 12-hour ambulances have roughly the same personnel cost as one 24-hour ambulance (of course they require two ambulances instead of one). The two 12-hour units can be placed where and when they are most needed. For high-volume cities such as Houston, this can result in substantial savings.

The recommended system redesign calls for having 68 ambulances at peak hours as opposed to the present 62; i.e., add 6 new vehicles. This contrasts with the 15 ambulances that would need to be added to the fleet to meet target unit hour utilization rates under the present system. Over five years this represents a saving of approximately $675,000. These savings should help offset one-third of the cost of purchasing squad cars and additional ALS equipment under the proposed system redesign.

The main issue in utilizing power shifts is that some personnel would have to convert from a 24-hour shift to a 12-hour shift. Shift changes come under the heading of a change in work conditions and usually have to be negotiated under collective bargaining agreements. The shift change can have profound effects upon an individual's lifestyle and domestic commitments, sometimes positively, sometime not. Many EMS systems have found that a percentage of the workforce would volunteer for a 12-hour shift for the same reasons others would not (e.g., working parents and others who prefer to be home part of each day). The current contract has expired, creating an opportunity to negotiate the option for some members to switch to 12-hour shifts. Alternative shifts are already used for dispatchers and inspectors.

The bulk of all field personnel do not have to change shifts; only those on the power shift units do. Personnel assigned to the other ambulances and squad cars can remain on a 24-hour shift, though there should be some consideration of using 12-hour shifts for all ambulance and squad car personnel to improve their health and reduce fatigue.

The preponderance of research on the subject of shifts underscores the contention that the 24-hour shift for high-volume EMS providers results in sleep deprivation and some temporary loss of full cognitive resources. However, there is a lack of adequate research on the impacts on the patients from long shifts. For the long run, research would

need to be undertaken to determine whether the rest of squad car and ambulance staffing should eventually be changed over to the 12-hour shift.

As noted earlier, an alternative shift for reducing stress on paramedics is to use a 24-hours-on/72-hours-off shift schedule to give longer rest between shifts; this is now used in Chicago, for example. Yet another variation is employed in Bellevue, Washington, where some ambulances are staffed with dual-role, cross-trained paramedics for half a day, and they fill in for the other half of the 24-hour shift as firefighters or paramedics to relieve people for training, increase staffing of a unit from three to four, or do other tasks.

A computation of the number of personnel at each EMS certification level that would be required to switch to the 12-hour shift by is given in Table 51 by staffing option.

Table 51: Number of Staff Who Would Switch to 12-hour Shift, by Staffing Option

Certification Level	Option I	Option II Variations					
	No Redesign; Add 15 Ambulances	Redesign w/ FF/EMT Ambulance Staffing – All Ambulance and Squad Pers. Convert to 12-Hour Shift			Redesign - Only Power Shifts Use 12-Hour Shifts*		
Firefighter/EMT	None	540			140		
Firefighter/EMT-P	None	200	or	300	50	or	75
Firefighter/EMT-I	None	200		100	50		25

* Recommended Option

It is possible to use the recommended system redesign while only requiring 100 to 240 HFD personnel to switch to (or be hired specifically for) the 12-hour shift. The variance depends on which staffing option is selected, as well as a decision whether to just switch over the power shift personnel versus all EMS personnel.

Another avenue the HFD should consider pursuing revolves around the current DROP program. Some 1,000 HFD employees are expected to retire over the next few years. If enough existing employees do not opt for a 12-hour shift, a portion of the new hires could be recruited who are willing to operate on the 12-hour shift. Some may wish

to join the Department on a 12-hour shift and later switch to 24-hour shifts. It also is possible to require some or all new recruits to work the 12-hour shifts.

While raised as a possibility, TriData does not recommend that the City augment its firefighter/paramedic force with civilian employees. The HFD has worked hard over the years to successfully integrate EMS personnel into the mainstream of HFD operations. These personnel have earned the respect of their peers and should remain an integral part of the HFD workforce. Their dual-role capacity helps to minimize cultural disparities (the "stepchild syndrome") and allows them to rotate onto engines in the fourth position. Systems using a mix of civilians and firefighters have two cultures and many problems. It is not worthwhile doing that, especially with the many workforce problems that already exist.

SIDE-BY-SIDE COMPARISON: Table 52 illustrates how the capabilities of the proposed new EMS system would compare with the current system:

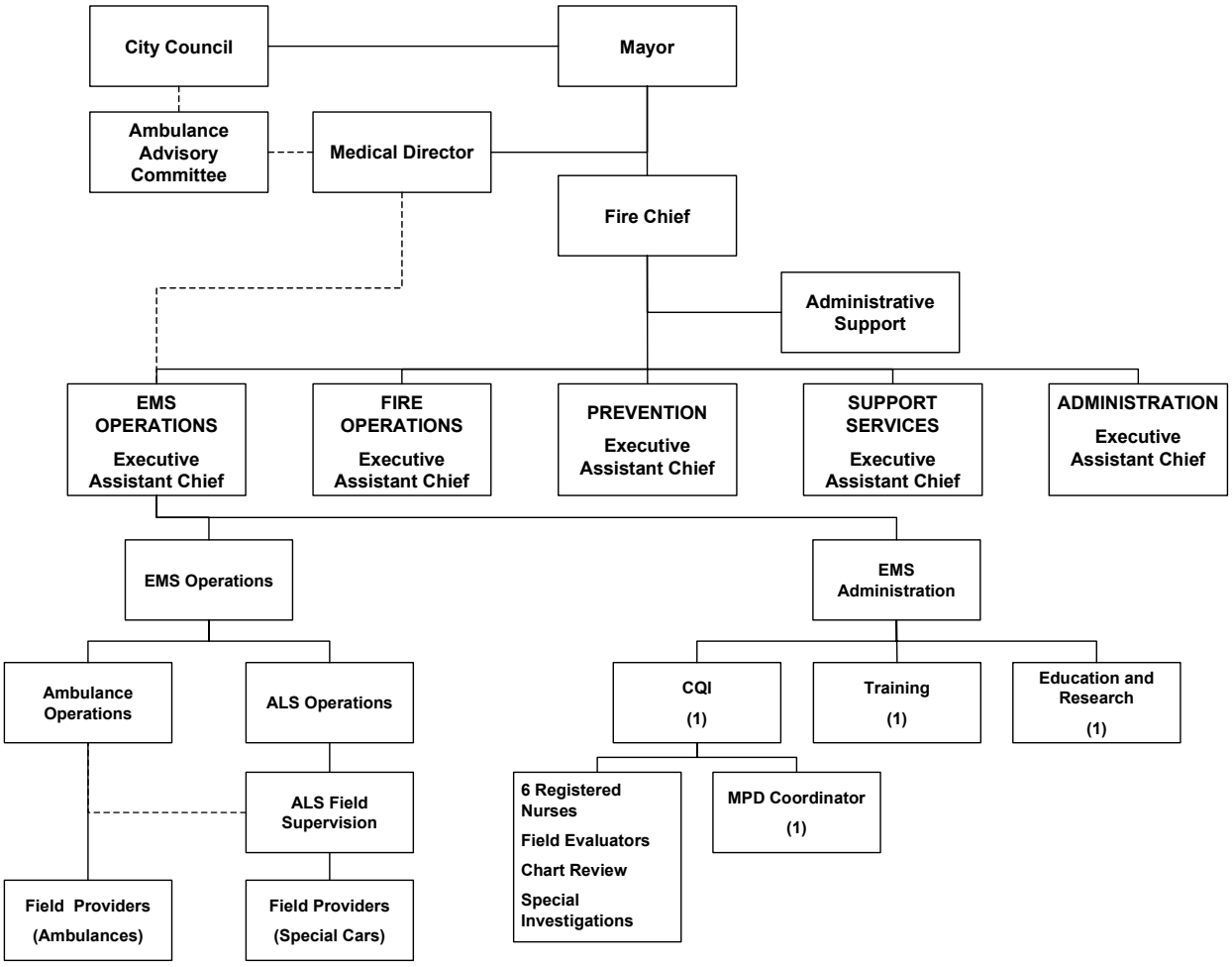
Table 52: Comparison of Current vs. Redesigned EMS System

Present System	Redesigned System
Tiered response (BLS or ALS sent)	All ALS response
Paramedics based on ambulances	Paramedics based in squad cars or on engine companies
Flat deployment of resources	Peak load deployment of resources
More staffing required to achieve response time goals	More efficient use of staff to reach much better response time goals
ALS and BLS ambulances	All BLS ambulances
Requires 77 24-hour ambulances to meet utilization goals (current 62 + 15 new)	Requires 54 24-hour equivalent ambulances to meet utilization goals (40 full-time + 28 half-time)
Requires eight squad cars for supervisors	Requires 58 squad cars (50 for paramedics + 8 for supervisors
Uses two paramedics per ambulance	Uses one paramedic + one EMT-I per ambulance
Requires the same "other" system technical support upgrades	Requires the same "other" system technical support upgrades
Requires 90,000 engine first responses/year	Requires at least 50 percent fewer
Requires 200,000 ambulance responses	Requires at least 12 percent fewer
ALS response time will reduce by about 10 percent, with the additional 15 ambulances	ALS response time will reduce by about 20 percent
More system over-capacity time	Significantly less system over-capacity time
No staffing alternatives	Allows for more economical staffing alternatives

ORGANIZATION SUMMARY OF REDESIGNED SYSTEM: The organizational chart Figure 31 shows the full proposed structure for EMS operations under Option II. Parts of

this chart were shown earlier. The EMS operations section is shown for the first time here.

Figure 31: Organizational Chart for Recommended EMS System Redesign



The proposed redesigned EMS system would have the following apparatus and personnel:

- 54 FTE BLS Ambulances
  - 40 on 24 hours per day (12-hour shift preferable but optional)
  - 14 deployed for 12 hours, Monday through Friday, 8 a.m. to 8 p.m., Saturday and Sunday 12 p.m. to 12 a.m.
  - 14 deployed for 12 hours, Monday through Friday, 12 p.m. to 12 a.m., Saturday and Sunday 4 p.m. to 4 a.m.

- 40 FTE ALS squad/cars and engines:
  - 30 on 24 hours per day (12-hour shift preferable but optional)
  - 10 deployed for 12 hours Monday through Friday 7 a.m. to 7 p.m., Saturday and Sunday 11 a.m. to 11 p.m.
  - Another 10 deployed for 12 hours Monday through Friday 11 a.m. to 11 p.m., Saturday and Sunday 3 p.m. to 3 a.m.

- Staffing requirements (field providers only, no supervisors and initial use of only half squad cars as 1 + 1, the rest as 2 paramedics)
  - 300 paramedics
  - 100 EMT–Intermediates
  - 540 firefighter/EMTs

- Power shift units may be held over in two-hour increments as needed should high volume conditions persist beyond scheduled shift end.

RECOMMENDED DISPATCH PROTOCOL: The present HFD dispatch practices reflect the complexity of operating a tiered ambulance fleet. The current dispatch priorities are as follows:

- D (Delta) – Immediate risk for loss of life and or limb;
- C (Charlie) –High probability the call is urgent, but not life threatening;
- B (Bravo) – Low probability the call is urgent;
- A (Alpha) – High probability the call does not warrant emergency response.

The priorities are assigned based on information received from the caller by the dispatch center call-taker. It would be preferable to implement the recommended new EMS deployment scheme after implementing the new Medical Priority Dispatch system, and improving the MIS system to give better feedback on system performance. The efficiencies of the redesign are predicated on the HFD's ability to fine-tune the system over time, using data on demand, response times, and other aspects of performance; that is:

- Monitor response times by area of the City;
- Compute UHUs;
- Review appropriateness of dispatch modalities.

The MIS and MPD systems are major tools the HFD will need to determine what requires adjustment.

Table 53 illustrates the recommended dispatch protocol for the system re-design, compared to the current dispatch protocols. The dispatch protocol governs what HFD resources will be sent to each type of call. The efficiencies of the newly proposed dispatch deployment scheme should be readily apparent. The key reason the scheme can be safely altered to this extent is that most first responses would be ALS. Staffing needs by type of call will be much more efficient. The vast majority (95 percent) of EMS calls would now require from one third to two thirds fewer personnel than at present.

Table 53: Dispatch Protocol Comparison

Alpha Codes	Present Scheme	Required Staffing	Recommended Scheme	Required Staffing
D (3 percent of calls)	Engine + (ALS A or Dual A) + P Supervisor. If ALS or dual A unavailable, send BLS A.	7	Engine + ALS Squad + BLS A + P Supervisor	9**
C (33 percent of calls)		6	Engine (optional) + ALS Squad + BLS A	4**
C1*	Engine + ALS A or Dual A			
C2*	Engine + ALS A or Dual A or BLS A with P Supervisor			
B (17 percent of calls)	ALS A or Dual A + Engine if round trip is elongated	6	ALS Squad (or ALS Engine) + BLS A	4-6
A (45 percent of calls)		6	BLS A	2
A1*	Engine + BLS A or Dual A			
A2*	Engine + BLS A or Dual A. (Cancel engine if system is in CRD)			

Key: P = Paramedic Supervisor A = Ambulance
NOTE: The staffing assumes 4-person engines. Where a paramedic engine is the closest ALS unit, it would be dispatched in lieu of an ALS squad and engine.
* The present HFD practice is to further segregate Charlie and Alpha calls, essentially creating six dispatch deployment schemes vs. four. An A1 call is relatively more of a concern than an A2 call. The same logic applies to C1 and C2.
** In parts of the City where ALS engines exist, an ALS squad would not be needed.

STATIONING OF RE-CONFIGURED FLEET: Table 54 and Table 55 present a scheme for the positioning of the newly configured fleet. Numbers refer to the station number. For example, ALS 3 is Squad 3, stationed at Station 3. The six paramedic engines are identified as PE and then their number.

We also listed whether an engine company or ladder company is currently located at these sites. That information will aid the city in determining whether the practice of pulling FF/EMTs from fire suppression apparatus for at least a portion of a 24-hour shift to staff the ambulances is feasible or not.

The unit placement recommendations were based on an analysis of call volume by key map location, Figure 32. The resources needed to deal with the demand were allocated roughly proportional to the demand. Power shift unit locations follow much the same pattern with the exception that call volume by time of day and day of week, and shifts in population by time of day, were factored in. These placement recommendations should not be considered "written in stone." HFD staff is can use its first hand knowledge and street sense to fine-tune the recommended deployment.

BLS Ambulance Staffing Options – As mentioned earlier, if the HFD accepts the recommended system redesign (Option II), it has three options by which it can staff the 54 FTE BLS ambulances:

II A. Staff with HFD firefighter/EMTs
II B. Create a new class of civilian HFD employee (EMT-B)
II C. Contract out ambulance services and patient transport to a private firm.

OPTION IIA: Industry standards call for a two-position ambulance, which results in a staffing requirement of 540 firefighter/EMTs for 54 ambulances, using a staffing factor of 5.

Figure 32: EMS Daily Call Volumes by Key Map

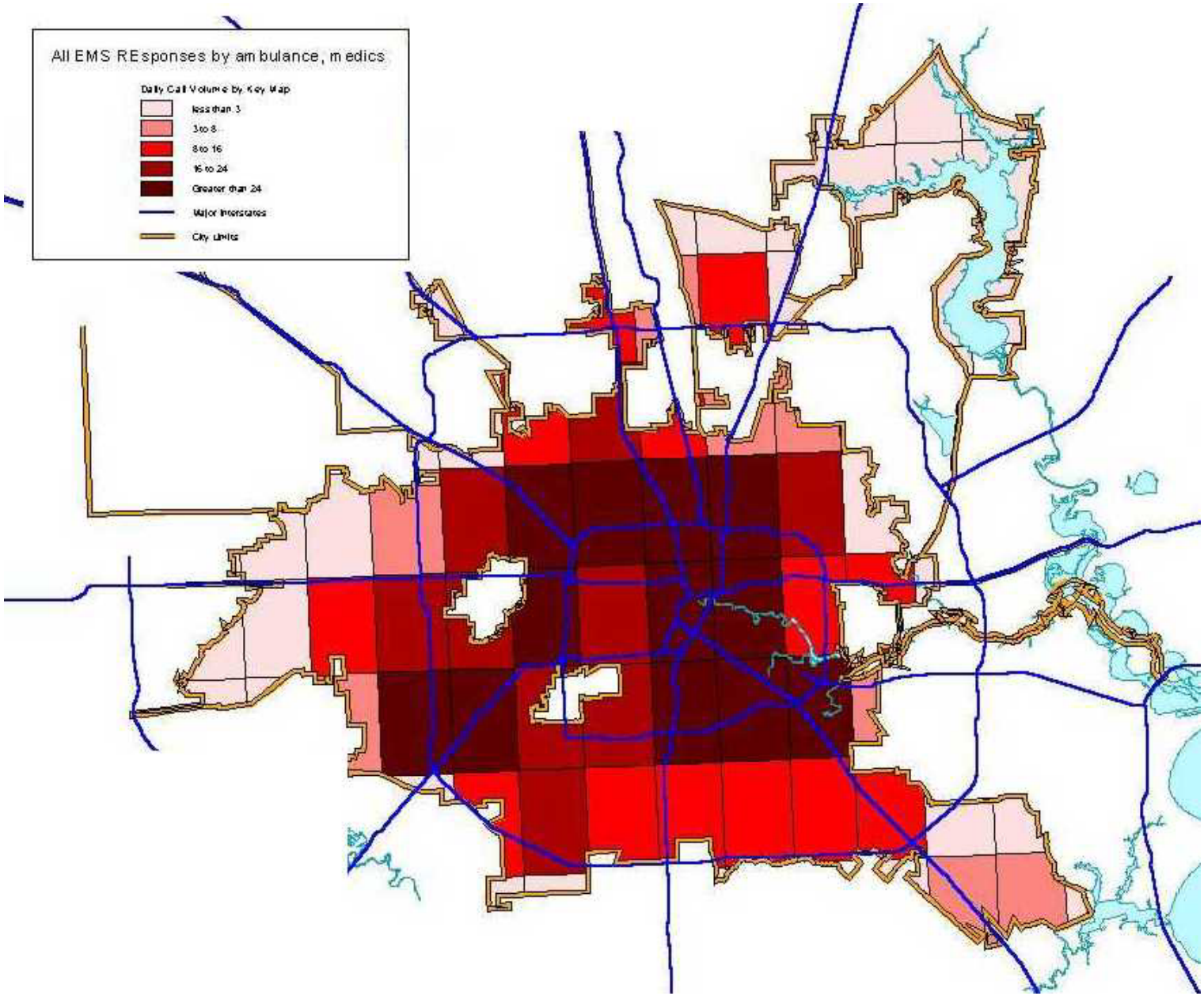


Table 54: Suggested Station Locations for ALS Units

Station with		Station with		Station with	
24-Hour ALS Units	E/L	ALS Power Shift 1 Unit	E/L	ALS Power Shift 2 Unit	E/L
3	E	1	E	2	E
7	E/L	6	E/L	9	E
17	E	15	E	10	E
19	E/L	16	E/L	13	E
23	E	18	E/L	21	E/L
29	E/L	25	E	26	E/L
33	E/L	30	E	32	E
34	E/L	31	E/L	48	E
40	E	41	E	69	E/L
43	E	56	E/L	77	E/L
44	E/L				
46	E/L				
49	E				
50	E				
55	E				
59	E/L				
60	E				
62	E				
67	E/L				
68	E/L				
70	E				
PE 71	E/L				
73	E				
PE 74	E/L				
75	E/L				
PE 78	E/L				
80	E				
PE 92	ARFF				
PE 96	E/L				
PE 101	E				

Table 55: Recommended Station Locations for BLS Ambulances

Station with		Station with		Station with	
24-Hour BLS	E/L	BLS Power Shift 1	E/L	BLS Power Shift 2	E/L
3	E	2	E	1	E
6	E/L	15	E	7	E/L
8	E	16	E/L	9	E
10	E	17	E	26	E/L
12	E	18	E/L	27	E/L
13	E	25	E	29	E/L
19	E/L	31	E/L	42	E/RS
21	E/L	34	E/L	43	E
23	E	37	E	49	E
25	E	38	E/L	52	E
30	E	46	E/L	60	E
32	E	63	E	75	E/L
33	E/L	82	E	76	E/L
35	E	93	E/L	80	E
36	E				
39	E				
41	E				
44	E/L				
48	E				
50	E				
55	E				
56	E/L				
58	E				
59	E/L				
62	E				
63	E				
64	E/L				
65	E				
67	E/L				
68	E/L				
69	E/L				
70	E				
71	E/L				

Station with		Station with		Station with	
24-Hour BLS	E/L	BLS Power Shift 1	E/L	BLS Power Shift 2	E/L
73	E				
74	E/L				
77	E/L				
78	E/L				
93	E/L				
96	E/L				
101	E				

At present, there are 305 HFD firefighter/EMTs assigned to ambulance duty. Another 235 would be needed to staff the BLS ambulance fleet (305 + 235 = 540). The cost of a mid-range firefighter/EMT in the HFD is approximately $52,000 per year, including benefits. Therefore, the personnel costs for Option IIA are from $12.2 million per year (235 x $52K) to $28.1 million per year, assuming 540 new hires.[56]

USE OF E/OS: HFD standard practice is to include an engineer/operator (E/O) in its four-person fire suppression crews (though many operate with three). The position carries a large salary premium over the basic firefighter/EMTs of $7,000 per year. Local 341 has argued that for vehicle operations safety and consistency reasons, an E/O be added to each BLS ambulance as a third position. Three-person ambulance-staffing configuration generally is not standard practice in the industry and is expensive. (Many fire departments in Florida, with very high elderly population and high ALS call volumes, use three-person ambulances. Often all three are paramedics). This staffing pattern would add some 270 positions (1 x 5 x 54 ambulances) to the HFD roster at a cost of approximately $59,000 per year per E/O, or approximately $15.9 million per year. There is no research data to show that better patient outcomes are obtained with three-person staffing.

The idea of using E/Os on ambulances does have some merit over and above emergency vehicle operations standardization, if they are one of the two on an ambulance. A variation on the firefighter/EMT ambulance staffing option might be to

[56] We include a price for 540 because part or all of the current number of FF/EMTs available for ambulance duty may represent borrowed bodies from fire suppression.

hire 270 E/Os under the condition that they convert to the 12-hour shift, are EMTs and are the only additional staff hired for ambulance operations.

CROSS-STAFFING AMBULANCES: An analysis of the current ambulance and the recommended placement scenario shows that all ambulances would be housed at stations with at least one engine company, and 44 percent would be housed with an engine and ladder company. If these fire companies had 4-person staffing, one of their firefighter/EMTs could be the second person with the E/O on a BLS ambulance per 12-hour shift. The engine or ladder companies would routinely operate with a five-person task force for fires (three on the apparatus, two on the ambulance). If the ambulance were on a call, the company can still respond with three.

The above approach would also allow the HFD to take full advantage of its dual-role, cross-trained personnel and station nine FTEs instead of 10 FTEs at stations with a ladder, engine, and ambulance, and five instead of six at engine and ambulance stations. The HFD would then reduce the number of personnel it needs to staff the ambulance fleet by half. Fire suppression personnel could stay on the 24-hour shifts, rotating which firefighter/EMT pulls ambulance duty. With four firefighter/EMTs assigned to the fire suppression apparatus per station location, each 24-hour firefighter/EMT could pull a six-hour ambulance shift. This would alleviate the problems caused by excessive fatigue in a high EMS volume system on 24-hour shifts.

The cost of this staffing scenario (call it Option IIA1) is $15.9 million per year.

OPTION IIB – CIVILIAN EMTS: This option would require a new class of employees to be established for the HFD. The position would not be "classified," as is the case for current personnel, but rather a civilian city EMT. Numerically, the staffing requirements would be the same as under Option I with a minimum of 540 new hires to fully staff the BLS ambulance fleet, assuming a similar work schedule.

According to the Journal of EMS (JEMS) Salary Survey, the average salary for civilian EMTs in the south central region of the United States is $18,241 per year. Adjusted to include a benefit package similar to what the HFD currently offers, the figure

becomes approximately $24,000 per year.[57] Hiring 540 civilian EMTs would cost the HFD approximately $13 million per year in personnel cost. If working in Houston required a premium above the South Central average, the cost would be higher but still less than hiring an equal number of firefighter/EMTs.

In addition to the salary savings, this option has two other distinct advantages over Option IIA. First, all new hires could be hired contingent upon working the 12-hour shift. Second, new hires could become a pool from which to recruit future classified HFD personnel.

However, this staffing option has a major flaw, the same as for privatization. The HFD has worked hard over the past decades to achieve a well-integrated, true dual-role, cross-trained system. By hiring a separate workforce for ambulance staffing, the HFD would be creating more opportunities to exacerbate employee relations in a department with many other human relations issues. Workload, pay, and benefit disparities eventually lead to ill feelings between the new workforce and the existing personnel. These ill feelings can paralyze departments. In two recent major studies conducted by TriData, the stepchild syndrome was identified as a leading cause of holding back improvements.

OPTION IIC – PRIVATIZATION: Under this option, ambulance operations would be contracted out to a private firm and include 911 scene response and patient transport.

This model has many precedents. The City of Birmingham, Alabama uses ALS squads with a private ambulance responding simultaneously to provide patient transport when needed. The City paramedics board the private BLS ambulances with their ALS equipment in cases where ALS skills are required. Forty percent of the nation's 200 most populous cities operate some major aspect of their EMS system through a private sub-contractual arrangement.

The operational advantage to the privatization of ambulance services is clear. Because the HFD would no longer transport patients, there is no need to hire more

[57] These are civilians, not classified personnel. Does not include the same retirement package as firefighters; the retirement package was assumed to be halved.

employees, civilian or classified. Also, no new ambulances would need to be purchased or maintained.

The question of whether it is economically desirable to subcontract this service is difficult to answer quantitatively. Emergency ambulance responses do not pay for themselves through patient billing. There are too many Federal (Medicare and Medicaid) and insurance company restrictions governing reimbursement to fully shift the cost of transporting the uninsured to the insured population. Recently, one of the largest national private ambulance companies, Rural Metro, announced the closure of all of its Texas-based operations due to the inability to turn a sufficient profit.

Therefore it is reasonable to assume that the privatization option would carry with it a hefty price tag. The HFD budget would be affected in two ways:

1. The private firm would provide for ambulance billings and collections, the HFD would therefore forfeit its current ambulance billing revenue of approximately $15 million per year. (With recommended improvements in billing, this will become $17 million per year);

2. Using a rough calculation based on the call volume forecasts, current regional rates of uninsured, and Houston's current market pricing for ALS and BLS transport, the minimum contract price would be in the range of $34 to $40 million, less billing and collections revenues of $17 million, for a total net contractual cost of $17 to $23 million per year.

Some cities (at least eight) have privatized ambulance services and keep costs down by adopting the "Public Utility Model" (PUM). We will call this Option IIC1. The PUM is predicated on the same laws that govern public monopolies. The classic analogy is electricity generation. Until recently, most cities/regions depended on one company to supply their electrical needs on the presumption that economies of scale would ensure lower prices. Pricing is then regulated by a utility board. In the case of EMS, the City could grant a monopoly over all inter-facility ambulance transports in Houston to the private service that wins the (9-1-1) ambulance services contract. The private contractor in turn shifts cost from revenues gained by the monopoly to the scene response sector of its operations. This would result in a lower subsidy from the City to cover the losses realized by all emergency scene response operations. The PUM could conceivably lower

the estimated costs of privatization by some $10 million. However, the legal/political ramifications of the PUM would add an additional year to the privatization timeline.

The operational disadvantages are similar to those using civilian HFD employees. By creating a separate workforce, the HFD would lose the considerable latitude it now enjoys as far as the mobility and interchangeability of its workforce is concerned and create two cultures. Systems that have selected this option have had to confront two other major stumbling blocks. These are:

1. Privatization of what has traditionally been the domain of public safety raises alarm within public sector. This alarm usually translates into fierce political opposition. In some cases, labor organizations that stand to lose potential new hires will utilize their political capital to either defeat or bog down the process. Also, the not-for-profit hospital community fears a loss of patient destination "fairness" when the profit motive is introduced. In turn, they mobilize their considerable political clout to either defeat or bog down the process.

2. A loss of direct line authority over ambulance operations can lead to miscommunication concerning operational matters. For example, problems related to dispatch and radio communications linkages could persist and medical control responsibilities as they relate to EMT quality assurance can deteriorate as a result of the loss of direct line control of employees.

The complexities and the high stakes of privatization argue that a more thorough, detailed study be undertaken prior to any serious consideration of privatization. City Council approval, the RFP process, the negotiating of a contract and the gearing up of the private firm selected, could push this alternative at least another year forward. The present utilization problems the HFD is experiencing argue strongly against postponing a solution for two years.

SUMMARY OF BLS AMBULANCE OPTION COSTS: To summarize, the costs for each variation of Option II are as follows:

Option IIA	Option IIA1	Option IIB	Option IIC	Option IIC1
Firefighter/EMTs	EMT/EOs	Civilian EMTs	Privatization	PUM
$12.2 to $28.1M	$15.9M	$13M	$17 to $24M	$7 to $14M

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Summary

Based on all of the preceding discussion, we make the following final overall recommendations for EMS:

Recommendation 112: Implement Option II, a system redesign for EMS. This will improve unit availability and EMS response times, conserve the number of paramedics needed in the system, and make better use of resources by tailoring the supply of ambulances and medic cars to the heavy workloads. (The HFD began implementing a new system using squad-based paramedics and an all BLS transport system in late 2000. Eleven paramedic squads were added in December 2000. Four additional paramedic squads and five ambulances were added in July 2001. Six BLS units were added between October and December 2001. Thus, the FY2002 expansion of EMS units has been completed. More additions to EMS will be pursued in FY2003 and beyond.)

Recommendation 113: The system redesign can use staffing Option IIA or IIA1. Option IIA is the FF/EMT BLS ambulance-staffing configuration. The major reasons for choosing this alternative:

- Remain consistent with current HFD staffing practices, requiring less change;
- Maintain productivity advantages of a dual-role, cross-trained system;
- Avoid the creation of a separate workforce, which would cause a two-culture problem.

Option II is complex to implement and will require from one to two years to complete. The unit availability problem, which is responsible for the occasional long response times currently being experienced by the HFD, should receive immediate attention. Therefore, for the immediate future:

Recommendation 114: Add at least 5 ALS and 5 BLS units immediately to bring relief to the existing fleet. These units should be stationed in the highest activity areas within the inner loop. They need only be on the streets for 12 to 14 hours per day. The BLS units can be staffed by FF/EMTs on overtime if necessary. (As noted under

Recommendation 112, 15 paramedic squads and 11 BLS ambulances have been added since 2000. This is a major step forward for Houston EMS.)

Recommendation 115: Consider the immediate hiring of 30 paramedics, preferably FF/paramedics. If the paramedics meet the HFD fitness criteria, they could become firefighters at a later date. (Following the initial report, the hiring process was modified to give preference to state-certified paramedics. Thirty probationary firefighters volunteered to attend paramedic school. Future cadet classes will periodically be sent to paramedic school to avert future shortages of paramedics.)

The cost of the previous two stopgap measures is estimated to be $3 million to $6 million, with the range dependent upon whether the HFD reserve ambulance fleet is capable of immediately fielding another 10 units or 10 new units must be purchased, and whether the number of paramedic new hires can be held to a minimum in the short term through a temporary increase in overtime for existing firefighter/paramedics.

VII. SUPPORT SERVICES

This chapter discusses a variety of functions that provide continual support to the line services. These include Training; Health and Fitness; Dispatch and Communications; Maintenance; and Management and Information Services.

Training and Promotion

The training of firefighters virtually never stops. After initial training as a rookie, the firefighter receives on-going training in the station and in an increasing number of specialties. Training is also needed to maintain physical fitness (addressed in a separate section) and to maintain health and safety.

Training a department comprised of over 3,300 sworn personnel spread in stations over 617 square miles presents a large challenge. The HFD, like other large metropolitan centers, must keep up with the changing environment of the fire service. To keep up with this challenge, the HFD must explore new and innovative techniques of classroom and hands-on training that will maximize training efficiency without sacrificing services to the community.

Two separate bureaus – the Professional Development Bureau and the Career Development Bureau – deliver training to personnel on the HFD.

Professional Development Bureau – Fire recruit training is accomplished by a combined effort of the HFD Bureau of Professional Development training staff and the Houston Community College. Fire Cadet training is 32 weeks long, and includes EMT certification, a vigorous physical conditioning program, and basic firefighting training. The training is done with a quasi-military philosophy that teaches the recruits respect of rank, discipline, and teamwork – all essential ingredients needed for command staff personnel to effectively manage emergencies.

During the first week of training, cadets are exposed to the expectations of the HFD. This first week of orientation includes a review of the Val Jahnke Training Facility Code of Conduct, testing and scoring criteria, and of the entire training schedule. During the second through the eighth weeks, members of the Houston Community College staff teach cadets EMT certification. The remainder of the training concentrates on teaching

cadets basic firefighting technical skills and skill application. The intensity of the training and the high graduation rate (92 percent) from the training academy in the last six years are excellent. (See Table 56.)

Table 56: HFD Academy Graduation Rates (1993-1998)

Year	Number of Trainees	Number of Graduates	Graduation Rate
1993	194	186	96%
1994	235	203	86%
1995	0	0	N/A
1996	220	209	95%
1997	141	132	100%
1998	72	61	85%
Total	**862**	**791**	**92%**

Current prevention training consists of 4 hours on public education, 8 hours on fire protection systems, and 16 hours on inspections. Given the importance of prevention, the need to involve the line companies in prevention to a greater extent than at present, and the need to get across the idea that prevention is a key part of the firefighter career, more time is needed.

When cadets graduate and get assigned to a station, they will be continuously exposed to suppression and emergency medical service, but will get little on-the-job training in prevention. They will need a sounder base. Some departments have assigned firefighters to prevention for a time before they are sent to a line company, to further address the above concerns.

Recommendation 116: Increase recruit training in prevention to a full week. This increases the training by only 12 hours. Having a full week on prevention can have a significant psychological as well as educational impact. The extra time could include an 8-hour inspection field trip following four hours of classroom lectures on inspections. (This was implemented starting with the March 2001 cadet class.)

Most of the training staff at the Houston Community College are full-time employees of the HFD. Prior to being hired by the college, instructors must take a 40-hour Educational Methodology course, possess an Associates Degree in Fire Science, and have a minimum of 5 years of fire service experience. After being hired by the

Community College, instructors are not required to take any continuing education courses to keep their teaching certifications.

Recommendation 117: Require fire recruit instructors from the Houston Community College to take continuing educational courses to maintain their certifications. This allows individuals to keep up with new training techniques, new training tools, technological changes in the fire service, legal issues, and changes in local, state and federal laws dealing with emergency service. The instructor training can include quarterly in-house sessions as well as continuing education courses.

Some of the instructors from HFD have been young captains detailed to the training academy directly off of the captain's eligibility list. They usually spend approximately one year training personnel before being assigned a regular firehouse. Some of these individuals have previous training experience while others do not. Occasionally, an individual will be detailed to the training academy for disciplinary reasons. This type of transfer is looked at as punishment because the individual must work a 40-hour schedule instead of the normal 24-hour rotation. This is not the best attitude for an instructor to have.

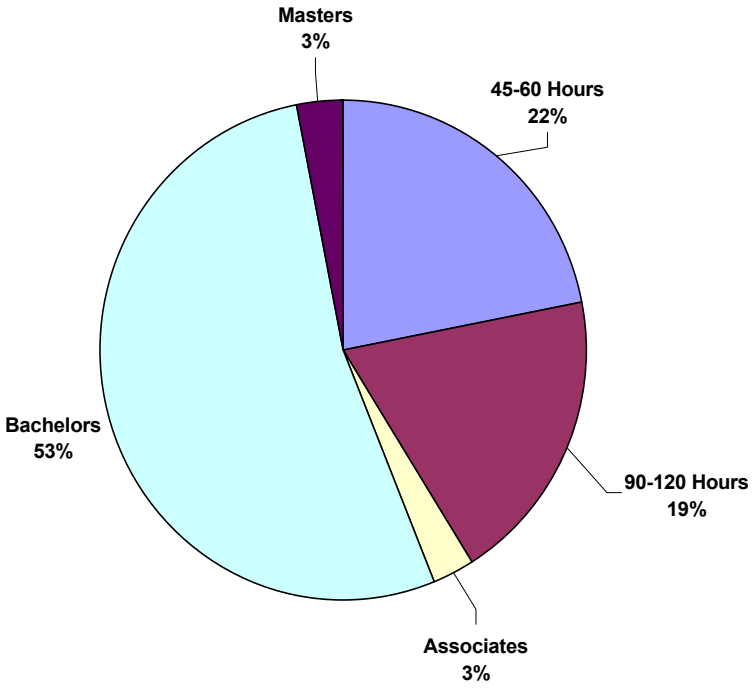
The HFD training budget should include funding for the ARFF senior officers to participate in pre-selected specialized conferences each year.

Recommendation 118: Personnel assigned to the Training Division and training functions should be certified to the levels identified in NFPA 1041, Fire Instructor Professional Qualifications, or the equivalent state certification. Appropriate instructor certification levels should be a prerequisite for Captains and Senior Captains. (The HFD policy in 2002 is that all instructors assigned to the Training Division are required to have Texas Commission on Fire Protection Intermediate Instructor Certification, which meets or exceeds the requirements of NFPA 1041 for Fire Instructors I and II. The present Administrative Chief on Training has Texas Commission on Fire Protection Master Fire Service Instructor Certification, which meets or exceeds the requirements of NFPA 1041 for Fire Instructor III.)

Recommendation 119: Recruit qualified training officers who desire to teach and train fire personnel. The Fire Academy should not be used as a way to discipline problem employees. To train recruits effectively, instructors must be highly qualified, motivated, and focused. This is not the place to put an individual for disciplinary reasons. Instructors should be certified to NFPA-Instructor standards, or the equivalent. The Training Division should also identify and create a resource pool of qualified instructors from all Divisions that will include Prevention, Arson, Dispatch, EMS, PIO, Hazmat, ARFF, etc.

Technological, environmental, and societal changes are occurring at a rapid pace, forcing fire departments to adapt quickly to these changes. Education and training are no exception. The educational level of firefighters who are currently being trained by the HFD versus the educational level of firefighters who were trained more than 15 years ago is vastly different. Today's firefighters are generally more educated than their predecessors. Seventy-eight percent of the fire recruits who were trained in the first class of 1999 had earned over 90 college credits. Fifty-three percent had Bachelor's Degrees and three percent had Master's Degrees (see Figure 33).

Figure 33: Fire Recruit Education Levels



Extra points are given to applicants for higher education as follows:

- 60 sem hrs = 1 pt
- 90 sem hrs = 2 pts
- 120 sem hrs = 3 pts
- Bachelor's degree = 4 pts
- Master's degree = 5 pts
- 6 hrs Physical or Biological Science = 0.5 pt
- 6 hrs English = 0.5 pt
- 6 hrs Mathematics = 0.5 pt

Recommendation 120: Higher education should be further encouraged and given extra weight in the selection of recruits and in the promotion of officers, especially at the chief level. With some well-targeted recruiting efforts, it should be possible to do this and still foster diversity. The fire service is increasingly requiring higher education for entry and especially for chief-level positions.

Career Development Bureau – The Career Development Bureau is responsible for delivery of management training and coordination of degree-related training. The HFD encourages sworn members to further their careers through educational programs from the National Fire Academy (NFA), University of Houston, Texas A&M, West Texas A&M, Houston Community College, San Jacinto Collego, and Western Illinois University. These programs encourage firefighters to acquire college degrees in a variety of areas as shown in Table 57.

Table 57: College Degree Programs Available

Associate of Applied Science Degree	Bachelor's Degree	Master's Degree
Fire Protection Technology	EMS Administration	Public Administration
Paramedic	Fire Administration	Business Administration
Arson	Management	Fire Administration
	Business Administration	
	Engineering Technology	

Although both the Professional Development Bureau and Career Development Bureau are responsible for training fire personnel, no one that the project team interviewed in either Bureau could explain why the training function was split between two separate bureaus.

Recommendation 121: Combine the Professional Development Bureau and the Career Development Bureau into one Training Bureau. All training for the HFD would be delivered and monitored by one central bureau. This is the norm in other departments. The HFD could eliminate one Assistant Chief's position. (This organizational consolidation was subsequently accomplished.)

The HFD provides four levels of educational incentives for fire personnel to continue their training and education, as shown in Table 58.

Table 58: Education Incentive

Level of Certification	Years of Service	Educational Criteria	Incentive Pay
1. Basic Firefighter	Entry	State of Texas Basic Fire Protection – 458 hours	Requirement
2. Intermediate Firefighter	4	6 semester hours of Fire Science or 96 hours of NFA	$60 Per Month
3. Advanced Firefighter	8	6 additional semester hours of Fire Science or 96 hours of NFA	$120 Per Month
4. Master Firefighter	12	60 semester hours, which must include 18 semester hours of Fire Science or an Associate's Degree in Fire Science Technology	$150 Per Month

This is an excellent way to encourage better education, and many firefighters are availing themselves of the opportunities. This program should be continued.

Promotional Testing – Closely related to cadet recruitment and training is the next phase of a firefighter's career – promotions. Currently, the HFD uses a 100-question multiple-choice test on all promotional exams. Written test questions are taken from a source material list of books and references, which are posted in all firehouses prior to the exam. Points for seniority are added to an individual's cumulative test score to produce a final test score, which determines a person's position on the eligibility list.

Historically, the HFD has not used any other method of promotional testing other than the current system. Although this type of promotional testing system had value years ago, the skills necessary for a fire officer today are difficult to assess by using only a written exam. Testing an individual's technical knowledge in fire science using a written exam is acceptable, and used by many fire departments across the country. However, few fire departments use a written exam as their only criteria for promotion. Many departments use a written test only to "weed out" unqualified applicants or use it in conjunction with other testing techniques. Fire officers spend a majority of their time managing people, whether in the firehouse, at a fire incident, or at another type of emergency. Effective fire officers must be trained to have good "non-technical" skills such as interpersonal relations, problem analysis, and conflict resolution. A written

examination alone cannot effectively gauge an individual's interpersonal and problem-solving skills.

Recommendation 122: Add an assessment center testing process to all promotional exams. The value of using the assessment center method, borne out by years of research, is its predictive ability. Success or failure is better correlated with how well one performs in the assessment center than on a written test alone. Assessment centers measure oral communication, written communication, problem analysis, judgment, organizational skills, interpersonal relations, development of subordinates, delegation, listening skills and decisiveness – all skills necessary to be an effective fire officer. (This recommendation is supported by the HFD Administration. It will have to be discussed under "Meet and Confer," or made feasible by amending Local Government Code.)

A second major promotional testing issue lies in the fact that for reasons unknown, minority candidates have not enjoyed the same success at promotional exams as their non-minority counterparts. Currently, there are 576 African Americans on the HFD. Thirty of these individuals or 5.5 percent are in promoted positions above the rank of equipment operator. Hispanic representation on the department as of January 1, 2000 was at 471 members. Sixty (12.7 percent) of these individuals are in positions above equipment operator. Compared with 626 out of 2264 (27.6 percent) non-minority members in promoted positions above equipment operator, minorities are underrepresented. (See Figure 34, Figure 35, and Figure 36.)

Figure 34: Proportion of African American Personnel Promoted Above the Rank of Equipment Operator

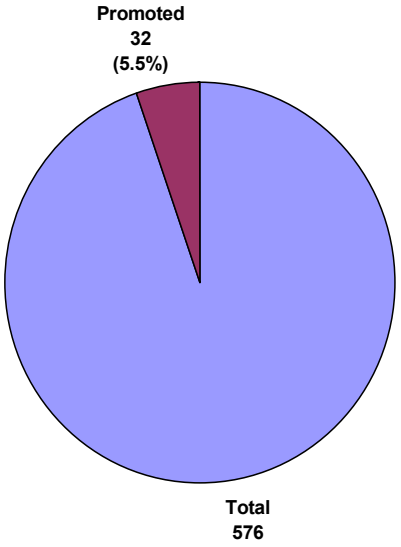


Figure 35: Proportion of Hispanic Personnel Promoted Above the Rank of Equipment Operator

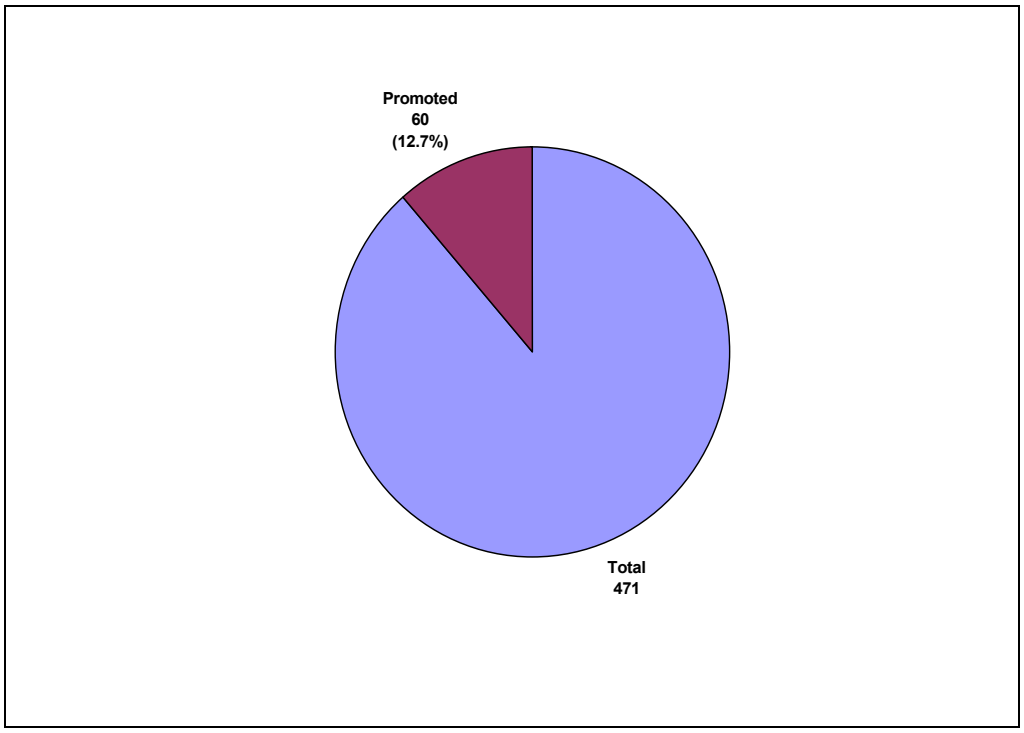
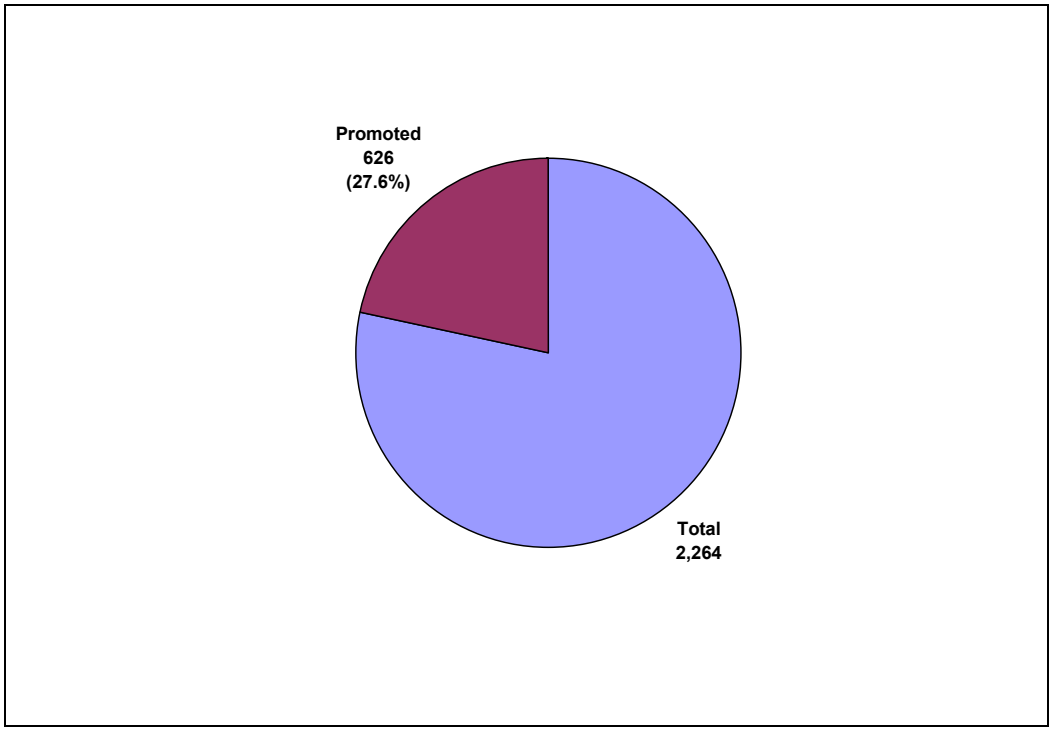


Figure 36: Proportion of Non-Minority Personnel Promoted Above the Rank of Equipment Operator



Adding the Assessment Center approach to promotional tests will probably assist minority members in attaining higher positions.

Training Records and Quality Assurance – A new computerized training records system has been developed. It is connected to 87 fire stations. Training can now be tracked by individual, station, and shift. This is an excellent improvement and should be maintained, with accurate records.

The training records will not only show whether the intended in-station training and other training is being accomplished, and who needs what make-up training, but is also important liability protection in the event of a lawsuit. They allow the City to show whether an individual has received the appropriate training.

Officer Training – As will be discussed in Chapter VIII, there is an urgent need to improve the human relations and personnel management aspect of officer training, particularly of first and second level supervisors. Specific suggestions can be found in that Chapter.

Training Academy – The Val Jahnke Training Facility is located at 8030 Braniff and was built in 1969. Although the facility is somewhat dated, it has been well maintained. Future renovation plans should bring the facility up to modern standards. The HFD has included state-of-the-art-training equipment in the latest budgets. The department is also considering purchasing five additional acres of land adjacent to the training facility.

Most fire companies must travel a long distance for training at the Academy. The Academy is in the southeastern corner of the city. Companies must stay out of service for the entire training period including travel time. Some companies spend as much as two-and-a-half-hours in round-trip travel time. This is time spent away from providing essential fire and EMS services, and can leave holes in coverage (see Table 59).

Recommendation 123: Build an additional training facility (or facilities) in more centrally located areas of the city. The HFD needs to decrease the amount of time fire, rescue, and EMS companies are out of service for training purposes. Possible sites for the development of additional training facilities are Station 64 and Station 75. The development of these two sites would create "North" and "West" training facilities, with the existing Training Facility (JTF) in the "South" sector. (There also will be additional

classrooms incorporated into the design of the new downtown fire "super station." It should be completed within three years.)

Table 59: Travel Time to Training Academy

Engine House	Location	Roundtrip Travel Time to Training Academy	Engine House	Location	Roundtrip Travel Time to Training Academy
1	410 Bagby	60 Minutes	36	7720 Airport Blvd.	10 Minutes
2	5880 Woodway	80 Minutes	37	3828 Aberdeen Way	50 Minutes
3	3735 W. Alabama	70 Minutes	38	1120 Silber	70 Minutes
4	6530 W. Little York	90 Minutes	39	5810 Pickfair	80 Minutes
5	2020 Hollister	60 Minutes	40	5830 OST	40 Minutes
6	3402 Washington	60 Minutes	41	805 Pearl	70 Minutes
7	1402 Elgin	60 Minutes	42	8675 Clinton	50 Minutes
8	1307 Crawford	60 Minutes	43	7330 N. Wayside	80 Minutes
9	702 Hogan	70 Minutes	44	675 Maxey Rd.	80 Minutes
10	6600 Corporate Drive	80 Minutes	45	4910 N. McCarty	80 Minutes
11	460 T.C. Jester	70 Minutes	46	3902 Corder	40 Minutes
12	1502 Alber	70 Minutes	47	2615 Tidewater	50 Minutes
13	2215 W. 43rd	70 Minutes	48	11616 Chimney Rock	50 Minutes
15	5306 North Main	70 Minutes	49	1212 Gessner	70 Minutes
16	1700 Richmond	70 Minutes	50	4420 Bingle	70 Minutes
17	2805 Navigation	60 Minutes	51	6902 Bellaire Blvd.	70 Minutes
18	619 Telephone	40 Minutes	52	10343 Hartsook	20 Minutes
19	1811 Gregg	70 Minutes	53	13349 Vicksburg	90 Minutes
20	6902 Navigation	50 Minutes	54	2500 Fuel Storage Rd.	120 Minutes
21	10515 S. Main	50 Minutes	55	11212 Cullen Blvd.	40 Minutes
22	7825 Harrisburg	46 Minutes	56	5820 E. Little York	90 Minutes
23	8005 Lawndale	40 Minutes	57	13602 Memorial Drive	100 Minutes
24	Reed Rd.	44 Minutes	58	10413 Fulton	90 Minutes
25	3902 Scott	40 Minutes	59	13925 S. Post Oak	60 Minutes
26	7111 Dixie	20 Minutes	60	2925 Jeanetta	80 Minutes
27	6302 Lyons	70 Minutes	61	9726 Monroe	8 Minutes
28	3100 Chimney Rock Rd.	80 Minutes	62	1602 Seamist	70 Minutes
29	4831 Galveston Rd.	30 Minutes	63	5626 Will Clayton Pkwy.	120 Minutes
30	6702 Irvington	80 Minutes	64	3000 Greens Rd.	110 Minutes
31	222 W. Crosstimbers	70 Minutes	65	11531 FM 1960 East	150 Minutes
32	8614 Tidwell	80 Minutes	66	5800 Teague	80 Minutes
33	7100 Fannin	50 Minutes	67	1616 W. Little York	90 Minutes
34	3100 Laura Koppe	80 Minutes	68	8602 Bissonnet	70 Minutes
35	5535 Van Fleet	30 Minutes	69	1102 W. Belt South	90 Minutes

Engine House	Location	Roundtrip Travel Time to Training Academy
70	11410 Beamer Rd.	24 Minutes
71	15200 Space Center Blvd.	40 Minutes
72	17401 Saturn Lane	46 Minutes
73	9640 Wilcrest Drive	90 Minutes
74	460 Aldine Bender Rd.	100 Minutes
75	1995 S. Dairy Ashford	100 Minutes
76	7200 Cook Rd.	100 Minutes
77	10155 Kempwood Drive	70 Minutes
78	15100 Memorial Drive	110 Minutes
80	16111 Chimney Rock Rd.	70 Minutes
81	7990 Paul B. Koonce	6 Minutes
82	11250 Braesridge	60 Minutes

Engine House	Location	Roundtrip Travel Time to Training Academy
83	Breezewood	100 Minutes
84	Ella Blvd.	100 Minutes
92	4300 Will Clayton Pkwy.	120 Minutes
93	911 FM 1959	30 Minutes
94	235 El Dorado	40 Minutes
95	El Dorado Blvd.	40 Minutes
96	7409 Willowchase Blvd.	110 Minutes
101	1863 Kingwood	160 Minutes
102	4102 W. Lake Houston Pkwy.	160 Minutes
103	2907 High Valley	160 Minutes
104	910 Forest Cove Drive	160 Minutes

Recruitment

Prior to entering the training academy, all individuals must successfully complete a job-specific recruitment process. Any individual wanting to be a firefighter for the City must be between the ages of 21 and 36. They must possess a Commercial Driver's License (CDL), have at least sixty hours of post-secondary education, and reside within 100 miles of the City while in the training academy.

The next phase of the recruitment process requires successful completion of a physical agility test, which includes some job-related testing stations, a stair climb exercise and a 1.5-mile run. Then a standard reading comprehension and math test are administered. An individual must achieve a minimum score of 18 out of a possible 30 on each of the exams to be allowed to continue through the process.

The next phase of recruitment involves scoring of any "bonus points," which are points added to an individual's final cumulative raw score for military service, additional education, and certification as an EMT in the State of Texas.

Once an individual successfully completes the above requirements, a polygraph examination, background investigation, medical investigation, and a drug test are given.

After an individual successfully fulfills all of the above requirements, he/she is placed on an eligibility list for firefighter.

Issues – The major recruitment problem is that the City has a very diverse population, but the HFD does not yet mirror the City's ethnic composition. Figure 1 shows the City of Houston's demographics, and Figure 2 shows the demographics of the Fire Department. Thirty percent of the Fire Department is non-Caucasian vs. 65 percent of the City. African Americans, Asians and Native Americans are the most underrepresented groups. The numerical goal for women in the Department is less clear, because no one expects the same proportion in the Department as in the City, but certainly they are under-represented as well. Strengthening recruiting efforts for minorities and women is needed.

The HFD recruits individuals within a 100-mile radius of the City. However, most minorities in the region live within the city limits. The HFD may not be utilizing its greatest recruitment resource – its own residents – to the extent it could.

Figure 37: City of Houston Demographics (2000)

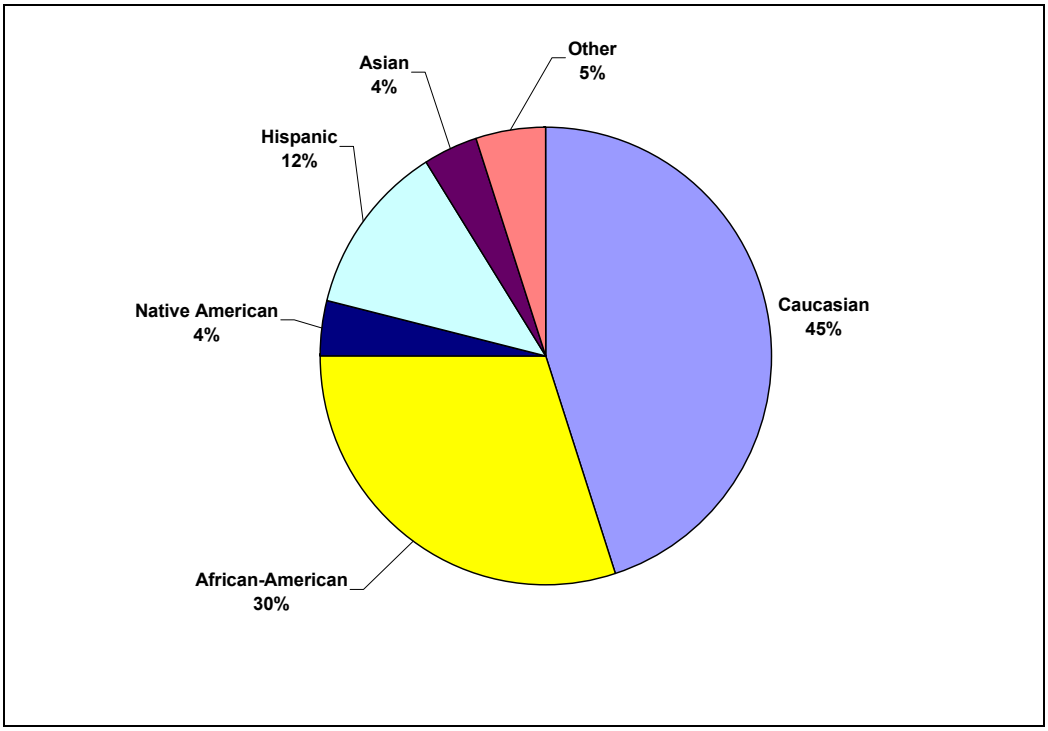
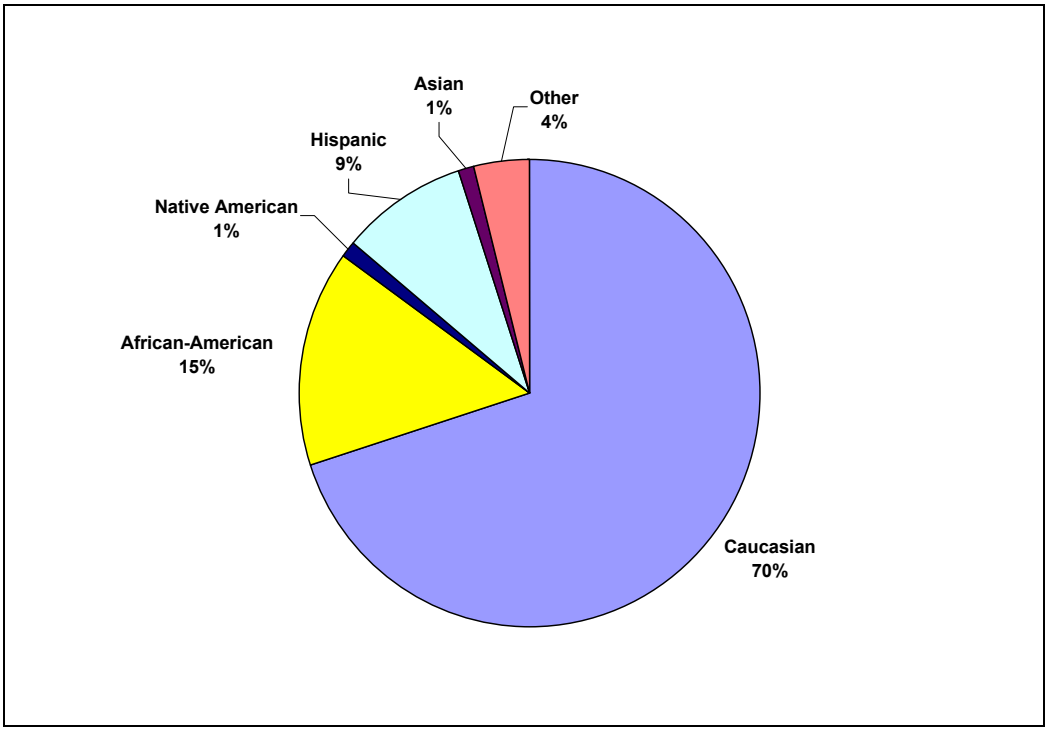


Figure 38: HFD Demographics (2000)



Recommendation 124: An incentive should be provided to individuals living in the City who successfully complete the recruitment process. Giving incentives to residents of the City will encourage more minority men and women to apply to the HFD. Since the City has approximately 55 percent non-white residents, giving incentives to residents of the city should result in a larger pool of minority applicants. Residency "bonus points" have been tried in a number of large fire departments across the country with success. When these bonus points are added to an applicant's final score, many minorities will be higher on the civil service firefighter eligibility list. (Implementing this recommendation may require a change in Hiring Guidelines and approval by the Civil Service Commission.)

Going further, one might consider limiting recruits to residents of Houston so long as enough high quality candidates are obtained from that pool, and if it helps meet affirmative action goals. The merits of such a change in relation to the needs of the Department and the political interests within the city require a careful review, because reducing the size of the recruiting area might reduce the number of good applicants.

Besides providing an incentive for residents, advertising and presentations should be made within the City to recruit under-represented groups.

Recommendation 125: Hire four recruiters to focus more recruiting efforts on minorities and females, until better representation is obtained. There are many successful examples of recruiting programs used in other cites. Key attributes of successful programs are (a) getting the recruiting message to places where qualified minorities and women are likely to be found (e.g., colleges, sports clubs, churches); (b) making it clear that they are welcome; and (c) providing role models from within the Department; e.g., develop recruit materials showing a variety of ethnic groups and females in uniform, and quoting their positive experiences. (To increase minority recruiting significantly without diminishing other recruiting would require about four additional recruiters. They would focus full time on the outreach programs outlined in the Strategic Plan. This would increase the number of full time recruiters from 6 to 10 positions.)

Health and Fitness Program

One of the areas singled out for special attention in the RFP for this study was the Department's physical requirements for personnel, both recruits and established employees. This was considered in the context of the broader health and safety programs of the Department.

The study examined the existing health and safety programs and made recommendations about health and physical requirements, with the multiple objectives of (a) improving the operational readiness of the Department, (b) improving employee health and performance, (c) reducing the likelihood of career-ending disabilities, and (d) saving valuable resources through more cost-effective approaches to the health and safety aspects of personnel management.

Personal fitness transcends the simple ability to perform the job; it also affects employee morale and longevity. Since more than 90 percent of the operating budget of the HFD is comprised of salaries, maintaining the human resources of the Department is a critical and disproportionately important task. Yet while much attention is paid to maintenance of apparatus and stations, maintenance of people often does not get adequate attention.

General Fitness Issues – There are few other jobs where the physical prowess of the workforce is as critical to the successful completion of occupational tasks as firefighting. In construction, for example, one's inability to perform a task would not likely lead to an injury or loss of property; the same cannot be said for firefighting. Thus, fitness is an important attribute that must be maintained and monitored.

Being physically fit also is one of the best protections against premature retirement or suffering a musculo-skeletal injury. Research has demonstrated that a physically fit public safety employee has half the injury incidence of his or her less-fit counterparts. However, physical fitness does not happen spontaneously. Rather, fitness must be created and maintained. Also, these programs are one of the most cost-effective approaches to the containment of rising healthcare costs in fire departments.

Despite the obvious advantages, many fire departments, including the HFD, are moving too slowly to change attitudes and pay sufficient attention to physical fitness. While fitness has received increased attention over the past five years, there is still resistance to addressing fitness in a systematic and progressive manner, and more needs to be done.

Current Practices – For incumbent firefighters, there are presently no requirements to meet any physical performance or fitness standard. A City firefighter is allowed to work out on duty, but cannot leave the station or put a piece of apparatus out of service to participate in structured exercise. One hour is allocated to exercise. One must be able to respond to an alarm from one's duty station during this time.

Some exercise equipment has been provided, but there is not a standard set of equipment issued to stations, and some stations do not have any workout equipment.

Physical exams are not required, but they may be obtained as a function of a co-pay arrangement through the Department's healthcare provider.

For recruits, there is a physical ability test administered as a condition of employment. The test consists of a number of disconnected work sample tasks. These evolutions are surrogates for fire-ground evolutions and include climbing stairs under load, working with ladders and other like tests. Rather than linking the tasks and making the test continuous, much as the tasks at a fire, the applicant completes an evolution before proceeding to the next.

There is also a requirement to demonstrate aerobic fitness through the use of a timed 1.5-mile run. Running a distance of 1.5 miles is a requirement for employment. Additionally, all recruits must be tested and pass the 1.5 mile run once per quarter.

Considerable emphasis and time is spent on the recruitment of suitable firefighter candidates, including their physical fitness. Once recruited, an even greater amount of time is spent on training these employees in the Academy. However, once in the station the implementation of a standardized fitness program is not addressed systematically.

Fitness Program Components – There are several critical components to a successful on-duty fitness program. These include top management support; supervision by mid-management; appropriate standards and goals; and adequate equipment, facilities, training, and education.

A fitness program must start as a management initiative. Through direction or general orders, fitness must become a regular part of the duty day. Station activities/schedules dictate when to schedule workout time, whether early in the daily schedule or later in the afternoon. The key is that it must be scheduled, not left open.

The preponderance of the scientific literature on exercise supports a regimen of three to five sessions of physical training per week. Three is the minimum for maintenance; four to five workouts are needed if improvement is expected. From a practical perspective, because of the time between shifts, firefighters also need to be involved in an off-duty program to maintain their fitness levels. This requirement comes with the profession.[58]

Recommendation 126: A minimum of one hour should be allocated for working out while on duty each shift. This is allowed in the HFD Rules and Regulations but is not being universally practiced. Employees should be encouraged to use the time to work out.

Adequate equipment and ample space are critical to in-station fitness programming. The current approach is a mosaic with eclectic sets of equipment brought in from home gyms or fabricated by the crews. There should be a minimum station configuration consisting of aerobic and strength training equipment. Equipment in fire stations needs to be of "mil-spec" quality or suitable for commercial health club use.

[58] If compensation is sought for the off-duty time, reference should be made to the case litigated in Miami, Florida, in which SWAT officers were denied extra compensation for time spent working out while not on duty. Since being fit is a condition of employment, the employer had a reasonable expectation that the employees ensure their fitness by acting professionally and ensuring that they maintained their fitness level.

Cost alone should not be the mechanism driving equipment purchase, because in the long run cheaper equipment will need to be replaced more often, off-setting any initial savings. Some fire departments put out bids for stationary cycles, take the lowest priced models, and have to replace them within a year. The HFD, too, has recently had some negative experiences in attempting to purchase low cost equipment.

Similar comments may be made about resistive training equipment. Simply stated, cheap equipment doesn't last. Olympic weight sets are not necessary, as the focus should be directed to training in the middle of the reps/sets zone. Said another way, the focus should be on maximizing the most weight that can be handled between 10 and 12 repetitions.

Recommendation 127: The HFD should develop the specifications and then outfit all stations with a full complement of exercise equipment. The budget might not allow the purchase of all equipment in a single fiscal year, but a plan should be developed to ensure that the project is accomplished within three years.

Another important aspect of a physical fitness program is to establish fitness objectives. Fitness is measurable in objective terms and training results can be reliably quantified. The measurements should be oriented toward the goal of successful job performance.

Recommendation 128: Identify quantitative standards for fitness. Labor and management should develop a program that will phase in reasonable and realistic standards that every member of the Department is capable of meeting. As examples, consider the approaches used by Fairfax County, Virginia, and Austin, Texas. (The HFD has now established standards for fitness and a fitness program for firefighters. The program is being evaluated.)

A Certified Fitness Coordinator, specialist, coach, counselor or trainer is an essential part of the fitness program. The U.S. Fire Administration and National Fire Academy have conducted research and produced a program of instruction for such fire department fitness program managers.

Recommendation 129: An instructional program should be established to create a network of peer fitness trainers. The class for the peer trainers should consist of three days of practical and didactic instruction. The ratio of students to instructors should be on the order of 20:1. Firefighters who demonstrate professionalism through their own fitness profile and adherence to a regular program of fitness should be given first consideration for selection as peer trainers. A screening program is needed to identify

firefighters who want to help others get fit and not just be trained to work out and display their own personal prowess. As part of their fitness training, peer trainers should be given health education training and information to pass on to their fellow firefighters. These individuals should serve as health and fitness mentors in an advisory capacity. (The HFD now is evaluating a peer fitness program.)

A systematic program of health education using the distance learning model should also be implemented. Continuing face-to-face training on health by health experts is expensive and requires a year or so to complete, considering the dynamics of four shifts and the large number of fire stations. Timely health topics can be developed and presented in a professional package using local access cable television.

Recommendation 130*: *Develop a health education program using a remote learning model. Contracting with local colleges and universities or health care providers to prepare a program of instruction may be a reasonable approach to developing a well-rounded package. (The HFD now is working on a remote learning program; the electronic capabilities are already present.)

Recruit Selection and Training Issues – There has never been a more critical time for recruitment within the HFD, nor a better opportunity to affect fitness in a short time. Over the next several years, the composition of the Department will undergo substantial change. In 10 years or less, only a fraction of the current employees will still be on the job because of new incentives to retire (the DROP program). Therefore, it is essential that recruitment and hiring efforts focus on finding the highest-quality employees because there will be less time than in the past for them to develop. The logical implication for recruiting is that the HFD must attract individuals who recognize the importance of their physical fitness to the performance of their job.

Outside of professional athletics, there are few other jobs more dependent upon the physical prowess of their workforces. Unlike professional athletes, many of whose careers last less than a decade (the NFL average is 5.7 years), a firefighter's employment spans multiple decades. The touchstone of firefighting is depending upon your buddy and his or her ability to do the job. If that confidence is broken, the whole paradigm upon which aggressive, interior fire suppression and rescue is based becomes a moot point.

Too often, the profession is sold to recruits on the basis of benefits and salary. When the tangibles start to eclipse the intangibles, such as giving back to the community and putting service above self, a very important dynamic of what makes a firefighter may

be lost. Firefighters should want to be firefighters more than anything else, not just because the job pays better than less hazardous jobs. One implication of this is that they must be willing to achieve and maintain their physical conditioning.

The HFD must consider how best to attract those individuals who have a penchant for a lifestyle that will allow them to be effective members of the HFD workforce over multiple decades. Given the desirability of a position in the HFD, the City can afford to have rigorous requirements for employment, such as attaining 60 hours of college credit. However, the current fitness criteria are not particularly challenging and need strengthening.

THE AEROBIC FITNESS REQUIREMENT: Many tasks performed in the first few minutes of an initial attack would be classified as anaerobic work. Forcible entry, advancing hose lines, and ventilation are often short-duration tasks requiring high levels of muscular strength and power. These are dimensions of fitness that are trainable to a certain extent, but like all other aspects of fitness, must be maintained through a regular program of structured physical fitness.

For longer-term operations at a working fire, where a number of disconnected tasks are performed sequentially, energy must be supplied on an ongoing basis. Oxygen must be taken in and used efficiently. Hence the need for aerobic fitness, i.e., a highly fit cardiovascular system. In a profession where disproportionately greater numbers of firefighters die from heart attacks than fires, focusing on maintaining high levels of aerobic fitness is critical. (Appendix F discusses aerobic fitness further.)

In the recent past, to be considered for employment, a candidate had to run 1.5 miles in 13:07 minutes. Recruits were also tested on a quarterly basis. This time standard is weak and imposes on the Academy training staff the burden of having to rehabilitate people who have not adequately prepared themselves for the rigors of cadet training. Given that the standards for entry are widely published, individuals desirous of employment would be well served to train rigorously prior entering to the academy. This would accomplish two objectives. First, it demonstrates discipline on the part of the applicant. Second, the training staff, with limited time and budget, can better focus training, using valuable time for instruction rather than rehabilitating less-fit candidates (recruits).

Recommendation 131: A 1.5-mile run should be included as an entry standard, and the time requirement stiffened to 11:30. This standard is based on research that examined the human energy costs of fire suppression tasks, not a political compromise. While some may be distracted by the perceived differences between running on a measured track and firefighting, the test focuses on an important element of firefighting, namely the ability to perform hard physical work for a duration of 11 minutes and 30 seconds. The utility of the 1.5-mile run has been demonstrated in a number of settings. The test is easily administered, requires little equipment (running shoes and a stopwatch), and can be practiced by any motivated applicant. The test is highly reliable and is objective. (Subsequent to the initial study, the HFD adopted the IAFF/IAFC Candidate Physical Ability Test (CPAT), which does not include a 1.5-mile run.)

More than 70 percent of the HFD applicants already meet or exceed the proposed physical fitness standard, according to data discussed with us during a site visit. Announcing the fitness requirement for future hiring should have the intended effect of reducing the numbers of marginal applicants while sending a strong message that HFD wants highly fit employees.

VALIDATION AND DISPARATE IMPACT: An issue that must be addressed when stiffening a physical fitness entry requirement is whether it has a disparate impact on a particular group, e.g., women, and if so, its validity. Under the Federal Uniform Guidelines for Employee Selection, any test that has a disparate impact on protected classes must be validated. Validation means there is a provable linkage between the test and performance on the job. The experience of the training staff strongly suggests that individuals who, on entry or during their HFD tenure, cannot meet the Academy graduation criteria of 11:30, require a disproportionate amount of personal instruction or have personal limitations that impede their progress or success in mastering the essential functions of the job.

While women were not singled out, some might expect women to fail the test more frequently than their male counterparts and thus fail the so-called "4/5 rule" for disparate impact of a test.[59] Without begging the question, experience shows that many women can and do pass this employment hurdle. And since the requirement is job-related, it meets the test, regardless of adverse impact. The standard is therefore

[59] A rule of thumb used by the Department of Labor and Equal Employment Opportunity commission is that if a group does not pass a test at a rate exceeding 4/5 the rate of the main group, it is said to have had a disparate impact. This rule of thumb, established in 1978, has held up to scrutiny in repeated court tests.

defensible. It should not be a barrier to obtaining significant numbers of female firefighters.

HEALTH PROGRAM: The length of recruit instruction at the Houston Fire Academy is nearly eight months. While this is a significant amount of time and a large investment on the part of the citizens, it is a relatively short period in the career of a firefighter. In many cases, behavioral changes in lifestyle are only tangentially addressed during a firefighter's career once on the job. The recruit training period represents a critical career point where attitudes might be positively altered before assignment to the field. Therefore, recruits need to be given the tools to ensure a healthy, safe, and productive lifestyle. There are operating and training manuals for just about every aspect of fire prevention, protection, and suppression. Similarly, there should be information on physical fitness integrated into the didactic portion of the Academy.

Recommendation 132: An "Owner's Manual" on how to set up a personal fitness program should be issued to every cadet. The content of that manual the cadet handbook on physical fitness should be taught as a part of the cadet curriculum (if not already done). There are some excellent books and manuals ideally suited for this target audience. (The latest cadet "handbook" now contains a chapter devoted to physical fitness. It recommends a fitness program as well as dietary guidelines and exercises that can be followed not only throughout the probationary period but the career as well.)

THE PHYSICAL ABILITY TEST: A local industrial psychology consultant has been retained to develop a valid physical ability selection tool for the HFD. The test is similar in scope, type, and appearance to many such physical ability tests, including the newly published Candidate Physical Ability Test (CPAT), which will be discussed in the next section.

There are a few problems with the design and administration of the test that can be easily corrected. Structural firefighting is comprised of a series of linked tasks done sequentially in real time**.** For this reason, the task testing should be continuous, meaning tasks given one after another.

It is appropriate to use a multi-function testing battery because there are a number of underlying constructs required in firefighting. By sampling widely across the spectrum of physical tasks, management increases the probability of appropriately

accepting those individuals who possess the capacities to perform the essential functions of the job and rejecting those candidates who do not.

An evolution that tests for ballistic force, which is required for forcible entry, should be added to the test battery. The Keiser Force machine can be used for this purpose. It is a simple, virtually maintenance-free, and relatively inexpensive tool that can be used to measure power objectively. With only one moving part, it can last for decades.

Recommendation 133: Improve the physical ability test by using a series of linked work-sample tests and adding a ballistic force (forcible entry-like) test. These work samples are surrogates for critical on-the-job tasks. The results of their physical ability testing should be ranked and an order of merit created. Using a "top-down" approach for hiring would diminish the need for defending a "cut-point"– a score below that is considered failure. The aggregate score of the physical ability testing should represent approximately 50 percent of the hiring decision. This paradigm has been used for more than two decades with great success by many fire departments. (Instead of this recommendation, the HFD has adopted the IAFF/IAFC CPAT, which is discussed below.)

The work-sample test also should become an integral part of the recruit training program. The standardized test battery allows recruits to monitor their personal level of fitness over the span of the eight-month recruit academy. By rotating through the testing in squads, efficiency is gained, since large numbers of cadets are not standing around waiting their turn on the course. Additionally, performing these tasks as close to the "real thing" as possible, e.g., wearing SCBA, is an excellent method of developing job confidence.

The clear benefits for the continued use of the current physical ability test vs. creating a new test are cost savings (no new validation research or equipment), familiarity, and the consideration that the current program functions within the confines of the existing facilities.

Candidate Physical Ability Test – Through the unprecedented joint efforts of the International Association of Fire Chiefs (IAFC) and the International Association of Fire Fighters (IAFF), a physical ability test for firefighter candidates has been developed that both organizations support. It is called the Candidate Physical Ability Test, or CPAT for short. Initially, this test instrument was intended for use solely by the 10 major cities

that originally participated in the development of the joint IAFC-IAFF wellness program. These departments shared proprietary information and formed a technical committee to develop a physical ability test from scratch.

While no test is perfect, the CPAT has attracted many supporters. One of its attractions is its implied endorsement by the Federal Enforcement Section of the Civil Rights Division of the Department of Justice, used in the videotape to advertise the CPAT. Clearly, no one wants to be sued. Even if a city prevails, the staggering cost of a legal defense is little reward for a win. For this reason, fire departments are jumping on the bandwagon and signing up to implement the CPAT.

However, there is a major caveat in using the CPAT that needs to be considered by the HFD: any jurisdiction that attempts to "borrow" this test has a responsibility under the law to validate the test locally. In spite of the implied Department of Justice endorsement (which is considered inappropriate by some in DOJ), use of this test will not guarantee protection from litigation. There is no passing point, no matter how low it is set, that will guarantee immunity from a legal challenge.

In view of the fact that the City already has a validated physical ability test, has used the test successfully, and would not have to procure approximately $20K worth of new equipment, it seems preferable to continue using the current test.

There are additional compelling reasons to stay the course. The space requirements of the CPAT are considerable and the equipment is weather sensitive. The logistics of the test are such that the throughput of candidates is quite slow. Also, there is the issue of conducting a transportability (validation) study. Several jurisdictions significantly smaller in size than Houston have contracted to have the CPAT locally validated, at a cost of $20-30K. For a city of Houston's size, it is conceivable that bids on the order of $100K might be tendered by industrial psychology firms. Finally, some CPAT users have found that the CPAT does not increase the numbers of female candidates; rather, it produces a greater number of weaker male candidates.

Recommendation 134: If the current physical ability test is not retained, and the CPAT is used, it must be validated locally. The test that was being used by the HFD is as good or better than the CPAT and less expensive to implement. There may be political or social reasons for a migration to the CPAT, but we are not aware of merit-based or scientific reasons to change the test. (If the HFD continues its new policy of using the

CPAT, then a "transportability" (validation) test must be developed; it can be based on the experience in several other cities.)

Condition of Employment Contract – The argument has been raised by employee associations that it is unfair to impose physical fitness standards on incumbents retroactively, since these individuals were not hired with an expectation to meet physical standards once out of the Academy. While the force of this argument is waning with the increased understanding of exercise science, a strong case can be made that at least all *new* employees should be conversant with job requirements regarding physical fitness**.** Moreover, they should be expected to maintain their personal fitness level as long as they are functioning within an employee classification requiring significant physical activity.

Recommendation 135: Develop a physical fitness condition-of-employment contract and standards for maintaining the fitness of incumbent employees. This contract should be executed for all new hires. Additionally, management should negotiate a timeline for implementing fitness standards for all incumbent employees. The timeline should be on a sliding scale, based on hiring date. (This recommendation is another issue for Meet and Confer.)

Adjusting Standards with Age – Clearly, age impacts every physiological function. Diminution of an individual's physical performance over time is expected. However, under the ADEA, (Age Discrimination in Employment Act) adjustment of standards based upon age are disallowed. In other words, the job dictates the requirements, not the age of the firefighter. A fire is the ultimate "equal opportunity" employer; there are no "over 40" or "under 35" fires. Standards must therefore be age and gender neutral.

One way to deal with aging is to hire people on entry who exceed the minimally acceptable level of fitness. Since without exercise an individual can regress about 10 percent per decade in most fitness parameters, it is critical that they exceed the minimum by a reasonable margin in order to enjoy an injury-free and productive career. However, even this is not enough. Unless regular physical fitness is an integral part of the daily schedule, physical obsolescence will result. It is only through a conscious decision to exercise that the link between aging and unfitness can be broken.

Occupational Health Program – Given the size of the HFD, the creation of an in-house Occupational Medicine section should be considered. It would administer the employee occupational health program. Its mission would be to enhance the personal

health, fitness, and well being of each member of the HFD by conducting health risk appraisals, treating minor traumas, and diagnosis/surveillance of current medical conditions. Fire department models for such programs have existed for over 20 years, e.g., in the Fairfax County (Virginia) Department of Fire/Rescue Services. Their program has demonstrated its cost-effectiveness and has been expanded to include the Police Department.

Recommendation 136: Create an Occupational Medicine section. It could be placed organizationally under the Risk Management or the Health and Safety functions. The unit could be staffed with a complement of physicians, nurses, therapists, and health educators. A large portion of the operating costs could be shared through a partnership with the Department's PPO (Preferred Provider Organization).

Workers' Compensation Issues – An initial review of the Department's expenditures for medical disability suggests that a detailed audit of the occupational and non-occupational disability policies and practices might result in significant savings. Nationally, reviews of disability programs result in average savings of 15 percent of direct costs and frequently much more. For Houston, the current costs of Workers' Compensation (WC) and non-occupational disability are in the range of $8 million, so the expected savings could be on the order of $1.2 million. Any dollar savings would be in addition to increased productivity and improved employee satisfaction.

Specifically, it is recommended that two primary review actions be taken: (1) quantification of total lost time (with associated direct and indirect costs); and (2) the review of disability processes/practices (to include claims management practices, the medical review process, and return to work policies). The results of the review should be used to determine the efficiency and effectiveness of the City's disability program in light of available best practices. This will set the stage for changes and reform that will both reduce costs and improve disability programs and services.

It is important that City leadership demand accountability and accurately quantify the total number of disability lost days and the direct and indirect costs associated with these absences. This requires identifying the true number of lost days for both workers' compensation, short-, and long-term disability. While this seems easy enough, fewer than 20 percent of the companies in America are capable of accurately doing so, and it is even more difficult in the public employment sector. The review will permit an objective evaluation of Houston's performance in reference to national norms, other cities of like

size, and accepted best practices. Such an effort can also identify specific areas that require immediate attention allowing the City to prioritize any reform measures.

Once the magnitude of the problem is defined, an evaluation of disability operational procedures can be undertaken. Areas to review should include how employees submit a claim of disability, how it is processed, who reviews it and who holds disability decision-making authority. The information flow and the timeliness of the process are crucial. For example, most organizations have a requirement for immediately reporting (within 24 to 48 hours) job related illnesses and injuries, but they allow as much as 30 days to report non-occupational disability claims. Such permissiveness restricts the organization's ability to retrospectively evaluate claims, influence medical treatment, or return to work. In most cases, the only decision is to pay or not pay, with a denial decision often leading to legal action and, at a minimum, employee disgruntlement. Best practices indicate that direct delivery of a claim with supporting documentation should be within no more than 48 hours for both occupational and non-occupational claims.

Recommendation 137: Undertake a detailed analysis of medical disability costs, and review disability processes and practices for occupational and non-occupational disabilities. The claims handling process should also be reviewed in-depth. Current practices to be reviewed should include:

- Timeliness requirements (submissions, documentation and decisions);
- Information flow, three-point contact (method and time line);
- Medical review guidelines; and
- Technology utilized for claims management.

The Risk Management Division can be assigned this project.

After disability policy, claims management is the next most important factor in cost control. Claims managers who derive accurate and early diagnoses of illnesses/injuries have been found to save as much as 25 percent of total direct costs compared to others who restrict more expensive diagnostic procedures until later in the disability process. The effect is that by spending dollars up front to identify the true scope of a disabling condition, a more timely treatment of the condition and a faster return to work can be effected.

Another area that has significant impact on disability costs is medical review. The guidelines for automatic medical review and the timeliness of these reviews will directly impact medical costs, return to work, and lost time. Timely medical review also can be an important factor in litigation actions for denied disability benefits. As a rule of thumb, minimal medical review guidelines should be in place that trigger automatic medical review, such as all cases of back injury or claims that will result in more than seven days' lost time and/or $3,000 in medical/lost time costs. This helps speed return to work by ensuring that employees get the appropriate medical care they need on a timely basis. It also helps keep the system honest, as opposed to blind acceptance of medical information from claimants' physicians.

The City's return to work (RTW) policy and process must also be reviewed. Frequently, large companies and municipalities have good RTW policies on paper but little compliance at the organizational level. An effective RTW program not only saves direct dollars, but also reinforces a work culture as opposed to an entitlement culture where employees view disability as an extension of vacation.

A review of the utility of standard and special reports should also be part of any comprehensive review of the City's disability program. An assessment should be made of how claims and disability data are analyzed and distributed for the benefit of management control. Among the questions to be asked are: What is the quality control process and how frequent are audits conducted? Are they for disability service vendors as well as internal organizations? If the claims are out-sourced, are there performance guarantees and/or incentives built into the claims management contract? If so are they valid and being met? Is there compliance with City policy?

With the above reviews and analyses, the City can look objectively at its costs as well as the disability practices and determine whether and where reform is required. Effective "best practice" processes can be put in place that work to the advantage of both the disabled employee and the City. Further, a review of the disability benefit policy and vendor services can be made to determine what changes can or should be made. Such a review can be conducted over a 90-day period.

Dispatch and Communications

The communications expert on the TriData project team extensively reviewed the HFD's dispatch and communications system, and the relationships between the Greater Harris County 9-1-1 Network, Houston Police Department communications center, and the Texas Department of Transportation (TransStar) transportation management center. The review included call-receipt taking; call dispatch; call management policy and procedures; staffing; 9-1-1; computer aided dispatch (CAD); fire station alerting (FSA); automatic vehicle location (AVL); ultra high frequency (UHF) radio; records management (RM) systems; the communications facility; and the training program.

The dispatch and communications system is in dire need of improvement. The City and HFD leadership recognize this need and have initiated a plan to address the present and future communications needs of both the Police and Fire Departments. Interviews with personnel at various levels of City, HFD, and communications center management, representatives of IAFF Local 341 and personnel of the other agencies noted above, all concurred with the need to revamp the dispatch and communications system.

Rather than repeat previous analyses of problems, the TriData project team was tasked to review the plans for improvement. The plan includes consolidation of 9-1-1 calltakers, HFD dispatchers, and Police Department dispatchers in a new state-of-the-art communications facility. That move, if planned properly, funded adequately, and staffed with properly recruited and trained personnel could provide Houston with a model public safety communications center. This move would add Houston to the growing list of large cities that are completely revamping and consolidating their public safety communications operation. These cities included Chicago, San Francisco, Minneapolis and Albuquerque, to name a few.

The communications consolidation plan appears to be excellent. Certain aspects of the plan are still under development or have not yet been solidified. Given the size, scope, complexity, integration of multiple technologies and systems, building design, primary and backup electrical power requirements, and costs associated with the proposed plan, specialized knowledge and experience will be needed to oversee the project. It is unlikely that internal City staff will have the time and expertise to monitor all of it.

Recommendation 138: The City should contract a firm to oversee development of the new dispatch and communications center. The Fire Department's original proposal to develop a communications center included contracting for such a firm. The firm should have experience with master plan development, requests for proposals, contract negotiation, contract compliance, change order management and approval, cost containment, project time line adherence, etc. It could serve as the primary point of contact for all contractors and vendors, with sole responsibility to protect the interests of the City, HFD, and Police Department and ensure that the project be completed on time and within budget. (This was done. The Communications Center is under construction, and the new CAD is expected to be phased in during 2002-2003.)

The consolidation plan includes many systems and subsystems, some that are new and others that will be enhancements to the current system. This leads to the next recommendation:

Recommendation 139: The implementation of communication sub-systems should be accomplished in a deliberate, phased manner. The reason for the phasing is that many systems require integration with other systems, and significant training in their operation. There assuredly will be delays, problems, glitches, etc. A phased implementation provides the opportunity to stabilize the hardware and software systems, build confidence in communications center and field personnel, and therefore maximize the success of the entire project.

One of the long range goals of the HFD is to acquire additional radio spectrum/channels to meet increasing operational needs and provide interoperability with other area fire departments and other City agencies. Since the 806 MHz and 821 MHz channels have been virtually exhausted in the Houston area, only the FCC-proposed use of the 700 MHz spectrum contiguous to the 806/821 MHz channels are possible for use and relief. The planned use of 700 MHz channels is currently the responsibility of the FCC appointed Public Safety National Planning Committee (NPC).

It is our understanding that, despite the acknowledged critical need for this spectrum by public safety agencies in many areas of the nation, the 700 MHz channels may not be available for public safety use for seven years or more because of current market forces.

Given the scope of the planned consolidation, and notwithstanding the need for it, it will no doubt be a process that takes longer to finalize the plans for and execute, as well as secure adequate funding to achieve than might be expected. The important thing is to

do it right the first time. Additional time spent planning initially will reap invaluable dividends in the end.

Maintenance

This section discusses vehicle, equipment, and station maintenance.

Vehicles – The mission of Fleet Command is to provide maintenance and repair of all vehicles and equipment assigned to the HFD, above that provided by vehicle operations. This entails the provision of effectual fleet management for over 900 vehicles, a major undertaking.

On the current HFD organizational chart, the Assistant Director for Fleet Management reports directly to the Fire Chief. This position is presently occupied by a civilian rather than a "classified" or uniformed individual. The Assistant Director for Fleet Management supervises five sections: Light Duty Fleet, Heavy Duty Fleet, Small Engine, Fabrication (FAB) Shop, and Body Shop. The Light Duty Fleet is composed of smaller departmental vehicles such as ambulances, vans, and cars, and the Heavy Duty Fleet is composed of the engines, ladders, and heavy rescue vehicles. Small Engine refers to outboard motors, generators, lawn mowers, or anything else within the HFD inventory that has a small engine (as the name implies). The FAB Shop performs a variety of work in the creation, remodeling, reworking, or reshaping of metal. Finally, the Body Shop repairs and/or replaces parts damaged in vehicular collisions.

LIGHT DUTY: The consolidation of Light Duty vehicle maintenance with similar work done by the Houston Police Department surfaced as a viable suggestion. This would include sedans, vans, ambulances, and like vehicles. The extent of mechanical specialization relative to these vehicles is not as great as that needed for engines and ladders and is highly compatible with similar vehicles operated/owned by the HPD.

Recommendation 140: The concept of a shared facility for the maintenance of the lighter HFD and HPD vehicles should be explored with an eye towards consolidating these efforts. The HFD has discussed this possibility with HPD. (As of 2002, the satellite garage of HPD will be utilized to maintain HFD sedans located outside the downtown area. The HPD facility downtown cannot handle the HFD vehicles at present.)

SMALL ENGINE SHOP: The Small Engine shop is staffed by "classified" employees or uniformed HFD firefighters. This work is not what firefighters are trained and compensated for, and could be performed as easily and efficiently by civilian employees. Also, according to Houston Civil Service regulations, classified employees cannot report to a civilian head. The current arrangement of the Small Engine shop necessitates a violation of the normal chain of command by having them report to a uniform individual not in charge of Fleet Management because the uniformed employees cannot report directly to the Civilian Assistant Director.

Recommendation 141: Classified HFD employees now assigned to the Small Engine shop should be replaced by civilian employees and reassigned to fire suppression duties. They can be phased out over time. (HFD agreed with this recommendation. The present classified employee is expected to retire in 2002, and be replaced by a civilian.)

STAFFING: Automotive maintenance and fleet management is an extensive undertaking in the HFD. The vehicle inventory, as mentioned earlier, contains over 900 vehicles or equipment in a variety of categories, all of which require both emergency and periodic maintenance. To accomplish this work there are over 100 personnel assigned to Fleet Management, including supervisory and mechanic positions. This is more than adequate.

FACILITY: A tour of the HFD repair facility suggested that it is more than adequate to accomplish present needs; this assumption was later confirmed by those interviewed. There is no plan for immediate or future expansion of the physical plant. Most automotive repair activity for the HFD is done at this location. Some work, including work requiring heavy lifting, work on major accidents, and work covered by warranty agreements is sent out. Provisions have been made for around the clock repair and refueling of fire apparatus that are in service and working at emergency events. When necessary, the towing of disabled fire vehicles is done on a contract basis. We do not recommend any changes to the HFD repair facility.

PREVENTIVE MAINTENANCE: The HFD operates an extensive and aggressive computer monitored preventive maintenance program. This program is vital in maintaining the viability of the automotive fleet. The HFD is currently in the process of exploring the upgrade of their General Equipment Management Information System (GEMS 2000), and the project team encourages this endeavor. The heart of the

preventive maintenance program is the periodic scheduled inspections of all vehicles. Set intervals have been established based on the hour usage of particular vehicles and/or the passage of time.

REPLACEMENT: The HFD is in an outstanding position in terms of the modernity of the automotive fleet. However, the impetus for this situation was crisis driven, garnered national attention, and was the product of a Task Force review. The resulting apparatus program amounted to a major purchase ($19.7M) involving over 60 engines and ladders scheduled for delivery through the year 2001. The state of the current fleet is now excellent. Every effort should be made to preclude the circumstances that necessitated crisis apparatus purchasing. Table 60 presents the year of purchase of all first line HFD engines and ladders and the number in each category.

The NFPA suggests a life expectancy of first-line vehicles from 10 to 15 years for engines, depending on their fire response frequency, and 15 years for ladders. The HFD's stated goal is a 10-year first-line life expectancy for both engines and ladders. Since the HFD is a busy fire department with a heavy response load, the project team agrees that this expectancy term is reasonable for engines. However, it might be extended another two years for ladders. Also, the HFD looks for two additional years in reserve status for each apparatus. This too is a realistic goal. Given the HFD's replacement schedule, the HFD complies with the NFPA recommendations.

Table 60: Age of Current HFD Engines and Ladders

Year Purchased	Engines	Ladders
1984		1
1986		11
1988	1	
1989		1
1990		2
1991	5	
1992	1	
1993	3	
1994	9	
1995	5	3
1996	5	1
1997	11	7
1998	3	4
1999	39	5
Total	**82**	**35**

Using the project team's suggestion to extend the first line life expectancy of ladders to 12 years, 12 ladder units should be replaced in the near term (the 1984 and 1986 pieces). By purchasing six in each of the next two years, the ladder fleet will be in a position to provide service for some years to come.

ENGINES: A long term cause for concern is the 39 engines purchased in 1999. Following the HFD's schedule, these units are all slated for replacement and/or transitioning to reserve status in 2009. This is a large number of fire engines to be replaced at one time, and can place a severe burden on a jurisdiction's financial resources. Thought should be given now as to how to fiscally structure this replacement process. As this section of the fleet approaches its life term of 10 years, new engines should be ordered in a staggered fashion. For example, in the year 2003 and for subsequent years the HFD might consider purchasing a like number of engines each year (eight to 10) in anticipation of the 2009 deadline. The engine inventory shown in Table 5 indicates that by 2003 there are 10 engines scheduled for replacement and by 2005 another 14 will also need to be replaced. However, there is nothing to discourage the HFD from buying new pieces now to replace six 1988 and 1991 engines presently in service and then implementing a new schedule based on our recommendation of buying eight to 10 per year from then on. Whatever plan is chosen, the goal should be to avoid the need for massive apparatus purchases in the future.

Recommendation 142: A structured apparatus replacement program should be developed and implemented to avoid the need for a mass purchase of fire apparatus in a single year. There are some economies of scale to purchasing a large number of vehicles at the same time, but most cities opt for spreading out the purchases or setting aside funds annually for the eventual purchases. That avoids having a large part of the fleet become obsolete or get worn out at the same time. (The HFD did not receive funding for any replacements in the FY2002 budget other than two heavy duty rescues. Consideration is being given to leasing vehicles, a major change.)

SPECIAL APPARATUS: Provision should also be made for the periodic replacement of special apparatus including the heavy rescue and hazardous material units as well as cascade and airport rescue units. Review of the first line Medic and ambulance units indicates a scheduled replacement procedure is in place and adhered to. We recommend this continue.

RESERVE APPARATUS: The NFPA suggests a reserve ratio of 25 to 33 percent of both the engine and ladder fleets. The HFD presently has a 26 percent engine ratio and a

34 percent ladder ratio. This is excellent. We suggest these ratios be maintained. As an aside, and to their credit, the HFD maintains ready reserve apparatus based throughout the quadrants of the City. These vehicles can be placed in service at a moment's notice and utilized in any number of ways. This, too, is an excellent practice.

MISCELLANEOUS: The testing and certification of all aerial ladder devices is done annually, and portable ladders carried on departmental apparatus are also tested and certified based on NFPA standards. Applicable NFPA standards are also used in the yearly testing of all engine unit pumps. Hose line used in the department is tested at the unit level and, again, on an annual basis.

Equipment – In terms of equipment, the HFD is also in outstanding shape. Every engine and ladder carries an Automatic External Defibrillator (AED), excellent practice.

The recent introduction of 46 handheld thermal imaging cameras is another equipment enhancement that will prove its value in the years to come. In addition to increasing life saving potential in fire situations, their ability to detect heat that the naked eye might miss will go a long way in reducing the damage caused by the overhaul process on fire scenes. These units were placed on ladder companies, hazmat units, rescue units, and the HFD's command van. One is also located at the Training Academy for familiarization purposes.

The personal protective gear of fire suppression personnel is cleaned twice a year on a contract basis, and is done in conformance with NFPA standards.

We have no recommendations here. Another excellent job.

Facilities – The objective of the Facilities Management Division is to restore and maintain current facilities to an adequate working and living environment. This is accomplished by developing and maintaining an aggressive facilities management program. The actual accomplishment of this goal is a major undertaking that demands constant and detailed attention, given that 87 fire stations are occupied 24 hours a day and experience heavy wear and tear. When the present facility management leadership took over, they faced a 15-year backlog of problems due to past oversight They have come a long way, and should take pride in the accomplishment. All stations visited by the

project team were found to be in a good state of cleanliness and repair, reflecting well on the HFD.

On the HFD organizational chart the Assistant Director for Facility Management reports directly to the Fire Chief. The position supervises four sections, including Facility, Station Renovation, HFD Capital Improvement Program (CIP), and New Building Construction. Seventy-four civilian positions are assigned to Facility Management. They are allocated to three components: administration (16 positions), renovation (24 positions), and maintenance (34 positions). These personnel follow normal work hours and "on call" procedure is in place when and if emergency work is needed out of hours.

To maintain its various facilities, the HFD has established a written list of objectives within the framework of the *Houston Fire Department Strategic Plan, Fiscal Years 2001-2005*. They include:

1. Continue the station renovation program;
2. Optimize the roof and slab repair program;
3. Identify special projects to be completed; and
4. Acquire funding for personnel and supplies to reduce the backlog of Priority 2 and 3 work requests.

These are all well thought out and fully documented goals that have been presented to the HFD's administration. The plans and programs supporting these efforts are extremely important because if existing facilities are allowed to deteriorate, the facility maintenance situation could reach crisis proportions, as happened to the automotive fleet. The maintenance of its facilities, renovation of existing stations, and new construction program are all areas where the HFD has paid a great deal of attention.

RENOVATIONS: An example of the outstanding work this group accomplishes is the In-House Station Renovation program. In the last five years some 21 stations have been completely renovated. These renovations included top-to-bottom replacement of nearly every component of the station with quality equipment, parts and materials, all performed by HFD employees. Once asbestos abatement was completed by the City's Building Services Department, the stations were gutted down to the studding and completely restored. The reduction of energy costs is a major consideration in these

renovations, and, to date, much money has been saved by this effort. The HFD estimates that this renovation program will be completed by the year 2011. Testimony to the value of this program is the fact that other municipal fire departments have modeled their programs after Houston's.

Table 61 provides a general overview of the status of facilities housing first line fire apparatus in terms of age. Most stations were built and/or renovated between 1976 and 2000. Forty-six of the 87 were constructed during this time frame; five of those were subsequently renovated. Barring exceptional circumstances, and assuming reasonable maintenance, it is generally accepted that a 25-year-old fire station is not considered a candidate for replacement. Seventeen of the 41 stations constructed prior to 1976 have been renovated between 1993 and 1999 and are considered to be in acceptable condition.

Table 61: Construction Dates and Number of HFD Stations

Year Built	Number
Pre 1950	1
1950 to 1975	23
1950 to 1975/Renovated	17
1976 to 2000	41
1976 to 2000/Renovated	5
New Construction	3
New Proposed	1

General or routine maintenance of fire stations and other department facilities is governed by a work request priority system, which is controlled and monitored by a computerized program. That system is illustrated by Table 7.

Table 62: Station Maintenance Priority Work Request System

Priority	Justification
1	Life or Health Threatening
2	Operational Impediment
3	Routine or General Items
4	Preventive Maintenance

In Fiscal Year 2000 100 percent of Priority 1 Work Requests were completed; over 93 percent of Priority 2s; and 83 percent of the Priority 3s. This is an outstanding

record, and one the HFD should be proud of. Moreover, as much effort and activity as possible should be directed towards supporting the continuation of this effort.

STAFFING: The augmentation of the general maintenance staff would help ensure continuation of excellent facility maintenance. The HFD is having difficulty filling its maintenance positions.

Recommendation 143: Consider increasing staffing for HFD facility maintenance services or contracting them out. Since the HFD has proven its ability to do excellent work in-house, maintaining an adequate maintenance staff in house seems the better, proven course. (Subsequently, HFD Facility Management was transferred to another City department, Building Services. It is hoped that grouping facility management for various City departments will create the synergy for improved services.)

Management Information Systems

This section addresses the HFD's use of computer-based technology and management information systems (MIS) to support its various divisions and functions. Issues addressed include: the structure and functions of the HFD Information Services (IS) Division; and the relationships between the IS Division, the City's Information Technology Department, and the centralized Police and Fire Communications Center. Throughout the section we discuss the degree to which improvements suggested in a 1995 review of the HFD IS Division have been implemented.

The role of the HFD IS Division is more comprehensive than is found in most other fire departments. The IS Division not only provides the typical application and hardware support, but also supports the network and communication infrastructures. Recently, the IS Division's focus has of necessity has been on providing the network and technology infrastructure required to position the HFD for future development.

Strategic Information Plan – In 1992, Andersen Consulting drafted a Citywide Strategic Information Plan (SIP). Having a SIP is a major advantage because it established future directions for information technology organization, technology, and application development. The plan provides a road map that will be relevant for at least another few years.

As part of the overall implementation schedule of the plan, individual departments were responsible for developing their own SIPs. In 1995, Andersen Consulting developed a SIP for HFD. It identified the fundamental Departmental information technology objectives and the resources needed to achieve them. The plan described where the HFD IS Division could be in three to five years.

During the planning process, an assessment was made for the HFD of the existing technical and systems environments; departmental information services organization; the extent of technology used for fire department processes; management reporting available; and the contingency plans and methodologies used by the IS Division. Strategies were recommended for uses of information technology, as well as directions/goals for data application and organizational structure. (Some of the more important aspects of the 1995 status assessment and May 2000 update are discussed later in this section.)

Organizational Role and Placement – The City's Information Technology Services (formerly called the Central Information Services Division) supports citywide information technology efforts including applications, voice systems, and connectivity to the City's WAN through the City's Internet service provider. Central IT sets architectural standards for hardware, data systems, voice systems and applications; establish standards for naming conventions; IP addresses; and support Citywide applications such as finance, accounting, purchasing, and payroll systems.

The roles for the City and departmental IS divisions were specified in the City's SIP and reiterated in the HFD SIP.[60] These roles are as follows:

- Central IT will redirect responsibility to the departments and narrow the scope of functions performed.
- Central IT will shift focus from operating operations to planning and standards control and managing information services operations.
- Central IT will administer and maintain the City's network infrastructure and manage the general standards environment.
- Departments will maintain and control their computing and communications resources.

[60] Ibid., Organization Plan, p. 1.

These roles likely will be reviewed soon by the newly created Chief Information Officer position, which was filled in June 2000. This position reports to the Chief of Staff in the Mayor's Office.

In the 1995 SIP, departmental IS divisions were given responsibility for installing and maintaining departmental connectivity including local area networks (LANs), wide area networks (WANs), and Intranets. This is an unusual split of responsibilities. Ordinarily, connectivity to the wall connection is provided by a central organization. The split places an extra burden on department information services divisions to support and fund this technology foundation. A significant level of staffing, including network specialists who are difficult to hire and retain, is required to support the hardware and communication software.

Recommendation 144: Consideration should be given to centralizing the HFD network infrastructure support services under the City's Centralized Information Technology Services, or the consolidated Communications Center or under contract with an external vendor. The HFD IS Division will probably have difficulty sustaining the information technology infrastructure in addition to their duties that require knowledge of the Fire Department. The general support tasks can be efficiently handled centrally, and the department-peculiar tasks are better left to the HFD IT staff.

(As of September 2001, the City's new Chief Information Officer will be reviewing all departmental vs. central information technology functions. The CIO is tasked with upgrading quality and developing a strategy to improve service response citywide. The HFD will be included in the City's overall information technology strategy.)

Management information systems (MIS) support for the HFD is primarily provided by its IS Division, another of their major roles. This Division currently reports to the Assistant Chief of Planning and Research Command. With the start of the new fiscal year in July 2000, the Division was to report to the Assistant Chief of the Central Command Division. This is a better reporting relationship because the Central Command Division is responsible for dispatch and much of the records management function.

A consolidated dispatch and communication center and a new CAD system are being planned to support both Fire and Police 911 call taking and dispatching. This center also will provide radio and wireless communication support. Consolidation of some or most information services under this new center might improve efficiency.

Recommendation 145: In the future, consideration should be given to moving the Fire Department's IS Division (and potentially all public safety information services) under the consolidated dispatch and communications center IS management. Alternatively, consolidate only the hardware, network, and software support functions of information services, and leave the applications under each branch of public safety. Consolidation of voice and data communications under a single management could provide better service and 24x7 coverage. Application development and support functions should be evaluated to determine how the best service can be provided to the HFD. The potential for greater efficiency should be balanced with Department's need to consider technological solutions for all departmental initiatives, not just dispatch and communications, and to control the development priorities and process.

Organizational Strategies – There were five "organization strategies" recommended in the 1995 HFD SIP, grouped as: (1) Information Systems Oversight and Planning; (2) Information Systems Organization and Staffing; (3) Policy and Procedure Recommendations; (4) User Training and Support; and (5) Information Services Training.

The Information Systems Oversight and Planning strategy was directed toward providing HFD management better access to information services management. This was so that the IS Division could "provide expert input on new department initiatives and advise division managers on the opportunities to be realized from automation."[61] Recommendations for implementing this strategy were to:

- Establish a standing Information Service Planning Committee (ISPC)/Steering Committee to oversee the HFD's IS Division's efforts, establish overall information services priorities, and determine major new projects to be undertaken.
- Ensure representation of divisional interests within the IS Division by either: (1) assigning specific individuals to represent the division's information services needs; (2) creating a standing committee comprised of IS and divisional personnel; or (3) incorporating dedicated IS Division personnel who have functional knowledge of various divisions.
- Establish formal IS reporting relationships with users throughout the HFD.
- Coordinate joint IS projects whenever appropriate.

[61] Ibid., Organization Plan, pp. 3 & 4.

Today, the HFD IS Division basically operates independently, without systematic input from HFD management. Although efforts have been made to establish an ISPC/Steering Committee, a functioning committee has not been established. This step is imperative toward integrating information services with HFD operations. It should take precedence over other implementation strategies because it provides the mechanism necessary to determine the relative priority of development projects. Currently, because departmental and divisional interests are not well represented, the IS Division determines which projects are given priority, irrespective of actual departmental/divisional needs. The rationale for dedicating resources to infrastructure foundation projects rather than application development is not understood nor necessarily supported by departmental management. Also, neither upper management nor divisional management are aware of the development plans for applications software. Further functional specialists are not currently involved in defining requirements and guiding development efforts for the information systems that will support them.

Recommendation 146: Establish a standing Information Service Planning Committee (ISPC)/Steering Committee and a representative User Group as recommended in the 1995 SIP. One of the Steering Committee's first projects should be to identify information technology development priorities. The Steering Committee should also review the rationale for developing custom applications when feasible alternatives exist such as applications used by other departments or proprietary software packages. (This recommendation was initially addressed in June 2000. With the subsequent changes in staff at the command level and the IS Division, the recommendation should be revisited.)

The 1995 recommendation to coordinate joint IS projects also has not been implemented. For example, an application development project is commencing to develop a custom application for the prevention inspection function. Prevention management and personnel are not aware of this effort. Currently the Plan Checking function of Prevention uses a portion of the Planning Department system. However, the potential use of systems already used by the Planning Department have been discarded by the HFD IS Division for technological and data structure reasons without user or HFD management involvement. Although we concur that the Planning Department software systems are not open or flexible and do not have a relational database, the operational needs of Prevention are so urgent that use of an immediate existing solution seems warranted. An interim solution also is appropriate because it will take a minimum of 18 months to two years before new Records Management System (RMS) is implemented as

part of the new CAD system. Without representation of operational needs and priorities the IS Division cannot fully evaluate these considerations and options.

Recommendation 147: Create a representative task force comprised of Prevention and IS Division personnel to identify and evaluate development alternatives and develop a migration plan to the new RMS for prevention information technology support. Alternatives to custom development, including use of Planning Department systems, should be considered. It should also be determined whether an interim measure would be more appropriate to meet the pressing needs and provide a migration path to the new RMS. Consideration should be given to developing a user interface on the hand-held units currently in inventory for this use. The potential of a developing a relational database reporting repository should be considered to resolve data structure issues. The Planning Department systems potentially could be interfaced or integrated into this repository.

The Information Systems Organization and Staffing recommendations in the 1995 study were directed toward clarifying roles within the HFD IS Division, establishing roles for application development teams and identifying technical skills and functional knowledge needed in the HFD IS Division. The recommendations were as follows:

- Restructure the IS Division into five subgroups (Systems Development, Application Support, Network Services, Technical Services and User Support).

- Establish an Advanced Technology subgroup to analyze and disseminate technical information.

- Establish a standard project management structure for each development project with a Team Manager, Team Leader, User Representative, Business Analyst and Technical Analyst/Programmer.

- Address IS Division skill requirements including specific technical expertise and more in-depth functional knowledge in the areas of client server technologies, project management, customer support training, and user training.

Most of the above recommendations have not been implemented. All activities are directed by the IS Division Administrator. The HFD IS Division is organized into

only two sections, administration and development and support. The development and support group is divided into four subsections: (1) client/server and database development; (2) fire incident and EMS records management operations, support, and development; (3) LAN server, desktop maintenance, and support; and (4) Internet development, which is staffed by firefighters. Also, overall responsibility for both development and maintenance activities are apparently still shared by a single group.

Recommendation 148: Implement the organizational recommendations for the IS Division that were made in the 1995 SIP. They are still valid.

According to the IS Division organization chart dated February 8, 2000, one third (10) of the 30 IS Division positions were vacant. Vacancies were difficult to fill during 1999 because demand for programmers was high throughout the industry due to Y2K projects, but that surge is now over. (However, rather than increasing its staff, the IS Division staff had decreased further by October 2001, to 17.) The high percentage of vacancies severely restricts the abilities of the HFD IS Division. The HFD is dependent on its information systems technology, and could get into a crisis situation with the low IT staffing. The IS Division management should be commended for cobbling together the staffing to keep the IT going, but the situation still merits a red flag here. Client server application development is not staffed; six of the seven positions assigned to this function are vacant, including the section supervisor. Perhaps most importantly, the Information Resource Manager responsible for supervising 24 employees remains vacant.

Recommendation 149: The positions for Information Resource Manager and Client Server Supervisor should be filled as quickly as possible. In the absence of these two positions, the IS Division Administrator cannot oversee much more than maintenance activities. (These two positions were still vacant as of January 2002; HFD was seeking approval for them. More details on specific staffing needs are discussed in a later section on staffing.)

Implementation – The implementation plan for the HFD Strategic Implementation Plan (SIP) had three phases: develop a technical foundation; core system, and then support system.[62]

[62] Ibid., Implementation Plan, pp. 2-15.

PHASE I: FOUNDATION: Establishing the technical environment required to support the technical direction recommended in the Plan was the first step. This included improving the IS Division's staffing and skills; developing project management and Help Desk systems; implementing change management; establishing a new technical environment; and migrating the Department's critical applications to a UNIX-based client server environment.

Phase I was scheduled for completion within 1.5 years, or by approximately December 1996. Only a few of the projects in this phase have been completed. The most important success was the implementation of a new UNIX-based client-server environment and migration of the CAD, GEO Database, and Tier II Data applications to this environment. In addition, Microsoft Office was selected and implemented as the Office Automation environment. Projects still requiring implementation include: changes in the organization's (Group's) size and skills; developing project management, and Help Desk systems; implementing Change Management (an information technology function involving testing and user input), and the fire/EMS run records project to create, store, index, and management fire, EMS, and hazmat incident records.

Recommendation 150: The organizational changes to the IS Division in structure, size, and skills that were recommended in both the SIP and this report should be implemented as soon as possible. (As of November 2001, things had moved backward rather than forward, with the previously mentioned decrease in IS Division staff.)

The SIP Implementation Plan assumed that full implementation of all three phases could be accomplished in a three year time frame, ending between approximately July and December 1998. This was an optimistic and aggressive time frame. It assumed that the organization and skills necessary to accomplish these projects were already in place. Also, because the implementation plan ended before 1999, it did not include projects necessary for Y2K preparation and conversion efforts. In actuality, implementing a new technological environment, migrating the critical applications to this environment, implementing an office automation environment, and preparing for Y2K consumed the years since the completion of the SIP. Phases II and III of the plan still are not implemented (as of 2001). Their objectives were as follows:

PHASE II: CORE SYSTEMS: Automate and integrate all of the inspection, permitting, arson functions, and human resource management functions.

PHASE III: SUPPORT SYSTEMS: Provide easy and timely access to information for management, planning, and decision making. This phase involved the implementation of three major projects: (1) Executive Information System; (2) Geographic Information System; and (3) Document Management System.

Implementation of the above needs to be reconsidered as the City's Central IT evolves.

Recommendation 151: The applications identified in Phases II and III of the SIP plan are necessary and should be implemented. The IS Division steering committee should consider the order of implementation based on current realities. For example, the need for a data repository may be more pressing since applications in Phase II were not implemented. There may be citywide solutions to these IT problems as the City's Central IT capability evolves.

Staffing – As noted earlier, the IS Division is understaffed to conduct its assigned responsibilities. Staffing is discussed in more detail below.

Table 63 illustrates the number of staff by type as suggested in the HFD SIP. Staffing recommendations made in this section are based on HFD IS Division performing these functions.

Table 63: 1995 - IS Division Staffing Levels Needed per Number of Users

Staffing Type	Number of Users		
	1 - 500	501 - 1000	1000 +
User support and help desk	1 - 4	3 - 5	5 +
Microcomputer hardware installation and support	1 - 2	2 - 3	3 +
Network management and support	1 - 3	3 -5	5 +

USER SUPPORT AND HELP DESK: A User Support and Help Desk function has not been established. Consideration should be given to providing staffing on a 24-hours-a-day, seven-days-a-week basis for basic help desk support. It is critical to help emergency service providers get information and enter information on incidents, patients, and buildings. We all know how frustrating it gets when computer systems do not let us do what we need to do. In an emergency environment dependent on computer information, help is needed to get past system problems or lack of user understanding of systems.

Recommendation 152: A minimum of five and preferably seven, including a working supervisor, are needed to establish a User Support and Help Desk function. If some of the IS Division functions are moved to the consolidated Dispatch and Communication Center, this function should be considered for consolidation. However, it should not be considered part of the dispatchers' responsibilities. (The City's CIO is also developing a strategy to upgrade Help Desk Support citywide, and that needs to be considered in the staffing decision.)

MICROCOMPUTER HARDWARE INSTALLATION AND SUPPORT: There are two microcomputer support analysts to install and maintain the hardware needs of 87 fire stations, and approximately 3,000 personnel. In year 2000, there were approximately 400 personal computers and laptops and approximately 100 printers to install and maintain. (Subsequently, a total of 600 new desktops were delivered to the HFD in 2001. This allowed the replacement of most of the Department's computers in the fire stations and administrative offices.)

The hardware maintenance task is complicated by the location of various HFD administrative buildings and fire stations throughout the City. The IT maintenance staffing is far below what is needed.

Recommendation 153: Consideration should be given to contracting out server and desktop hardware installation and maintenance, or (as previously proposed) centralizing this function under the new consolidated Dispatch and Communications Center management. The City's CIO is developing strategies that may affect the decision. (As of late 2001, the demands of maintaining the technical environment continue to consume the IS Division management and technical resources. Although the new technical environment may require fewer resources to maintain than it did to implement, contracting or consolidating this function outside the HFD would allow internal IS resources to focus on application development, where close contact with the users is important. Contracting or consolidating the hardware functions result in improved service because of faster responses to equipment outages, 24 by 7 coverage, and potentially more timely equipment upgrades. While the benefits and costs of each option should be evaluated, it is doubtful that both existing microcomputer hardware analysts could be replaced totally by contract services for hardware installation and support. It is likely that at least one and possibly both microcomputer analysts could be needed to provide immediate emergency support and to coordinate the work of the contractor. If the function remains in HFD IS Division, more staff is needed.)

Recommendation 154: If microcomputer hardware installation and support remains a function of HFD IS Division, then a minimum of five positions (three new positions) are needed to achieve the minimum required staffing 24-hours-a-day, seven-days-a-week. (Here again, the new CIO strategies will affect whether this staffing is needed within the HFD or in the City's IT Department.)

There is one technical hardware analyst to maintain the hardware, terminals and printers required for the CAD system. This includes three Bull ESCALA's (R/S 6000's), 12 Bull PCs, 44 terminals, 12 workstations, 3 system consoles, and 30 printers. The CAD system is maintained by BULL 24x7, with a four-hour response, and by in-house IT staff. This work should not be totally contracted out, as the crucial nature of the CAD system demands no unscheduled downtime and immediate service. One Technical Hardware Analyst is insufficient to provide 24-hours-a-day, seven-days-a-week on-call coverage for the CAD hardware support.

Recommendation 155: Consideration should be given to rotating the CAD-related maintenance responsibilities between at least two technical hardware analysts so that on-call coverage is available at all times.[63] One or both of the technical hardware analysts in Network Support could be trained for this support area. This would create additional coverage without increasing staff here.

NETWORK MANAGEMENT AND SUPPORT: There is one LAN specialist and two technical hardware analysts to install and maintain 12 servers and approximately 170 hubs and routers for the LAN. A recommendation was made above to evaluate contracting out this function. However, it is doubtful that all internal hardware analysts supporting this function could be replaced. The primary benefit to contracting may be 24 by 7 coverage. Response time and downtime criteria should be specified as essential components of a contract.

Recommendation 156: If the Network Management and Support functions remain in the HFD IS Division, then approximately five positions are needed for this function. (The policies of the City's new CIO will affect this decision, too.)

Table 64 summarizes the staffing recommendations for the User Support and Help Desk, Microcomputer Hardware Installation and Maintenance, CAD Hardware Maintenance, and Network Management and Support. The recommended staffing levels assume all the functions remain the responsibility of HFD IS Division. The estimated staffing levels assume the functions of Hardware Installation and Support and Network Management and Support are contracted and that a minimal level of internal staffing is maintained to coordinate the contractor's activities and to provide emergency support.

[63] Side definition note: "Analyst" here is a hardware specialist who analyzes problems, not a mathematical analyst.

The actual number of minimal internal staffing required must be determined based on the services contracted and the level of performance specified of the contractor.

Table 64: IS Division Staffing Needed

Staffing Type	Current Staffing	Recommended Staffing*	Estimated In-House Staffing**
User Support and Help Desk	0	5 to 7	5 to 7
Hardware Installation and Support			
Microcomputer Support	2	3 to 5	1 to 2
CAD Hardware Support	1	2	2
Network Management and Support	3	5	1 to 2
Total Staffing	**6**	**15 to 19**	**9 to 13**

* If function staffed by HFD IS Division.

** If function contracted out.

Systems Support – As discussed in the 1995 HFD SIP, the staffing level for programmers depends on the numbers of systems and users supported. The SIP recommended putting new application development projects under one programming section, on-going application support and maintenance under a second section, and training under a third section. The 1995 recommended staffing levels for each function are shown in Table 65.

Table 65: 1995 - IS Division Programmers Staffing Recommended per Number of Application Systems

	Number of Application Systems		
	1-15	16-30	30+
Application Development Programmers	1 - 3	3 - 5	5 +
Application Support Programmers	1 - 2	2 - 3	3 +
Trainers	1 - 2	2 - 3	3 +

Currently there are between three and four application environments requiring support: (1) CAD R/S 6000; (2) custom RMS; (3) client server, database environment; and (4) internet. We support the SIP-recommended separate staffs for support, development, and training and have incorporated this organization into our staffing scenario. Based on the staffing proportions recommended above, the staffing needed for each of the environments supported today is shown in Table 66.

Recommendation 157: Approximately six more positions – four more programmer/ analysts and database staff positions, and two trainers – are needed, in addition to filling the current seven vacancies. A 44 percent vacancy (seven out of 16) has paralyzed development efforts in 1999. The positions would be used as shown in the table below.

The number of programmer staff supporting each environment and type of support needed will increase and decrease over time. As major development projects are initiated, the need for development staff will increase. As major projects are completed, the need for support staff will increase. For example, the need for development staff for the CAD system may decline as the need for development staff for RMS increases. The rationale for the needed staff is discussed below, with the numbering keyed to Table 66.

Table 66: Programmers Needed

Environment Supported	Staffing Type	Current Staff	Recommended Staff
1. CAD R/S 6000	a. Application Support	2 (both currently vacant)	2
	b. Application Development	0	3
	c. Training	0	1
2. RMS	a. Application Support	6 (1 currently vacant)	2
	b. Application Development	0	3
	c. Training	0	(1) – shared with 1.c.
3. Client/Server (Includes Data Base)	a. Application Support	6 (3 currently vacant)	1
	b. Application Development	0	7
	c. Training	0	1
4. Internet	a. Application Support	2 (1 currently vacant)	1
	b. Application Development	0	1
	c. Training	0	As needed
Total Staff		**16**	**22**

1A. CAD R/S 6000: APPLICATION SUPPORT: Currently two positions are allocated to support the CAD R/S 6000 environment. Both of these positions are vacant.

If these positions were filled, the CAD application would have the recommended level of support are the capability to provide 24/7 support. However, a new CAD system may require more support for the first two years or so.

1B. CAD: APPLICATION DEVELOPMENT: No resources have been allocated to development of the new CAD system. Between one and three positions are needed for this development. The level of staff committed to this development effort is dependent on the vendor support during the implementation phase. A development staff probably will be needed for some time after implementation to refine the application.

1C. CAD 12/S 6000: TRAINING: We recommend one training position be established, which could also be the position used for RMS training.

2A. RMS: APPLICATION SUPPORT: There are six staff positions (one of which is vacant) and one supervisor assigned to support the RMS environment. We estimate that between 1 and 2 positions are needed for RMS support. The large support staff has probably been necessary in the past because of the custom software supported. However, the level of support needed in the future should be minimal because the application is mature and will be replaced in the next 18 to 24 months. To better allocate resources, the supervisor and two staff positions should be moved to RMS development and two staff positions should be moved to a client server development team.

2B. RMS: APPLICATION DEVELOPMENT: At this time, we do not recommend allocating resources to RMS development. A development team of approximately three personnel will be necessary in six to 18 months for the new RMS implementation, which is planned after the CAD system is implemented. To accommodate the hiring and education process, this development staff should be organized soon, with priority given to current RMS support staff.

2C. RMS: TRAINING: We recommend one training position for the new RMS system, which could be the same position used for CAD training, so an additional position is not included.

3A. CLIENT SERVER/DATABASE: APPLICATION SUPPORT: A total of six positions (four programmer analysts, one database administrator, and one supervising consultant) are currently allocated to the support and development of client server

applications. The consultant position and 2 programmer analyst positions are vacant. There are approximately 20 PC based applications that require some level of support. Even though these are not true client server applications, they should be converted to client server applications. Therefore, the support for these applications could be assigned to the client server support group. Since the maintenance needed on these systems should be minimal and the need for development is so great, we recommend only one programmer analyst be dedicated to support at this time.

3B. CLIENT SERVER/DATABASE: APPLICATION DEVELOPMENT: Currently, no positions are dedicated to client-server, database development, a vital function. We recommend seven positions, as discussed below. The need for database development staff is so great that the IS Division steering committee may recommend even more than seven development positions and/or use of external resources until the development backlog becomes manageable.

To get the seven positions, we recommend moving two staff positions from RMS support to client server/database development and dedicating five staff positions (currently assigned to support and development of client server applications) to client server application/database development. Two development teams are needed to fill these functions:

- Two to three positions should be dedicated to database development.

- Three to four positions should provide support for Fire Prevention projects. The data from the discontinued Prevention system should be converted to a relational database so that historical trend data are available for analysis. An application is needed for the handheld devices so that the hardware can be utilized. An assessment of the Planning Department systems is needed to determine which systems can benefit Prevention immediately. Also, an assessment is needed to evaluate how Fire can use the digitized plans being developed by the Planning Department.

3C. CLIENT SERVER/DATABASE: TRAINING: We recommend one training position for the client server applications and database systems.

4A,B,C. INTERNET: APPLICATION SUPPORT: There are two technical hardware analyst positions assigned to support and develop the internet environment. One of these positions is vacant. This position should be filled and one analyst should be assigned to internet application support and the other to internet application development. A training position should be utilized as needed.

Technological Infrastructure – The HFD was in the process of migrating to a Local Area Network (LAN) environment in 1995. LANs were being installed to service administrative users at the Logistics Center, Fire Alarm Building, Fire Station 1 and the Training Academy and to provide a basis for future wide area networking. There were no plans to connect other fire stations to the LANs. Stations were to remain connected to the Bull computer systems through the AT&T Paradyne Network system.

The move to LANs was to free up resources on the Bull computer and thereby improve the poor performance of the crucial CAD system. Also, office automation users and applications would be moved from the Bull computer to LAN using Microsoft Office.

Also, there were redundant systems between divisions within the HFD, between the HFD and other City Departments and between the HFD and other Citywide systems. Systems were developed by both the IS Division and by individual divisions within the Fire Department. Further, the Honeywell Bull computer systems were outdated and difficult to maintain. Finally, the CAD systems was not on a dedicated server and did not have a "hot" backup.

As of May 2000, many of these problems have been remedied. As recommended in the 1995 SIP, the HFD has moved to a newer, more flexible open architecture. In 1997, the Honeywell Bull computers were upgraded to high availability ESCALA Risk 6000 systems using an AIX UNIX operating system. These are full fault tolerant systems that insure against unscheduled downtime with one gigabyte of memory, which is sufficient.

Several other steps have been implemented to insure performance and provide hardware backup for the CAD system, which has been isolated on the "A" Bull computer. Performance of the CAD system has improved substantially with no slow downs experienced since the system was upgraded and isolated.

Other steps have been implemented to plan for disaster and recover in the event of hardware failure. The "B" Bull computer has been dedicated as a 'hot' backup for the CAD system so the possibility of experiencing a computer processor failure has been substantially reduced. RAID 5 disk arrays have replaced removable disks. This newer disk technology provides for both data stripping and mirroring, which guards against the loss of data in the event of a disk failure. Data is backed up daily and taken off-site. Using this data to recover the system is tested twice a year. If power is lost to the Preston location where both A and B computers are located, a UPS system, supported by backup generators, is available to provide power. These generators are tested every Thursday.

While the above changes are significant improvements, the CAD system remains vulnerable to the loss of the facility, which leads to the following recommendation:

Recommendation 158: Due to the crucial nature of the CAD system, a remote CAD 'hot' site should be established. The current CAD system is scheduled for replacement in phases during 2002-2003. A remote hot site for the CAD system should be evaluated to determine if a short term, cost effective back up could be found. In the long term, an alternative remote hot site should be considered for the new CAD system. One short term approach to obtaining a remote hot site for the current CAD system is to use the existing Bull computer in Administrative Services. Another alternative is to move the "B" Bull computer to an off site location (possibly to the City's IS computer location or to the Emergency Management command location). While there would be a considerable distance between the "A" and "B" computers, the tradeoffs, solutions to lag times in data updates, and other potential operating problems might be acceptable to gain the extra security of a remote hot site. (As of 2002, the current police dispatch center at 61 Reisner is planned to be the backup to the new CAD and new emergency dispatch center.)

A potential single point of failure may exist for voice communication if the Preston location has telephone service from a single substation. A potential single point of failure may exist for data communication if a single network backbone serves both CAD computers.

Recommendation 159: The risks of a single point of failure in data and voice lines necessary to support the 911 system should be evaluated. Steps should be taken to provide backup alternatives so that no single point of failure exists in the 911 system. (This is to be addressed in the new emergency dispatch center, but will be a concern until then.)

Other potential risks and costs of business interruptions should be evaluated for the loss of the RMS and other HFD data and systems. Although other systems are not as crucial as the 911 CAD system, the more important departmental systems should be assessed to determine how long (in terms of hours, day, weeks, or months) the functions supported can operate without the use of these systems. Based upon this assessment, other systems and data may need backup and recovery plans.

Recommendation 160: Business interruption risks and costs should be evaluated. If deemed necessary, recovery plans should be developed and tested for remote recovery of RMS and other HFD data and systems. (The IS Division steering committee will assess needs and requirements.)

Administrative systems were moved to a third Bull ESCALA AIX system that is in a different physical location. The Fire and EMS Records Management System (RMS), Hydrants, and Hazardous Material applications have been moved to this computer. Currently, this platform also is used for development.

Recommendation 161: The need for a dedicated development server should be evaluated. As development activities increase, it is unlikely that the administrative server will be sufficient for both purposes.

There also are 13 special function servers. These are used for e-mail, fire, communication, and applications servers.

The LAN is a TCP/IP routed network with three layer switching. The 3Com WAN routers and switches are no longer supported or marketed by 3Com. We estimate that this network will be obsolete in approximately 1.5 years. The HFD IS Division is recommending a migration to Cisco as a replacement for these network components. However, funds have not been budgeted for this replacement.

Recommendation 162: Plans should be developed and funds budgeted to replace the LAN technology as soon as possible. This is a vital foundation component of information systems. The current platform (3Com) should be replaced with Cisco components ASAP. (Funds had not yet been budgeted to do this, as of October 2001).

Recommendation 163: To prevent redundancy, all HFD application systems should be developed by the HFD IS Division. In many cases, section specific applications (usually Microsoft Access databases) have been developed because automated information was so inadequate. Also, the IS Division steering committee

should, in their review of needs and requirements, also try to eliminate or reduce redundant systems. City and other department's application systems should be used whenever feasible. Enhancements to these systems should be considered to address specific fire department needs.

1995 TECHNICAL ARCHITECTURE PLAN: Five computer system architectural issues were identified that hindered further successes. These were:

1. Data querying and report writing were not up to industry ease of use standards.

2. Information interfaces and access were slow and cumbersome due to character-based user interfaces.

3. High cost of centralized processing.

4. Non-standard development environment did not provide for increased productivity during systems development.

5. The existing database was non-relational.

In 2000, data querying and report writing remain a major hindrance. When data was requested during this study, it was either not available, had to be obtained from individual supervisors, or the IS Division had to write a report. This inability to easily access and analyze data severely hampers the HFD and limits its ability to use analysis to improve operations.

Little new development has been undertaken. The IS Division plans to implement a relational database management system, but a development team has not been formed to design and implement such a project. This is probably the most important issue immediately facing the HFD. Also, a standard development environment has still not been instituted. Although the City procured First Case as the Citywide development methodology standard, the IS Division Administrator is the only one trained in its use.

Recommendation 164: Train all database analyst and software developers in the First Case methodology as soon as possible. The only reason not to do this is if the First Case methodology standard is not to be used by the HFD.

The SIP plan also recommended utilizing package software where applicable. A package solution has been selected for the new CAD and RMS systems. Other package solutions are needed to meet the functional needs of HFD.

Recommendation 165: An end-user reporting tool, such as Crystal Reports, is needed to allow users access to data for analysis and management purposes. Crystal Reports is a commercial-off-the-shelf (COTS) tool. It is recommended that tools such as Crystal Reports be used wherever possible.

Application Development, Support, and Training

PROCESS: The 1995 assessment of process said that "processes" at the HFD were generally manual. There were limited computer aids. There was no direct interface or real time information exchange between the HFD systems and the citywide systems such as finance and payroll. Revenue collection rates on ambulance billing and Prevention were low, due in part to poor information gathering processes.

In 2000, the information handling processes at HFD still are generally manual, there are no direct interfaces to the citywide systems and revenue collection rates on ambulance billing remain low. Organization and staffing recommendations made earlier provide the basis for application development to create automated interfaces to perform these functions, which would improve efficiency.

Recommendation 166: The IS Division steering committee should formalize development priorities for projects to automate manual processes. This is another function that the previously mentioned steering committee should take on.

MANAGEMENT REPORTING: In 1995, centralized management reporting information was not available for planning and directing resources.

In 2000, the lack of centralized management reporting information may be worse than it was in 1995. Data are not available for planning and directing resources in any division. Data required for accreditation are collected manually. For example, in Prevention, the reporting responsibility has been shifted from a centralized divisional group to the Senior Inspectors. However, in Central Command, there is excellent control over fire incident reporting because the files are centralized, incident reporting coding is verified by uniform officers, and the data are reported systematically by knowledgeable management and staff.

Recommendation 167: Consider consolidating records management and reporting for departmental operations (fire incident, EMS, prevention, etc.) under Central Command. Automated record management systems should be evaluated to replace any manual files still used by any of these functions. It would provide a more efficient method of records management.

APPLICATION DEVELOPMENT: Two large development projects that were underway in 1995 were not successfully implemented. One major project was to develop a data repository and inspection system for Prevention. Over the past five years, Prevention has become less automated and more isolated.

Currently, application development is further behind than it was in 1995. The IS Division Administrator identified four projects planned for implementation which are in keeping with the HFD SIP.

1. The dot matrix printers in 85 fire stations are being replaced with bubble ink jet printers. The new printers provide copying, printing, scanning and faxing capability all in one device. This should be completed by the end of June 2000.

2. A project is beginning to develop an application to utilize the hand held devices purchased for Prevention several years ago.

3. A project is anticipated to develop a Sequel database, which will be a data repository for reporting.

4. A project for emergency alerting is in the pilot phase at one fire station. This project envisions providing laptops in District Chiefs' vehicles and in fire apparatus to provide dispatch data while responding. This is seen as the first step of a multiphase project to provide automated support for dispatching the nearest units, pre-planning and incident management.

Application development has neither the direction nor the staff necessary to support the HFD's automated needs. This is a major deficiency within the IS Division. A substantial investment of money and resources is needed to hire the development management and staff necessary to support needed development projects. Management within the IS Division must implement the project management structure and techniques

recommended in the SIP plan. HFD management should be involved in determining the development priorities. More management attention must be focused on finding information services solutions to providing information and tools necessary to improve operations. The HFD SIP Plan provided a data and application plan applicable to the current situation. In addition to the steps discussed previously, some of the more important strategies that were recommended in the 1995 HFD SIP are listed in Appendix G. We concur that these are strategies that should be implemented

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In summary, the partnership between the IS Division and HFD management has not been perfected. The management expertise and development resources have not been available in the HFD IS Division to accomplish both technical infrastructure upgrades and manage development projects. HFD must decide how to best structure the internal information services function so that it becomes an integral part of management decision making.

VIII. EMERGENCY MANAGEMENT

The City's Emergency Management Division is the prime agency for coordinating disaster preparedness. It reports to the Mayor's Office of Public Safety and Drug Policy. Since the events of September 11, 2001, it is all the more important that this function be adequately staffed and managed. It must be given high priority.

The Fire Department plays a major role in emergency preparedness and mitigation through its hazardous materials special operations and the involvement of virtually every unit in the Department, as well as Emergency Medical Services to treat victims. The project team was asked to review the emergency management functions of the City as well as the role of the Fire Department in emergency management.

Emergency Management Functions – The subject of emergency management is generally discussed in terms of four functions: mitigation, preparedness, response, and recovery. These functions often are the four phases of an emergency in time sequence, too. Effective emergency management requires the successful implementation of each of these phases. They are generally defined as follows:

- **MITIGATION:** Actions taken to eliminate or reduce the degree of long-term risk to human life and property from natural and man-made hazards. These include public education, building/safety codes, litigation, and disaster insurance. In other words, they are the prevention-oriented functions.

- **PREPAREDNESS:** Activities that governments, organizations, and individuals take ahead of time to prepare for coping with disasters. They include the development and exercise of emergency response plans/systems, creation of mutual aid agreements, and training of personnel.

- **RESPONSE:** Actions taken immediately before, during, or directly after an emergency occurs to save lives, minimize damage to property, and enhance the effectiveness of recovery. They include the activation of an emergency plan, staffing of the Emergency Operations Center (EOC),

search and rescue operations, the evacuation and shelter of victims, logistics, and emergency medical operations.

- **RECOVERY:** Activities to return life to normal or improved levels after a disaster. This consists of such things as crisis counseling, damage assessment, disaster loans, temporary housing, and reconstruction.

In the event of a disaster or other emergency, the Emergency Management Division coordinates the activities of all City agencies, a number of volunteer groups (e.g. Red Cross), charities (e.g. Salvation Army), and various State and Federal agencies. It also coordinates a mutual aid network that includes almost every community surrounding the City of Houston. To obtain Federal disaster monies through the Federal Emergency Management Agency (FEMA) or to have an emergency declared the Division must coordinate with the Mayor's Office and the City's Department of Finance and Administration.

Organizational Role and Placement

Currently, the Division is under the supervision of the Mayor's Office of Public Safety and Drug Policy. Formerly, the Division had been a function of the Finance and Administration Department, and prior to that, had been located in the Fire Department. The EM Coordinator currently reports to the Director of the Office of Public Safety and Drug Policy.

Local Emergency Planning Committee – The Division's staff includes the City's Local Emergency Planning Committee (LEPC) Administrator, a senior staff analyst. The LEPC Administrator assists the Executive Committee of the LEPC in accomplishing its mission as the focal point for chemical emergency response planning and implementation in the community. The LEPC is a valuable resource for data and information on the transport, manufacture, and storage of hazardous materials in and around the City.

In the event of a major hazardous materials incident, the primary emergency response would come from the HFD, and would involve both suppression personnel and the Hazardous Materials Response Team. To efficiently and safely mitigate an incident, these personnel need as complete information as possible on the materials released. For

this reason, the LEPC Administrator would be better placed under the supervision of the HFD Special Operations Division, to ensure a close working tie. This would provide a better framework for the City of Houston to prepare for and perform its emergency response functions during a hazardous materials incident. It would also facilitate the sharing of data collected on fixed facilities and transportation routes by the LEPC and the HFD hazardous materials inspection unit (which also has been moved around).

Therefore, we recommended in Chapter VI that the LEPC Administrator be reassigned to the Special Operations Division of the Fire Department.

Placement – The organizational location of the emergency management function varies from city to city. It is a difficult and somewhat arbitrary decision. Most large cities have it assigned to the Mayor or City Manager's office, some have it assigned to the Fire Department. It is often moved around, as it has in Houston. The dilemma is that the function needs to coordinate across City departments, which suggests it not be in any one department, versus putting it in the Fire Department because of its large role in dealing with many disasters.

Table 67 shows who the Office of Emergency Management reports to in a group of large cities in Texas and elsewhere. Some emergency management organizations cover a city and its county.

Houston city administration and HFD management have considered transferring supervision of the Division from the Office of Public Safety and Drug Policy to the HFD. However, given the Emergency Management Division's role as an interagency coordinator, it is well placed and should remain under the auspices of the Office of Public Safety and Drug Policy where it is afforded regular access to a variety of City agencies. In the event of a disaster, the HFD would certainly be involved in a variety of ways, including administering emergency medical treatment and engaging in technical rescues. Nationally, the expanding role of fire departments in disasters has raised questions about the desirability of having them coordinate other agencies' activities at the same time they are managing their own operational response. As a result, many cities, such as New York, Los Angeles, and Atlanta have placed their EM function outside the Fire Department.

Recommendation 168: The Emergency Management Division should remain a function of the Office of Public Safety and Drug Policy. There is no strong reason to move it, especially with the Fire Department undergoing many changes and having a full plate of issues for the foreseeable future, and with the need for it to have high visibility.

Table 67: Comparison of Emergency Management Staffing

Jurisdiction	Population (millions)	Staff	Emergency Agency	Emergency Staff per Million Pop.	Reports To
New York	7.3	55	Office of Emergency Management	7.5	Mayor
Miami-Dade County	1.9	17	Office of Emergency Management	8.95	Fire Chief
Los Angeles	3.4	16	Emergency Preparedness Division	4.7	City of Administration Officer/Mayor
Atlanta/Fulton County	3.7	13	Emergency Management Agency	3.5	Mayor and County Executive
San Diego County	1.2	10	Office of Disaster Preparedness	8.19	Deputy Chief Admin Officer for Public Safety
Houston	**1.9**	**9**	**Division of Emergency Management**	**5.04**	**Senior Executive Assistant to the Mayor for Public Safety**
Dallas	1.0	5	Office of Emergency Preparedness	4.65	Assistant Fire Chief
Philadelphia	1.4	5	Office of Emergency Management	3.48	City Managing Director
Detroit	1.1	5	Emergency Coordinator	4.5	Fire Commissioner
Phoenix	1.2	1	Office of Emergency Programs	0.83	Deputy City Manager

Staffing

The EM Division has a total staff of nine, including the Director, a Division Manager, three analysts, three Administrative Assistants, and the LEPC Administrator.

Table 67 compares staffing levels in Houston with those of comparably sized jurisdictions throughout the country. Other jurisdictions have between 3.5 and 12 EM staff per million population; Houston has approximately 5 per million population, which is in the middle of the range. One must be slightly wary of these comparisons because some cities have additional personnel in the Mayor's Office or elsewhere who play a significant role in emergency preparedness but are not formally assigned to the EM function. Also, the number of staff needed should be developed on the basis of tasks that need doing in Houston, and not just a general rule of thumb.

Table 68 summarizes how a number of jurisdictions assign their EM personnel to various functions. In some, personnel assignment is dependent on job classification, in others by the individual's emergency role. Following the table are brief descriptions of how emergency management is organized in several jurisdictions of comparable size and/or population to the City of Houston.

NEW YORK: The Mayor's Office of Emergency Management (OEM) is headed by a Commissioner on the same level at the Police and Fire Commissioners who reports to the Mayor. They have a staff of 55 persons.

The agency is responsible for all planning, preparedness and response issues dealing with emergency management. It supports the public safety agencies and coordinates their efforts as well as the other city agencies. This organization also coordinates the planning and response issues of federal, state, and private sector, emergency management entities as they interface with New York City responders. The OEM is charged with ensuring for the optimum use of NYC resources while at the same time eliminating potential conflict among responding agencies, which may have areas of overlapping expertise and responsibility.

By executive order, OEM is designated the "on-scene interagency coordinator." OEM's role is to coordinate the participation of all city agencies in resolving the event. OEM will assist the incident commander in his or her efforts in the development and implementation of the senior official from the lead agency having responsibility for the event (police, fire, environmental protection, etc.) In those instances where the incident is so multifaceted that no one agency immediately stands out as the incident commander, OEM will assign the role of incident commander to an agency as the situation demands.

Table 68: Deployment of Emergency Management Staffing by Function

Staff Members	New York	Miami-Dade County	Los Angeles	Atlanta/ Fulton County	San Diego County	Houston	Dallas	Philadelphia	Detroit	Phoenix
Director Coordinator	Details were not available.		1	1	1	1	1	1	1	1
Deputy/Asst. Director			1	1	1	1		1		
Sr. Emer. Mgmt. Specialist					1				1	
Emer. Mgmt. Specialist						4			2	
Office Coordinator						0	1			
Computer Technician			(3 Interns)				1			
Hazardous Material					1			1		
Planning			3	1	1	1	1	1		
Exercise Training Officer			2	1	1		1			
Admin. Assistant/Clerical			4	3	3	2	1	1	1	
Emer. Operations Center			3		1					
Details from Police and Fire			2					(1-2)		
Mitigation				2						
Recovery				2						
Response				2						
Total Staff	**55**	**5 (+1 to 2)**	**16 (+3)**	**13**	**10 (+4)**	**9**	**6**	**5 (+1 to 2)**	**5**	**1**
Population Served (million)	**7.3**	**1.4**	**3.4**	**3.7**	**2.1**	**1.9**	**1**	**1.4**	**1.1**	**1.2**

OEM staffs around the clock response in each of the five boroughs. In addition to appropriate shift response vehicles, OEM operates a command bus for extended operations to support head agencies command, center, and communications.

In addition to incident response support, OEM is responsible for preparation of all emergency plans and coordination and implementation of training programs, drills, and exercises.

MIAMI-DADE COUNTY: The OEM is a division of the Miami-Dade Fire-Rescue Department with 14 staff members. Its Director reports to the Director of the Fire-Rescue Department.

The OEM coordinates mitigation, preparedness, response and recovery efforts the County and municipalities and develops the Comprehensive Emergency Management Plan (CEMP). It also maintains a registry of residents requiring evacuation assistance in the event of an emergency or disaster. Further, OEM operates the EOC.

LOS ANGELES: The Emergency Preparedness Division is headed by a Division Chief on a par with the Fire Chief, and reports to the City Administrative Officer. It has a staff complement of 16 positions.

The Division is responsible for coordinating the planning, preparedness, response and recovery efforts of the 42 city departments and numerous non-governmental organizations in the city.

The 16 positions are assigned responsibilities for plan development (3), preparation (2) (which includes liaison with other city agencies), training (2), and support and maintenance of the Emergency Operations Center (3). The director, deputy director, and full-time assignments of a fire Battalion chief and police captain are the core responders. Secretarial and administrative support completes the staffing.

The staff is also complemented by the assignments of college interns (three at present) who are assigned such tasks as computer support, Web development, research, and communications support.

ATLANTA/FULTON COUNTY: With a combined population of 3,650,000, Atlanta and Fulton County together have a joint Emergency Management Agency. It is an independent agency headed by a Director who reports to the Mayor of Atlanta and the County Executive Officer. They have a staff complement of 13 positions.

The Agency is structured along the lines of the Federal Emergency Management Agency (FEMA), under of the four phases of emergency management. Two staff members are assigned to mitigation measures. Two are tasked with preparation (plans development and training), and two are assigned the lead on recovery activities. Two others, plus the Director and his Deputy lead response activities. All staff members are expected to respond to emergencies. Administrative, graphic, and secretarial support rounds out the staff.

The Agency coordinates all emergency response efforts. It is the point of contact for the emergency coordinators from all city/county departments. The Agency maintains a Duty Officer for full-time response. The agency's role is that of resource provider and coordinator of multi-disciplinary response assistance from federal, state, local, and non-governmental sources. The Agency also activates and operates the Emergency Operations Center for large-scale emergencies.

SAN DIEGO COUNTY: The Office of Disaster Preparedness ensures for the preparation and execution of emergency plans in order to protect life and property within the San Diego Operational Area in the event of a major emergency or disaster. The San Diego Operational Area is comprised of the 18 incorporated cities within the county and the County of San Diego, which represents the unincorporated areas.

The Office of Disaster Preparedness provides for a single operational area for coordination of disaster activities relating to mitigation, preparedness, response, and recovery. The office operates under a Joint Powers Agreement that provides for cooperation and coordination between member jurisdictions.

In a major emergency or disaster, the purpose of the Office of Disaster Preparedness is to staff the Operational Area Emergency Operation Center (EOC) and provide for coordination of efforts among County departments, cities, special districts, and other agencies with the County, as well as with state and federal agencies.

DALLAS: The EM function is under the Assistant Fire Chief of Communications, who reports to the City Manager. They have a staff of six.

The Office is responsible for the City's disaster management program, which includes mitigating against, preparing for, responding to, and recovering from all manner of emergencies and disasters. Also, they maintain, prepare, and activate the EOC. The EOC coordinates response and recovery activities with three Mobile Communications Units operated by Fire, Police, and Street & Water.

PHILADELPHIA: The Office of Emergency Management (OEM) is headed by a Director who reports to the Managing Director of Operations for nine city departments, including police, fire, health, water, and sewage. The Managing Director, in turn, reports to the Mayor. They have five full-time personnel.

The OEM is responsible for the planning, preparedness, response, and recovery aspects of the City's EM program, and for activating and managing the EOC during an emergency incident.

The OEM coordinates the efforts of the emergency operations group, comprised of a representative from each of the City's major departments. OEM staffing is supplemented by long-term details, some up to a year in duration, mainly from the Police and Fire Departments. The most recent of these was an HFD Battalion Chief assigned for an eight-month period to work on Y2K issues.

DETROIT: The Emergency Coordination function reports to the Fire Commissioner. They have a staff complement of five.

Emergency Management coordinates preparedness, mitigation, response and recovery activities for natural and man-made emergencies and also coordinates evacuations during multiple alarm fires. During a declared emergency, Emergency Management establishes and manages the Emergency Operations Center to coordinate the response and recovery activities.

PHOENIX: The Office of Emergency Programs is part of the City Manager's Office and its Director reports to the Deputy City Manager. The Emergency Management Coordinator is the Office's only full-time employee.

The Office is responsible for the management and activation of the EOC, development of protocols for disaster response and recovery, and media relations during a disaster. When the EOC is activated, a "rumor control" hotline, staffed by City Hall personnel, is also activated.

Recommendation 169: The Division of Emergency Management should consider augmenting its staff by a college intern program.

The current full-time staff is about adequate for a city the size of Houston. The college intern program could assist the full-time staff in researching such projects as chem-bio terrorism, emergency planning, and community risk management, as is done in Los Angeles.

Management/Supervisory Issues

The study team's review of the EM Division, which included interviews with the staff, found that morale in the office was low. There is a lack of spirit and trust as well as petty bickering among the staff. The Employee Assistance Program (EAP) also found morale in the EM Division to be poor. The staff described the management style as "dictatorial" and "intrusive." These issues have adversely affected working relationships internally between Division staff members and externally with key City customers, including the HFD, Police Department, and the Department of Public Works. The Director and Assistant Director of the EM Division were criticized for their own poor working relationship, which has resulted in confusion regarding their roles and responsibilities and disillusionment among the staff. Evidence of this situation is management's lack of staff meetings, insufficient planning, and practice for incidents, lack of promoting teamwork, and lack of cross-training of personnel to perform multiple functions on incidents. Clearly, this situation is problematic and needs to change. Houston has the talent and resources to plan for disasters. To be effective, they must be utilized in the most efficient manner possible.

The management of the Division needs to be improved. It is a critical City function. The staff need better leadership. The current management team needs to instigate some changes immediately, or be reassigned elsewhere.

Recommendation 170: Management of the Emergency Management Division should strengthen and encourage communication between staff members and with the

City's customers (e.g. Fire, Police, PW&E, Harris County, etc.). Improving internal communications and training will promote teamwork and boost morale among the staff. Better communication with the Division's customers will allow it to provide the appropriate level of service, and increase the efficiency during non-emergency and emergency operations. The HFD presently (2001) has members on the Joint Referral Committee and the Metro Life Safety Committee, which provide a number of channels of communication.

The EAP review made a series of recommendations as to how the Division management and staff can begin to address their issues. We support their recommendations.

Recommendation 171: Emergency Management Division leadership needs to develop, with input from its staff, a set of long and short term goals and action plans to improve the effectiveness of the office. By determining priorities and scheduling activities to improve and maintain the desired level of emergency management capabilities, the Division's effectiveness and efficiency will be increased.

TranStar Facility

The Division of Emergency Management is housed at the Greater Houston Transportation and Emergency Management Center. A consortium of Local and State government agencies built this state-of-the-art facility, also known as TranStar. The TranStar organization includes representatives of police, transportation, and emergency management agencies from the City of Houston, Harris County, the Metropolitan Transit Authority of Harris County, and the State of Texas. These agencies are collectively responsible for the planning, design, operation and maintenance of transportation and traffic emergency management operations within the Greater Houston Area.

TranStar is located at 6922 Katy Road in the northwest part of Houston. The building is set back from a two-lane divided roadway and is approximately 100 yards from a major railway artery. The 52,000 square foot facility was specially constructed to accommodate a variety of high technology components and facilitate the integration of member agencies' activities. The facility includes a central control operations room, communications room, telephone switch room, Emergency Operations Center, and three floors of offices for the staff of participating agencies. It also contains viewing areas where the public and news media can monitor information during special and emergency events.

ACCESS: Access to TranStar is by a main entryway and by several side doors. The side door's access is controlled; it requires use of key-cards 24 hours a day. During business hours, visitors may enter only through the main entryway. After hours, access to the main entry is also controlled by key-card.

To access the various work centers located throughout the facility, visitors must generally pass by a receptionist. During TriData's visit to the offices of the Division of Emergency Management, visitors were walking past the receptionist without question. Essentially, the receptionist acts as a greeter, but does not check identification or buzz visitors through. Also, the receptionist is occasionally not present. Unauthorized persons could easily enter the facility during business hours. Further, in the event the EOC is activated, it is crucial to know exactly who is in the facility. All individuals, including employees and visitors, should be accounted for at all times.

Recommendation 172: An access control mechanism should be installed in the main hallway of the TranStar facility (as well as the side doors). Such a device might be a door lock with a buzzer to grant entry to authorized individuals. This will limit access to those individuals authorized by the TranStar management staff and keep unauthorized individuals from entering.

EMERGENCY OPERATIONS CENTER: In the event of an emergency or disaster, the EOC must be fully accessible by authorized persons, able to function uninterrupted, and capable of operating self-sufficiently for up to 72 hours. This means that the EOC must be able to supply its own power, food, water, air recycling, and sleeping and bathing facilities.

Houston TranStar is only partially prepared for a large-scale disaster. TranStar stores enough diesel fuel to operate its power generator and water for drinking, etc. to function independently for approximately 7-10 days. While these stores are adequate, other aspects of the EOC facility support are problematic.

The Heating, Ventilation and Air Conditioning (HVAC) system is an open system. As a result, the HVAC system is only able to take in and circulate fresh air from outside the facility and cannot recycle air within the building. In the event of a hazmat incident on the roadway, train tracks nearby, or an attack on the facility, fumes could be taken into the building and circulated by the HVAC. Depending on the material involved and its concentration, these fumes could harm TranStar employees.

The EOC also lacks adequate bathing facilities. There is only one shower available for all TranStar employees, regardless of gender. During an extended emergency operation, it could become difficult to accommodate the bathing needs of the many employees required to operate the EOC. Also, there are no sleeping facilities within TranStar; if deployed for a long-lasting disaster, personnel would need to sleep on the floor. Finally, TranStar does not keep food in storage. Thus, food must be delivered prior to or during an emergency. Depending on the emergency, the delivery of food could be delayed or even impossible, which would create a potentially dangerous situation for TranStar employees.

Recommendation 173: The TranStar facility should be updated to be fully self-sufficient in the event of an emergency. Updates should include an overhaul of the TranStar facility's HVAC system including a transition to a closed-system that allows for the recycling of air within the building. Bathing facilities should be updated to include additional showers and allow for the separation of genders. Foldaway cots, pillows, hospital-style sheets, blankets, and pillowcases should be purchased and stored for use during emergencies. Finally, at least enough food rations should be kept in storage for consumption during the first 24 hours of an emergency. If necessary, additional food can be delivered while the EOC is in operation.

LOCATION: Though it is generally best to house an emergency management and operations center outside of a city's main downtown area (as TranStar is now), its current location is less than ideal. The TranStar complex is prone to regular flooding rendering the facility inaccessible to incoming staff members. Also, Houston is located in one of the Nation's most hurricane prone regions and TranStar lacks a sufficient hurricane protection system. According to several employees, it takes approximately two full days (48 hours) to plan and install plywood over all of the windows to protect them from hurricane-force winds and flying debris. This is too long. A Hurricane *watch* is issued for a coastal area when there is a threat of hurricane conditions within 24-36 hours; a *warning* is issued when hurricane conditions are expected in a specified coastal area in 24 hours or less. While hurricane watches often precede warnings, there is not necessarily enough time between the issue of a watch and the arrival of the hurricane to safely board-up and protect the building. Putting up shutters after a watch or warning is issued may result in inadequate protection from the impending storm's winds and flying debris. In other words, to effectively install shutters on the TranStar facility, employees must begin working *before* a watch is issued.

The roadway in front of the building is heavily trafficked by trucks, including many that commonly carry hazardous materials. The nearby railroad tracks are main corridors for rail transportation to and through the City and often have moving or stationary hazardous materials stored in railcars close to the TranStar building. As mentioned previously in this section, the TranStar complex, in its current location, is vulnerable to hazardous material leaks, spills, fires, explosions or other disasters on the adjacent roadway and/or rail tracks.

In our opinion, this combination of factors renders the TranStar facility questionable as a location for the City's EOC. While TranStar is an excellent traffic management center, supporting emergency operations requires the facility to meet different standards.

Recommendation 174: The potential exposure to hazards of the TranStar location warrants consideration of relocating the EOC to the proposed Public Safety Communications Operations Center. The EOC should be situated in a location far from hazard-prone areas. Optimally, it would have automated hurricane shutters that could be deployed rapidly. Additionally, it should be close to, if not in the same location as, police and fire emergency communications. Finally, the Center should be capable of functioning self-sufficiently for up to 7 to 10 days with its own power system, recycled air and ventilation system, and have enough food, sleeping and bathing facilities for the appropriate number of employees present during an actual emergency.

Medical Strike Team

As discussed in Chapter IV, on the HFD organizational chart the Houston Medical Strike Team (HMST) reports to the HFD Special Operations Division. The HMST is a volunteer team composed of medical personnel supported by a logistical and administrative staff. The team deploys wherever needed in the nation with sufficient supplies to sustain themselves for 72 hours while providing medical care to casualties. These teams are strategically located throughout the nation and are organized by the United States Public Health Service.

Given the disaster-related mission of the HMST, it may be more appropriate for them to function under the supervision of the Division of Emergency Management, which may be better equipped to coordinate the interagency support and response necessary for the effective deployment and training of the team's personnel.

As noted earlier in Recommendation 76, we suggest that the organizational location of this function could be swapped with that of the Local Emergency Planning Committee administrator. Although by their names the organizations seem well-located, an examination of their mission and day-to-day functioning suggests differently. (As of 2001, overall administration of the team is by Emergency Management, and operations is handled by the HFD.)

IX. PERSONNEL AND SUPERVISORY ISSUES

The focus of this chapter is on personnel and supervisory issues that affect the Houston Fire Department. Most large fire service organizations share similar human relations problems. What distinguishes the organizations that manage these problems well from those that do not are the quality of personnel and supervisory practices. This chapter examines the perceptions of the members of the department about human relations issues, the existing personnel and supervisory practices, and recommendations for improvement. Obviously this material is sensitive from several points of view, but the issues need to be addressed. The overriding purpose here is to improve the work environment for all members, which, in turn, improves the delivery of services.[64]

Background

Personnel policies and practices not only define the parameters for everyday behavior in the Department, but also shape the culture of the organization. The supervisory structure is the backbone of an organization. Supervisory personnel exert influence over the day-to-day operations by modeling positive behaviors themselves, assisting work groups in achieving optimal performance, evaluating and guiding work behaviors, interpreting and carrying out departmental policies and procedures, intervening in situations that pose obstacles to accomplishing tasks, and ensuring communications among all levels in the organization.

Personnel and supervisory needs often do not receive the same attention in the fire service as do technical functions. This can result in a myriad of internal human relations issues that may fester for years and then erupt. The challenge of managing these issues is greater than in other types of organizations because the fire service is a unique working environment where many people live together on 24-hour shifts. In addition, fire departments are challenged by a number of significant trends that affect the work environment, including the increasing numbers of workplace laws, disputes over the application of affirmative action goals, acquisition of new services that cause significant

[64] As a minor point of nomenclature: the RFP for this study used the term "personnel and management" practices. We instead use the term "personnel and supervisory" practices to distinguish management of personnel issues from management of services or issues, which were addressed in previous chapters.

cultural clashes with existing operations, and the hiring of new personnel who may have generational differences in values.

The personnel and supervisory issues are discussed in three sections below. The Methodology section describes how the data related to supervisory and human relations issues were collected. The Participants' Issues section briefly summarizes the information collected from participants. The Analysis and Recommendations section suggests initiatives the department should consider to address the supervisory and human relations issues identified by participants. The Summary and Implementation section provides a general implementation schedule for recommended actions.

Methodology

The general approach used here was developed and tested in other fire department studies, most recently in Chicago, but tailored to the HFD's environment. The review of the personnel and supervisory practices involved three steps: assessment, analysis, and recommendations. The assessment included an examination of relevant Department documents, but relied mainly on interviews of a sample of the Department's hierarchy, work groups, and employee associations. A cross-section of Department personnel participated in the interviews, including management, supervisory, and line personnel. Though not a random sample, it was drawn to be reasonably representative of various viewpoints. The project team identified the individuals and work groups to participate in the interviews. We had complete independence as to who was interviewed. Appendix B lists the groups that participated in the interviews.

The project team constructed a list of 23 questions to guide the interviews (they are shown in Appendix C). Not every participant was asked every question; the list was just a guideline for the interviews. The assessment focused on five key elements of the Department's personnel and supervisory systems: policies and procedures, practices, structure, style, and skills. They were defined as follows:

Policies and Procedures – The formal documents that guide Department members on various aspects of individual and organizational behavior.

PRACTICES: The actual behaviors demonstrated by Department personnel, especially supervisors.

STRUCTURE: The organizational structure that defines supervisory responsibilities and span of control.

STYLE: The desired supervisory techniques to effectively manage employees.

SKILLS: The knowledge areas that require demonstrated competency to manage and supervise a diverse work force.

The assessment did not use an investigative methodology to determine facts or conclusions such as might be used in a complaint process. Rather, the assessment captured the perceptions of the participants, which were not necessarily factually accurate nor necessarily the conclusions of the consultants. This approach allowed participants to express their points of view in a candid, confidential manner. Perceptions affect behaviors and need to be dealt with whether or not they are accurate.

An orientation was held with department and city officials in February 2000 to review the proposed methodology. Interviews then started with the executive staff and continued with various groups and individuals through May 2000. They involved a sample of field, HFD leadership, and civilian personnel. Some personnel from other City departments who have a significant relationship with the Department were also interviewed.

The initially proposed target number of interviewees was 50; in the event, 119 participated. Table 69 shows the number of interviewees by work group, and Table 70 by ethnic group. Line firefighters as well as supervisory staff were interviewed. By gender, 95 were male and 24 females. Many other department personnel were interviewed informally for other parts of this report, and their comments relevant to supervisory issues were also taken into account. The length of the interviews ranged from one-and-a-half to four hours, which allowed comments to be made in depth. Some individuals were interviewed more than once. Participants were asked to provide perceptions concerning (1) the issues that affect the department's personnel and supervisory practices, (2) their concerns about the department as a workplace, and (3) recommendations for improvement.

Table 69: Interviews By Work Group

Work Group	#
Management	14
Fire Suppression	63
EMS	6
Prevention	10
Civilian	23
Non-Department	3
Total	**119**

Table 70: Interviews by Ethnic Group

Ethnic Group	#
White	54
African American	35
Hispanic	30
Total	**119**

The principal consultants for this section of the study, Dan Bay and Kenneth Hawkins of *Hawkins*Bay, brought extensive experience in assessing organizational needs, strategic and operational management, diversity issues, conflict management, training, and communications for a variety of private and public sector organizations, including fire departments. They were assisted by local consultants Tatcho Mindiola, Jr. and Sanders Anderson, Jr. The findings also drew on the experience and observations of other members of the TriData project team. The interviewers used for this part of the study had a diversity of racial and ethnic backgrounds.

Participants' Issues

As might be expected, interviewees identified a number of wide ranging issues that can be grouped into 16 topic areas:

- Organizational change
- Labor management relations
- Prevention
- Civilians
- Gender
- Dispatch and communications
- Race
- Staffing
- Leadership and supervision
- EMS/suppression staff relationship

- Testing and promotions
- Career development and training
- Policy and procedures
- Recruiting
- Culture, values and politics
- Internal communications

We present below a brief summary of the comments received on each area. One of the desired outcomes of this report is to create a discussion between interested individuals and groups that enables a thoughtful consideration of opposing views and leads to a resolution of the problems that affect the organization. A number of the recommendations following this section seek to create appropriate forums for such communication.

Much of the information collected is anecdotal, and told from the employee/participant's perspective. It is important to read the entire chapter to get the proper context for the issues, many of which are interrelated. The various comments form a complex mosaic of human interactions, feelings and events. Many other chapters in this report contain information related to the issues discussed here. The human relations aspects are the focus here; the service delivery and organizational structure are the focus in the other chapters.

Before proceeding, it is important to stress that most participants expressed a high regard for the opportunity to be in the Houston Fire Department and to serve the citizens of Houston. When participants were asked what they like about their jobs, the dominant response was that they enjoyed helping people and making a difference in the lives of so many. The camaraderie with fellow workers, the work schedule (for those in operations), and the nature of the work were very important. But the quality of work life and morale is being affected by many issues, and that can affect the quality of service delivered to the citizens. The human relations issues therefore have to be taken seriously, and addressed appropriately

The various issues are summarized in turn starting with organizational change. They are not necessarily in order of importance. Following this section, we offer observations and recommendations of our own. The perceptions presented may or may not be correct, but they are the views of many members of the department. Our occasional editorial comments are in brackets.

Organizational Change – Following what many believe to be years of organizational neglect, the current fire leadership developed an aggressive change plan, called the Strategic Plan. Many interviewees lauded the plan as a significant step toward upgrading the organization, enhancing the professionalism of its members, and strengthening accountability. However, many also raised serious concerns about the style, force, and speed the fire leadership was using to accomplish change. According to many participants, there was a serious lack of attention to human relations issues in the strategic plan, and the changes have led to significant conflicts within the Department. There also appears to have been insufficient explanation to the members of the Department on the intent behind many changes. [A strong feeling of distrust toward the fire management has developed throughout much of the organization.]

Many participants expressed concern about the stability of the changes being made: Were they sound and logical enough to survive into the next change in the HFD management team, or too much oriented to the idiosyncrasies of current leadership?

The participants also believed that the Department lacks a deep and broad pool of highly capable candidates available to fill management roles without losing essential skills during a transition. A few participants felt that real change will not occur until the mayor and council agree on and approve a vision and plan for the Department. They pointed out that various groups often play off each other and their respective political allegiances, which can cause chaos.

The style of management changes has been particularly troublesome to many; fears of retribution for raising any disagreement were mentioned by too many people for a healthy workplace environment.

Labor Management Relations – Characterized as once having had great promise, labor-management relations were perceived to have degenerated into a deeply polarized impasse. Participants offered many views as to reasons for the current state of affairs. Proponents of the administration's view believed that the union is predisposed to resist any changes. On the other hand, the union is deeply suspicious of fire management and became embroiled in two highly controversial conflicts in defense of dispatch and prevention division workers. Both sides have been unable to communicate effectively, which promotes end-runs to the rank and file or to the City Council or Mayor. Some believe that personalities issues must be reduced or eliminated to improve the situation.

Prevention – More so than with any other unit, except perhaps the dispatch center, there is a serious rift between the Prevention Division and the chief. The Fire Marshal was the immediate past chief. Relations are adversarial and acrimonious. Proponents of the Chief's position stated that the Division's performance has been sub-par and that improvements must be made. While many [including the study team] agree with this, it was believed that the cause of the degraded performance is at least in part due to the rift.

Participants sympathetic to the Prevention Division contend the Division's employees are being disrespected by the HFD leadership and have been the targets of irregular and unfair treatment. Significant changes in work schedules for some prevention personnel employees as a result of the FLSA lawsuit and changes in availability of vehicles are two major points of aggravation. Some prevention participants believe they are treated like second-class citizens when compared to suppression personnel. Given the importance of prevention, they believe that adequate financial and equipment resources are not provided. [The chapter on Prevention has recommendations for improvements to the prevention program.]

Gender – Many participants believe that gender is the most dominant human relations issue. While most men and women in the Department try to manage their working relationship at a professional level, there are still some serious issues between men and women in the Department. Women are not fully accepted because they are not perceived as having the physical strength to perform all suppression tasks. Even though some men are not as physically capable as others, the women are under a microscope to perform. Some suggested that better training would help, including putting a female training officer on staff.

Though the first women entered the Department many years ago, there is a continuing adjustment. This appears to be due to the relatively low number of female suppression members and some entrenched negative attitudes. Until recently, female suppression personnel did not have proper fitting uniforms. Both male and female participants reported that men are very cautious around females for fear of having a claim or action filed against them. Some participants described inappropriate behavior by both males and females toward each other. There is also a fear on the part of female members that promoting to the officer ranks will present a host of new gender-related challenges.

Many participants commented that it is imperative that the HFD create an environment in which all concerns, gender as well as others, can be addressed.

Concerns were raised about the Department's pregnancy and transfer policy for pregnant female suppression personnel, in particular the delay for a pregnant female firefighter to transfer to light duty. While not suggesting fault with the Department, there was also a concern raised about the perceived high incidence of miscarriages by female firefighters.

Dispatch – For several years, the dispatch and communications center has been plagued with many problems. The department authorized a study of dispatch conditions by internal staff a few years ago. The study described the unit as demoralized and suffering from deplorable working conditions including human relations, a poor physical environment, and obsolete equipment. The recommendations of that study were not acted upon immediately (though there now are plans for a wholly new Dispatch Center), and the team building initiatives have not been addressed. These long-standing issues have been exacerbated by more recent events, especially the settlement of a Fair Labor Standards Act lawsuit that required the department to adjust the dispatch shift from 24 to eight hours. [Note: Very few dispatch operations use a 24-hour shift; it is highly unusual for dispatchers to be on the same schedule as line firefighters.] The change in shift has been viewed as devastating by the firefighters who serve as dispatch personnel because of the preference for working the longer shift [presumably to accommodate second jobs and a desired lifestyle].

Participants who favored the old shift said a reasonable change could have been accommodated, but the HFD leadership wanted to punish the workers for filing legal action. The suddenness of the changes in the schedule also is a factor in the low morale of the unit. The change resulted in a mass exodus back to the field; the resulting loss of personnel added to the stress level in the unit. They believe that the HFD management views dispatch with disdain and, like other support groups, sees it as a burden. They feel that little has been done to alleviate existing poor work conditions within the dispatch unit and that eventually the center will be staffed with civilians, resulting in a lower quality of service and a loss of career opportunities for suppression personnel.

Race – During the last two decades of the 20th century, many urban fire departments continued to experience significant race issues, as did the Houston Fire

Department. Spurred by civil rights actions all over the country, minority groups in Houston fought to gain admission and increase their representative numbers in the Department. Once inside, they used legal means through a Federal Consent Decree to force modest reforms. These actions caused considerable divisiveness within the Department and with some community groups.

Today, there are many examples of HFD mixed crews that work well together, and other positive signs of progress made over the past decade. But there also are signs – especially the low number of minority officers – that the Department has a long way to go to resolve the underlying, smoldering racial issues. Areas of concern include promotions, testing, work groups dominated by a single ethnic group, inappropriate literature being seen at a few stations, and a general feeling by some minority members that their issues are not being adequately represented or heard. There are divergent views on the reasons for this, but among some minority members there is little confidence in the fire leadership's willingness to address these long time concerns because they believe the Department will protect and promote the dominant power culture. According to some participants, there are also conflicts and areas of discomfort between different minority groups within of the Department.

Many participants expressed the need for the Department to adopt a diversity plan and practices that would enable all groups to improve their work relationships.

Staffing – The suppression employees interviewed felt that inadequate staffing of emergency operations was the issue that most affected morale. While the department has been attempting to manage the problem through an extra-board agreement with the union, participants cited numerous implications of the ongoing staffing shortage. The most serious concern is that inadequate staffing affects the safety of department personnel and fire victims. [This is an almost universal comment heard throughout the fire service today. We address the adequacy of staffing in other chapters in this report.]

There are other aspects of staffing shortages that also raise concerns. Scheduling vacations or needed off time has become problematic and, at times, a morale issue. Because of the continuous staffing shortages and the unwillingness of some personnel to work in certain areas perceived as undesirable, the Department has had to regulate the use of personal time off. This has encouraged an abuse of sick time and other ways to get

time off. Many participants believe the only remedy is more funding to increase regular staffing, or to increase overtime to time and a half as an incentive to work extra hours.

Many participants were concerned about a long-range strategic staffing issue: the expected retirement of a sizable portion of the department's workforce under the DROP program. There are three major concerns: (1) sufficient personnel are not being trained to replace future retirees; (2) the expected loss of veteran expertise and leadership, and (3) the unfunded liability for personal time saved up that will result in a large balloon payment. The recommendations offered were to request more funds to support the transition; plan ahead for recruiting and training of new personnel to fill in for retirements; and training current personnel to take on more responsibility when they get promoted to fill higher ranks depleted by retirement. [All of these seem reasonable approaches.]

Civilians – As is typical in most fire departments, civilian personnel raised concerns about feeling "second class" in the department. Many do not believe they are recognized as an important part of the team. Other concerns raised by civilian employees include the desire to have better communication with the fire leadership, the negative attitude of some supervisors toward civilians, unclear guidelines on how the incentive pay program applies to civilians, and other compensation issues. Two significant recommendations were to create forums for open communication to address civilians' concerns, and to provide the opportunity for feedback to supervisors free of retaliation.

EMS/Suppression Relationship – Some participants commented that there has been much improvement in the relationship between the paramedics and firefighters, but there still are some observable strains between the two groups even with cross-trained paramedics. A few participants said that some paramedics behave like doctors and have the habit of "dumping" responsibilities on EMTs. For instance, they may shift the responsibility to the EMT for transporting a patient if they think an injury is not serious enough. [Some might feel that is a good, efficient practice, freeing the paramedics.]

Paramedics have been criticized for not carrying out their fair share of station work. The paramedics' perspective is that they make substantially more runs per day than a suppression crew and think the overall workload should be balanced. Paramedics also perceive that they have a tough, high-stress job that carries considerable more

liability threat than suppression duties. These conditions affect how paramedics feel about their job and their interactions with suppression personnel.

Some people are concerned that there is a lack of EMS experience amongst ranking officers. They believe this contributes to the strife between groups, and the belief that EMS personnel are second-class.

Leadership and Supervision – Participants provided numerous direct and indirect observations about leadership, often intertwined with comments about supervisory practices. Participants felt that there are many highly capable and dedicated supervisors in the HFD, but the development of the Department's leadership capability and supervisory structure need much more attention. Many managers are excellent at the technical aspects of the job and good commanders in the field, but lack supervisory skills in day-to-day people management.

Participants also provided numerous examples of supervisory problems and inconsistent disciplinary practices. Issues related to discrimination, harassment, and gender pose the greatest challenges for supervisors. There is a general concern that many supervisors behave too much like "one of the guys" and that the organization's culture is dominated by "good ol' boy" practices that favor relationships over doing what is professionally right.

The participants identified a list of qualities and attributes that supervisors should possess, shown in Table 71. Most said that the majority of supervisors would not score well on this set of criteria.

The fire leadership has recognized that more must be done to improve the interpersonal skills of supervisors. It has instituted a quarterly training program to expose supervisors to contemporary management subjects. The HFD has initiated an effort to enhance empowerment and accountability of supervisors. It is also incorporating training to encourage supervisors to think more proactively. However, a number of participants commented that these sessions do not build necessary supervisory skills. They believe they have the proficiency to fight fires and handle EMS needs, but they have not adequately developed their management skills.

Table 71: Desired Supervisor Attributes (as listed by interviewees)

Good leader
Leads by example
Knows how to manage a range of situations
Separates self from subordinates
Fair and honest
Able to pull all groups together to achieve goals
Morale builder
Strong communication and interpersonal skills
Calm in stressful situations
Good instructor
Keeps subordinates up to date
Respects and cares about subordinates
Promptly and effectively deals with issues
Does not forget where he/she started from
Accountable and responsible
Presents himself or herself to other very well
Innovative
Aware of cultural differences
Asks for your opinion

A number of participants commented about the lack of adequate experience and credentials at the assistant fire chief level. While some people were perceived to have backgrounds to justify their selection, others did not. Many believe that politics and friendships are key elements of the selection process for these positions. It was recommended that the Department upgrade the pool of eligible candidates for the highest positions. The HFD recognizes the need for this and has commenced an initiative under career development.

Participants identified many examples of positive supervisory behaviors. They cited supervisors who knew their job and were able to teach subordinates essential skills. In particular, participants cited supervisors who had the ability to blend people into an effective team.

Career Development and Training – Some participants reported that career development and training is a major focus of the current administration and have been incorporated into the department's strategic plan for 2001 – 2005. Driven by the belief

that continuing education is essential to healthy professional and organizational growth, career development and training objectives address the preparation of officer candidates, and target existing operational needs. A considerable amount of time has been spent establishing criteria for classified positions to enhance performance, and to prepare members for the next step in their career.

The Department has taken steps to strengthening training for new and veteran officers. It has instituted a 40-hour curriculum for new officers and has commenced a half-day program four times a year for veteran supervisors that focuses on contemporary supervisory skills (see Appendix D). A number of participants acknowledged that these efforts are a vast improvement over the past. However, others commented that there is much more to be done, and the existing programs for new and veteran officers only scratch the surface.

A few participants stated that the role of training officers is undervalued by the organization. Training officers are drawn from newly promoted captains. In some cases, personnel are sent to training as punishment.

There have been strains as a result of the HFD's aggressive training objectives. Some participants questioned the fairness of accomplishing these objectives within the shift when there is no adjustment for workload. The Fire Department is faced with developing an attractive training package that will be motivational, substantive, and adaptable to a 24-hour shift schedule.

Some participants were concerned about the weight and relevancy of educational requirements, and others about the lack of adequate emphasis on educational requirements. Many HFD veterans are at a handicap compared to younger personnel who graduate with a college education and have good study habits. To compensate, one participant suggested that credit be given to veteran members for experience. Proponents of increased standards for formal education stress that it is essential for improving professional skills and knowledge that will be essential to improved personal and organizational performance.

Testing and Promotions – Promotions were another major area of concern brought up by many interviewees. The subject was often the most controversial area of discussion.

The testing process has a direct impact on anyone who aspires to be hired or promoted. A number of participants advocated the inclusion of an assessment component in the exam process. They argued that the current test method is a paper test that only measures a person's ability to memorize, and does not effectively evaluate their ability to do the job. Promotional candidates are given a set of books from which the test material is drawn. They study these books, sometimes individually, more often in larger groups. In order to cover the large amount of material, the study groups will divide up the textbooks among members. Candidates take a written test and are ranked by score. As explained by one participant, "What is lacking is a critical measure of judgment, essential nuances that relate to the tested position, and a host of other factors that may be inherent to determining whether someone can do the job." For example, engine operators are not tested for their driving skills, and captains and above are not tested for their ability to supervise and lead subordinates.

Some believe that there should be a common test for all supervisory positions that would allow personnel to transfer across operational divisions. They cited the Police Department as an example of where this is done.

On the other hand, many participants favored the current system, especially those who have been successful under it. They acknowledge that there may be some problems in measuring position skills, but it is an honest and fair method. Their principal objection to the inclusion of an assessment component is that it would disrupt the integrity of the process by making it more subjective. Many participants cited the example of exempt appointments to support their position. At this time, every classified position in the department is tested through the rank of deputy chief. The only exempt positions are the fire chief and assistant chiefs. The latter appointments were believed by many interviewees to be influenced significantly by political forces and personal friendships. Many fear that the inclusion of an assessment component in the testing process will lead to the same kind of influence for the lower, civil service tested positions as well, resulting in a system based more on "who you know and not what you know." Some participants suggested that the assessment center concept should be initiated with the assistant chief positions. Positive results will build confidence and acceptance of the idea for lower ranks, they believe.

One interviewee put it this way: The system promotes people who memorize the six required books, and then the HFD is concerned over the quality of leadership. The

testing process was never designed to identify leaders and it does not do what it was not intended to do.

Recruiting – A number of participants expressed concerns about the Department's recruiting program. [Hispanics, African Americans, and females are indeed under-represented in the Department.] Part of the reason for this is the lack of a focus on recruiting minorities and females, which in turn is attributed to the attitude that recruiting is not a priority, because an adequate number of candidates has always been available. Until this year, the Department did not have a recruiting plan. This is particularly significant because the recruiting plan is the essential marketing vehicle for attracting qualified diverse applicants.

Several participants raised the concern that the Department currently draws applicants from the greater metropolitan area. They questioned why this was done rather than draw from among eligible candidates who live within the city limits and who are more likely to reflect the diversity of the City. Some participants believe that broadening the geographic scope is intentional manipulation to avoid hiring more minorities.

Some participants are concerned about recruiting personnel who are not physically capable to perform suppression tasks. This concern was raised in the subsection on Gender, but involves both male and female members.

Recommendations offered by participants to improve recruiting include giving points to candidates who live in the City of Houston; giving points to candidates who demonstrate bilingual ability; reducing the Department's two year college requirement to 18 months; and giving the civil service admission test before allowing candidates to participate in the recruit academy. Regarding the last recommendation, some participants felt that the current department practice may be illegal because it allows people to complete the academy before taking the civil service exam, improving their chances of passing the test. [Our recommendations on recruiting were made in Chapter VII.]

Policies and Procedures – There were comments about a variety of departmental policies and procedures, including the evaluation of new initiatives, condensing and making documents more understandable, performance evaluation, the complaint process, and bilingual pay. The tone of management was an oft-stated concern: policies and procedures are often conveyed as a negative message or directive,

with a threat of negative consequences. The policy or procedure often only addresses symptoms and not causes, some said.

Another concern is the need to evaluate the effectiveness of new directives or orders. This is not done as a rule. Each directive should be thought through with respect to the desired outcome and the criteria by which it can be measured, and subsequently modified if necessary rather than just assuming it will work as intended, suggested some.

Some participants discussed the need to better articulate policy and procedural changes in written general orders. Existing policy and procedures were felt to be too voluminous and not always clear, making it difficult to have consistent interpretations. The documents need to be condensed and made more user-friendly. [These issues indeed are being worked on by the Department.]

Participants commented that along with the HFD's policy initiative to empower supervisors is the need to train the supervisors in ways to take more initiative. Front-line supervisors are not encouraged to take risks. The role of a supervisor is highly prescribed by formal and informal practices, which lends itself to a system that favors protecting one's job security versus taking risks that may better serve the public.

Performance evaluation also drew much comment. Beginning this year, the Department implemented a new performance evaluation system for all personnel. The new system is based on individual performance measures that are more closely aligned to each position's job tasks. Many people acknowledged that this has been quite an accomplishment and is a positive contribution to the management of employees. However, like any new system, it will take time to be integrated effectively into supervisory practices. A few participants commented that the system must produce positive consequences for the people receiving good evaluations and negative consequences for the people receiving poor evaluations if the performance measurement system is to be effective.

Another problem area was raised in connection with the state law requiring a 48-hour moratorium after the department receives a discrimination or harassment complaint. The law, known as the 48-Hour Rule, severely inhibits an effective investigation and intervention. It was reported that some chief officers purposely violate the law by questioning the involved parties immediately, so that any negative findings will be

rendered invalid by virtue of violating the lawful procedure. This was cited as another example of the " good ol' boy" network working to protect its own.

A few participants stated that the Department should encourage more effective discipline and intervention at the line level through its policies and procedures. One participant commented that the impetus for improvement should be from "the top down," implying the importance of the command staff in serving as role models for the desired behavior that is dictated in a policy.

Some participants reported problems with certifying and compensating people for their bilingual skills and abilities. While bilingual pay is open to all department members, there appears to be resistance toward certifying Hispanics. The guidelines were said to have not been followed consistently and there is an arbitrary application of policies and practices.

Internal Communication - A number of people commented directly or indirectly about shortcomings of internal communications practices. To improve communication with the field, the HFD leadership has established an open door policy. Command staff conduct open discussion forums at select stations, usually on Thursdays, as a means of staying in touch with issues important to line personnel and conveying information about administration initiatives to them. The HFD leadership has utilized committees to collect feedback on initiatives that have been proposed, before they are implemented. [All of these are good practices.]

However, some participants felt that there was a tendency to appoint personnel to the committees who already favor the leadership's point of view. It was recommended that the HFD would be better served if a cross-section of personnel representing divergent views were selected. It would give more credibility to the final product.

Some participants talked about the department newsletter, *Burning Issues.* It can be a good vehicle for information and discussion of important issues, but its publication frequency is inconsistent.

There was strong sentiment for improving the quality and quantity of communications throughout the Department. Also, it was recommended that chief

officers spend more time in discussions with subordinates to stimulate creative thinking and participatory practices.

Organizational Culture, Values, and Politics - Some participants talked about culture, and values. Most mentioned politics, usually in a negative context. All three have a significant influence on how the department operates formally and informally. The HFD leadership has aggressively set out to change the organization. To do so, it must change the culture to have lasting impact. To change the culture, basic values have to be altered or reinforced to support the change. But participants said there were inconsistent behaviors and double standards that exist within supervisory ranks. They believe that if a rule is good for line personnel, it should also be good for those above it. They state that a higher value should be placed on role modeling the desired behaviors; i.e., practice what you preach.

Many participants seemed resigned to the idea that politics is a fact of organizational life. The question for some is whether one is or is not in the current power group. A few people offered the view that the influence of politics on everything from promotions to daily operations must be diminished if the Department is truly going to move ahead.

Analysis

In the above section, we briefly summarized as accurately as possible what we heard from the interviewees. Here we switch from reporting the comments to analysis and then recommendations by the project team. Many of the following points about personnel and supervisory issues apply to most career fire service organizations as well as to the Houston Fire Department:

Change in Mission – The fire service has undergone considerable change over the past two decades, most notably a shift from a mostly suppression to a mostly emergency medical service organization. Like any shift of this magnitude, there are associated operational and human relations strains and stresses. These changes have increased need for highly skilled leadership at the managerial and supervisory levels. The investment in leadership and skill development has often seriously lagged behind these trends, adding to the challenging nature of existing conditions.

Unique Work Environment – The fire/emergency medical service is a complex, unique work environment. Most people in a fire service organization live as well as work together. This element of work life presents unique opportunities and challenges for managers and supervisors. It creates an atmosphere that socializes new members into a culture with strong traditions that guide behavior. Novice and veteran members alike describe these relationships in terms of an extended family. The bond that often grows between those in the fire service is remarkable. They are socialized to trust and rely on each other because of the hazardous nature of their work. Conversely, one of the challenges is the natural resistance to change, whether positive or negative. Some of this resistance can be found in any organization undergoing change. It places a significant burden on fire management to maintain organizational stability by proactively stating a clear vision for the organization and addressing emerging issues. Otherwise, fire management is forced into a reactive position dealing with the elements of conflict and mistrust that often dominate the work environment during a change period.

Multiple Employee Groupings – Organizations are rarely homogenous. They are usually comprised of a major labor unit and a number of affinity employee groups. It is imperative that the fire leadership and these groups form healthy partnerships and recognize their interdependence while maintaining respect for their differences. The labor group is usually the most significant because it represents the employees in bargaining and represents a broad range of employee needs. Therefore, labor and management share the primary responsibility for achieving a productive relationship that will benefit employees/members as well as the community they serve.

Employee Development – There is a broad acknowledgment that the most important asset of any organization are its employees. Despite the best equipment, facilities, and financial support, organizational performance ultimately relies on the output of employees. Accordingly, it is important that management focus on the human relations element to maintain organizational well being, and strive to develop employees as a means to enhance performance. Fire service managers should be routinely asking questions about how human relations and resources are managed within the organization. Is there a governing plan and philosophy that guide and develop the potential of employees? Are correct policies in place? Are systems that focus on positive corrective techniques in place to deal with inevitable human relations problems? Are resources committed to developing and maintaining management, supervisory, and technical skills? An under-commitment to the human resources and relations element results in a

weakening of the organization's most important asset and the ability to achieve its mission.

Societal Issues in the Workplace – Societal issues such as racism, gender bias, favoritism, inequality, and unfairness find their way into the workplace in a number of ways. The perceptions that individuals hold about the causes and remedies of such issues vary widely. Rarely is there an opportunity for thoughtful, safe discussion about such matters because of the sensitivity and volatility of the subject matter, which causes people to fear being misunderstood, or labeled in some negative way for stating a politically incorrect view, or being labeled as a trouble maker or divisive militant. Consequently, individuals and groups often retreat from direct communication and draw conclusions about each other with limited information.

These attitudes are often reinforced wittingly and unwittingly in the workplace. Individuals will interpret and filter daily events to support their beliefs. Their perceptions may be contrary to the facts, but it reflects their view of everyday life. As a result, it is easy to shut out others who do not hold the same views. Segregation can occur physically, and it can happen mentally.

To overcome these dynamics, one must guard against practices and behaviors that reinforce these attitudes and behaviors. One of the best ways to accomplish this is to reach out to members of other groups. Sincerely ask them for their views, actively listen to their comments, and share perspectives. This form of communication is essential to creating understanding and finding solutions to complex issues. It is difficult to achieve because many people are not willing to participate in such dialogues.

Testing and Promotions – No subject is more contentious than testing and promotions, in particular as it relates to affirmative action. Nationally, it has created a heated debate about practices that may be perceived as favoring groups who have been traditionally excluded. One side contends such practices pit one group against another, erode the quality of service, and, in some cases, pose a serious threat to the well being of coworkers and service recipients. The other side in this debate says that there are many people capable of doing the work, but they have been excluded by use of invalid standards and discriminatory measures.

Second Class Citizens – Teamwork is a cornerstone value of the fire service. Suppression personnel who go through the academy experience are repetitively told about the need to rely on each other to accomplish the mission. This is again reinforced post-academy during actual and practiced emergency experiences. Unfortunately, some key members of the team are left out or not given appropriate recognition. Personnel in prevention, EMS, dispatch, and support services are often perceived as "second class citizens" and extraneous to achieving the primary mission of fire suppression. Civilians also are often not considered real team members. These are forms of occupational bigotry that create ill feelings and erode morale. While these attitudes often are associated with suppression personnel, in some cases, the feeling is reversed (e.g., paramedics looking down on firefighters). If teamwork is to be truly valued in an organization, everyone must be valued for his or her contribution.

Teamwork is a cultural value that can strongly influence individual and organizational behavior. One must ask is this a value or a privilege intended for only a few? How many members, in spite of their feelings about someone else, are willing to extend themselves to improve the situation or work cooperatively? For this to happen requires a true commitment to teamwork behavior by each Department member. They must become architects in the construction of a new culture.

Recommendations

The recommendations below are a synthesis of participant inputs and the project team's suggestions. The overall goals of these recommendations are as follows:

- Strengthen the ability of the Department's supervisory structure to manage a diverse work force
- Enhance the capability of the Department to manage conflict dynamics and intervene in interpersonal disputes in an earlier more effective manner
- Reduce organizational and individual liability
- Create employee buy-in and support for proposed recommendations
- Improve teamwork, productivity, and morale

The recommendations are divided into four areas: planning and change; practices; policy and procedures; and leadership and skill development.

Planning and Change – The HFD leadership should be commended for the development of the strategic plan, which is a major undertaking and commitment of resources. Having such a plan is critical to managing the change process. However, the current plan does not adequately address human relations issues. That gap must be filled in light of the many human relations problems we identified.

The human relations component of a strategic plan often is the most challenging task to implement. The existing strategic plan mentions morale issues but is sparse in references to the leading human relations issues. The recommendations in this subsection are intended to strengthen the Department's ability to achieve positive, sustained change in the organization and its culture. The recommendations also address some of the more contentious relationships with labor and employee groups.

Recommendation 175: Incorporate a team-based human relations model into the strategic plan. It is imperative that the City and HFD take decisive actions to address the negative human relations forces that exist in the Department. The development of a team-based human relations model for the Department can address organizational issues, such as the change process, race, gender, diversity, labor management, and other concerns reported by the participants in this study. The human relations practices in all likelihood will not receive necessary attention unless highlighted in the strategic plan. (As of 2001, the HFD was planning to incorporate the model in its revised strategic plan.)

Recommendation 176: Develop a human relations five-year "change plan" to establish positive human relations practices. This is a companion to the preceding recommendation. The human relations change plan should provide a road map that identifies the major initiatives to be undertaken. It should also provide a means of monitoring and evaluating the effectiveness of the overall strategy and proposed initiatives.

The process for creating the human relations change plan is as important as the strategic plan document itself. First, the fire chief, the management team, and the field command staff should review the findings and recommendations here. A department-wide communication then should be distributed to all members to apprise them of the document's findings and recommendations, and those that will be implemented. The purpose is to ensure an understanding of this study and the basis for subsequent actions the department will undertake to address its recommendations. Second, an employee advisory committee (EAC) should be appointed to consult with the fire chief on the development and monitoring of the plan.

(As of 2001, the HFD was planning to incorporate a human relations five-year "change plan" into the Department's new strategic plan. Goals, objectives, and action plans will be put in on improving sensitivity, diversity, conflict resolution, and other associated topics. A problem foreseen in implementing the human relations training is the HFD's staffing problem, which must be addressed to facilitate getting firefighters to the classroom from Emergency Operations assignments.)

The Department has some very capable in-house staff resources to assist in this human relations planning process, such as Chris Connealy, the former Assistant Chief for Career Development. He was instrumental in designing the executive development strategic plan, and is now the Fire Chief.

The human relations planning process will be an opportunity to bring together key individuals and employee groups from throughout the department, including the union and the affinity organizations, to serve as an advisory committee for the development of the plan. That would be critical to breaking the "us versus them" mentality that exists. The representatives on the employee advisory committee would be responsible for communicating its activities to their constituencies and soliciting input from their constituencies. Adoption of this initiative will send a clear message from management that change in human relations is important, and employee input is essential to the process. This fosters buy-in and ownership by all employees to insure success of the plan. This does not mean that these individuals will agree on everything that is proposed, but the committee will be a forum for creating a consensus for understanding and constructive action. This process has been used successfully in other cities.

Many participants in this study talked about the negative influence of politics in the operation of the department, such as the change in the entire upper tier of management of the department when a new fire chief takes office. The turnover creates a gap that is filled by less experienced supervisors. This can impact the quality of services and management of the department.

Recommendation 177: The Mayor and City Council should commit to a change plan for the Fire Department, and to stability in the leadership of the Fire Department. The HFD leadership has set out to address some of the human relations areas that need attention, but more has to be done. This issue is intertwined with executive and career development initiatives, but improvement must begin with a consensus agreement amongst city elected officials to create a better management structure, and to keep it stable, especially at the top. Several participants referred to the Houston Police Department's management structure and policies as a model to consider.

Participants in the interviews in year 2000 described a labor-management relationship that had become contentious, vindictive, and disrespectful. It is expected that labor and management will not see eye to eye on many issues but, in general, there should be a way to work out differences within reasonable parameters. That was not the case here. In 2001, under a new chief, relations had improved. The following recommendation is an attempt to further rehabilitate the relationship.

Recommendation 178: Conduct facilitated sessions between union and administration leaders. The nature of the labor-management relationship must change for the health of the Fire Department and the individuals involved. A facilitated intervention by people expert in the process usually produces successful results so long as the parties proceed in good faith, and agreements are anchored with measurable objectives short of changing leadership of both factions.

Local and national studies indicate that whites and minorities tend to view race relations differently. While many interviewees felt that race relations in the department had improved over the years, minority and non-minority interviewees also believe there are serious issues that need to be addressed, including inconsistent practices, recruiting, testing, and promotions. Racial issues are volatile and complex, which explains why it is difficult to talk about them and requires a special setting to do so openly and constructively.

Recommendation 179: Conduct a facilitated planning session with members of each employee group to address racial and ethnic issues in the department. A facilitated planning session provides an opportunity for the city and department to address these matters in a way that will yield measurable actions. Also, outside opinions generally give a higher degree of respect to negotiated outcomes. It is not an easy task; there are strong opinions on both sides that will require careful discussion. (The Fire Chief already has instituted monthly employee group meetings. Employee group relations have improved dramatically.)

The facilitated planning process should include key individuals and employee groups, with a strong emphasis on leadership roles of administration and union. The facilitators have to be experienced in conducting these sessions and chosen from outside the Department. If successful, the HFD can become a national model for fire departments and communities that struggle with these issues.

(As part of its strategic plan, the HFD leadership recognized the need to improve internal communications. It has done so by establishing opportunities for the command staff to interact directly with line personnel in the field through Friday forums held at various stations. A newsletter and informational memos and directives carry important information. However, there still is a critical lack of understanding of a number of

administrative initiatives, and even the role of the Fire Chief. Developing a communications plan would enhance the internal communication process by getting the HFD leadership to focus on key messages and activities that must be conveyed to department members in a consistent manner.)

Recommendation 180: Design and implement a communications plan that supports the goals and objectives of the strategic and human relations change plans as well as other department initiatives. Similar to the Department's strategic plan, the communications plan would be comprised of goals, strategies and tactics to provide direction, yet be flexible to changing conditions of everyday department life. For example, the HFD has recognized the need to improve the professionalism of the officer corps. It has undertaken some activities to address this area including policy and training initiatives. The communications plan would support these areas through a series of planned communications. A Department-wide training event can be preceded and followed up by memos and newsletter articles on the purpose and importance of the program. In each case, the communication would have key messages on the importance of raising the level of professionalism in the department and how members and citizens would benefit.

We also recommend that the Austin, Texas Fire Department newsletter be reviewed; it is one of the very best in the nation and bears emulating its good ideas. The Q&A column with the chief is particularly candid and effective in directly addressing concerns and rumors.

Values drive individual and organizational behaviors. They are the foundation on which the organization's culture is built. Inconsistent values and practices can lead to diminished impact or negative results. For example, the HFD has endeavored to enhance accountability throughout the organization by making personnel more responsible for their actions. Yet, it is widely known, as stated by some participants, that this espoused value/practice is being substantially undermined by the behavior of ranking personnel. Personnel would embrace the accountability initiative more rapidly if they saw superiors role modeling the desired behavior.

Recommendations 181: Department leaders should take careful stock of the values that currently promote positive and negative practices in the organizations. Values, if they are to mean anything, must translate into behaviors that support them. In the long run, if sustained cultural change is going to occur, top managers most provide consistent positive leadership by demonstrating the desired behaviors that subordinates should copy. In firefighter parlance, they need to walk the talk. (There has been increased use of positive coaching and counseling under the new Fire Chief, and it needs to continue.)

Practices – The following set of recommendations is directed at enhancing the ability of the Department's command and supervisory structure to respond to current as well as future human relations issues.

The relationship between the HFD leadership and the prevention division has been severely strained. Both sides contend it is for different reasons. The prevention program has low morale and is suffering because of the rift. It is too important a program to allow this state of affairs to continue. The nature of this type of conflict warrants a confidential mediation that is guided by a neutral third party. Mediation often is successful in focusing participants on the issues that are obstructing their work relationship and impacting operations.

Recommendation 182: Conduct mediated sessions between key leadership officials and the Prevention Division leadership. This may be useful for some other divisions as well. It requires a skilled, neutral mediator. (The Fire Chief held an unmediated session with Prevention in July 2001, followed by a meeting mediated by the HFD psychologist in October 2001. A meeting was help with the Arson unit in September 2001. The next mediated session was scheduled for early 2002. Many issues have been resolved in these meetings.)

Recommendation 183: The Fire Department and city leadership need to re-emphasize the policy that prevention is the first priority in fire safety. The prevention function needs to be fully supported, and its personnel commended and reinforced. Most firefighters do not enter the profession to serve in prevention and the function needs exactly the opposite environment that it currently has. The selection and retention of a fire chief should be contingent on his or her ability to support prevention as well as fire operations and EMS; it is that important for public safety.

Dispatch and Communications has been another major problem area. Although there are plans by the City to create a new emergency communications center, the working conditions in the current dispatch center reached a serious level many months ago. The situation presents serious potential risk to the employees and liability to the department and city. An aggressive team building intervention needed to be initiated immediately. It was even more urgent for dispatch than for prevention.

Recommendation 184: Conduct a team building intervention for Dispatch. As a part of the intervention, facilitated discussions should be held between representatives of the HFD, union and dispatch staff on the major issues affecting working conditions. We also recommended that mediated sessions be held between certain employees within dispatch and between employees with dispatch and outside. The dispatch supervisors can identify them.

(There has been much progress since this recommendation was first made. Several meetings were held between HFD command staff and Dispatch. A Dispatch Improvement Committee was started in October 1999 and is co-chaired by two Chief Dispatchers from the Communications Command Staff. One Senior Dispatcher, and one Junior Dispatcher were voted by each shift to serve as shift representatives on the committee. The Presidents of the Houston Chapter of the International Association of Black Firefighters, Local 341 of the International Association of Firefighters, and a representative from the Hispanic Caucus of Local 341 also were invited to participate on the committee. The Fire Chief has instituted changes to improve working conditions and relationships with Communication's personnel as a result of this committee's recommendations.)

Harassment and discriminatory behaviors against gender, race, or ethnic group affiliation must be promptly addressed. The targets of such behavior often are not able, or do not want, to confront the offending party until it becomes too late. In a large part, this may be because of a status differential in the relationship. The examples provided by interviewees suggest a troubling pattern. According to some participants, there are female as well as male members who behave inappropriately. These situations must be dealt with swiftly, too.

Recommendation 185: The HFD should improve its ability to monitor harassing and discriminatory behavior and to take effective intervention for the benefit of all members of the Department. While most of the above proposed recommendations for improving human relation skills of supervisors will also help address harassment and discrimination issues, fire leadership can take immediate action by (1) alerting command and company officer staff to be diligent in monitoring the work environment to identify problem behaviors; (2) investigating any rumors or formal information that suggests inappropriate behavior, and (3) reaffirming its commitment to a harassment-free environment through written communication to all members of the Department specifically.

(The Command Staff and all District Chiefs completed EEO/Diversity/Sensitivity training in October 2000. Now this training is being given to stations in minority neighborhoods, and will continue until members in all stations are trained. The HFD conducted this type of training in the past, but it plans to further emphasize it in the years ahead.)

Recommendation 186: The HFD must be diligent in monitoring and responding to inappropriate material being displayed on fire department property. Everyone has a right to their personal views, but they do not have a right to display those views in a public work place if the material or method is offensive to others. Sometimes this may mean walking a fine line between Constitutional rights and providing a harassment-free environment, which the department has a responsibility to maintain.

(By September 2001 the HFD has sent out a bulletin that inappropriate material would not be displayed on fire department property, and was planning to give supervisors additional training in human relations and cultural differences.)

Many participants identified serious human relations shortcomings that impact the quality of work life. Improving management and human relations requires an understanding by the management team of the issues impeding the organization and the strategies and initiatives that can be designed to address them. These issues involve complex themes such as race, gender, occupational bias, perceptions of fairness, and a host of other matters that challenge effective management.

Virtually everyone interviewed stated that supervisors are in need of additional training to improve their performance. The HFD leadership recognizes the need to increase training efforts and has begun to offer some limited supervisory training activities. Recommendations have been made by the Department to further improve the level and frequency of supervisory training. This additional supervisory training is critical to the health and effectiveness of the HFD and we strongly concur in the rapid implementation of stronger supervisory training programs. To go further, as part of implementing this initiative, a series of facilitated summits should be held that include members of the management team, union representatives, and key department staff. The focus should be on problem identification and resolution.

The set of recommendations below will further enhance supervisory capabilities. Supervisory training per se is addressed in the next sub-section (Career Development and Training).

Recommendation 187: Further develop the capabilities of the HFD management team to effectively address and manage the human relations issues affecting the Department. As part of implementing this initiative, a series of facilitated summits should be held that includes members of the management team, union representatives and key department staff. The focus should be on problem identification and resolution.

(Among the measures taken since this report was initially written were a two-day leadership seminar in November 2000 for the command staff and their staffs and a seminar in February 2001 on methods of successful people. Human relations also is part of new career development courses. Planned to start in 2001-2002 for new first-level supervisors and to be expanded to more senior managers.)

It will take some time to plan and implement a comprehensive program to improve supervisory skills. In the interim, it is imperative that supervisors and all members of the department be provided with some alternative support.

A peer mediation program is an early intervention conflict resolution protocol that may be a good measure to consider starting in the short term (and possibly use indefinitely). Integrated into the Department's policy and procedures and practices, it creates a "safety net" for catching unresolved conflicts that may impact quality of work life, and may increase individual and organizational liability. It can be established relatively quickly.

Recommendation 188: Enhance the Department's near-term conflict management capabilities by implementing a peer mediation program. This form of mediation should not be confused with the version used during labor negotiations. The focus of the peer mediation program is to empower employees to resolve workplace conflicts through a voluntary process facilitated by a trained in-house mediator. A cadre of mediators would be trained. The program does not disrupt the chain of command because the mediators have no power; they just try to assist in resolving a dispute. The program is adaptable to the department's unique working environment. It provides early intervention resources that managers and supervisors can use to address complex and ambiguous human relation issues. The suggested program is based on a model developed by the City of Sacramento Fire Department.[65] The Houston Police Department has an "alternative dispute resolution process" that also could be a model. But it is considered a "Meet and Confer" issue for HFD as it was for HPD. Elsewhere this has been considered an informal, not binding process and has not required formal negotiations; as noted above, it is *not* the same type of mediation as used in labor negotiations.

The following examples illustrate how a peer mediation program could operate.

> ***EXAMPLE:*** *A female firefighter believes she has run into a hostile attitude from her crew. She feels she does not get support from the company officer or district chief. She is reluctant to bring these matters up because the situation might get worse and she'll be labeled a whiner. Because of department communications about the peer mediation program, she locates the name of someone on the approved mediator list pinned to the bulletin board at the station. She contacts the person to discuss her situation in confidence. The mediator asks her if she has discussed this directly with the company officer and, if not, why she is reluctant to do so. After hearing her concerns, the mediator may advise her on ways to*

[65] HawkinsBay, the lead consultant for this section of the report, designed and implemented the program used successfully in Sacramento, California (and subsequently other organizations).

address the matter directly, or the mediator may facilitate an intervention among all concerned parties.

EXAMPLE: *There is a growing conflict between a firefighter and his company officer. The firefighter believes the officer singles him out for petty violations that other members of the crew also commit. The company officer does not believe he is treating anyone differently. While the firefighter has raised his objections directly with the company officer, there does not appear to be any resolution other than to transfer to another company. The district chief, who is aware of the situation, suggests use of the peer mediation program.*

EXAMPLE: *There is a strain in the relationship between the EMS and suppression personnel at a same station. The company officer and district chief have tried to resolve the situation, but they are perceived by EMS personnel as members of the suppression fraternity. One option is to transfer some members of the crew to other stations. The crews reluctantly agree to mediate their differences after they select co-mediators from the Department list. The mediators function as neutral facilitators. One is from the EMS ranks and the other is from suppression.*

EXAMPLE: *Two engine operators (EOs) have had an off-duty verbal confrontation. Observers say it was very heated. The two work at the same station on different shifts. The outburst appears to be the result of ill feelings over the maintenance of station apparatus. One of the parties, who has been an EO for only 18 months, has heard that the other more veteran EO made some inappropriate remarks about his ethnic heritage after he found some equipment out of place on the rig. The company officers believe they have done everything possible to confront the behavior, including threatening discipline and transfer. In an effort to maintain otherwise well-functioning crews on both shifts, the district chief suggests mediation for the two individuals.*

To broaden individual experience, and enhance promotion capabilities, some form of an officer rotation program should be considered. Rotations also address the problem that many officers behave "like one of the guys," subordinating supervisory responsibilities to the pressures of the peer group.

Supervisory personnel do acquire valuable specialized local experience by spending years in one assignment, but they can get stale, and need broadened experience if they are to rise in the organization. Rotations also bring in fresh thinking. However, it would be unwise to rotate all the officers experienced in some discipline of specialized area (e.g. high-rise firefighting) at one time. So the rotations need to be staggered to preserve some experience in every area at all times.

Rotations also are important across divisions, e.g. rotating some officers through prevention or administrative duties. There is a case to be made for periodic rotation of line employees as well as officers. Some large cities such as New York, find that rotation of firefighters through busy units is important to improve their skills and increase safety. If firefighters are rotated, they should not stay with the same officers in the new assignment. While many may view rotation with disdain, it will ultimately benefit the members and the public.

Recommendation 189: Modify the collective bargaining agreement to allow rotation of officers, and eventually line personnel. Officers should be rotated about every three years. This practice also will help balance other work group needs, and facilitate achievement of personal and organizational professional development goals. Some or even the majority of rotations might be made within geographic areas patterned after the once-used quadrant system, i.e., keeping the people in a general region but not the same station. This might also accommodate the commuting needs of the personnel.

The rotation should be staggered, e.g., one-third of the officers rotated each year, so the entire system does not suddenly go into flux every third year. Some departments do rotations on an individual basis, e.g. when promotions, retirements, or other causes open slots up, which lessens global impacts on the department even further.

Transfers may be affected by state statutes, and should be considered in negotiating a new contract.

Many metro-size departments are confronted with the critical problem of how to upgrade the skills of the supervisory personnel in the near term. Since a comprehensive upgrading process takes time, it is important to quickly develop critical human relations skills in a few personnel selected from across the organization. Formed into "consulting teams," these groups enable the Department to respond more quickly to human relations problems. Team members serve as subject and situation experts similar to those for any fire or EMS technical skill. Members at all ranks in the Department can draw on their expertise as in-house consultants on how to deal with human relations problems. Moreover, they would model desired behaviors for other members.

Recommendation 190: Develop and implement human relations consulting teams. The members of the team should be selected for their natural leadership or good human relations abilities. They should be taught the core human relations competencies discussed later in this chapter. Members of the team may also serve as peer mediators.

The consulting teams could be drawn from a pool of field command and company officer personnel within each quadrant, or forming a consulting group within the

quadrant. The Department may prefer teams drawn from across the whole Department. Some exempt staff (management and civilian) should be included in the consulting team pools, because these positions have the greatest schedule flexibility, which would reduce or eliminate the need for overtime compensation.

Recruitment of human relations consulting team members should consider factors that promote employee buy-in, such as ensuring the representation of a cross-section of personnel on the team, including females, Hispanics, and African Americans.

The training of the consulting team members would focus on contemporary supervisory issues in the HFD such as interpersonal conflicts, inconsistent discipline practices, perceptions of discrimination, and gender issues. A Department-wide training bulletin could communicate the various aspects of the program to all members; this would make the availability of this new service known, build an understanding of the approach, and enhance the relationship between the supervisory personnel and the trainer/consultants. The consulting teams would be given specific assignments, woven into their regular duties that will enable the department to integrate critical human relations skills into daily interactions with peers and subordinates.

The following three examples illustrate how consulting team members might be used:

> ***EXAMPLE:*** *A potential disciplinary matter is brought to the attention of a district chief. The chief contacts another district chief on his shift who is a member of the consulting team for his analysis of the situation. After conducting a preliminary investigation, the consulting district chief identifies the existence of a more complex set of issues. He recommends a series of actions drawing on the skills of other consultant team personnel and two of the Department's newly trained mediators. Together they craft conflict resolution and team building interventions designed to remedy long-standing issues that have existed within a crew.*
>
> ***EXAMPLE:*** *A company officer on the consulting team is contacted by one of his/her peers to discuss a work group conflict between two members. The consulting team officer suggests intervention techniques that the company officer might use.*
>
> ***EXAMPLE:*** *A district chief and a senior captain on the consulting team jointly train peers on assessing human relations dynamics in station crew.*

Supervisors are responsible for the work climate under their command. Aside from emergency operations, this is their most critical supervisory function. Department supervisors are held accountable for this task under the new employee performance evaluation system. In the field, it is already standard practice for district chiefs to conduct an inspection of stations as part of their daily duties, using the Station and

Apparatus Evaluation Form. This form can be extended to incorporate a human relations inspection protocol, to be conducted on at least a monthly basis.

This approach would be part of a series of actions for the Department to rapidly identify and prevent the escalation of human relations problems, enhance accountability and support supervisors in the management of their personnel.

Recommendation 191: Add a human relations assessment component to the routine inspection and quality assurance protocols of field operations managers. A check-off inspection form on human relations issues would be completed and filed with the shift and division commanders. This exercise also would establish direct conversation about the current state of the work group and identify potential problems that might arise. The district chief would ask a series of brief questions to determine the existence of issues that need attention. Appropriate boxes on the form would be checked off and/or comments noted. If the district chief identified emerging issues, constructive action could be taken.

As part of developing this protocol and the associated form, input should be solicited from suppression and EMS personnel. The training of district chiefs and company officers in use of the form could be done by members of the proposed consulting teams and supervising district chiefs. The approach should be pilot tested before being integrated into department protocols. Concurrent with the development and implementation of this procedure, there should be communications throughout the department about the intent and benefits of the exercise.

Participants in the interviews provided numerous examples of incidents involving serious conflicts between particular individuals or groups. Unfortunately, either the involved parties cannot resolve their differences or there is fear of retaliation. These situations could be dealt with through a facilitated process that protects the participants and focuses on constructive resolution.

Recommendation 192: Conduct facilitated discussions between select supervisory and subordinate personnel, as well as groups. As elsewhere, this requires use of skilled facilitators, preferably from outside the Department.

Recommendation 193: The fire chief and command staff should systematically hold problem identification and solving sessions with employees from all HFD divisions. Staying in touch with employee concerns is a challenge, but is imperative to maintaining morale and a healthy work place. Simple minutes should be kept summarizing issues and actions to enable everyone to measure progress. It is imperative that employees be encouraged to speak freely without fear of retaliation. (Since this recommendation was initially made, the new Fire Chief and several command staff

members have started holding such sessions. It is their stated intent to continue these meetings as part of an improved, open internal communications process.)

There are written Department guidelines for discipline (Volume I-30 of the Houston Fire Department's Guideline Manual, titled Coaching, Counseling, and Motivating Members). This guideline has been in effect since September 1999, and a tracking log of all discipline has been maintained, to be reviewed for compliance.

As mentioned earlier, there is a strong perception of a lack of consistency and fairness in applying discipline, a complaint heard in almost every large fire department and many medium-sized departments as well. Whether perception or fact, the comments indicate an area of risk to the Department and City.

The company officer and district chief positions are essential to the proper monitoring and intervention of inappropriate employee conduct. The complaint that too many of them behave like "one of the guys" and shirk their organizational duties suggests that representatives from these positions be drawn into providing insights and leadership in the review of current practices to correct the situation.

Recommendation 194: Review department disciplinary practices and develop appropriate guidelines to ensure consistency across the department's work units. The Department must carefully examine its practices in these areas to ensure appropriate uniformity, and that the disciplinary system achieves the highest level of integrity. The management team must examine these patterns, and identify ways to counter lack of uniformity through training, communications and clarification of policies and procedures.

(At present, all disciplinary matters are forwarded to Staff Services, and a recommendation from the Fire Chief is received. This is intended to ensure consistency across the Department's work units. The HFD is developing a behavior manual that outlines appropriate behavior and defines discipline for specified infractions. This will provide more consistency in disciplinary practices. A review board will be incorporated into this process to evaluate the consistency and fairness of the Fire Chief's actions concerning discipline of members.)

Policies and Procedures – Many of the interviewees' comments related to specific policies and procedures. They ranged from pregnancy policy to recruiting and employee evaluations.

Recommendation 195: Review the Department's pregnancy and related transfer policies. The administration has started to reach out to female employees, as it should

with any group or individuals, to better understand their needs. The pregnancy and transfer policy areas need to be reviewed, as does an apparent pattern of miscarriages. Attending to this issue should help facilitate a stronger partnership among administration, the union, and female members to define the problem, and explore potential causes and remedies.

Recommendation 196: Modify the employee performance evaluation system to emphasize and measure supervisor performance in managing work group and human relations behaviors. The evaluation form should be adjusted periodically to measure supervisory performance against department initiatives. This will create an incentive for supervisors as well as convey a message that the initiative is important. For instance, one task supervisors are responsible for is promoting teamwork, under employee relations and development. If the department adopts our recommendation to incorporate a human relations inspection protocol, supervisors could then be measured on their ability to achieve goals or activities related to this initiative. The HFD can use the performance evaluation system as a useful tool to change behavior.

Leadership and Skills Development – It is imperative that new supervisors be provided a level of training that enables them to perform their duties with a reasonable degree of confidence and skill. The Department's past training programs have been deficient in preparing new supervisors for their roles. Department officials have proposed an expanded training curriculum for new officers, but its human relations components are deficient.

The following recommendations seek to enhance essential professional skills of the Department's supervisory and newly hired personnel, as well as modify key systems to create personal incentives to acquire new skills. Additional suggestions focus on executive and career development processes.

Recommendation 197: Establish core competencies for managers and supervisors that will enable them to supervise more effectively a diverse work force. The core competencies should include team building, conflict resolution, interpersonal communication, leadership, diversity, and supervision. Appendix E outlines a set of learning points for each of these topic areas. The competencies should be integrated into the Department's training, promotional testing, and performance evaluation. This will present an opportunity for all supervisors to acquire managerial knowledge and skills, and create an incentive to develop and maintain proficiency.

The initial focus of competency development should be conflict resolution skills, an area in which all managers and supervisory staff should be proficient, especially at the company officer and district chief levels, where direct supervision of employees is greatest. It is an essential skill necessary to defuse potentially complex or even minor situations that can erupt. The investment rapidly pays for itself.

(As of November 2001, a set of competencies had been tentatively selected for a new supervisors course. The HFD suggested that future promotional exams assess diversity and human relations scenarios, a good idea. The HFD Command Team will finalize the core competencies in first quarter 2002.)

Recommendation 198: Expand the introductory training program for new officers to integrate the core supervisory competencies into the curriculums. The program should be expanded by 40 hours (to a total of 80) to allow more training on human relation skills. (As of November 2001, planning for a mandatory course for new captains was almost complete; it will be given to new supervisors and offered to the last group promoted to Captain, then expanded further in outreach.) The additional 40 hours could be provided by City of Houston Human Resources and/or outside HR trainers.

Veteran supervisors also need better management training. To its credit, the Department has initiated a supervisor training program to begin to make up for the past lack of investment in this critical area. But the need is much greater than available resources and program activity. The Department currently sponsors half-day programs for supervisors that include up to 120 personnel. A highly qualified outside instructor delivers a program on a contemporary subject area. While the presentations have been well received, they are not permanent skill building experiences. A commitment of financial resources and creativity, plus a prudent long-term focus, is now necessary to effectively correct the situation.

Recommendation 199: Enhance the Department's training program for veteran supervisors. The core supervisory competencies should become a meaningful part of an ongoing curriculum to enhance the professional capabilities of veteran as well as new supervisors.

Many participants reported that many, if not most, of the executive command appointees are unprepared for the roles they assume, and that the selection process is too political. The degree to which this is true is unclear, but it is clear that the management of the department has become too complex to allow politics to be the dominant factor for key executive selections. While politics may always be a part of the selection criteria, the preparation of executive candidates can be greatly improved.

Recommendation 200: Design and implement an executive development and succession program. The Department already has initiated a career development program, but more must be done to deepen the pool of highly qualified candidates who can be selected for future top appointive positions. The process must be institutionalized and jointly managed by the Mayor's office and the Department to ensure program stability.

(The new Department leadership recommended in 2001 that an executive development program be designed with mandatory as well as voluntary components in areas such as management principals, human relations, etc. The mandatory components would be minimum requirements to apply for the rank of Executive Assistant and Assistant Fire Chief. An example would be the recently offered "Essentials of Leadership." This is a good idea toward enhancing the quality of the pool of candidates for promotion to the top ranks.)

In the long term, the investment in executive development should produce a cadre of leaders with a high level of contemporary skills in management principles, strategic and operational management, and human relations, as well as fire and emergency service management.

While the City and Fire Department must improve their investment in management training, managers and supervisors who aspire to executive positions must themselves assume some responsibility for their personal and professional growth. Demonstrating self-initiative for personal growth itself is a desirable attribute of future leaders.

Recommendation 201: The Department should develop either a mandatory or voluntary self-study curriculum as a companion component for all of the previously discussed human relations training modules. Such self-study courses provide a means of reaching large audiences in a convenient manner that is compatible with their schedules and other workplace demands. These courses do not replace the high quality interactive classroom experiences, but they would be a valuable supplement to professional development. (The HFD suggested in 2001 that a way to provide self study modules is by having educational vendors who specialize in management and human relations skill building to provide modules for self-training by computer. Besides designing self-study materials, they could identify some method of objective assessment for skills retained.

The Department is on the verge of losing a significant number of veteran members to retirement. The experience and knowledge they have acquired are invaluable. One of the best means to transfer this knowledge is to establish mentor relationships between the up and coming staff and the veterans. Mentoring often occurs informally when a veteran takes someone under his wing. It is a hit and miss practice that leaves some junior members without access to valuable veteran talent. This adds to perceptions of exclusion and discrimination. A formal program comprising an ethnically diverse group of volunteer mentors would be an important resource for all members of the Department.

Recommendation 202: Develop a mentoring program. The Department, union, and employee associations could work cooperatively to identify members who are willing to participate as mentors, and then screen them for suitability. The list of mentors could then be and then identified in a department-wide communication. The Department would have to draw up guidelines for the mentors to avoid any conflict of interest situations or other problems. The program should operate as an adjunct to the career development or training commands, which would augment its department-wide effort to improve training opportunities.[66] (The HFD has a Field Training Officer Program in place. Additional members can be identified who have the desire and potential to act as effective mentors. These individuals could then be paired with probationary trainees and non-officer members of the Department. The current strategic plan called for starting a mentoring program in FY2001, but it has not started yet.)

The number of new HFD employees will grow in significant numbers over the next few years because of the DROP retirement plan. It would be good to get them started on the right course from the beginning of their careers.

Recommendation 203: Incorporate a human relations module for new recruits into the academy. As an example, consider the City of Sacramento Fire Department's communication and conflict resolution course for new hires. Their eight-hour course is designed to give recruits essential interpersonal skills and to support the communication and conflict resolution protocols instituted by the department. (Additional hours on human relations are being added to the recruit firefighter curriculum and to the new supervisors program.)

Several female firefighters noted that they have learned on the job a variety of techniques (e.g., alternative ways to lift victims) that were helpful to them and not taught in the Academy.

Recommendation 204: Consider adding a female training officer to the Division of Training. The Training Division would benefit from access to a female staff member on a daily basis to help develop the curriculum and consider areas especially helpful to female firefighters. It would be anticipated that improved training techniques and some practical tricks of the trade would lead to better performance. This also would send a good message on diversity and encourage female firefighters. (The first female training officer, a captain, was assigned to the Academy in October 2001.)

[66] There is much research available on how to be a good mentor and how to conduct on-the-job training. A total of 57 skills for doing on-the-job training have been identified by Klein & Associates. The Los Angeles County Fire Department, U.S. Army, and Marines have pioneered testing of the teaching of mentoring skills as part of their research. See for example "OJT: A Cognitive Model and Prototype Training Program for OJT Providers," U.S. Army Research Institute for the Behavioral and Social Sciences, Alexandria, VA, by Klein Associates, Inc., under Contract MDA903-93-C-0092, August 9, 1995."

Over the next few years, a significant number of veteran officers will retire from the Department creating scores of vacancies at the line, middle and upper ranks. Therefore, this is an opportune time to modify the testing process in a direction to enhance the leadership and supervisory capabilities of the department.

One of the best means of institutionalizing positive supervisory practices is to construct incentives. The inclusion of a subject on exams is a good incentive to learn it and an indication that the Department values that topic area. Therefore:

Recommendation 205: Modify future promotional exams and/or interviews to test for critical supervisory and human relations skills such as conflict resolution, team building, diversity, and work group assessment. Promotional candidates could be provided exercise and resource material that will enhance their extensive study activities on supervisory skills and human relations, which would contribute to upgrading supervisory skills. (As noted earlier, HFD management agrees with this concept, and felt it should be discussed under "Meet and Confer."

The current promotional test is solely a written test based on remembering facts in a proscribed set of books and manuals. As was recommended in the Training section in Chapter VIII, the current process of testing for classified positions should be changed by adding assessment centers for most if not all positions.

Generally speaking, an employee's professional development can be improved by explicit professional development and career planning, which includes setting goals and defining the activities to achieve the goals. The Department has implemented a career development program.

Recommendation 206: The Department should stress the importance of the career development component of the employee performance evaluation form. The new employee performance evaluation includes a career development component. The intent is to insure a formal planning relationship between the Department and its employees for their ongoing professional education. The supervisor is critical to the quality of this exercise. If he or she takes it seriously, the employee will benefit from a sense of direction and the Department would be provided with important information that can be used in the design of training initiatives. The Department can underscore the importance of this task by developing a training exercise for supervisors on how to help employees do career planning. The exercise can be conducted by district chiefs.

(Following release of the draft of this report in October 2000, meetings have taken place with employee groups to design criteria for eligibility for promotional exams. This also was discussed with Local 341 in meet and confer negotiations.)

Summary and Implementation

The HFD leadership deserves credit for recognizing and addressing the need to improve the operation of the Department. Based on a number of comments from participants in the interview process, both pro and anti- current leadership, there was a broad recognition that a number of areas needed to be fixed. While progress has been made in some areas, the human side of the change process appears to have been given less than the needed attention. The HFD leadership has exacerbated the situation by instigating or being drawn into a series of unmanaged conflicts.

After interviewing more than one hundred department personnel, it is evident that the structure of the personnel and supervisory system is generally sound, but the execution is lacking. There is a significant gap between desired supervisory style and practices and actual behavior, which can be attributed to the lack of skill development at the supervisory and management levels. Some policies and procedures require fine tuning to better support desired changes. Tone and content should emphasize positive rather than negative incentives.

Thirty-five recommendations were made above. City and fire leadership will have to decide on their merits and a viable schedule for their implementation. Many of the recommendations are inter-related. They were formulated as a package. It is suggested that they be implemented in three timeframes: immediate, near future (1-2 years), and long term.

In the immediate category, attention should be given to the acute personnel issues in the dispatch and prevention unit; addressing employee disputes; and the gender, race, and the labor management relationship issues. Top managers must lead the way in forging the kind of values and practices that will accomplish sustained change in the Department's culture.

In the near future, the process for designing the team-based human relations model should start as a strategy for focusing divergent groups on a common goal. The recommendations that strategically inject the department with essential skills and

programs that will strengthen supervisory performance and develop badly needed internal expertise also should be started in that time frame. These include peer mediation, the consulting teams, and human relations assessment. Development of the communications plan also should be done in the near future because of the need to keep the three thousand plus members of the Department informed while significant change is occurring.

On a longer-term basis, career development, training, and policy and procedure initiatives should be implemented. They require more preparation and will have a more profound impact on improving individual and organizational behavior in the desired direction to create a more pleasant and more productive work environment.

X. PRIORITIZATION OF RECOMMENDATIONS

The following lists all of the explicit recommendations in the report. (There are some other suggestions and recommendations implied in the text.) Next to each recommendation is the TriData project team's suggested priority, using the following ranking:

Urgent – Those recommendations that should be started immediately, that have a clear, direct link to the public safety, and that are feasible to start immediately.

Important – Those recommendations that should be started as soon as possible but which are slightly less critical than those designated as "Urgent."

Needed – Changes that do not have to be made immediately but that should be made or started within the next year.

Virtually all of the recommendations are deemed necessary and desirable to start as soon as possible or they would not have been made in the first place.

The last column in the list shows linkages between recommendations; i.e., where a group of recommendations need to be considered as a whole, or where one recommendation needs to be done before another can be started. In general, the sets of recommendations in each chapter should be considered together. Most importantly, any changes made to staffing of EMS Operations should be coordinated with changes in the staffing of Fire Operations, since both use firefighters.

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
II. Overall Management and Organization				
1. Organize the HFD under five major commands, each headed by a new rank, Executive Assistant Fire Chief.		√		
2. Reduce the number of senior positions appointed by the Chief and increase requirements for Executive Assistant Fire Chiefs.			√	Depends on 1.

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
3. All Chief-level officers (those above the rank of Senior Captain) should be considered members of management, and removed from the firefighters union.		√		
4. A Company Officer and District Chief assignment rotation policy be developed and instituted.		√		
III. Fire Prevention				
Organization and Management				
5. The Fire Marshal should remain a Civil Service position.		√		
6. The Fire Marshal and Assistant Fire Chief Prevention should be responsible for all the functions of the Prevention Division.			√	Depends on 1.
7. Consideration should be given to eliminating one level of Prevention Division management, and establishing a new position of shift Deputy Fire Marshal.			√	
8. An emergency response command structure should be established in Prevention and used for on-call situations, special events and emergency situations.		√		
9. The Prevention Division should make use of District Training Officers and Field Training Officers.			√	
10. In addition to formal certification of inspectors in the UFC and UBC (recommended later in Recommendation 24), periodic training should be given to Inspectors that is tailored to the requirements of the particular occupancy and/or function assigned the Inspector.			√	Link to 24
11. Cross-train Fire Inspectors in the Uniform Building Code and cross-train Building Inspectors in the Uniform Fire Code and in fire fighting considerations.			√	Link to 10.
12. The Fire Marshal should conduct a monthly Management Meeting including all division management from Senior Inspectors and up.			√	Link to 13.
13. The Fire Marshal should meet at least monthly with the senior staff group comprised of Chief Inspectors and Chief Investigators.			√	
14. Consideration should be given to using the Planning Department computer system as an interim solution for prevention inspection reporting.	√			

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
15. Evaluate the feasibility of using the (available) hand-held devices for field capture of inspection data.		√		Integrate with 14 in short term and 16 in longer term.
16. Eventually combine the prevention records management function with the Records Management System function of the new CAD.			√	
17. Evaluate the use of the Planning Department's automated voice system for scheduling inspections to determine if it will suffice for scheduling field inspections.			√	
18. Create a centralized telephone information function.			√	
19. Consideration should be given to having Fire Inspectors conduct more comprehensive progress inspections during construction.		√		Link to 20.
20. Consideration should be given to increasing the authority of the Fire Marshal in reviewing building plans to include: (1) joint approval with the Planning Department of alternate methods for meeting the safety requirements, (2) joint approval of Certificate of Occupancy, and (3) checking all plans for fire resistive construction methods and material, fire exit signage, hydrants, access roads, etc.			√	
21. The Fire Marshal should have authority to approve building plans for certain types of construction techniques that could pose life safety threats to fire fighters and/or adjacent buildings.			√	
22. The Fire Department should have the authority to declare a structure using potentially hazardous types of construction as a "defensive-response-only" structure, unless the structure is fully sprinklered.			√	Link with 21.
23. Centralize all types of plan checking, including hazmat and high pile storage, under the single plan-checking unit of Prevention located at 3300 Main.			√	

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
24. Fire Inspectors involved in plan checking should be certified by International Conference of Building Officials (ICBO) in the Uniform Building Code (UBC). They also should be certified in the Uniformed Fire Code (UFC). Inspectors responsible for plan checking and field inspections of LPG tank installations should be certified in LPG.			√	Link to 10.
25. Develop a digitized database of building plans.		√		
26. Obtain fire protection engineering capability for plans review, one way or another		√		
Fire Inspections				
27. An internal mechanism should be developed in the Prevention Division to annually reassess risk by occupancy type.			√	
28. A career development plan should be developed for all promotional positions in Fire Prevention.			√	
29. The Prevention Division should collect detailed management data, including the number of inspections performed by inspector and by type of inspection; inspection hours spent by type of inspection; and travel time and miles driven by inspectors.	√			
30. Prevention should obtain or develop maps showing the location of buildings by type of occupancy.			√	
31. The Fire Department and City Administration should decide whether the occupancy-based permitting system previously proposed in the 1995 Abbey Group Report is to be enacted.			√	
32. In devising an inspection strategy, consider using line companies to augment inspectors		√		Link to 29 to determine size of need.
33. Consider expanded use of self-inspections for low risk properties.		√		Link to 29 to determine size of need.
34. Management practices should be instituted to improve uniformity of inspections and code interpretations.			√	
35. Monthly inspection workload reports for each inspection section should be presented to Prevention management and the Fire Chief.	√			Link to 29.

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
36. Reconsider allowing inspectors to take their vehicles home.		√		Link to 29.
37. Consider using the Teletrack system used by the Planning Department to track inspector activity.			√	
Public Education				
38. Improve the public education program outreach by increasing its staff by four to six public educators and increasing emphasis on injury prevention.		√		
39. Make a greater effort to track past juvenile firesetters; proactively check on them once a year for several years after counseling.		√		
40. With the cooperation of the school districts, institute an annual school homework assignment on smoke detectors.	√			Link to 38
41. Consider a broader, more aggressive citizen CPR and AED citizen training program.	√			Link to 38
42. Make it a Fire Department goal to have a working smoke detector in 100 percent of the residences in the city of Houston.		√		
Fire/Arson Investigation				
43. The City should reassign the fire investigators doing background investigations and internal investigations back to fire investigation work	√			
44. Finish setting up the office space for investigations.			√	
45. Establish a Training Coordinator position.			√	
46. Hire or assign an information technology systems analyst for the Division.		√		
47. Arson Division vehicles should be equipped with police radio frequencies to facilitate communications with law enforcement		√		
48. The Arson Division should acquire a canine as part of the unit assigned to one of the unit's trained fire investigators.	√			
49. The configuration of work shifts should be changed to make more investigators available for criminal investigation and case development.		√		

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
50. Give first priority to bolstering arson investigation, the juvenile firesetting program, and fire prevention/public education with funds confiscated or raised by the Prevention Bureau or Community Relations			√	
IV. Fire Operations				
Unit Staffing				
51. For the immediate future, establish a uniform policy across shifts as to which specific units should receive priority to staff with four personnel.	√			Link to 52.
52. Plan in the near future to staff all HFD engine and ladder units (as well as the heavy rescue units) with a minimum of four personnel, comprised of one officer and three firefighters.		√		
53. Remove full-time dedicated staffing from the 11 on-duty booster positions and use the 11 positions to be the fourth person on an additional 11 engines or ladders; when needed, cross-staff the booster units with a person from the company where they are stored.		√		Needed for 52.
54. Personnel from the special (auxiliary) units should be reassigned to engine and ladder companies to augment staffing of those units.		√		Needed for 52.
Demand For Service				
55. A process should be developed to address the large number of false alarms experienced from automatic alarm systems.	√			
Response Complements				
56. Add one additional engine company to the standard assignments for structural fires for use as a Rapid Intervention Team (RIT).		√		Link to 73
Fire Station and Unit Locations				
57. A combination of strategies should be considered for reducing response times, including adding units to improve unit availability; reducing or diverting some of the demand for service; providing adequate support resources to assure that existing resources are being utilized most efficiently; traffic light preemption; and having a different approach to service delivery, especially for EMS calls.	√			Link to EMS system recommendations.

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
58. Give priority in traffic light preemption installation plans to thoroughfares in remote parts of the City where response times are significantly worse than average.		√		Part of 57.
59. The City either should not close Station 1 or should add a company in the downtown area to replace Engine 1 in the next five years.		√		Part of 57.
60. Above and beyond the stations currently in the HFD plans, at least three to four additional units spread across two or three existing stations will be needed to meet fire demand between now and 2010.		√		Part of 57.
V. Special Operations				
Hazardous Materials Response Team				
61. The Standard Operating Procedures of the Hazardous Materials Incident Management System seems appropriate; they should be documented			√	
62. The hazmat team (HMRT) should remain as one functional response district operating out of Station 22.			√	
63. The rehabilitation of Station 22 for the HMRT should be added to the capital budget.			√	
64. The Training Division, assisted by the HMRT, should provide training for all field personnel to the Hazmat Operations level of competency.			√	
65. Create three full-time civilian Administrative Assistant positions to handle the administrative functions of the HMRT.			√	
66. The Hazardous Materials Inspection Team should be transferred to the HFD Special Operations Division and assigned to the HMRT.			√	
67. The HFD should develop a MIS that shares information among the HMRT, team management, and the Hazmat inspectors.			√	
68. Develop an apparatus and equipment replacement plan for the HRMT.		√		
69. The LEPC Administrator should be transferred to HFD Special Operations Division.			√	
Technical Rescue				
70. Relocate Rescue 42 to Station 11.			√	

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
71. Plan for the expansion of rescue services by equipping the rest of the ladder trucks with extrication tools and equipment.		√		
72. While they are assigned to the TRC, personnel should receive assignment pay.			√	
73. A Technical Rescue Command (TRC) unit should be designated as the Rapid Intervention Rescue Team for working commercial, industrial, and multi-alarm structural fires			√	Link to 56.
74. The Technical Rescue Command personnel should receive a baseline medical examinations and then annual medical examinations.		√		
75. Develop an apparatus replacement plan for all TRC units and equipment.		√		
76. Transfer oversight and organizational placement of the Houston Medical Strike Team from the HFD Special Operations Division to the Division of Emergency Management.			√	
Airport Operations				
77. Add one firefighter per shift at Hobby.		√		
78. Create a new position of Airport Operations District Chief.	√			
79. Revise the District 54 personnel assignment procedures (and preferably procedures for all specialized units and functions).			√	
80. Initiate statistical tracking of the various types of emergency service responses by District 54 Units, and by other units to the airport			√	
81. The practice of having airport operations personnel investigate requests for emergency services before notifying the fire department should be discontinued	√			
82. Upgrade and increase the mass casualty supplies on hand.			√	
83. New ARFF vehicles should include the most current technologically advanced equipment, including elevated turrets with piercing devices, aerial ladders or platforms, halon alternative clean firefighting agent, and Driver's Enhanced Vision Systems (DEVs).		√		

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
84. A review of airport radio communications procedures should be initiated to eliminate the procedural problems involving multiple frequencies.		√		
85. All ARFF personnel should participate in full-scale fire training at a flammable liquid hydrocarbon facility at least in alternate years, as required by the FAA.			√	
86. Consider obtaining virtual reality training simulators for ARFF units.			√	
VI. Emergency Medical Services				
87. The bifurcated EMS command problem needs to be solved so that other improvement initiatives can proceed unencumbered	√			Needs to be solved before other recommendations can proceed.
88. In the near future (one to three years) the HFD should embark on a "Make the Right Call" program.		√		Link to 103
89. Consider converting each Dual Unit to either an ALS unit or BLS unit (5 ALS and 4 BLS).	√			
90. In the future, the Fire Chief and the proposed Assistant Chief for EMS preferably should have a sound background in EMS.			√	
91. The position of the Medical Director should remain under the auspices of the Mayor's Office.			√	Tie to 87
92. The Ambulance Advisory Committee should officially recognize not just the contributions of the HFD physicians, but also the field providers and fire command personnel for their individual efforts in supporting EMS research.			√	
93. An internal analysis should be undertaken to identify and quantify the HFD resources directed towards research.			√	
94. Work with Local 341 to poll EMS field providers to ascertain the number of current members who would be willing to have or prefer a 12-hour shift.	√			Link to 112, system redesign
95. There must be an organizational structure to plan and implement FF-EMT CME on a routine and recurring basis.			√	

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
96. Also make continuing education available to the paramedics at their station houses to the extent possible.		√		
97. Continue the current EMS training contract.		√		
98. Re-establish a high passing grade requirement for paramedics.		√		
99. Consider transitioning to an all-ALS system that is based on use of squad cars and paramedic engines.		√		Link to 112
100. Houston should consider modifying its response policy to permit non-emergency response to selected calls.		√		Link to 88
101. Use the call-screening system (ProQA) offered by Medical Priority Consultants of Salt Lake City, Utah, or something equivalent.	√			
102. Obtain certification and accreditation for the dispatch operation.			√	
103. The Internet web site used to track hospital diversion status should be accessible from ambulances.	√			
104. Communications through the Telemetry Office should be recorded.			√	
105. The new Command Center should incorporate automatic identification and notification of RMD status in the dispatch software.			√	
106. As a stop gap measure to improve EMS data, purchase file server that will allow promper access to CAD data than is possible at present.		√		Consider all MIS changes (106-109) together
107. Develop a new mobile computer based patient record keeping system to include ALS, BLS, and squad providers.		√		
108. Ensure that the new CAD system will have the capability of downloading patient dispatch information to an automatically generated patient record.			√	
109. Consider further expansion of the system to include BLS first responders. This recommendation should be implemented as a third and final step, after all glitches are rectified and the system is working well for the ambulance based ALS and BLS providers.			√	
110. Staff the field evaluator positions for EMS.		√		

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
111. Add three EMS quality assurance positions. Two positions are needed to address liaison issues for dispatching and training, and one is needed for investigation of adverse EMS field incidents.		√		
112. Implement Option II, a system redesign for EMS.		√		Linked 94, 95, 99, 100
113. The system redesign can use staffing Option IIA or IIA1. Option IIA is the FF/EMT BLS ambulance-staffing configuration.				
114. Add at least 5 ALS and 5 BLS units immediately to bring relief to the existing fleet overload.	√			
115. Consider the immediate hiring of 30 paramedics, preferably FF/paramedics.	√			
VII. Support Services				
Training and Promotion				
116. Increase recruit training in prevention to a full week.		√		
117. Require fire recruit instructors from the Houston Community College to take continuing educational courses to maintain their certifications.			√	
118. Personnel assigned to the Training Division and training functions should be certified to the levels identified in NFPA 1041, Fire Instructor Professional Qualifications, or the equivalent state certification.		√		
119. Recruit qualified training officers who desire to teach and train fire personnel.		√		
120. Higher education should be further encouraged and given extra weight in the selection of recruits and in the promotion of officers, especially at the chief level.			√	
121. Combine the Professional Development Bureau and the Career Development Bureau into one Training Bureau.		√		
122. Add an assessment center testing process to all promotional exams.	√			
123. Build an additional training facility (or facilities) in more centrally located areas of the city.			√	

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
Recruitment				
124. An incentive should be provided to individuals living in the City who successfully complete the recruitment process		√		
125. Hire four recruiters to focus more recruiting efforts on minorities and females, until better representation is obtained.			√	
Health and Fitness Program				
126. A minimum of one hour should be allocated for working out while on duty each shift.		√		
127. The HFD should develop the specifications and then outfit all stations with a full complement of exercise equipment.		√		
128. Identify quantitative standards for fitness.		√		
129. An instructional program should be established to create a network of peer fitness trainers.			√	
130. Develop a health education program using a remote learning model.			√	
131. A 1.5-mile run should be included as an entry standard, and the time requirement stiffened to 11:30.		√		
132. An "Owner's Manual" on how to set up a personal fitness program should be issued to every cadet.		√		
133. Improve the physical ability test by using a series of linked work-sample tests and adding a ballistic force (forcible entry-like) test.	√			
134. If the current physical ability test is not retained, and the CPAT is used, it must be validated locally.			√	
135. Develop a physical fitness condition-of-employment contract and standards for maintaining the fitness of incumbent employees.			√	
136. Create an Occupational Medicine section.			√	
137. Undertake a detailed analysis of medical disability costs, and review disability processes and practices for occupational and non-occupational disabilities.			√	

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
Dispatch and Communications				
138. The City should contract a firm to oversee the implementation of the new Dispatch and Communications Center.	√			
139. The implementation of communication sub-systems should be accomplished in a deliberate, phased manner		√		
Maintenance				
140. The concept of a shared facility for the maintenance of HFD and HPD vehicles should be explored with an eye towards consolidating these efforts.			√	
141. Classified HFD employees now assigned to the Small Engine shop should be replaced by civilian employees and reassigned to fire suppression duties.			√	
142. A structured apparatus replacement program should be developed and implemented to avoid the need for a mass purchase of fire apparatus in a single year.			√	
143. Consider increasing staffing for HFD facility maintenance services or contracting them out.			√	
Management Information Systems				
144. Consideration should be given to centralizing the HFD network infrastructure support services under Central IT, or the consolidated Communications Center or under contract with an external vendor.		√		
145. In the future, consideration should be given to moving the Fire IS Division (and potentially all public safety information services) under the consolidated communications center IS management.			√	
146. Establish a standing Information Service Planning Committee (ISPC)/Steering Committee and a representative User Group as recommended in the 1995 SIP.			√	
147. Create a representative task force comprised of Prevention and IS Division personnel to identify and evaluate development alternatives and develop a migration plan to the new RMS for prevention information technology support.			√	
148. Implement the organizational recommendations for the IS Division that were made in the 1995 SIP.		√		

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
149. The positions for Information Resource Manager and Client Server Supervisor should be filled as quickly as possible.	√			
150. The organizational changes to the IS Division in structure, size, and skills that were recommended in both the SIP and this report should be implemented as soon as possible.		√		
151. The applications identified in Phases II and III of the SIP plan are necessary and should be implemented.		√		
152. A minimum of five and preferably seven, including a working supervisor, are needed to establish a User Support and Help Desk function.	√			
153. Consideration should be given to contracting out server and desktop hardware installation and maintenance, or (as previously proposed) centralizing this function under the new consolidated Dispatch and Communications Center management.	√			Do 155 or 156
154. If microcomputer hardware installation and support remains a function of HFD IS Division, then a minimum of five positions (three new positions) are needed to achieve the minimum required staffing 24-hours-a-day, seven-days-a-week.	√			
155. Consideration should be given to rotating the CAD-related maintenance responsibilities between at least two technical hardware analysts so that on-call coverage is available at all times.		√		
156. If the Network Management and Support functions remain in the HFD IS Division, then approximately five positions are needed for this function.		√		
157. Approximately six more positions – four more programmer/analysts and database staff positions, and two trainers – are needed, in addition to filling the current seven vacancies.	√			
158. Due to the crucial nature of the CAD system, a remote CAD 'hot' site should be established.		√		

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
159. The risks of a single point of failure in data and voice lines necessary to support the 911 system should be evaluated. Steps should be taken to provide backup alternatives so that no single point of failure exists in the 911 system.		√		
160. Business interruption risks and costs should be evaluated. If deemed necessary, recovery plans should be developed and tested for remote recovery of RMS and other HFD data and systems.		√		
161. The need for a dedicated development server should be evaluated. As development activities increase, it is unlikely that the administrative server will be sufficient for both purposes.		√		
162. Plans should be developed and funds budgeted to replace the LAN technology as soon as possible.			√	
163. To prevent redundancy, all HFD application systems should be developed by the HFD IS Division.			√	
164. Train all database analyst and software developers in the First Case methodology as soon as possible.		√		
165. An end-user reporting tool, such as Crystal Reports, is needed to allow users access to data for analysis and management purposes.		√		
166. The IS Division steering committee should formalize development priorities for projects to automate manual processes.		√		
167. Consider consolidating records management and reporting for departmental operations (fire incident, EMS, prevention, etc.) under Central Command.		√		
VIII. Emergency Management				
Organizational Role and Management				
168. The Emergency Management Division should remain a function of the Office of Public Safety and Drug Policy.			√	
Staffing				
169. The Division of Emergency Management should consider augmenting its staff by a college intern program.			√	

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
Management and Supervisory Issues				
170. Management of the Division should strengthen and encourage communication between staff members and with the City's customers (e.g. Fire, Police, PW&E, Harris County, etc.).			√	
171. Management needs to develop, with input from its staff, a set of long and short term goals and action plans to improve the effectiveness of the office.		√		
TranStar Facility				
172. An access control mechanism should be installed in the main hallway of the TranStar facility (as well as the side doors).	√			
173. The TranStar facility should be updated to be fully self-sufficient in the event of an emergency.		√		
174. The potential exposure to hazards of the TranStar location warrants consideration of relocating the EOC to the proposed Public Safety Communications Operations Center.		√		
IX. Personnel and Supervisory Issues				
175. Incorporate a team-based human relations model into the strategic plan.		√		
176. Develop a human relations five-year "change plan" to establish positive human relations practices.		√		
177. The Mayor and City Council should commit to a change plan for the Fire Department, and to stability in the leadership of the Fire Department.	√			
178. Conduct facilitated sessions between union and administration leaders.	√			
179. Conduct a facilitated planning session with members of each employee group to address racial and ethnic issues in the department.	√			
180. Design and implement a communications plan that supports the goals and objectives of the strategic and human relations change plan as well as other department initiatives.	√			
181. Department leaders should take careful stock of the values that currently promote positive and negative practices in the organizations.		√		

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
182. Conduct mediated sessions between key leadership officials and the Prevention Division leadership.	√			
183. The Fire Department and city leadership need to re-emphasize the policy that prevention is the first priority in fire safety.		√		
184. Conduct a team building intervention for dispatch.	√			
185. The HFD should improve its ability to monitor harassing and discriminatory behavior and to take effective intervention for the benefit of all members of the Department.		√		
186. The HFD must be diligent in monitoring and responding to inappropriate material being displayed on fire department property.		√		
187. Further develop the capabilities of the HFD management team to effectively address and manage the human relations issues affecting the Department.		√		
188. Enhance the Department's near-term conflict management capabilities by implementing a peer mediation program.	√			
189. Modify the collective bargaining agreement to allow rotation of officers, and eventually line personnel.			√	
190. Develop and implement human relations consulting teams.	√			
191. Add a human relations assessment component to the routine inspection and quality assurance protocols of field operations managers.			√	
192. Conduct facilitated discussions between select supervisory and subordinate personnel, as well as groups.		√		
193. The fire chief and command staff should systematically hold problem identification and solving sessions with employees from all HFD divisions.		√		
194. Review department disciplinary practices and develop appropriate guidelines to ensure consistency across the department's work units.		√		
195. Review the Department's pregnancy and related transfer policies.		√		

Recommendation	Urgent	Important	Needed	Linkages between Recommendations
196. Modify the employee performance evaluation system to emphasize and measure supervisor performance in managing work group and human relations behaviors.		√		
197. Establish core competencies for managers and supervisors that will enable them to supervise more effectively a diverse work force.		√		
198. Expand the introductory training program for new officers to integrate the core supervisory competencies into the curriculums.		√		
199. Enhance the department's training program for veteran supervisors.		√		
200. Design and implement an executive development and succession program.		√		
201. The Department should develop either a mandatory or voluntary self-study curriculum as a companion component for all of the previously discussed human relations training modules.			√	
202. Develop a mentoring program.		√		
203. Incorporate a human relations module for new recruits into the academy.			√	
204. Consider adding a female training officer to the Division of Training.			√	
205. Modify future promotional exams and/or interviews to test for critical supervisory and human relations skills such as conflict resolution, team building, diversity, and work group assessment.		√		Link to 122, Assessment Center.
206. The Department should stress the importance of the career development component of the employee performance evaluation form.			√	

APPENDIX A: APPARATUS BY STATION (2000)

Station	Address	Key Map	Apparatus	Year Built	Year Renovated
1	410 Bagby	493L	- Engine - Medic Ambulance - 2 Senior Ambulance Supervisors - Shift Commander	1965	
2	5880 Woodway	491K	- Engine - Cascade - Fireground Safety Officer	1992	
3	3735 W. Alabana	492S	- Engine - Medic Ambulance	1959	
4	6530 W. Little York	411T	- Engine - Ladder - Ambulance Supervisor	1986	
5	2020 Hollister	450R	- Engine - District Chief	1977	
6	3402 Washintion	493E	- Engine - Ladder - Basic Ambulance - District Chief	1987	
7	1402 Elgin	493T	- Engine - Ladder - Medic Ambulance	1969	
8	1307 Crawford	493O	- Engine - Basic Ambulance - District Chief	1968	1993
9	702 Hogan	493G	- Engine - Medic Ambulance	1969	
10	6600 Corporate Drive	529H	- Engine - Basic Ambulance - District Chief - Rescue Boat	1985	

Station	Address	Key Map	Apparatus	Year Built	Year Renovated
11	460 T. C. Jester	492C	- Engine - Heavy Rescue Truck - Evacuation Boat - Rescue Boat - EMS Supervisor (District Chief) - Command Van - Trailer Utility Vehicle for Rescue Personnel	1995	
12	1502 Alber	453Z	- Engine - Basic Ambulance	1959	1997
13	2215 W. 43rd	451M	- Engine - Basic Ambulance	1956	1993
15	5306 North Main	493S	- Engine - Basic Ambulance - Fireground Safety Officer (District Chief)	1942	1999 (New)
16	1700 Richmond	492Z	- Engine - Ladder - Basic Ambulance - Ambulance Supervisor	1978	
17	2805 Navigation	494N	- Engine - Basic Ambulance - Rehab Truck - Big Blow (Exhaust Fan) - Supply Truck - HPD SWAT Tank - Rescue Boat	1983	
18	619 Telephone	494T	- Engine - Ladder - Medic Ambulance	1981	
19	1811 Gregg	494E	- Engine - Ladder - Medic Ambulance - District Chief	1979	

Station	Address	Key Map	Apparatus	Year Built	Year Renovated
20	6902 Navigation	494V	- Engine - Ladder - District Chief	1968	
21	10515 S. Main	532T	- Engine - Ladder - Basic Ambulance - District Chief	1972	
22	7825 Harrisburg	495W	- Hazardous Material Trucks #1 and #2 - Foam Engine - Haz-Mat Coordinator (District Chief) - Assistant Coordinator (Sr. Captain) - Utility Truck	1969	
23	8005 Lawndale	535B	- Engine - Basic Ambulance - Fireground Safety Officer - Cascade truck	1976	
24	Reed Road		- New - Proposed-Funded	TBD	
25	3902 Scott	533D	- Engine - Basic Ambulance	1979	
26	7111 Dixie	534V	- Engine - Ladder - District Chief	1953	1996
27	6302 Lyons	494H	- Engine	1940	
28	3000 Chimney Rock Rd.	491X	- Engine - Ladder - Basic Ambulance - District Chief	1987	
29	4831 Galveston Road	535R	- Engine - Ladder - Medic Ambulance - Ambulance Supervisor	1978	1996

Station	Address	Key Map	Apparatus	Year Built	Year Renovated
30	6702 Irvington	453O	- Engine - Cascade - Basic Ambulance - Ambulance Supervisor	1977	
31	222 W. Crosstinbers	452M	- Engine - Ladder - Medic Ambulance - District Chief	1982	
32	8614 Tidwell	455C	- Engine - Basic Ambulance - Evacuation Boat - Booster	1980	
33	7100 Fannin	532B	- Engine - Ladder - Medic Ambulance	1950	
34	3100 Laura Koppe	454E	- Engine - Ladder - Medic Ambulance - District Chief	1989	
35	5535 Van Fleet	534S	- Engine - Basic Ambulance	1964	
36	7720 Airport Blvd.	575B	- Engine - Basic Ambulance	1957	1999
37	3828 Aberdeen Way	532J	- Engine	1955	
38	1120 Siber	491C	- Engine - Ladder - Basic Ambulance	1955	1995
39	2810 Pickfair	454O	- Engine - Basic Ambulance	1955	1997
40	5830 OST	534G	- Engine - Medic Ambulance	1956	
41	805 Pearl	495 F	- Engine - Basic Ambulance	1954	1999

Station	Address	Key Map	Apparatus	Year Built	Year Renovated
42	8675 Clinton	495T	- Engine - Heavy Rescue Truck - Rescue Boat - Evacuation Boat - Utility Truck	1981	
43	7330 N. Wayside	455K	- Engine - Medic Ambulance	1981	1998
44	675 Maxey Road	496G	- Engine - Ladder - Dual Ambulance	1976	
45	4910 N. McCarty	455U	- Engine - Ladder - District Chief	1985	
46	3902 Corder	533O	- Engine - Ladder - Medic Ambulance - District Chief	1976	1994
47	2615 Tidewater	572L	- Engine - Booster - Evacuation Boat	1960	
48	11616 Chimney Rock	571B	- Engine - Basic Ambulance	1960	1997
49	1212 Gessner	450W	- Engine - Medic Ambulance	1960	
50	4420 Bingle	451E	- Engine - Medic Ambulance	1960	
51	6902 Bellaire Blvd.	530H	- Engine - Ladder	1960	1998
52	10343 Hartsook	576K	- Engine	1962	
53	13349 Vicksburg	497E	- Engine	1957	1999
54	2500 Fuel Storage Rd.	333Y	- Airport Crash Rescue Equipment (Bush International)	1968	
55	11212 Cullen Blvd.	573M	- Engine - Ladder - Medic Ambulance	1962	2000

Station	Address	Key Map	Apparatus	Year Built	Year Renovated
56	5820 E. Little York	414V	- Engine - Medic Ambulance - Ladder	1972	
57	13602 Memorial Dr.	489F	- Engine - Ambulance Supervisor	1966	1999
58	10413 Fulton	413X	- Engine - Basic Ambulance	1966	
59	13925 S. Post Oak	571O	- Engine - Ladder - Medic Ambulance	1966	
60	2925 Jeanetta	490X	- Engine - Medic Ambulance	1966	
61	9726 Monroe	575O	- Engine - Ladder	1967	
62	1602 Seamist	452W	- Engine - Medic Ambulance	1968	
63	5626 Will Clayton Pkwy	374D	- Engine - Booster - Medic Ambulance - ATF Van	1972	1999
64	3000 Greens Road	374N	- Engine - Ladder - Basic Ambulance - District Chief	1991	
65	11531 FM 1960 East	339K	- Engine - Medic Ambulance - Booster	1984	
66	5800 Teague	450A	- Engine	1973	1993
67	1620 W. Little York	412X	- Engine - Ladder - Medic Ambulance - Booster - Evacuation Boat	1971	1997

Station	Address	Key Map	Apparatus	Year Built	Year Renovated
68	8602 Bissonnet	530T	- Engine - Ladder - Medic Ambulance - Booster - Evacuation Boat	1973	1993
69	1102 West Belt South	489R	- Engine - Ladder - Basic Ambulance - District Chief	1980	
70	11410 Beamer Road	576X	- Engine - Dual Ambulance - District Chief	1984	
71	15200 Space Center Blvd.	618F	- Engine - Ladder - Dual Ambulance - District Chief	1992	
72	17401 Saturn Lane	618Q	- Engine - Dual Ambulance	1978	1999
73	9640 Wilcresct Drive	529U	- Engine - Medic Ambulance	1985	
74	460 Aldine Bender Road	373W	- Engine - Ladder - Dual Ambulance	1984	1995
75	1995 S. Dairy Ashford	488R	- Engine - Ladder - Medic Ambulance	1984	
76	7200 Cook Road	529E	- Engine - Ladder	1985	
77	10155 Kempwood Dr.	450J	- Engine - Ladder - Basic Ambulance - Booster	1990	
78	15100 Memorial Drive	488C	- Engine - Ladder - Dual Ambulance	1987	

Station	Address	Key Map	Apparatus	Year Built	Year Renovated
80	16111 Chimney Rock Road	611A	- Engine - Booster - Dual Ambulance - Evacuation Boat	1987	
81	7990 Paul B. Koonce	575K	- Airport Crash Rescue Equipment (Hobby) - Medical Safety Unit	1987	
82	11250 Braesridge	570C	- Engine - Basic Ambulance - District Chief - Ambulance Supervisor	1995	
83	Breezewood		- New - Proposed-Funded		
84	Ella Blvd.		- New - Proposed-Funded		
92	4300 Will Clayton Pkwy	374B	- Airport Crash Rescue Equipment - Medical Safety Unit (Bush International Airport)	1987	
93	911 FM 1959	617B	- Engine - Ladder - Basic Ambulance - Booster - Evacuation Boat	1999	
94	235 El Dorado Blvd.	617R	- Engine	1993	
95	El Dorado Blvd.		- New - Proposed-Funded		
96	7409 Willowchase Blvd.	370P	- Engine - Ladder - Medic Ambulance - District Chief	1999	
101	1863 Kingwood	336C	- Ladder (Quint) - Dual Ambulance - Booster - Rescue Boat	1991	

Station	Address	Key Map	Apparatus	Year Built	Year Renovated
102	4102 W. Lake Houston Pkwy.	297T	- Engine - Ladder (Quint) - Dual Ambulance - District Chief - Evacuation Boat	1990	1999
103	2907 High Valley	297V	- Engine - Booster - Evacuation Boat	1991	
104	910 Forest Cove Drive (Kingwood)	--	- Engine	–	
		Summary Totals:	**83 Engines** **37 Trucks (2 Quints)** **21 District Chiefs** **62 Ambulances** **27 Medic** **9 Dual** **26 BLS** **9 Ambulance/EMS Supervisors** **2 Rescue Trucks** **11 Boosters** **3 Fireground Safety Officers** **10 Evacuation Boats** **5 Rescue Boats**		

APPENDIX B: POSITIONS AND GROUPS SAMPLED FOR HUMAN RELATIONS INTERVIEWS

The table below identifies the HFD positions and work groups from which was drawn the sample of personnel who were interviewed on supervisory and personnel issues. They represented a cross-section of the department's hierarchical and employee groups. The selections were made in consultation with department officials to ensure representation from suppression, fire prevention, emergency medical, administrative, and civilian work groups. Some participants recommended other individuals to interview. Larger samples were drawn from some groups than others; these were not random samples. Interviews were conducted with non-department staff for the purpose of collecting information from City units and the Mayor's Office that have a relationship with the Department.

Table 72: Employee Positions and Workgroups from which Interviewees were Drawn

Management and Administration Fire Chief Assistant Fire Chiefs Director of Finance and Administration	***Emergency Medical Services*** Medical Director Assistant Chief Paramedics
Suppression and Prevention Prevention Command Staff District Chiefs Captains Firefighters	***Employee Groups*** Union Representatives (Suppression, Paramedic, Civilian) Black Firefighters Association Representatives Hispanic Firefighter Representatives Women in the Fire Service Representatives
Civilian Personnel Supervisors Line Personnel	***City Officials*** Representatives from Mayor's Office Select City Personnel

Obviously not everyone in each group was interviewed.

APPENDIX C: PERSONNEL AND SUPERVISORY ISSUES INTERVIEW QUESTIONS

The following questionnaire was used to guide the interviews. Not every question was asked of every interviewee – the interviews went into more depth on some issues than others, depending on the largest concerns of the interviewee.

Questionnaire

The following list of questions is designed to stimulate a discussion of personnel and supervisory issues. The questions span five elements: policies and procedures, practices, structure, style, and skills. Your response to the following questions will depend on your role in the Department. You may not need to address each question. Questions not listed on these pages may be asked during the discussion to clarify a response or seek additional information. (Note: Use of the term supervisor includes management.)

The first three questions are designed to establish a time and strategic context for your responses:

1. Are there any major changes that have occurred in the Department over the last three to five years that have affected personnel practices or the supervisory structure and function of supervisors?
2. What are the major current issues affecting the department that supervisors must address?
3. Within the next three to five years, what are the major issues that will challenge the department's supervisory personnel?

Policies and Procedures

- What policies and procedures establish personnel practices and the supervisory structure and define the role, authority, and behavior of supervisory personnel?
- Do policies and procedures clearly define the role, authority, and behavior of supervisors?
- Do management and supervisory personnel support these personnel policies and procedures? Line personnel?

- What is the organizational development philosophy of the Department? Does the supervisory structure complement it?

Practices

- What are the gaps between desired and actual supervisory behavior?
- What human relations issues challenge supervisory personnel? Are these issues handled appropriately?
- How do line personnel perceive supervisory staff?

Structure

- Is the supervisory span of control correct for each service area?
- What areas, e.g., operational, human relations, pose challenges for supervisors?
- How are supervisors supported? How are they not supported?
- Do promotional exams test for desired supervisory behaviors and knowledge?
- What are your recommendations for improving the supervisory structure?
- Supervisory performance? What benefits will the Department and its employees realize?
- How are personnel evaluated? What criteria are used to evaluate their performance? Is the performance evaluation effective?

Style

- Within the Department, what are the attributes of a good supervisor? Within your work group? Who are the people in the Department who are respected for their supervisory ability?
- What is the dominant style of supervision? What is the desired style of supervision?

Skills

- What are the curriculum subjects in which supervisors must demonstrate competency?
- Are new supervisors prepared for their role?
- Are veteran supervisors provided continuous training?

- What are the training requirements for supervisors?
- What are the differences between desired training requirements and actual programs?

APPENDIX D: NEW OFFICERS CURRICULUM

The following is a list of subjects and the estimated time suggested for each module in a proposed new curriculum for training officers in supervision and management.

- Leadership – 2 hours
- Management Theory – 1 hour
- Customer Service – 1 hour
- Group Dynamics – 1 hour
- Role of an Officer – 2 hours
- Organizational Structure and Principles – 0.5 hour
- Written Operating Guidelines – 0.5 hour
- Documentation and Discipline – 4 hours
- Motivation – 1 hour
- Empowerment – 0.5 hour
- Communication – 2 hours
- Training – 1.5 hours
- Human Resource Issues – 2 hours
- Conflict Resolution – 1 hour
- Career Development – 0.5 hour
- Employee Assistance Program – 2 hours
- Resource Management – 0.5 hour
- Legal Issues – 4 hours
- Testifying in Court – 1 hour
- Job Knowledge – 1 hour
- Overview of all Commands in the Department – 10 hours
- Accreditation – 0.5 hour
- Strategic Planning – 0.5 hour

Total: 40 hours

APPENDIX E: CORE COMPETENCIES FOR SUPERVISORY AND HUMAN RELATIONS TRAINING

The following lists some of the competency points (learning objectives) for each of the human relations and supervisory skill areas identified in Chapter VIII. These core competencies can be integrated into training, promotional review or exams (civil service and exempt), and performance evaluation processes.

Team Building

Teamwork is the hallmark of the fire service. Research is overwhelming on the positive benefits that team-based organizations experience, such as improved productivity and morale. Moreover, a team-based approach provides a context for all employees, managers, officers and line staff to enhance their interactions with fellow workers.

Competency Points/Learning Objectives:

- Define effective teams and teamwork relationships in the department
- Understand the key ingredients of effective and high performance teams
- Identify specific benefits to improving teamwork
- Define the symptoms of ineffective teams
- Understand the obstacles to teamwork in the department and the specific circumstances when team relationships are most likely to break down
- Define measures that enhance performance and accountability
- Examine the significance of culture – when cultural differences matter
- Address problems involving cultural issues from a team based perspective
- Clarify the values that promote high levels of cooperation and interdependency
- Increase the levels of cooperation and effectiveness among department members
- Use planning methods to anticipate and address actual or potential obstacles facing the department
- Use a collaborative problem solving model to handle specific team issues

Effective Communication Skills and Strategies

The following are basic competency points in interpersonal communications for managers, officers and executives. The emphasis will be on understanding and addressing personal attributes and addressing areas that deter effective communication.

Competency Points/Learning Objectives:

- Analyze how one's own communication style and values affect interactions in the workplace
- Use communication skills for critical analysis of situations and problem solving
- Increase the understanding of personal issues and needs in order to minimize the potential for misunderstandings
- Build positive relationships between supervisory staff and employees
- Deal with the causes of problems rather than focusing on symptoms
- Establish clear work expectations regarding roles, functions and the chain of command
- Deal effectively and consistently with discipline issues
- Use communication skills in performance evaluations for "people building" and minimize perceptions of bias
- Handle the 'difficult people' challenge
- Increase motivation and morale

Leadership

Supervisory and management personnel are natural role models. On a day-to-day basis, they have significant influence throughout the department. Their leadership is crucial to successful performance of subordinate personnel.

Competency Points/Learning Objectives:

- Define the characteristics, skills, and qualities of effective leaders in the role of officer and manager
- Examine and address specific challenges facing leaders in fire service organizations

- Based on organizational vision and goals, develop leadership skills and strategies to move the department to a higher level of effectiveness and build employee morale and commitment
- Manage the shifting paradigm – the chain of command and the desire for employee participation
- Deal with one's responsibility, accountability and the need for follow-through
- Understand and manage ambiguity
- Enable managers to effectively work with, and be a leader to, all groups in the department
- Develop and commit to a personal leadership development plan
- Practice applying policies and standards fairly and consistently
- Discipline progressively and effectively
- Use evaluation as people builders
- Define the department's clients

Conflict Resolution

The ability to effectively resolve conflict is an essential management skill. Throughout their careers, managers and supervisors are confronted with minor and complex human relation situations that can escalate into serious grievances or litigation. It is imperative that supervisors and managers have the skills to effectively manage and resolve conflicts.

Competency Points/Learning Objectives:

- Learn about the dynamics of interpersonal, intergroup, and organizational conflict
- Identify common causes of conflict escalation
- Understand the significance of the four conflict management styles
- Assess one's own conflict management style and understand the implications for supervisors and managers
- Understand the typology of dispute resolution from negotiation to litigation
- Examine the nature and history of conflict in fire departments
- De-escalate conflict and make difficult situations more manageable
- Use the one-to-one conflict management model to address issues
- Use the peer mediation model to handle conflicts quickly as they arise

- Know how managers can function effectively in role as mediators
- Address cultural and gender based issues through conciliation or mediation management
- Effectively address complex discipline issues

Diversity

Cultural elements such as values, preferences, and assumptions are manifested in the everyday work environment. These elements can profoundly shape individual and organizational behavior. It is essential that supervisors and managers understand the elements of their own personal culture as well as those of their subordinates.

Competency Points/Learning Objectives:

- Understand how culture influences workplace relationships, assumptions, expectations, and choices
- Cultural genealogy: the history of ethnic and gender evolution and the issues that challenge each group (past and contemporary)
- Grasp the significance of one's cultural programming
- Understanding the department's culture
- Define how organizational culture affects who fits in or who does not
- Learn how diversity relates to individual and organizational performance
- Define aspects of the department's organizational culture that require change
- The subtle forms of bias – how minorities experience it from the majority, how the majority experiences it from minorities
- Understand and deal with intra-group issues
- Define differences between a clique and a support group. Who are in them? How are group dynamics and race relations affected?
- Identify expectations that are placed on managers and supervisors
- Clarify the values that promote high levels of cooperation and build on commonalties
- The importance of cultural ambassadorship

Supervision

Supervisors have a profound influence on creating a positive work environment. In addition to the competencies identified above, they must be proficient in a number of day-to-day skill and knowledge areas.

Competency Points/Learning Objectives:

- Understand the basic elements of supervision
- Create a positive work environment by fostering team based behaviors
- Learn to prevent and intervene in harassment and discrimination behavior
- Use performance evaluation systems as people builders
- Move from punitive to motivational models of supervision
- Understand progressive discipline as a tool for success
- The importance of documentation
- Understand when hard decisions must be made and the process for making them
- Deal with the issues of people shifting from peers to supervisors

Schedule

The above information can be used in developing training courses. The following table lists a minimum and preferred number of hours for each subject area based on experience in other fire departments:

Course Subject	Minimum Hours	Preferred Hours
Team Building	8	16
Communication Skills	8	16
Leadership	8	16
Conflict Resolution	8	16
Diversity	8	16
Supervision	16	24
Total	**56**	**120**

APPENDIX F: AEROBIC FITNESS AND FIREFIGHTING

One of the major underpinnings of firefighter fitness is the ability to take up and utilize oxygen. While the term aerobic is ubiquitous, understanding the kinetics and need for oxygen consumption does not appear to be universally understood within the fire service. The fact that there is an HFD requirement to demonstrate adequate levels of fitness of this construct (endurance) upon application is laudable. The basis for the exact standard is not clear. The validation report of Jeannerat & Associates appears to base the pass time upon normative data, rather than linking a standard to an empirical study.

Research investigating the occupational requirements for firefighting has been published in peer-reviewed literature for over 25 years. Some highlights:

Any physical activity involving the large muscles of the body for periods greater than 30 seconds requires energy supplied from aerobic metabolism stores. The greater the ability to take up and utilize oxygen, the greater the work output. Individuals with low levels of oxygen consumption are unable to perform arduous physical activity. Conversely, those with high levels of aerobic fitness have a resistance to fatigue that allows for high levels of work to performed for protracted periods of time.

Aerobic fitness is measured and expressed as a function of oxygen consumed per minute (liters per minute). It can also be expressed relative to body weight, in which case, the measure is milliliters per kilogram of body weight. Physical activity that requires movement of one's own body weight generally is used to demonstrate relative aerobic fitness. Running is one such event. We can reasonably extrapolate an individual's fitness level by knowing the rate of travel over a measured course.

Studies conducted in human performance laboratories allow us to utilize field expedient measures with precision, since the laws of thermodynamics can be extended to a number of types of physical activity.

Firefighting differs from running in that the individual performing tasks during suppression activities is encumbered with approximately 50 pounds of equipment. This is why a 1.5 mile run test has limitations in explaining, or predicting job performance. Individuals who are larger in stature are at a distinct advantage when performing external work since the personal protective ensemble represents a significantly smaller percentage

of their total body weight. For example, a 225-pound firefighter wearing 50 pounds of equipment has his efficiency reduced by 22 percent whereas a 150-pound firefighter is 33 percent less effective under the same conditions.

From a practical perspective, the 150-pounder must be more fit on an absolute basis than the 225-pounder in order to keep up. There is another benefit that comes with being larger irrespective of fitness. Size provides an advantage in the absolute amount of stored energy. This is why larger firefighters, who may appear to be less aerobically fit, can sometimes perform arduous work beyond their expectations: their reservoir of stored energy is simply larger due to body size.

Aerobic fitness will deteriorate if not used. While many believe that fitness declines with advancing age, what is really happening is application of the FIT principle. What you do not use, you lose. In order to maintain fitness, the cardiovascular system must be challenged. A minimum of 3 workouts per week must be performed in order to maintain cardiovascular fitness. If improvement is expected, four or more days of relatively intense conditioning must be administered.

The 1.5-mile run is simply a benchmark or status check. Ideally, the Houston Fire Department will adapt such a field expedient measure to determinate cardio-vascular fitness. While maintaining a reasonable level of cardiovascular fitness is not an iron-clad guarantee of sound medical health, it does come with a number of corollary benefits. Those individuals who routinely exercise have five times the chance of surviving a heart attack, should they have one- not bad when you consider that in most cases, the first symptom of heart disease is sudden death.

In summary, aerobic fitness is an essential ingredient in firefighter fitness. High levels of fitness allow firefighters to perform more work and reduce the effects of fatigue. They tolerate heat better Poorly fit firefighters are at increased risk of sudden death and heart attack, and increase the personal peril of becoming an injury statistic due to exhaustion and collapse.

A personal fitness program must include regular, systematic exercise involving the large muscles of the body for at least 20 minutes, preferably every day. Field tests, such as the 1.5-mile run are an excellent, cost effect and efficient method of determining cardiovascular conditioning.

APPENDIX G: APPLICATION DEVELOPMENT: STRATEGIES RECOMMENDED IN THE HFD SIP PLAN

1995 Data/Application Plan

Application development strategies include:

1. Utilize package software whenever possible. "It is a City-wide standard to use package software as the preferred means of satisfying functional requirements where appropriate." It is considered appropriate when a package can satisfy 70 to 80 percent of the requirements.

2. Clearly define the role of IS in packaged software procurement. Both HFD IS personnel and users should be involved in the selection process.[67]

3. Incorporate HFD design and other selection criteria into the software selection process. "Detailed design requirements are critical to a successful purchase." These must include functional and technical needs, City and HFD standards, integration standards, user requirements and vendor issues.[68]

4. Define standards for development, documentation, review, and backup and help ensure that all systems meet defined standards.[69]

5. Re-engineer work processes before system development whenever possible. "The IS Group should review the work processes to determine their importance and effectiveness with respect to the results that they generate. Processes that do not add value and are not effective should not be automated."[70] Both IS and user groups should analyze the processes.

[67] Ibid., Data/Application Plan, p. 3.
[68] Ibid., Data/Application Plan, p. 3.
[69] Ibid., Data/Application Plan, p 2.
[70] Ibid., Data/Application Plan, p. 4.

6. Utilize complementary application modules or fully integrated systems where possible. Integrate the information and applications between HFD and City-wide systems.[71]

7. Develop applications with complete user involvement and support. Users should be involved throughout the entire process of application development.[72]

8. Utilize a common application architecture for hardware platforms. HFD IS should develop and implement a standard application architecture (software structure) for all new systems. Standard components for data exchange, batch transaction processing, batch reporting should be developed. CASE tools should also be implemented. The Common Application Architecture should consist of custom reports and applications; package applications, function modules/common application code, local/wide area networks and open architecture operating system.[73]

9. Develop an office automation application infrastructure.[74]

10. Develop new applications or system enhancements in a standardized, modular, re-usable form.[75]

11. Utilize subject databases and develop custom interfaces to tie standalone applications together.[76]

12. Develop micro technology standards. This was recommended in the City SIP.[77]

[71] Ibid., Data/Application Plan, p. 4.
[72] Ibid., Data/Application Plan, pp. 4 & 5.
[73] Ibid., Data/Application Plan, pp. 5-7.
[74] Ibid., Data/Application Plan, p. 7.
[75] Ibid., Data/Application Plan, pp. 7 & 8.
[76] Ibid., Data/Application Plan, p. 8.
[77] Ibid., Data/Application Plan, pp. 8 & 9.

13. Maximize use of successful concepts and application systems from other fire departments.[78]

14. Take advantage of joint departmental application development project when appropriate.[79]

15. Maximize application integration to allow for data sharing.[80]

16. Integrate common applications and eliminate redundancies.[81] The steps included are:

    16.1 Enhance and integrate Run Records
    16.2 Enhance and integrate Fire Personnel Information
    16.3 Integrate Redundant Systems (Communication Equipment Repair, Supply, Fleet Maintenance, Hazardous Materials, Building Maintenance and City ADPICS and GFS Purchase Requisitions and Pos
    16.3.1 Integrated and enhanced Work Order Systems.
    16.4 Enhance and integrate Time Reporting.
    16.5 Provide for Document Management.
    16.6 Provide for management reports and sharing of information.

17. Establish procedures for use of current systems. Formalize user training and lessen data reconciliation, data from multiple systems and maintaining end user applications.[82]

[78] Ibid., Data/Application Plan, pp. 9 & 10.
[79] Ibid., Data/Application Plan, p. 10.
[80] Ibid., Data/Application Plan, p. 10.
[81] Ibid., Data/Application Plan, pp. 11-17.
[82] Ibid., Data/Application Plan, p. 18.