Pursuant of information that relates to critical infrastructure (Sec. 418.181 of the Government Code) and information that relates to security issues for computers (Sec. 552.139 of the Government Code), selected information has been withheld from public disclosure.

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MITRE TECHNICAL REPORT

End-to-End Houston Emergency System Performance and Process Assessment

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Executive Summary

The City of Houston began to consolidate its public safety emergency systems in September 2000 when the City Council approved a lease/purchase agreement formalizing the creation of the Houston Emergency Center (HEC) facility. This consolidation was part of Mayor Brown's management improvement initiatives in 1998[1]. The facility was designed to house the personnel and some, but not all, of the systems that supported the Houston Police Department (HPD), Houston Fire Department (HFD), and Emergency Medical Service (EMS) call takers and dispatchers operations. The Computer Aided Dispatch (CAD) system was one of the systems located in the HEC facility that supported common and shared call taking and dispatching operations. The new CAD was acquired through an upgrade to the existing HPD CAD system. This new system replaced both the HPD and HFD CAD systems and provided interfaces to external systems including the Greater Harris County 911 emergency network, the mobile data terminals (MDTs), and HPD Record Management System (RMS).

The CAD has experienced several major outages prior to and since system acceptance. These outages have led to concerns with the performance of this new system. The City of Houston executed a contract with The MITRE Corporation to conduct an end-to-end performance and process assessment of the new system. The scope of The MITRE Corporation effort was to analyze the performance and processes of the public safety data systems located at the HEC. The other data and radio systems were not included in the contract. The MITRE Corporation assessed the following:

- Existing contracts and other documents that defined system performance and whether these performance requirements were met.
- Technical design of the system and overall end-to-end performance.
- Existing processes that support the system performance.
- Technical solutions and engineering processes that were needed to improve performance.

The team assessed the report which initially described the new call taker and dispatcher operations written by Arthur Andersen in 2002. Arthur Andersen was engaged by the City of Houston to provide a Technology/Management Plan for the new consolidated Houston Emergency Center. The principal purpose of this engagement was to prepare an organization structure, combining the related organizations in a unified command concept, and to prepare a budget[1]. The plan showed the need for a new system to support the recommended consolidated operations. The decision was made not to replace all of the voice, data, network and computer systems at once. Instead, based on budget and other constraints, the decision was made to upgrade the central components,

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[1] Houston Emergency Center Technology Management Plan, 26 March 2002.

the CAD and RMS. The operations and management of the upgraded system was assigned to the city organization called the HEC. With the exception of the internal computer network within the HEC, the other public safety data and voice systems remained under the responsibility of the departments that operated and maintained them.

In general, MITRE's team findings focus on two constant themes. First, the public safety system needs additional resources and staffing to provide end-to-end management, sustainment and maintenance support. The team noted the high degree of customized code that was needed to support the identified operations and to provide the capability to interface to the external systems. The team also recognized many large cities and counties procure customized dispatch systems. However, customization typically requires long-term funding and resources, which have not been sufficiently provided for the City of Houston's public safety system. Second, the overall public safety system is not operated and maintained as a single homogeneous end-to-end system. HPD, HFD, HEC, and Information Technology Department (ITD) maintain separate systems that comprise the overall public safety communications system and departments work together to resolve critical issues. A homogeneous system would contribute significantly to performance enhancements.

The MITRE analysis began with the identification of performance requirements. The public safety system is comprised of the various systems managed by HEC, HPD, HFD and the ITD shown in Figure 1. There is not a single source document that specifies end-to-end performance requirements for all of these systems. With the exception of the CAD/RMS system, no formal requirement document exists for the systems. The majority of them are legacy systems that have been sustained by the City for a period of years. The HEC is responsible for managing the agreement with Northrop Grumman for the CAD, RMS, Message Switching System (MSS) and Storage Area Network (SAN). The MITRE team conducted an in-depth review of the requirements in the contract between the City of Houston and Northrop Grumman. The analysis of the contract showed the following:

- The majority of requirements contain: configuration specifications for the equipment, functional specifications to support call takers and dispatch operations, and specifications for network interfaces to the various voice, radio, and data legacy systems.
- The performance requirements primarily apply to the initial system design and to the acceptance test criteria. Thus, user response, system reliability, system monitoring, and engineering process requirements do not exist to sufficiently validate the current CAD/RMS performance against baseline requirements.
- The performance requirements primarily apply to the CAD application performance.

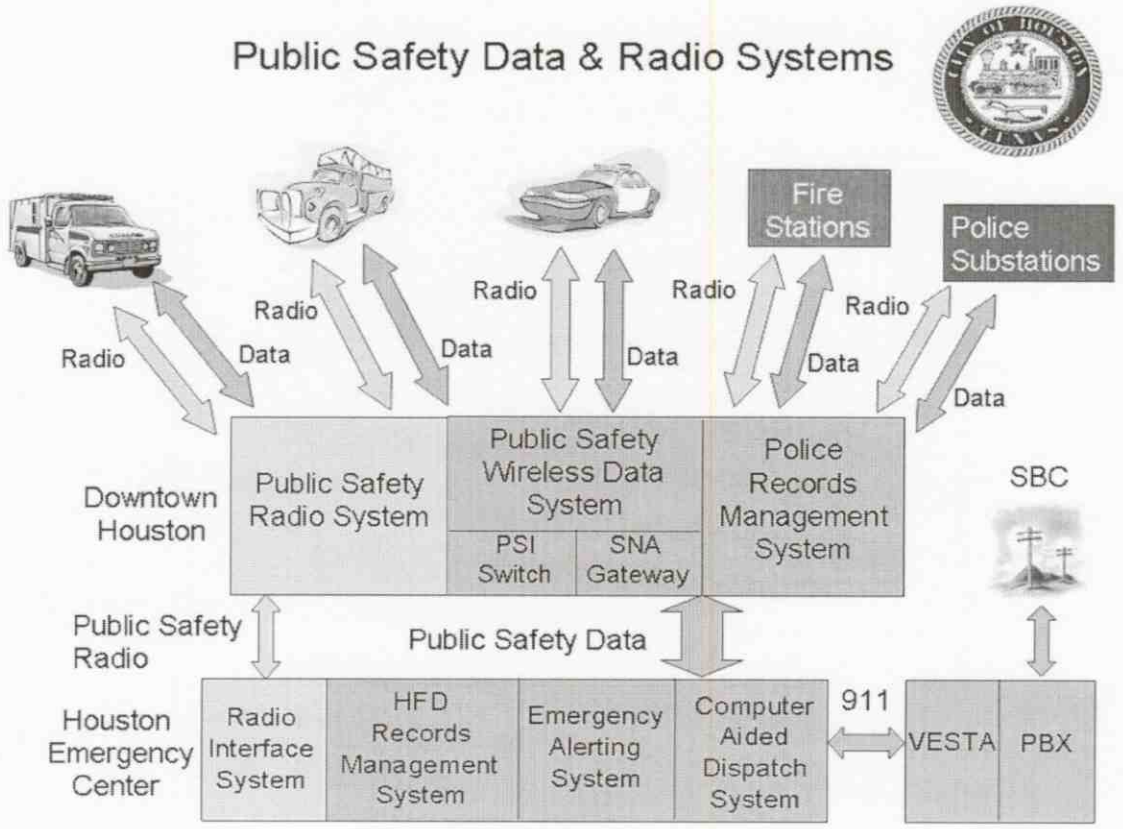

Figure 1. Public Safety Data and Radio Systems[2]

The team next evaluated the architecture and design of the current system. The evaluation showed that the systems' design reflects the requirements within the agreement between the City of Houston and Northrop Grumman as well as the current legacy systems architectures, the upgraded CAD/RMS, and SBC network. The team first assessed whether the failure of any equipment could lead to an outage that would prevent a large number of users from being able to access and use the system, referred to as a single point of failure. Several single points of failure were identified and analyzed. Where appropriate, technology or process changes were recommended to reduce the risk of outages due to failure of the equipment or system.

The team analyzed the architecture and design to identify equipment that may be at the end of its life. End of life means replacement parts cannot be obtained or the vendor has stated that the equipment will no longer be supported. The team identified equipment and software at its end of

[2] Drawing provided by HEC.

life that needed to be replaced. The team analyzed the security posture of the system by reviewing the security assessment conducted by Strategic Network Consulting (SNC) and assessing security vulnerabilities based on configuration information. [redacted] A back-up capability does exist to support call taking and dispatching voice and paper operations at another location. A concept of operations describes the planned operations and it identifies the need for data access to data resources.

After gaining an understanding of the requirements and the architecture, the MITRE team analyzed the performance of the system. The analysis included:

- Evaluation of the times that the system failed (i.e., outages).
- Determination of the system availability and reliability.
- Analysis of user and data performance.

The MITRE team was provided detailed summaries of the outages to the CAD that occurred prior to and after acceptance of the system. Outage was defined as the public safety dispatch system becoming unavailable to the majority of call takers and dispatchers. It did not include failures in the radio system. Ten of these outages occurred prior to acceptance and seven occurred after. The team noted that the frequency of the outages has decreased but that the time period of recovery of the outages increased. The analysis showed that the outages occurred for various reasons including equipment failure and human error. Further, the analysis showed that some incidents did not start from CAD directly, but they still caused CAD to be unavailable for operational use. The team recommended the following to prevent future outages:

- Elimination of major single points of failure.
- Expand system monitoring to identify and correct potential problems
- Increase staff skill base and training.

MITRE assessed the system availability and reliability of the HEC portions of the public safety system using the system outage data. The analysis calculated the system availability for the end-to-end system and the major subsystems, CAD, RMS, MSS, and SANs. The calculations showed that the system availability is approximately 99.7 while the CAD availability is higher at 99.8. Of the major systems, the SAN appears to have the highest rate of failure. The team provided suggestions for enhancing the overall and subsystems availability through better isolation of the CAD from other subsystems and component failures as well as improving the stability of the SANs. The team next calculated the daily availability figures for the major subsystems. This calculation showed that on seven days since system acceptance the availability has been less than 100%. Further, on three days the system was less than 80% available. The team recommends that a risk mitigation strategy be