OFFICE OF THE CONTROLLER

CITY OF PHILADELPHIA PENNSYLVANIA

800 MHz RADIO SYSTEM: REVIEW IN RESPONSE TO REPORTS OF USER DISSATISFACTION

DECEMBER 2005

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December 28, 2005

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The Controller's Office conducted a review of the city's 800 MHz radio system in response to reports of user dissatisfaction. This review was conducted pursuant to Section 6-400 (d) of the Home Rule Charter. The results of this review are contained in the attached report a synopsis of which is provided in the executive summary.

We have discussed the findings and recommendations contained in this report with representatives of Police and Public Property at an exit conference. Your administration's response to the findings and recommendations, submitted by the Public Property Commissioner, is included with our report. Our recommendations have been numbered to facilitate tracking and follow-up in subsequent years. We believe that, if implemented by management, these recommendations will improve system effectiveness and avoid future system-implementation problems.

We would like to express our thanks to the management and staff of the Department of Public Property, the department's consultants, Alta Management and RCC Consultants, and the management and staff of the Police Department and the Fire Department, for the courtesy and cooperation displayed during the conduct of this investigation.

Very truly yours,

JONATHAN A. SAIDEL
City Controller

cc: Honorable Anna C. Verna, President,
          and Honorable Members of City Council
        Members of the Mayor's Cabinet
        Commissioner Joan Schlotterbeck, Department of Public Property
        Commissioner Lloyd Ayers, Fire Department
        Commissioner Sylvester Johnson, Police Department

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Purpose

The Controller's Office conducted a review the 800 MHz radio system in response to reports of user dissatisfaction and system malfunctions. Our purpose was to determine if there was any basis to the complaints, and to develop recommendations for possible remedial action.

Background

In 2002, the city began the rollout of a new 800 MHz, digital, trunked, simulcast, radio system. The system was acquired from the Motorola Corporation at a cost of $54.8 million. Police officers began complaining about the radio system almost from the day the radios were handed out. Firefighters also reported problems. In addition to police and firefighter complaints, the system experienced numerous malfunctions, some of which were serious.

Results in Brief

Police and fire personnel have complained about radio-system malfunctions and about operating characteristics that cause them concern. Though problems do exist (for example, talkgroup busy signals), training and communication issues may have magnified those problems and fueled user resistance. The Controller's Office has identified actions that could improve system performance and help avoid user resistance to future system implementations.

Principal Findings

System configuration could increase the risk of busy signals.

The Police Department represents 75 percent of the radio-system's activity, yet the Police Department operates on 50 percent of the system's channels. The police-district talkgroups represent 90 percent of the activity of the police side of the radio system, yet the police districts operate on 16 percent of the department's talkgroups. The channel assignment has resulted in a channel load for the Police Department that is three times the channel load for the Fire Department and other municipal users. The talkgroup assignment has resulted in a talkgroup load for the busiest police districts that is nearly twice that of some other districts. The heavier the channel load, the less able a system is to meet spot demand during an emergency. The heavier the talk-

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group load, the more likely the user is to get a busy signal when he or she attempts to talk.

The city administration has informed us that they have recently acquired five additional channels for the Police Side of the system, that installation has begun, and that rollout is planned for June 2006.

MDTs represent an opportunity to reduce congestion on the police talkgroups.

Mobile Data Terminals (MDTs) have the potential to draw additional radio traffic off the airwaves. Transaction logs analyzed by the Controller's Office show relatively little MDT activity. Though the Police Department has informed us that the logs do not capture all of the MDT activity, the logs do make clear that some units are logging 20 times the activity of some others. Periodic analysis of all MDT activity, combined with unit reconfiguration to allow officers to respond to assist calls on their MDTs, could help reduce talkgroup congestion.

Training and communication issues may have magnified system problems and fueled resistance.

Problems experienced with the rollout of the new radio system may have been magnified by user resistance, but the users (particularly the police officers) had many issues of concern in the transition from the old to the new system. What may have aggravated this transition was police training that was substantially less in scope than the training received by the firefighters: some police officers received no training at all. In addition, police training did not address, or did not address in detail, issues that were likely to be stumbling blocks to system acceptance. Communication of policy changes may also have been an aggravating factor.

Fire personnel have fewer complaints but still have issues.

Among the most common complaints by firefighters have been excessive busy signals at the fireground, a malfunctioning "hot mic," and in-building and below-ground reception. The department has identified strategies to deal with the busy signals and has repaired the radios with malfunctioning hot mic's. Mobile, portable, and fixed repeaters can be used to improve in-building and below-ground reception. Mobile and portable repeaters have not been brought on-line because the technology has been in transition. Fixed repeaters (signal boosters that are part of a building's infrastructure), will require legislative action.

Though other jurisdictions are having radio-system problems, they do not appear serious	The Controller's Office contacted 34 government agencies around the country to follow up on press reports or word-of-mouth reports about radio-system problems. Though many told us of problems, most said that difficulties had been mitigated, or that they were "normal" for new systems, or that complaints had diminished as users became used to the new equipment.
Cell-phone interference is a concern that should be remedied shortly.	The city commissioned several studies to assess the extent of cell-phone interference in Philadelphia. The most recent study, December 3, 2004, identified 56 trouble spots and assessed the level of interference at each. The city's consultant claims success in mitigating the problem, and this claim is echoed by jurisdictions that we spoke to around the country. FCC regulations require NEXTEL, the largest source of this interference, to move out of the 800 MHz radio band. Philadelphia will be among the first jurisdictions in the country to benefit from this regulation.
The city has no documentation of pre-purchase site visits.	City personnel visited other cities prior to selecting the Motorola 800 MHz system. However, there is no documentation of any of these visits. Consequently, there is no record of whom the city officials spoke to (city management? police management? fire management? police officers? firefighters? EMTs?), what questions they asked, what responses they received, or how those responses affected their decision to acquire the specific system we now have.
RECOMMENDATIONS	To increase the effectiveness of the 800 MHz radio system and to avoid future system-implementation problems, the city administration should consider taking the following actions:

- Moving channels from the Fire/Municipal Side to the Police Side of the radio system if there is any delay in the rollout of the additional channels recently acquired for the Police Side.

- Increasing the number of talkgroups available to the police districts.

RECOMMENDATIONS - continued

- Replacing leased phones lines with microwave transmitter/receivers.

- Producing, on a periodic basis, reports that capture and analyze all MDT activity and using these reports to assess utilization and formulate policies to maximize it.

- Reprograming MDTs to allow officers to respond to assist calls made over the air.

- Providing enough training time to ensure that all relevant facts concerning new systems and equipment are introduced and reinforced.

- Requiring personnel attending training courses to sign in; reconciling sign-in sheets to personnel rosters; and retaining sign-in sheets for a suitable period of time. [Management should consult the Law Department as to what constitutes a suitable period of time.]

- Centralizing responsibility for ensuring that all personnel are trained.

- Ensuring that training programs address all operational characteristics of systems or equipment that could be stumbling blocks to user acceptance.

- Ensuring that policy changes are communicated through a standardized process that ensures communication to staff.

- Deploying analog repeaters and developing operating practices to ensure that fireground safety is not compromised when these repeaters are in use.

- Exploring alternatives for legislation that would require the installation of fixed repeaters in high-rise buildings.

- Documenting pre-purchase site visits and retaining the documentation.

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BACKGROUND

Project History and Rationale

In 1990, the city acquired a license from the Federal Communications Commission for the use of thirty 800 MHz radio channels. Four years later, the city began developing a plan for the replacement of its thirty-four-year-old analog system with a state-of-the art 800 MHz digital system.

The existing system had several serious shortcomings.

- **Limited capacity.** The system's channels were very congested, a characteristic cited as a contributing factor in the 1994 Eddie Polec incident.

- **Poor in-building coverage.** The system did not work particularly well in high-rise buildings, a shortcoming cited in the deaths of three firefighters in the 1991 Meridian Bank fire.

- **Poor citywide coverage.** The system did not provide signal coverage throughout the city, particularly for portable radios, which were becoming the tool-of-choice for public safety operations. Poor coverage resulted in numerous "dead spots."

- **No interoperability.** The system did not permit police and fire personnel to talk to one another, or city public safety personnel to speak to their suburban counterparts. The importance of interoperability was demonstrated during the 1985 Move incident, the 1982 Air Florida crash (Washington, DC) and the 2001 World Trade Center disaster.

In contrast, the new 800 MHz system would provide far greater capacity, citywide coverage (the system would be specifically designed for portable radios), improved in-building coverage, multi-level redundancy, push-to-talk ID (the system would be able to identify a "keyed" radio), prioritized transmission (certain callers would go ahead of others), encryption technology (prevention of eavesdropping by scanners), interoperability, and computerized diagnostics and alarms.

In 1994, the city advertised nationally, requesting that firms submit their qualifications to provide a radio system. The city received responses from three firms: Ericsson-GE Corporation, E. F. Johnson Company, and Motorola Corporation. A year later, the city issued a request for proposal to all three firms. Ericsson and Motorola responded; E. F. Johnson did not.

The city appointed a selection committee to evaluate the proposals. The committee included members from City Council, Police, Fire, Water, Public Property, Law, Procurement, and the Managing Director's Office. The committee, and the city's consultant, RCC Communications, unanimously selected Motorola for two reasons: (1) the system proposed by Ericsson was not in operation for public safety use anywhere in the U.S., and (2) Motorola's proposal was more detailed.

The city signed a purchase contract with Motorola in June 1999, and construction commenced. The system rollout began with the non-public-safety departments in the first quarter of 2002. The Fire Department went online in October 2002, followed by the Police Department.

Cost and Funding

The 800 MHz radio system cost $58.36 million. In addition to this cost, the city paid $3.60 million for three years of system maintenance.

COST OF 800 MHz RADIO SYSTEM		
(millions)		
Original contract price		$51.19
Change orders		
Additions	$7.61	
Credits	(3.99)	3.62
Amended contract price		$54.81
Consultants		3.55
Total system cost		$58.36
Maintenance years 1 - 3		$ 3.60

The cost of the system was financed primarily through a $1 surcharge on every telephone line in the city. Additional revenue came from Water and Aviation fund contributions ($11 million) and the sale of existing channels that were not suitable for radio-system use ($5 million).

The system the city purchased did not include coverage in the subway system because of insufficient funds. The cost of such coverage was estimated at $22 million.

System Problems

Police officers began complaining about the radio system soon after the radios were given out. The Fraternal Order of Police held a meeting in November 2002 to discuss officer concerns. Since that time, the complaints have included busy signals (the no-talk-over feature), key-up delays, dead spots, cell-phone interference, dead batteries, in-building coverage, below-ground coverage, and the loss of mobile (dashboard-mounted) radios.[1] [Note: Officers we spoke to indicated that the battery situation was much improved.]

Both the Fire Department and the firefighters' union admitted during Council testimony that the firefighters lodged far fewer complaints than the police officers. The union president admitted that he had had no complaints until complaints were solicited. However, among issues voiced by the firefighters were in-building coverage, below-ground coverage, excessive busy signals at fire locations, a non-functioning "hot mic" (emergency-call) feature, dead spots, and cell-phone interference.[2]

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[1] Complaints are discussed in published sources, Council testimony, and notes from focus groups.
[2] Complaints are discussed in published sources and Council testimony.

In addition to individual police and firefighters complaints, the system has experienced a number of malfunctions. Though several have been serious, most have not been severe. Among the more serious were the following:

> **March 25, 2004.** During a triple assist (citywide call for police backup), a dispatcher reported that his console, as well as the rest of the consoles in the room, locked up. The situation lasted three to three and half minutes. Two-way communication was interrupted.

> **May 18, 2004.** During a triple assist, a number of dispatch consoles, as well as officers on the street, began to experience system busies (no channel available for broadcast). There was limited communication between the officers and dispatchers because only half of the channels were available. The problem persisted for a number of hours.

> **July 9, 2004**. The system experienced intermittent breakup of communications. Officers sometimes had to repeat themselves; words were lost. The problem persisted from July 9 into July 11, 2004.

> **August 28, 2004.** During a assist-officer call pursuant to a running gun battle, a piece of communications equipment became overloaded. It switched to backup, causing a temporary loss of communications for the officers on the street.

In discussing system malfunctions, it should be emphasized that some have been attributed to problems with telephone lines rather than with Motorola equipment. Telephone lines connect the transmission towers with police and fire dispatch centers. Verizon Communications, the company that provides the telephone connections for the city's radio system, has taken responsibility for three of the system malfunctions.

It should be noted that despite the level of frustration with the radio system's malfunctions, city officials are in general agreement that Motorola has continued to work tirelessly with the city to identify the causes of the these malfunctions and to provide timely corrections.

Cell-Phone Interference

Cell-phone interference for public-safety radios systems operating in the 800 MHz band became public knowledge in 1999. "In April 2000, the Federal Communications Commission ("FCC") brought together representatives of commercial mobile radio service ("CMRS") providers and pubic safety communications officers to discuss the problem of interference between commercial mobile and public safety radio networks. The FCC stated that it had received an increased number of reports of interference to public safety radio networks in the 800 MHz band apparently resulting from the operations of nearby CMRS systems."[3]

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[3]The Association of Public-Safety Communications Officials – International, Inc., the Cellular Telecommunications & Internet Association, Motorola, Inc., Nextel Communications, Inc., and the Public Safety Wireless Network, *Avoiding Interference between Public Safety Wireless Communications System and Commercial Wireless Communications Systems at 800 MHz: A Best Practices Guide*, December 2000.

Cell-phone interference in the 800 MHz band emerged as a national problem at about the time the city signed its purchase agreement with Motorola (June 1999). This was nine years after the city acquired its 800 MHz channels (1990), and five years after the city began its 800 MHz development project (1994). By the time the problem became apparent, the city was well into the final stages of its radio project.

The speed with which the interference problem developed is apparent in the growth of wireless subscribers during the late 1990s. In 1995, one year into the city's quest for a radio-system provider, there were 33.8 million wireless subscribers in the United States. By 2000, one year into system construction, there were 109.5 million subscribers. By 2004, the number had grown to 180.5 million.[4]

The city had its first experience with cell-phone interference during the August 2000 Republican National Convention, and the city immediately met with NEXTEL, the suspected source of the interference, to discuss the problem. The city had its consultant, RCC Consultants, Inc., conduct a study of the problem from October 2000 through April 2001. RCC's "Preliminary Interference Report" was published in August 2001. The most recent RCC study, December 2004, identified 56 sites where interference was taking place.

What should be noted is that by the time the fire and police departments went online with the new radio system (late 2002), the cell-phone-interference problem was well-known to the public-safety community. (See finding #6 for a further discussion of the cell-phone issue.)

Terminology

Analog vs. digital radio system. An analog system converts sound vibrations into electrical vibrations that are reconverted into sound at the receiving end of the system. A digital system converts sound vibrations into a series of numbers (ones and zeros) that are reconverted to sound at the receiving end of the system.

Conventional vs. trunked radio system. Under a conventional radio system, users are assigned dedicated channels for their exclusive use. When a user, for example, police district A, is not using its channel, the channel sits idle. Under a trunked system, a device known as a controller assigns incoming messages to the first available channel. In this way, optimal use is made of existing frequencies. A trunked system allows an entity to operate on fewer channels.

Talkgroup. A talkgroup is a virtual channel. When transmitting over a radio, only the members of the talkgroup can communicate with one another. This kind of system configuration gives talkgroup members the impression that they have the exclusive use of a channel. In reality, however, hundreds of talkgroups are making use of a handful of actual channels.

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[4] Source: CTIA – The Wireless Association, as printed in the *NYT Magazine*, March 20, 2005.

OBJECTIVES, SCOPE, AND METHODOLOGY

The Controller's Office conducted a review of the 800 MHz radio system pursuant to complaints of user dissatisfaction and reports of system malfunctions. The purpose of our review was to determine if there was any basis to the complaints, and to develop recommendations for possible remedial action.

The scope of our review included the procurement process, the requirements of the purchase contract, the problems reported by police and fire personnel, and the city's response to those problems. The cause or causes of specific software or hardware malfunctions were outside our scope because the cost of such an assessment was the beyond the limitations of the Controller's Office operating budget.

Our work consisted principally of interviews of city officials and their consultants, a review and analysis of project documents, a review of the Motorola contract, various analyses of radio-system data, inquiries of city and county officials around the country, discussions with officials of the police and fire unions, and interviews of police and fire personnel.

Our work was conducted in accordance with *Government Auditing Standards* issued by the Comptroller General of the United States. Our fieldwork extended from September 2004 through May 2005.

1. SYSTEM CONFIGURATION COULD INCREASE THE RISK OF BUSY SIGNALS

The Police Department represents 75 percent of the radio-system's activity, yet the Police Department operates on 50 percent of the system's channels. The police-district talkgroups represent 90 percent of the activity of the police side of the radio system, yet the police districts operate on 16 percent of the department's talkgroups. The channel assignment has resulted in a channel load for the Police Department that is three times the channel load for the Fire Department and other municipal users. The talkgroup assignment has resulted in a talkgroup load for the busiest police districts that is nearly twice that of some other districts. The heavier the channel load, the less able a system is to meet spot demand during an emergency. The heavier the talkgroup load, the more likely the user is to get a busy signal when he or she attempts to talk.

How the System Functions

Talkgroups and Trunking. On the old 400 MHz analog system, police districts were, in general, paired on a single radio channel that only those districts could use. This arrangement was an inefficient use of resources because the channel sat idle when no one was speaking.

On the 800 MHz system, police districts are paired on talkgroups. A **talkgroup** is a virtual channel that gives the paired districts the allusion that they have their own channel. It is not evident to the user that he or she is actually sharing channels with users across the city.

The 800 MHz system is a **trunked system**, that is, it directs talk-group messages to the first available channel. In this way, the system ensures the most efficient use of all channels on the system.

No talkover. On the old 400 MHz analog system, police officers could talk over each other, that is, they could interrupt or "step on" an ongoing transmission if they had a priority or emergency message. The result would be a transmission that was difficult to understand, at best, or incomprehensible, at worst. The 800 MHz system does not permit talk over: only one person can talk at a time. If an officer attempts to talk while someone else is transmitting, that officer will receive a **busy signal**, that is, a **"busy bonk."** The idea behind "no talkover" is that if the system restricts itself to one message at a time, that message will be clear to the intended recipient. The consequence of no talkover is that competing users have to wait their turn.

The new radios do have a **priority** (**emergency or override) button** that will permit someone with a priority to override an existing transmission (that is, push it out of the way and take priority). However, misunderstanding of its appropriate use and its location on the radio's housing have presented a problem for some users. Also, one priority message cannot override another.

How the System Is Configured

General Configuration and Channel Distribution. The 800 MHz system is really two systems that exist side by side and use the same broadcast towers: the **Police System (called the B System or B side)** and the **Fire and Other Municipal Departments System (called the Fire/Municipal System, the A System, or A side).** Each system has 15 channels.

Most radios systems are configured as a single system used by all operating departments. The city's A and B configuration (two systems using the same infrastructure with each serving as backup to the other) is somewhat less common. Less common still is restricting the Police Department to one side of the system and all other city departments to the other side, except in the event of a system emergency. This configuration, coupled with a 50/50 channel split, has resulted is a channel allocation that is disproportionate to the activity on the two sides.

Figure 1				
800 MHz RADIO SYSTEM				
ACTIVITY AND CHANNEL ALLOCATION				
		System B		**System A**
		Police		**Fire/Municipal**
% of total activity		75%		25%
% of total channels		50%		50%

The effect of this channel distribution is evident in a review of system activity reports. The channels on the Fire/Municipal side show a **load (ratio of air-time used to air-time available)** of 14 percent. The channels on the Police Side show a load of 40 percent. The higher the channel load, the smaller the cushion available to meet spot demand in the event of an emergency. [The city administration has informed us that the load disparity stems from the fact that additional applications were planned for the Fire/Municipal side but these applications never materialized.]

For comparative purposes, the Controller's Office contacted the Baltimore, Maryland, Police Department. Baltimore has a system that is similar to Philadelphia's. City officials have visited Baltimore in the past to compare notes.

Baltimore has a 28-channel system, two fewer channels than in Philadelphia. However, Baltimore does not have the police segregated on one side of the system. Thus the police have access to 28 channels instead of 15, as in Philadelphia. The Baltimore police do share the channels with all other system users (fire and other agencies), but the channel load for all of the users is 28 percent, 12 percent lower than the load for the Philadelphia police.

The impact is apparent from a comparison of system busy signals (all channels occupied). When city officials visited Baltimore in August 2001, Baltimore officials indicated that they had experienced one system busy in 21 months. In July 2004, Philadelphia's system logged 469 system busies.

The city has applied to the Federal Communications Commission for an additional five channels for the Police Side. The city administration recently informed us that they have secured the five additional channels and have begun installation. Rollout is planned for June 2006. Because our

radio system has shown a propensity to malfunction under stress, it is imperative that stress be minimized. For that reason, we believe that if there is any delay in the rollout of the new channels, the city administration should consider moving channels from the Fire/Municipal Side to the Police Side of the system to balance the distribution of channel resources. [20805.01]

Talkgroup Distribution. A further potential problem for some police users is the assignment of talkgroups. The Police Department has 83 talkgroups or virtual channels, thirteen of which are assigned to the police districts. The police districts represent 90 percent of the activity on the Police Side of the radio system, yet the districts use 13 talkgroups, 16 percent of those available. Figure #2 illustrates the disparity between activity and talkgroup allocation.

FIGURE 2			
ACTIVITY AND TALKGROUP ALLOCATION			
POLICE SIDE OF RADIO SYSTEM			
		Police	**Other**
		Districts	**Police Units**
% of total activity		90%	10%
% of total talk groups		16%	84%

This allocation results in significant load disparities among the police talkgroups (see figure 3). The busiest district talkgroups are operating with a load that is nearly twice that of the slowest districts. Some non-district talkgroups have almost no load at all.

Figure 3		
LOAD ON POLICE TALK GROUPS		
JULY 2004		
Percent Load*	**Number of Talk Groups**	
40 - 45	4	**Police**
35 - 40	2	**Districts**
30 - 35	3	
25 - 30	3	
20 - 25	1	
		Other
15 - 20	0	**Police**
0 - 15	70	**Units**
Total	83	

*Figures should be read as follows: greater than or equal to 40% but less than 45%.

Note: Sixty talkgroups reported a load of less than 1%.

A load of 45 percent means that someone is on air 45 percent of the time, on average. "On average" means that there are times when the load can be higher or lower than 45 percent. The higher the load, the greater the likelihood of busy signals. A spokesman for the Police Department indicated during Council testimony on July 14, 2004, that talkgroup busy signals were the single most common complaint that officers had with the radio system.

The Fire Department is also beset by busy signals at certain times (multi-alarm fires) and during certain kinds of operations (medic runs). The department has addressed the problem of multi-alarm fires by spreading personnel over additional talkgroups at the fireground. The department is addressing the problem of growing medic traffic by creating a new talkgroup for medic use.

In should be noted that for July 2004, South Medic, the busiest of the medic talkgroups, reported a load of 31 percent. Nine of the police talkgroups had a load equal to or greater than that. We, therefore, recommend that the Police Department consider adding additional talkgroups for the busiest police districts to reduce their talkgroup load. [20805.02]

Problems with the A/B Configuration. As mentioned above, the city's A/B configuration is unique. Where this type of configuration is employed, the A and B systems are geographically adjacent; for example, they might serve the eastern and western portions of a state. Under such a system, radios affiliate (log onto) the A or B system as the user moves from one side of the state to the other. What makes Philadelphia unusual is that the two systems occupy the same geographic area and utilize the same towers. This has presented a problem when radios from the A side have attempted to affiliate with the B side, or vice-versa, for no apparent reason.

Though the ability of radios to roam from one side of the system to the other is considered an element of system redundancy (radios can move from one side to the other if one side shuts down), it can present a operational problem when radios spontaneously move in an affiliation stampede for no apparent reason. This can result in the malfunction of system components or in the overload of the side to which the radios are drawn.

The city administration has informed us that the radios have been adjusted to reduce their sensitivity and that the roaming problem has been solved.

Problems with Phone lines. The city's radio system uses leased phone lines to connect the transmission towers with the police and fire dispatch centers. These phone lines have, on several occasions, been the source of radio-system malfunctions.

An alternative approach to connecting the towers and dispatch centers is microwave transmitter/receivers. Though installation of microwave transmitter/receivers would cost between $2 and $3.5 million, we believe the cost would be justified if it eliminates the risk of phone-line-related system malfunctions.

We, therefore, recommend that the city consider replacing its leased phone lines with microwave transmitter/receivers. [20805.03]

2. MDTs REPRESENT AN OPPORTUNITY TO REDUCE CONGESTION ON THE POLICE TALKGROUPS

Mobile Data Terminals (MDTs) have the potential to draw additional radio traffic off the airwaves. Transaction logs analyzed by the Controller's Office show relatively little activity. Though the Police Department has informed us that the logs do not capture all of the MDT activity, the logs do make clear that some units are logging 20 times the activity of some others. Periodic analysis of all MDT activity, combined with unit reconfiguration to allow officers to respond to assist calls on their MDTs, could help reduce talkgroup congestion.

Background and Activity

An MDT is a laptop computer mounted in a patrol car that communicates with police dispatch via a cell-phone network. By utilizing an alternate communication system, MDTs help to reduce the volume of voice traffic on radio channels. The city installed MDTs in the mid-1990s in response to concerns about channel congestion.

The Controller's Office investigated the issue of MDTs because of their potential to reduce radio traffic and, therefore, mitigate the problem of busy signals, an issue voiced by many officers. A spokesman for the Police Department indicated during Council testimony on July 14, 2004, that the Police Department recognized MDTs as one possible solution to the radio-system complaints.

To determine the extent of MDT usage, the Controller's Office requested reports on MDT activity. Figure 4 summarizes the "transaction log" for January 2005. About one-third of the units reported fewer than 50 transactions for the month. Two-thirds reported fewer than 200 transactions for the month. By contrast, 26 units reported more than 1,000 transactions, and one unit reported nearly 3,000.

Figure 4 MOBILE DATA TERMINAL (MDT) USAGE JANUARY 2005					
Transactions*			**# of MDTs**	**% of MDTs**	**Cumulative Percent**
0	-	50	286	37%	37%
50	-	200	218	28%	66%
200	-	400	127	17%	82%
400	-	600	70	9%	91%
600	-	800	25	3%	95%
800	-	1000	16	2%	97%
1000 or more			26	3%	100%
Total MDTs			768	100%	
Minimum usage			2		
Maximum usage			2,925		
*Read: Greater than or equal to zero, but less than 50.					

The Police Department informed us that the transaction logs do not capture all MDT activity. However, even if there is substantial activity that the logs do not capture, the activity they do capture shows that some units (a relative handful) are logging 20 times the activity of some others, units that represent a third of all the MDTs deployed. Moreover, if all of the MDT activity is not being captured and analyzed on a regular basis, an opportunity to reduce radio traffic may be overlooked.

We believe that the Police Department should consider producing, on a periodic basis, reports that capture *and analyze* all MDT activity. Such reports could be used to assess utilization and formulate policies to maximize it. [20805.04]

MDTs and Assist Calls

The December 2004 edition of *The Peace Officer*, the FOP newsletter, included a very informative article on common problems with the 800 MHz radio system. Regarding the problem of getting on the air during emergencies (specifically during assist-officer calls), the article posed the following question:

> If you hear 10 officers responding to an assist call and you are the eleventh, is it more important that you tell radio that you are 'in' on the job [that is, that you are responding to the call] or is it more important that you just go in and leave the airwaves free in case the officers actually involved in the assist need the air?

This question identifies two alternatives: responding to the call after voice acknowledgement or responding to the call without voice acknowledgement. Given that reducing on-air traffic is the MDT's reason for being, we questioned the Police Department about why the MDT was not cited as an operational alternative during assist calls, when a critical communication concern is keeping people off the air.

The Police Department explained to us that the reason the MDT was not cited as an alternative is that the department's MDTs are not programmed to allow officers to respond to nonspecific calls. Officers can only respond on their MDTs to jobs that are specifically directed to them via their MDTs; they cannot respond to general alarms broadcast over the air.

Regarding busy signals during assist calls, a spokesman for the Police Department said the following during Council testimony on July 14, 2004:

> I [can] tell you that — and it almost always happens in every big incident that we have, every assist. Every assist that's an issue. Every double or triple assist, I almost always hear complaints at my level that they're complaining that they can't get in [can't get on the air]. *And it's true; they can't get in*. [Emphasis supplied]

Because assist calls represent an exceptional demand for radio resources, and because MDTs could help reduce that demand, we recommend that the Police Department explore the possibility of programming their MDTs to allow officers to respond to general assist calls made over the air. [20805.05]

3. TRAINING AND COMMUNICATION ISSUES MAY HAVE MAGNIFIED SYSTEM PROBLEMS AND FUELED RESISTANCE

Problems experienced with the rollout of the new radio system may have been magnified by user resistance, but the users (particularly the police officers) had many issues of concern in the transition from the old to the new system. What may have aggravated this transition was police training that was substantially less in scope than the training received by the firefighters: some police officers received no training at all. In addition, police training did not address, or did not address in detail, issues that were likely to be stumbling blocks to system acceptance. Communication of policy changes may also have been an aggravating factor.

Importance of Training

The consulting firm Booz Allen & Hamilton performed a study of 800 MHz systems at the request of the United States government. In their March 1998 report, Booz Allen had the following to say with regard to the importance of training in successful implementation of 800 MHz systems:

> The 800 MHz radio systems are state of the art technology. As with any new technology there is an inherent transitional 'learning curve.' User education and training for the new radio systems are critical components (emphasis supplied) to a successful transition to, and implementation of, an 800 MHz system. . . .[5]

> Many system users and administrators who had moved to 800 MHz systems identified education and training as a significant operational problem. Often, this was attributed to computerized technology so radically different from any previous radio technology that the learning curve is exceptionally steep.[6]

Motorola, the manufacturer of the city's new 800 MHz radio system, recommended 1½ to 3 hours of training for end-users, depending on class size and user experience level. Training for the city's firefighters consisted of two four-hour training sessions: an introductory session and a refresher two years later. Philadelphia police saw a twenty-minute video at roll call. The department informed the Controller's Office that the video was supplemented with instruction by supervisors who had previously attended a four-hour training session. The nature and extent of this supplemental training is unclear.

The adequacy of police training was an issue that surfaced during focus groups conducted by the Police Department in the fall of 2004. Officers present expressed the view that the radio-system training was inadequate or nonexistent. Ten percent of the officers present claimed they had never seen the training video. This oversight might be due to the fact that the Police Department did not require officers to sign in, that is, the department maintained no record of who was trained and who was not. [NOTE: The Fire Department did require attendees to sign in, but the

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[5] *A Study to Assess the Relative Merits of Spectrum Around 800 MHz as an Operating Frequency Band for Public Safety Communication,* Booz Allen & Hamilton, March 23, 1998, p. 10.
[6] Ibid. , p. D-23.

sign-in sheets were discarded after the attendance was posted to the department's training database.]

Resistance to Change

In published reports, the city administration expressed the view that problems with the radio system were overblown. During Council testimony, the administration suggested that police officers were resistant to change, a view that was seconded by the Fraternal Order of Police.

It is quite possible that *some* system problems were overblown. For example, officers complained that the new radios did not work in the subway. The Controller's Office participated in a test of the radio system in the subway areas around City Hall. The radio worked in all but a handful of locations, despite the fact that Motorola makes no warranty the system will function underground.[7]

Given the many issues of concern to police officers in the transition from the old radio system to the new (delayed response, busy bonks, out-of-range bonks, cell-phone interference, battery failures, loss of mobile radios, and system malfunctions), the resistance factor for the new system was likely to be quite high. Though some resistance to new systems is unavoidable, its effects can be mitigated through training (making sure that users know how the equipment operates) and by explaining the equipment's characteristics and the rationale for management decisions.

In reviewing the 800 MHz training materials, auditors noted that certain potential sources of user anxiety were either not addressed or not addressed in detail:

- Cell-phone interference. Though this issue surfaced in 1999 and was expected to worsen, there was no discussion of it in the training materials for either the Police Department or the Fire Department.

- "No talkover." This feature is mentioned in the training materials, but what is not mentioned is why no talkover (and its attendant busy signals) is a safety feature and not a safety issue. A discussion of the downside of talkover (incomprehensible transmissions), audio examples of garbled talkover messages, and an explanation of the false sense of security associated with talkover would have been helpful.

- Limitations of the new radio system. This matter was included in the Fire Department's training but not in that of the Police Department. The PowerPoint presentation for police supervisors explained that the new system achieved a 99.6 percent success rate during coverage testing. However, the presentation did not explain that Motorola provided no assurance with regard to coverage in elevators, stairwells, basements, tunnels, bank vaults, jails, x-ray rooms, or facilities or locations shielded by metal walls or with heavy

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[7] The radio was tested in the Suburban Station concourse and on the train platform; in the Broad Street and Market Street concourses; in the 13th Street, 15th Street, and City Hall subway stations; and in the pedestrian tunnels connecting these various areas. The radio worked everywhere except the City Hall subway platform and in those tunnel areas where there were no stairways or airshafts, that is, no portals to the street. The test did not extend into the train tunnels.

construction or with no windows or doors. The 2004 focus groups noted that officers did not appear to understand where the system would work.

- Loss of mobile radios (unique to the Police Department). Training materials did not explain that the old portable radios did not work well because the old radio system was not designed to support portable radios. Furthermore, the new portable radios were expected to work considerably better because the new system *was* designed to support portables. Misunderstanding of this issue became apparent during the 2004 focus groups.

- Key-up delay. The Police Department testified before City Council that problems with this feature were anticipated. Booz Allen reported that this feature presented a stumbling block in other jurisdictions.[8] The Police training video explains that the delay exists and why it exists; but it does not explain that it has been a problem in other jurisdictions, that concern about it is unwarranted because it only lasts a half second, and that the key-up delay and busy-signal delays are not the same thing.

- Battery life. The Police training video mentions that the radio batteries would work for 10 to 12 hours, but it does not explain how this level of performance had been achieved. It might have been helpful for the officers to know that city officials had researched the issue in a city that used portable radios exclusively (Baltimore, Maryland) and, acting on advice from Baltimore officials, secured high-performance batteries that would cover more than 8 hours of continuous use.

Addressing these issues head-on in training might have reduced user anxiety.

Communication

Given the fact the 800 MHz radios have a priority button that allows officers to override existing transmissions, it was difficult for us to understand the level of frustration with busy signals. In conversations with city officials and their consultants, we learned that the title for the priority button had been changed twice. The first designation was "assist button." The Police Department realized that this was a mistake because officers might have a priority message to transmit and not require the assistance of other officers.

In the training video, the button is referred to as an "emergency override button." The department soon realized that this was not a good idea because officers were reluctant to use the button if they didn't consider their situation a bona fide emergency. The name was finally changed to "priority button" and officers were encouraged to use it whenever they felt they needed priority access to the air.

Realizing the significance of these title changes, we asked the Police Department how these changes were communicated to the staff. We were directed to an article in the *Peace Office*, the FOP newsletter, for December 2004. The article did explain in detail how the title of the button had evolved over time and what the current department policy was concerning its use. However, explaining a policy like this in a union newsletter presupposes that all officers religiously read it.

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[8] Booz Allen and Hamilton, pp. 9 and D-23.

For those who do not, a critical piece of information regarding the use of the priority button would be missed, and a partial solution to the nagging problem of busy signals would be lost. A communications glitch could add to frustration and fuel resistance to the new system.

Recommendations

To reduce user resistance to the implementation of new systems and equipment, management should

- Provide enough training time to ensure that all relevant facts concerning new systems and equipment are introduced and reinforced. [20805.06]

- Require personnel attending training courses to sign in. Sign-in sheets should be reconciled to personnel rosters and retained for a suitable period of time. Management should consult the Law Department as to what constitutes a suitable period of time. [20805.07]

- Centralize the responsibility for ensuring that all personnel are trained. [20805.08]

- Ensure that training programs address all operational characteristics of systems or equipment that could be stumbling blocks to user acceptance. [20805.09]

- Ensure that policy changes are communicated through a standardized process that ensures communication to staff members. [20805.10]

4. FIRE PERSONNEL HAVE FEWER COMPLAINTS BUT STILL HAVE ISSUES

Among the most common complaints by firefighters have been excessive busy signals at the fireground, a malfunctioning "hot mic," and in-building and below-ground reception. The department has identified strategies to deal with the busy signals and has repaired the radios with malfunctioning hot mic's. Mobile, portable, and fixed repeaters can be used to improve in-building and below-ground reception. Mobile and portable repeaters have not been brought on-line because the technology has been in transition. Fixed repeaters (signal boosters that are part of a building's infrastructure), will require legislative action.

Busy Signals and Hot-Mic

Just as with the police officers, the firefighters have been plagued by busy signals on the new radio system. During a three-alarm fire this past fall, the Fire Communications Center logged more than 1,000 busy signals in a four-hour period. During the busiest part of the fire, the radio system was logging busies at the rate of 1 every 2.3 seconds.

The Fire Department believes that this problem can be addressed by making more of its existing talkgroups available to firefighters during major incidents. In this way, the radio traffic on each talkgroup will be reduced. In addition, the Fire Department intends to create an additional medic talkgroup to reduce the rate of busy signals on the medic channels.

"Hot mic" refers to a feature of the 800 MHz radio that provides ten seconds of airtime to a firefighter who depresses his or her emergency button. The radio's microphone opens without the user having to key the push-to-talk button. The Fire Department was finding that when the emergency button was pushed, an emergency was declared on the dispatch console, but the radio microphone was not opening.

The Fire Department has advised the Controller's Office that all of the malfunctioning radios have been repaired and that this issue is now resolved.

In-Building and Below-Ground Coverage

Among the complaints most frequently voiced by firefighters have been problems with in-building and below-ground coverage (e.g., basements and subways). Because the radios currently in use are not guaranteed to work in interior areas shielded from radio signals or in any below-ground areas, addressing these complaints will probably require system enhancements.

After the World Trade Center disaster, the New York City Fire Department retained the management consulting firm of McKinsey and Company to develop recommendations for improving emergency response. Among the McKinsey Report's recommendations were several for improving in-building and below-ground coverage. Among the equipment recommendations were portable and mobile repeaters and fixed, building-specific repeaters.[9]

Mobile and portable repeaters. Mobile (vehicle-mounted) and portable (suitcase-type) repeaters are devices that amplify radio signals to boost in-building and below-ground reception. These devices have been around for some time. Washington, D.C., which has an 800 MHz system very similar to Philadelphia's, has been using repeaters for years.

The Philadelphia Fire Department has not moved forward with mobile or portable repeaters because the devices currently available are analog, that is, they can only be accessed by radios operating in the analog mode. The radios the department is currently using can operate in the analog mode, but, when doing so, an important feature of the radios is lost. When the emergency button is depressed, an emergency condition is not signaled on the dispatch console; the condition is only signaled on the screen of radios operating at the fire ground. Thus the alarm signal is not as emphatic as when the radio is operating in the digital mode. For this reason, the department thought it best to defer consideration of mobile and portable repeaters until such time as digital repeaters became available, sometime late in 2005 or early in 2006.

The Fire Department has recently been advised that the model radio it is currently using (the XTS 3000), will not be compatible with the new digital repeaters. To use a digital repeater, the department would have to replace all of the radios currently in inventory.

The department has tested an anlog repeater and has found that it works very well. Because this is the only kind of repeater currently compatible that will work with the XTS 3000 radio, we believe that the department should give serious consideration to deploying such a repeater and

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[9] McKinsey and Company, *McKinsey Report – Increasing the Fire Department of New York's Preparedness*, August 2002, pp 90–91.

developing operating practices to ensure that fireground safety is not compromised when the repeater is in use. [20805.11]

Fixed, building-specific repeaters. Fixed, building-specific repeaters (signal boosters) are devices that are built into high-rise structures to provide radio coverage throughout the building. Around the United States, at least 23 jurisdictions have ordinances, policies or codes that require signal boosters or permit them as alternatives to other fire-safety measures. Some require the devices for new buildings only, while others require them for any building that impedes radio transmission.

According to McKinsey, fixed repeaters are relatively inexpensive to install in new construction: between $.30 and $.60 per square foot. Based on this estimate, a fixed repeater for the Comcast Center would cost between $400,000 and $800,000 or between 0.09 percent and 0.18 percent of construction cost. The cost-impact on the owners of existing buildings would have to be explored, but certainly a compromise could be reached based on the size, location, and age of the structure.

We recommend that the city administration work with City Council to explore alternatives for legislation requiring the installation of fixed repeaters in high-rise buildings. [20805.12]

5. THOUGH OTHER JURISDICTIONS ARE HAVING RADIO-SYSTEM PROBLEMS, THEY DO NOT APPEAR SERIOUS

The Controller's Office contacted 34 government agencies (see figure 5) to follow up on press reports or word-of-mouth reports about problem radio systems. We also contacted several agencies that we knew were not using 800 MHz systems to find out why.

What we anticipated finding was agencies with problems similar to or worse than those being experienced by the city of Philadelphia. What we did find was something quite different.

Of the 34 agencies, 30 were using 800 MHz systems; of those, 23 were Motorola and 5 were M/A-Com (formerly Ericsson). Two did not disclose their vendors.

Twenty-one agencies told us they were having problems with cell-phone interference, but 11 (more than half) told us they had been able to mitigate the problem by working with local wireless carriers to, among other things, reduce the power of the wireless transmissions or get the carrier to change frequencies. One spokesperson who told us his agency had not been able to reduce cell-phone interference still told us his agency was happy with its radio system.

Figure 5
AGENCIES CONTACTED

Jurisdiction		Agency	Jurisdiction		Agency
Abington	PA	PD	Los Angeles	CA	PD
Anne Arundel Co	MD	FD	Miami	FL	PD
Anne Arundel Co	MD	PD	Montgomery Co	PA	EDS[3]
Atlanta	GA	PD	Montgomery Co	MD	PD
Atlanta	GA	FD	New Orleans	LA	PD
Austin	TX	FD	Orange Co	CA	PD
Baltimore	MD	PD	Phoenix	AZ	FD
Boston	MA	FD	Phoenix	AZ	PD
Chicago	IL	OEMC[1]	Portland	OR	PD
Cleveland	OH	PD	Rehoboth	DE	PD
Cleveland	OH	FD	Seattle	WA	PD
Cleveland	OH	ORC[2]	Seattle	WA	FD
Denver	CO	PD	State of Delaware	DE	DSHS[4]
Fauquier Co	VA	PD	Trenton	NJ	PD
Honolulu	HI	PD	Upper Merion	PA	PD
Kansas City	MO	FD	Washington	DC	FD
Los Angeles	CA	FD	Washington	DC	PD

[1]OEMC = Office of Emergency Management and Communications

[2]ORC = Office of Radio Communications

[3]EDS = Emergency Dispatch Services

[4]DSHS = Department of Safety and Homeland Security

Twenty agencies described other problems, chiefly deficiencies with in-building and below-ground coverage, dead spots, and generalized coverage issues. These problems had been mitigated with, among other things, fixed and mobile repeaters, additional towers, additional equipment, or newer equipment. No agency that had added equipment indicated that the vendor had sold the agency less equipment than was needed. One agency emphatically stated that the coverage problem was not the vendor's fault. The vendor sold them exactly what they had asked for: on-street coverage. But when users began to complain, the system infrastructure had to be expanded.

Two agencies reported system malfunctions. One indicated it was having "failsoft" problems (system going to backup); the other reported four system malfunctions over a 15-month period. A spokesperson for the first agency told us that, despite its problems, the system was working effectively and there were few complaints. A spokesperson for the second agency indicated that the system performed well and was a great improvement over the agency's old system.

Seventeen agencies (over half of the agencies with 800 MHz systems) told us they were satisfied with their systems. The others did not indicate they were dissatisfied; they were just noncommittal. Two of the agencies told us they were reluctant to talk about their problems.

A number of agencies told us the problems they were experiencing were "normal" or were "not serious." Others told us that complaints had diminished as personnel had gotten used to the new system. One indicated that coverage was "excellent."

There were some dissenting voices among the agencies who were not using 800 MHz systems. Among the four we spoke to, three told they had no intention of going to 800 MHz. The reasons cited were cost, cell-phone interference, and safety.

Though most of the agencies told us they were having problems of one kind of another, not one of the agencies told us it was having serious problems with an 800 MHz system.

We should also point out that, as part of our review, we attempted to solicit information from police and fire unions in other jurisdictions. We even enlisted the cooperation of the Philadelphia Fraternal Order of Police and Local 22 of the International Association of Firefighters. Though one or two individuals expressed generalized dissatisfaction, not one police officer or firefighter related any specific information about a problem radio system.

6. CELL-PHONE INTERFERENCE IS A CONCERN
     THAT SHOULD BE REMEDIED SHORTLY

Probably no issue regarding the 800 MHz system has received more publicity than cell-phone interference, a phenomena that can result in dead spots, that is, areas of reduced radio coverage.

The city commissioned several studies to assess the extent of cell-phone interference in Philadelphia. The most recent study, December 3, 2004, identified 56 trouble spots and assessed the level of interference at each.   A summary of those assessments, from least severe ("intermittent") to most severe ("substantial"), is presented in figure 6.

Figure 6
INTERFERENCE ASSESSMENTS
DECEMBER 3, 2004

Assessment	Number of Sites	
Intermittent	25	44.6%
Notable	12	21.4%
Substantial	19	33.9%
	56	100.0%

Given the fact that the level of interference depends on the proximity to a problem site and the severity of interference at that site, it is quite possible that one system user might perceive interference as a significant problem while another individual might not.

RCC, the consultant that prepared the December 2004 study, concluded that most of the interference issues could be resolved at many of the existing sites. RCC maintains that the city has achieved some success already. These assertions are consistent with findings from our discussions with other government jurisdictions.

Regardless of the extent of cell-phone phone interference and the city's success in mitigating it, the cell-phone problem is expected to be resolved in the near future. Under an FCC plan (the Consensus Plan), Nextel, the carrier most frequently associated with cell-phone interference, will swap its 700 MHz and 800 MHz frequencies for frequencies in the 1.9 gigahertz band. Nextel will then cover the costs of retuning and upgrading public-safety radio systems around the country. In other words, Nextel will vacate and reconfigure the airwaves it now occupies to accommodate public-safety radio systems. This process began June 2005 and is expected to take three years. The good news for Philadelphia is that the city is among the first group of jurisdictions to be "rebanded."

7. CITY HAS NO DOCUMENTATION OF PRE-PURCHASE SITE VISITS

Buying a radio system is not like buying most other products. You cannot simply borrow a few radios and try them out. A radio system includes infrastructure: dispatch consoles, computers, software, and broadcast towers. How well the system functions depends on the quality and characteristics of the components and how they are arranged and constructed. The design is influenced by such things as the geography of the area, the kinds of users, and the number of users. The only way to assess how well a radio system might function in your jurisdiction is to go and see one in action in another jurisdiction.

City personnel did visit other cities prior to selecting the Motorola 800 MHz system. However, there is no documentation of any of these visits. Consequently, there is no record of whom the city officials spoke to (city management? police management? fire management? police officers? firefighters? EMTs?), what questions they asked, what responses they received, or how those responses affected their decision to acquire the specific system we now have.

The Controller's Office has reviewed notes on visits by Philadelphia officials to the city of Baltimore. But both of these visits (April 2000 and August 2001) took place after the city signed its purchase contract with Motorola (June 1999).

To ensure that evidence obtained during pre-purchase site visits is adequately documented and that future pre-purchase site visits can build on past experience, we recommend that the city administration prepare and retain reports documenting the results of their site visits. [20805.13]

8. WARRANTY EXPIRED BEFORE
SYSTEM MALFUNCTIONS BEGAN

The city's contract with Motorola contained a one-year warranty. Though it might appear counterintuitive that a system costing in excess of $50 million could carry a warranty shorter than that on most motor vehicles, that was, in fact, the case. Furthermore, our research indicates that this type of warranty is standard for the purchase and installation of systems such as the city's 800 MHz system.

The warranty on the 800 MHz system expired at the end of December 2003, some months before system malfunctions began. Despite the fact that the warranty had expired, Motorola, as a sign of good faith, continued to work with the city to resolve system problems.

CITY OF PHILADELPHIA

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JOAN SCHLOTTERBECK
Commissioner

December 2, 2005

The Honorable Jonathan A. Saidel
City Controller
12th Floor, Municipal Services Building
1401 John F. Kennedy Boulevard
Philadelphia, PA 19102-1679

Re: **800 MHz Radio System: Review in Response to Reports of User Dissatisfaction September 2005**

Dear Mr. Saidel:

As a result of the review of the audit, and the exit conference we attended on October 21, 2005, this memorandum summarizes the audit principal findings and incorporated response to the recommendations.

PRINCIPAL FINDINGS:

(a) System configuration could increase the risk of system malfunction and the risk of busy signals.

(b) Mobile Data Terminals represent an opportunity to reduce congestion on the Police talk groups.

(c) Training and communication issues may have magnified system problems and fueled resistance.

(d) Fire personnel have fewer complaints but still have issues.

(e) Though other jurisdictions are having radio system problems, they do not appear serious.

(f) Cellular telephone interference is a concern that should be remedied shortly.

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(g) The city has no documentation of pre-purchase investigations.

RECOMMENDATIONS

- (page 7-8) The city has applied to the Federal Communications Commission for an additional five channels for the Police side, but it may be years before these channels are obtained. Because our radio system has shown a propensity to malfunction under stress, it is imperative that stress be minimized. For that reason, we believe that until additional channels are acquired, the city administration should consider moving channels from the Fire/Municipal side to the Police side of the radio system to balance the distribution of channel resources.

  The city administration strongly disagrees with this conclusion and except for a few incidents in 2004, which have been corrected, the system as designed functions extremely well under full load conditions. During the initial build out of the system, the project team identified the potential need to increase channel capacity for the Police side of the system and planned for additional channel capacity. The implementation of the additional channels was intentionally delayed by the city until all of the known issues in 2004 were resolved and the system retested to ensure all issues have been permanently remediated. The city has initiated the licensing for five additional channels and the installation of the equipment occurred in August of this calendar year. The new channels are expected to be online by June of 2006. Therefore, the city finds the recommendation of moving or reconfiguring the current system resource not a valid solution and will proceed with plans for the additional channels for Police.

- (page 9) We, therefore, recommend that the Police Department consider adding additional talkgroups for the busiest police districts to reduce their talkgroup load.

  The district talk groups are assigned based on the Police Department's organization of patrol. Busy districts are busy due to police activity in the district. This talk group busy condition is a result of high usage of radios in those districts. The radio system could easily provide additional talk groups per district; however, Police have determined it would provide several operational challenges for the dispatchers and patrol officers. Therefore, the city will not consider this recommendation to be of benefit to the Police Department.

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- (page 9) Though the city would be losing an element of redundancy, we believe the administration should consider reprogramming radios to turn off the roaming feature to reduce the risk of system malfunction.

  The city has fully investigated the issue of the roaming feature and finds no evidence to consider this recommendation.

- (page 9) We, therefore, recommend that the city consider replacing its leased telephone lines with microwave transmitter/receivers.

  The city has fully investigated the issue and has determined that there are no systematic issues with the leased telephone circuits that support the city taking the uncertain risk associated with the recommendation and, therefore, will not consider this as a plausible recommendation.

- (page 11) We believe that the Police Department should consider producing on a periodic basis, reports that capture and analyze all MDT activity. Such reports could be used to assess utilization and formulate policies to maximize it.

  The Police Department is investigating the feasibility of implementing this recommendation; however, the city does not agree that the availability of the MDTs has had any impact on the end users' complaints of dissatisfaction with the new radio system.

- (page 11) Because assist calls represent an exceptional demand for radio resources, and because MDTs could help reduce that demand, we recommend that the Police Department explore the possibility of programming their MDTs to allow officers to respond to general assist calls made over the air.

  The Police Department currently has the functionality in the MDTs to allow an officer assigned to a specific call to respond using the MDT; however, since the purpose of an officer assist call is to get the most immediate response to an officer in need, the practicality of assigning units responding across the city to an assist call renders the use of the MDTs programming an undesirable recommendation. The city does not agree that the functionality of the MDT was the root cause of any of the difficulties the Police Department experienced with the use of broadcast assist officer calls, nor does the city agree that it had any impact on the end users' complaints of dissatisfaction with the new radio system.

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- (page 15) Providing enough training time to ensure that all relevant facts concerning new systems and equipment are introduced and reinforced.

- (page 15) Requiring personnel attending training courses to sign-in; reconciling sign-in sheets to personnel rosters; and retaining sign-in sheets for a suitable period of time.

- (page 15) Centralizing responsibility for ensuring that all personnel are trained.

- (page 15) Ensuring that training programs address all operational characteristics of systems or equipment that could be stumbling blocks to users' acceptance.

- (page 15) Ensuring that policy changes are communicated through a standardized process that ensures communication to staff members.

  The city agrees that some of the Police Officers' training experience has impacted their perception and level of dissatisfaction with the new radio system. The Police Department has made many adjustments to its radio training and has already implemented several of the aforementioned recommendations.

- (page 17) We believe that the department should give serious consideration to deploying such a repeater and developing operating practices to ensure that fireground safety is not compromised when these repeaters are in use.

  The city will continue to explore the technical and operational feasibility of portable radio repeater technology, but has yet to identify any commercially available product that meets the city's requirements.

- (page 17) We recommend that the city administration work with City Council to explore alternatives for legislation requiring the installation of fixed repeaters in high-rise buildings.

  The city accepts this recommendation.

- (page 21) To ensure that major capital purchases are based on objective and verifiable evidence and that future pre-purchase investigations can build upon past experience, we recommend that the City Administration document pre-purchase investigations and retaining the documentation.

  The City Administration requests this section be entirely deleted as it has no bearing on the audit purpose to determine if there was any basis to complaints and dissatisfaction of

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end users of the radio system. The section narrative suggests that the selection of Motorola was based solely on city personnel visits to other cities, and intentionally excludes the very lengthy vendor pre-qualification process and request for proposal process which took over five years to complete.

The lack of documentation of the site visits is further evidence that the views and opinions of the city personnel were not deciding factors on the award. The site visit results were specifically excluded from the evaluation criteria which were extensively documented. The documentation that does exist clearly indicates that personnel from the Office of the Controller not only approved the contract award, but participated throughout the construction and implementation of the radio system, and approved all payments. This portion of the audit appears disingenuous and not relevant or helpful in ensuring the public or city employee confidence in a very critical and complex public safety system.

Sincerely,

Joan Schlotterbeck
Commissioner

JS/dl

c: Lloyd Ayers, Fire Commissioner
        Ernest Hargett, Deputy Fire Commissioner
        Sylvester Johnson, Police Commissioner
        Charles Brennan, Deputy Police Commissioner
        James Donaghy, Deputy Managing Director
        Joseph James, Deputy Commissioner, DPP
        Frank Punzo, Communications Superintendent, DPP
        File