MITRE recommends that the HEC acquire a full test suite of equipment and software. At a minimum, the full test suite should include the same architecture configuration of the production system including CAD and RMS equipment and software as well as external equipment such as MDTs. The configuration should be used for the following:

- Functional and regression testing of major system upgrades.
- Functional and regression testing of maintenance software releases.
- Load testing of current configuration and to address possible growth.
- Interoperability testing of current and future changes to legacy and external systems.
- General troubleshooting and analysis.

6 Recommendations

The end-to-end performance of the City of Houston public safety system can be improved through the incorporation of short term technical solutions and long term strategic activities. Many of the recommendations are similar in overall scope to major goals and priorities identified in the "City of Houston Technology Investment Plan, Fiscal Years 2005 – 2009." The MITRE assessment independently identified solutions that can improve the performance of the existing public safety system. This section will identify the solutions and activities that should be taken by the City of Houston.

The first actions that should be taken are those that are needed to reduce the occurrences of major outages that have been experienced in the past. These actions include:

- Establish responsibility for end-to-end system management and integration.
- Eliminate single points of failure and establish effective automatic fail over.
- Increase system maintenance scope and time periods to provide a tiered 7x24 support team (technicians and public safety system help desk).
- Enhance HEC system performance monitoring and analysis.
- Enhance security ███████████████████████.
- Document current processes and incorporate formal configuration management and risk management processes.

MITRE recommends that the City of Houston appoint or identify at least two positions with overall responsibility for the end-to-end system management and integration of the public safety system. The first position would be responsible for the performance of all of the systems (i.e., network, radio, voice and computer) that support the full operations of public safety from call taking to emergency response as shown in Figure 6-1. The position would be responsible for resolving system integration issues, budget preparation, technical staffing, contact monitoring and direction, and other related management responsibilities. The second position would establish a lead program engineer to provide technical support to the management position. The lead program engineer would be responsible for resolving technical issues, overseeing system testing and performance monitoring, establishing and implementing engineering processes, and providing technical advise as necessary. These positions should not be established to replace or supplement current roles served by HEC, HPD, and HFD staff. On the contrary, they would support the Director of Public Safety in his responsibilities to oversee the operations of the public safety system. This recommendation requires increased personnel budget costs for the manager and engineer and is a recurring cost.
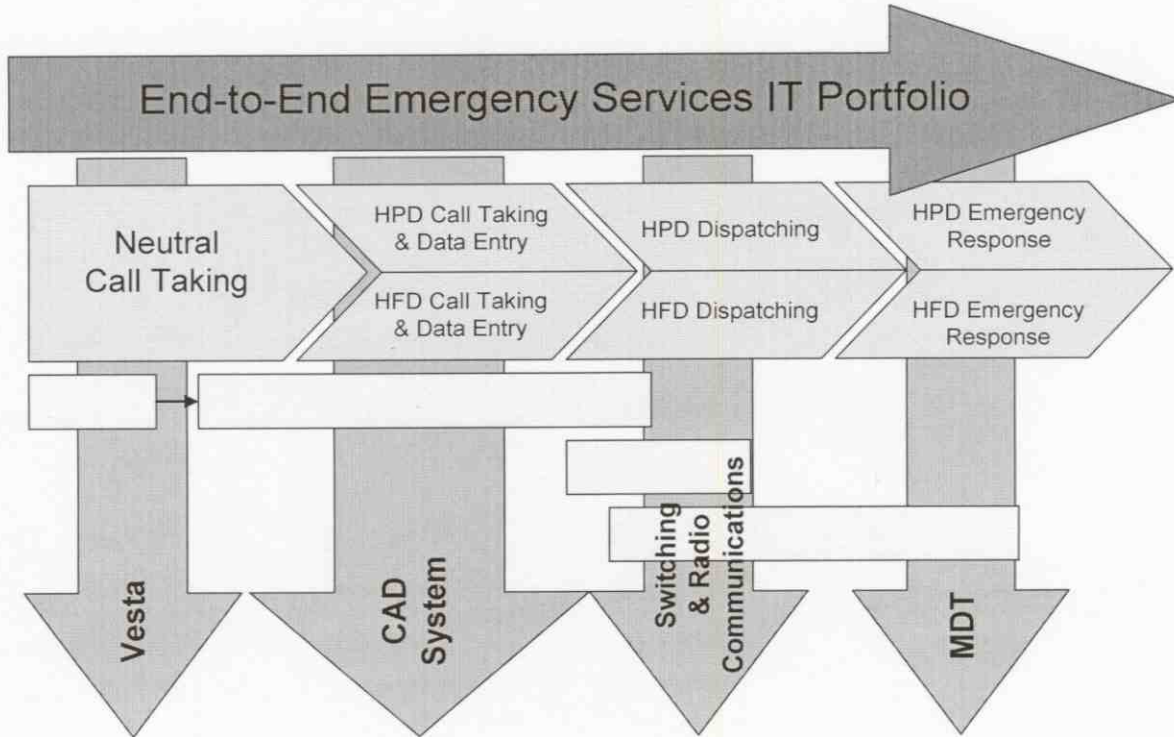
Figure 6-1. End-to-End Portfolio

MITRE recommends that the City of Houston immediately eliminate major single points of failure that could render the public safety system unavailable to HEC, HPD, and HFD users. The SANs and the integrated database should be upgraded ▓▓▓▓▓▓▓▓▓▓ as discussed in Section 3. Both of these components have caused major outages in the past and a failure in them could cause repeat occurrences. Some of the fixes may involve technical changes while others may incorporate new processes or procedures. This recommendation impacts one-time equipment cost during the year of purchase.

MITRE recommends that the City of Houston expand the maintenance contract to expand the equipment warranty coverage, help desk support, and 7x24 service. The City of Houston currently has basic support service and preventative maintenance under their current agreement with Northrop Grumman. The City of Houston should consider exercising the option to add corrective maintenance offered by Northrop Grumman or to obtain an equivalent service. This option would help to potentially resolve issues while the new system is still going through its early stages of operations. The estimated cost to add the expanded maintenance coverage above what the City of Houston currently has is approximately $550,000 annually.

MITRE recommends that the City of Houston enhance its system performance monitoring and analysis capability. The network monitoring tools discussed in Section 3 should be procured and operated to help monitor system performance and to support isolation of technical problems before they become major problems. In addition, the City should request the monthly and other reports required to be gathered by Northrop Grumman according to the Scope of Service and Maintenance Agreement to help analyze overall system performance. This recommendation requires a contract review with Northrop Grumman to determine if the tools provided by Northrop Grumman can meet the performance monitoring and reporting requirements. If not, then additional tools will need to be purchased.

The existing engineering processes should be documented and approved by the appropriate manager. In addition, the City of Houston should incorporate configuration management and risk management processes that can be applied to all departments. This recommendation requires development of formal policies and procedures. It impacts all departments current operations and requires personnel resources from all of them.

The next recommendations are intended to identify how the general system performance can be improved. They include:

- Measure and monitor the system's end-to-end availability.

- Develop end-to-end performance monitoring and analysis.

- Replace obsolete equipment and software. HEC should establish tighter control and tracking of equipment and software expected life through a formal configuration management process. At a minimum, the equipment identified as end-of-life in this report should be replaced.

- Enhance testing capabilities and processes.

- Identify and measure user and system performance statistics.

The current system availability requirements only apply to the CAD and RMS applications. Other failures can occur and cause long outages without consequence or requirements for immediate resolution. MITRE recommends that the City of Houston define and measure system availability to include all hardware, applications, software, communications systems and interfaces. The availability numbers should be based on the criticality of the system or function to the effective operations of the call takers and dispatchers. This recommendation

impacts current contracts and may require significant changes. It also impacts the budget for recurring warranty services and new equipment.

Performance monitoring and analysis are needed at all levels and for all parts of the system. MITRE recommends that each department have the capability to monitor and analyze the portions of the system that they primarily maintain and operate. This information should be shared to provide a City-wide view of system performance that can be analyzed and shared with all departments. This recommendation impacts current department operations and sustainment. It requires a significant financial investment and change in some staff roles.

All equipment and software should be tracked and monitored to identify possible end of life or obsolescence. This information should be documented and incorporated within the strategic planning and budgeting for new systems. The cost of this upgrade is for equipment that needs to be upgraded or replaced.

Northrop Grumman and HEC's testing role in incorporating new changes and upgrades need to be formally documented to ensure that complete testing occurs. The testing process needs to include the following tests: functional, regression, loading, and interoperability. In addition, the City of Houston should acquire and maintain a complete test configuration of the system. This test configuration should include all of the CAD, RMS, MSS, SANS equipment and software, as well as external systems, where feasible. This configuration will provide full testing capabilities and may also be an additional back-up system to the existing equipment. ██ This recommendation impacts recurring personnel costs for new staff role. It also impacts one-time equipment costs.

The current system has limited system and user performance requirements that need to be met throughout the life of the system. The City of Houston needs to define minimum performance requirements that need to be met and monitored. These requirements should identify the critical functions and performance times that must be sustained throughout the system life. Both the average and threshold performance parameters should be specified. This recommendation impacts contractual agreements. It requires new change order specifications or contract modifications to identify performance requirements.

The last recommendations are those that are needed to support the life-cycle of the system through operations and sustainment.

- Determine appropriate Contractor and City of Houston system operations and sustainment model.
- Develop end-to-end public safety strategic plan, architecture and roadmaps.
- Incorporate disaster recovery system and processes.
- Decrease application customization.

The current agreement and operations do not clearly specify the roles of contractors and the City of Houston to support an end-to-end system. This lack of understanding contributes to operations and sustainment performance issues. As a part of its overall strategic planning, the City of Houston needs to determine whether it will primarily use an outsourcing model for operations and sustainment or whether these skills will be developed in-house. Next, the City of Houston will need to specify with the contractors, the various roles and approach for achieving the model selected.

The City of Houston has developed strategic goals and plans for its information technology consolidation. MITRE recommends that a separate effort be focused on developing strategic goals, planning, and budgeting for the public safety system. This end-to-end approach should include the current system as well as all systems that rely on it.

MITRE recommends that the City of Houston develop a disaster recovery capability for the current data system. This capability should include the minimum equipment necessary for call takers and dispatchers to continue emergency services operations in the event the HEC facility equipment is not available.

The current system software has a large percentage of customized code. This customization matches the current operations of HFD, EMS and HPD. Over time, the degree of customization will affect the systems long-term performance and sustainment. Based on information that is widely accepted in the industry, most CAD systems are replaced every ten years. However, the software is usually updated periodically during this period as new software releases are made available. For those systems that are highly customized, agencies budget out year monies to port existing customizations to the vendor's latest software releases. Because of the additional out year costs, (integration services) associated with upgrading these one of a kind systems to the vendor's current software release(s), smaller locals and agencies tend to install the vendors base software offering from day one. Larger locals and agencies that have customized software and can afford these integration costs budget accordingly.

On the hardware side, users usually change out their hardware (servers, disk storage, routers/switches, and workstations) every three to five years depending on new technological breakthroughs, vendor discontinuation and support, or new configurations or new software capabilities that require newer hardware to function properly.

MITRE recommends that the City of Houston assess where customization can be decreased or eliminated. This assessment will evaluate the two primary functions that the customization supports. These functions include: fire and police tall taking and dispatch operations and (2) monitoring legacy systems.

Appendix A   Referenced Documents

1. Contract to PRC Public Sector, Inc., to Implement Consolidated Dispatching at the Houston Emergency Center, Request for Council Action, August 20, 2001
2. Houston Emergency Center Technology Management Plan, Arthur Andersen, May 15, 2002
3. Strategic Technical Plan For the City of Houston, Friday, July 20, 2001, Arthur Andersen
4. Policy to Direct and Monitor Technology Efforts, Executive Order No. 1-44 Revised, November 25, 2002
5. Agreement for the Purchase of Equipment and Licenses of the Police and Fire CAD System and Fire RMS/MIS Systems Software and Hardware and Provision of Services and Maintenance
   Attachments:

   1. Scope of Services

   2. Police MIS Database

   3. ANI/ALI Message Format

   4. Existing Police CAD Interfaces

   5. Racial Profiling Data Collection

   6. Workcard Data Collection

   9. Response Levels

   11. Emergency Alerting System

   12. TDH Trauma Reporting

   13. Quick Dispatch Requirements

   14. Resource Recommendation Procedure

   15. Highrise Documentation

   16. HAZMAT Documentation

   19. RMS Issues

   22. RMS EMS Field Layout

   23. Existing Keyboard Layouts

   24. Disposition Processing

   25. Personnel Accountability Review

26. HFD Running Schedule Regeneration Documentation

27. PSI Deliverables and Pricing

    a. PRC's Response to the City of Houston's Revised Scope of Services for Houston Public Safety Dispatch System

    b. CAD & RMS Acceptance Test Plans

    c. Acceptance Test Plan for Altaris® Fire RMS Implementation

    d. Cost Proposal

    e. Bill of Materials

    f. Compaq Value-Added Implementation Services

    g. Preliminary Project Schedule

    h. Training Plan

    i. Documentation and Manual Requirements

    j. Electrical Specifications

    k. Oracle Licensing Requirements

    l. Network Requirements

28. Payment Schedule

29. Maintenance Agreement

6. Approval of Change Order #1 to Contract With PRC Public Sector, Inc,. for Implementation of Houston Emergency Center Consolidated Dispatching System, Request for Council Action, July 16, 2003

7. City Of Houston Technology Investment Plan V1, Fiscal Years 2005 – 2009, Draft, December 10, 2004

8. HEC ITS FY04 Budget (1820)

9. Houston Emergency Center, Dress Rehearsal #2, August 12, 2003

10. Houston Emergency Center, Dress Rehearsal #3, September 12, 2003

11. HEC Go-Live Timeline, September 22, 2003

12. Police Call Processing Time Reports, September 2003 – November 2004

13. Monthly Report, Response Time by District, Priority One – Priority Three, January 2003 – November 2003

41. Houston Police Call Takers Attending Training, March – May 2003

42. Policies and Procedures

   HEC Acceptable Use Policy, Draft

   HEC Antivirus Update and Configuration Procedure, Draft

   HEC Change Management Policy, Draft V1

   HEC Data Backup and Recovery Policy, Draft V1

   HEC Desktop/Laptop Build Procedures, Draft V1

   HEC Intrusion Detection Standard

   HEC IT Department Security Policy, Draft V1

   HEC Network Access Policy, Draft V1

   HEC Password Standards Policy, Draft V1

   HEC Patch Management Procedure, Draft V1

   HEC Router/Switch Security Procedure, Draft V1

   HEC Systems Monitoring Policy, Draft V1

   HEC Third Party Equipment Standard, Draft V1

   HEC ███████████████████████████████

   HEC VPN Access Procedure, Draft V1

   HEC Windows 2000 Security Update Procedure, Draft V1

43. Security Assessment Report Findings and Recommendations, Strategic Network Consulting, July 26, 2004 and Supporting Material

44. Budgets 2003 – 2005

45. CAD Appendix F: PRC TCP/IP Protocol Specification

46. CAD Appendix G: Houston CAD Message Content Document

47. Functional Design Control Number, 001 – 071

48. City of Houston Houston Emergency Center Computer Aided Dispatch Server Configuration Information, October 22, 2004

49. City of Houston Houston Emergency Center Message Switching System Installation and Configuration, September 2, 2004

50. Altaris® CAD System Manager's Guide Prepared For Houston Emergency Center, February 2, 2004 – Draft