CITY OF LOS ANGELES

CALIFORNIA

FIRE DEPARTMENT

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June 13, 2006

The Honorable Jack Weiss
Chair, Public Safety Committee
Room 395, City Hall
200 North Spring Street
Los Angeles, CA 90012

Dear Chair Weiss:

City/Regional Public Safety Radio Communications Interoperability Project

The Los Angeles City Fire and Police Departments have been actively pursuing cooperative technology projects since 1999. The purpose of these efforts has been to improve operations at a reduced cost. The search for joint projects to improve operations intensified after 9-11. The most beneficial technology enhancement has been identified as the ability to communicate by radio across departments. This capability has become widely known as "interoperability".

In order to prove the concept of interoperability across Los Angeles City public safety departments, a request for proposals (RFP) to study interoperability was released in January of 2005. Because of the many potential disasters we face in the Los Angeles region, the focus of the interoperability study was expanded to include all public safety agencies throughout the County of Los Angeles. This was done to ensure a coordinated and interoperable response to natural disasters and acts of terrorism anywhere in the region. Funding for the study was provided through the Federal Urban Area Security Initiative and State Homeland Security Grant funding by the City and County of Los Angeles.

As a result of the RFP process, RCC Consultants Incorporated was hired in July of 2005, to conduct the feasibility study, develop three conceptual radio designs, and prepare rough order of magnitude budgets to demonstrate how radio interoperability might be accomplished and at what cost.

RCC completed their work in January of 2006. RCC found that it clearly is feasible to build a regional public safety radio system in the Los Angeles region. The best way to design a radio system for this purpose is to pool assets throughout the region. By the pooling of assets, a regional radio system can be developed that will provide the best coverage and capacity and at the least cost.

To coordinate interoperability initiatives across the greater Los Angeles area, a Los Angeles Regional Interoperability Steering Committee (RISC) was formed on April 5, 2005. The following officials comprise the RISC:

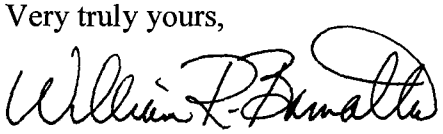
William Bamattre, Los Angeles City Fire Chief (Chair)
William Bratton, Los Angeles City Police Chief
William Fujioka, Los Angeles City Chief Administrative Officer
Thera Bradshaw, Los Angeles City Chief Information Officer
Lee Baca, Los Angeles County Sheriff
P. Michael Freeman, Los Angeles County Fire Chief
Carol Meyer, Director of Los Angeles County Emergency Medical Services Agency
David Janssen, Los Angeles County Chief Administrative Officer
Dave Lambertson, Los Angeles County Chief Information Officer
Richard Elliott, Los Angeles Area Fire Chiefs' Association President
Randy Adams, Los Angeles Area Police Chiefs' Association President
Fred Latham, President of the Independent City Managers' Association
Mark Alexander, President of the Contract City Managers' Association

RCC's report, its recommendations, and primary conceptual design were accepted by the RISC at their meeting of May 18, 2006, as best meeting the operational needs of our region's public safety departments. The RCC Final Report as well as the Summary of the Final Report are attached for your review.

RISC has identified the next step in developing regional interoperability as the pursuit of funding through the various grants and appropriations identified for this purpose. To this end, the members of the RISC are notifying their respective policymakers of the need to obtain funding, pursue grant opportunities, and engage in discussions at the Federal and State levels in an effort to identify monies for a joint-effort, regional, public safety interoperability system. This initiative will require the collaborative support of county Mayors, City Councils, Board of Supervisors, as well as the county Congressional and State delegations.

We respectfully request that the Public Safety Committee support legislation and/or administrative action, which would provide funding to implement a new technical standard for public safety interoperability communications in the Los Angeles Region.

Very truly yours,



WILLIAM R. BAMATTRE
Fire Chief

WRB/vk
Attachments

City of Los Angeles
Public Safety Radio Communications Interoperability Project

Summary of Final Report

For

The Regional Interoperability Steering Committee

May 21, 2006

Prepared By:

RCC Consultants, Inc.

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1.0 INTRODUCTION

RCC Consultants, Inc. (RCC) has been engaged by the City of Los Angeles to study its needs for public safety radio communications interoperability between the Los Angeles Police Department (LAPD), Los Angeles Fire Department (LAFD), Port of Los Angeles Police, Los Angeles World Airports (LAWA) Police, Los Angeles County Sheriff's Department (LASD), Los Angeles County Fire Department (LACoFD), Los Angeles County Department of Health Services (LACoDHS) and other public safety agencies within the Los Angeles County area.

RCC conducted fifty interviews with members of public safety agencies in the Los Angeles area. Some key findings from the interviews are:

- The currently available interoperability solutions do not meet all agencies' needs. The "radio swap" concept is cumbersome and time-consuming, and patch systems are limited in their effectiveness.
- Nearly all interviewees voiced support for a regional shared radio system. "Operability" problems with their existing radio systems, such as an insufficient number of radio channels and the lack of wide-area coverage were cited as reasons for supporting such a system, as well as interoperability with other agencies.

2.0 RECOMMENDATION

It is RCC's opinion that interoperability between the public safety agencies of the City of Los Angeles and the other public safety agencies in the region will best be achieved with the creation of a shared, region-wide voice and data radio system. The new radio system would be shared by LAPD, LAFD, LASD, LACoFD, LACoDHS and the many municipal public safety agencies within Los Angeles County. It would be created by pooling the agencies' UHF band radio frequencies into a shared trunked radio system for voice, and the agencies' 800 MHz frequencies into a shared mobile data system. It would also involve pooling other telecommunications resources, such as radio towers.

RCC's opinion is based on the fact that a radio system of this type is the only way to satisfy the critical criteria for interoperability that were identified and described in detail in the Final Report.

3.0 BENEFITS OF A SHARED RADIO SYSTEM

- All users of the system will have greater communications system capacity than they now have. More channels will be available for dispatch or tactical uses.
- All users will experience better coverage than they now have.
  - Within the City, the number of antenna sites in use will have increased from 22 to 33 (under the recommended conceptual design), improving coverage inside buildings and penetration into canyons.
  - In all areas of the County, users will experience far fewer dead spots and areas of scratchy signals because of the overlapping coverage of the multiple tower sites.

When the signal becomes weak, the radio will automatically find a better signal and switch to it.

- Interoperations with other public safety entities will be significantly improved.
  - All users have identical, region-wide coverage.
  - All users will have access to the same mutual-aid/tactical channels, without the need to patch channels together. A greater number of mutual-aid channels may be created than is now possible.
  - Users can access the correct mutual aid/tactical channel immediately, prior to arriving at the scene of the incident, without waiting for new radios to be distributed or a patch to be set up.
  - Training requirements for interoperability will be minimized because the radio used for interoperability is the same radio that is used every day.
  - Costs to operate and maintain redundant tower sites and duplicate infrastructures can be eliminated.

3.0 COST AND FUNDING

The new radio system is expected to cost between $484.8 million and $604.6 million. A substantial portion of the funding may come from Federal and other grants. The remainder could come from existing grants, provided that the money is spent in ways that are compatible with the regional radio network plan. Agencies with immediate requirements to maintain their radio systems should endeavor to purchase equipment that will be usable with the regional radio system when it is completed.

4.0 CONCLUSION

As has been shown in this report, the implementation of a regional shared radio system will have significant benefits to the day-to-day communications of the public safety agencies of the City of Los Angeles, as well as Los Angeles County and the many other municipalities within the region. In addition, the proposed radio communications system will enable instant communications between agencies in the event of a natural disaster or terrorist event. This is an opportune time to construct a shared radio system, as many entities are planning to upgrade or replace their existing radio systems. The most notable of these are LASD and LACoFD, which have engaged RCC in a separate project to plan a countywide radio system for their joint use. The addition of the County's resources (frequencies and tower sites) to that of the City would create a system of tremendous capacity and coverage. Other agencies within the region also have resources to contribute, making the potential even greater.

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City of Los Angeles
Public Safety Radio Communications Interoperability Project

Deliverable #8 -

Final Report

January 30, 2006

Prepared By:

RCC Consultants, Inc.

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1.0 EXECUTIVE SUMMARY

1.1 Introduction

RCC Consultants, Inc. (RCC) has been engaged by the City of Los Angeles to study its needs for public safety radio communications interoperability between the Los Angeles Police Department (LAPD), Los Angeles Fire Department (LAFD), Port of Los Angeles Police, Los Angeles World Airports (LAWA) Police, Los Angeles County Sheriff's Department (LASD), Los Angeles County Fire Department (LACoFD), Los Angeles County Department of Health Services (LACoDHS) and other public safety agencies within the Los Angeles County area.

1.2 Recommendation

It is RCC's opinion that interoperability between the public safety agencies of the City of Los Angeles and the other public safety agencies in the region will best be achieved with the creation of a shared, region-wide voice and data radio system. The new radio system would be shared by LAPD, LAFD, LASD, LACoFD, LACoDHS and the many municipal public safety agencies within Los Angeles County. It would be created by pooling the agencies' UHF band frequencies into a shared trunked radio system for voice, and the agencies' 800 MHz frequencies into a shared mobile data system.

RCC's opinion is based on the fact that a radio system of this type is the only way to satisfy the criteria for interoperability that are identified and described in detail later in this document. The new radio system is expected to cost between $484.8 million and $604.6 million, with a substantial portion of the funding expected to come from Federal and other grants. The remainder could come from existing grants, provided that the money is spent in ways that are compatible with the regional radio network plan. Agencies with immediate requirements to maintain their radio systems should endeavor to purchase equipment that will be usable with the regional radio system when it is completed.

This is an opportune time to construct a shared radio system, as many entities are planning to upgrade or replace their existing radio systems. The most notable of these are LASD and LACoFD, which have engaged RCC in a separate project to plan a

countywide radio system for their joint use. The addition of the City's resources (frequencies and tower sites) to that of the County would create a system of tremendous capacity and coverage. Other agencies within the region also have resources to contribute, making the potential even greater.

A more detailed explanation of RCC's conclusions is contained in the following sections.

1.3 Analysis of Interoperability Requirements

RCC conducted fifty interviews with members of public safety agencies in the Los Angeles area, including LAFD, LAPD, Los Angeles General Services Police, Port of Los Angeles Police, LAWA Police, Los Angeles County Sheriff's Department, Los Angeles County Fire Department, Los Angeles County Department of Health Services (LACoDHS) and the police and fire departments of many of the Los Angeles area municipalities. From those interviews, RCC developed a list of key findings:

A. Law Enforcement and Fire use interoperable communications differently in most situations. For Law Enforcement, interoperable communications is needed on an exception basis, rather than being routinely used. Situations requiring interoperability are generally infrequent and of short duration. Moreover, usually only one channel is needed except for major incidents. For Fire, interoperable communications is used routinely. Incidents demanding interoperability are frequent, of long duration, and usually require multiple channels (based on the incident command structure of the particular incident).

B Intra-service interoperability (Fire/Fire and Law Enforcement/Law Enforcement) was felt to be the greatest need. Fire/Law Enforcement interoperability is considered important but is required much less often.

C. The currently available interoperability solutions do not meet all agencies' needs. All agreed that the "radio swap" concept left much to be desired. A number of agencies have implemented patch-type solutions, and several stated that they were adequate. However, many interviewees view patch systems as being limited in their effectiveness, and a temporary solution at best. Communications vans with radio patching equipment are very useful, but cannot be deployed quickly enough

to be of any benefit during the early stages of a rapidly developing incident. The LARTCS system was regarded as useful and a necessary part of the region's interoperability plan, and some agencies felt that LARTCS was all the interoperability technology they would need. However, other agencies were concerned about delays and/or the possibility of denial when requesting a LARTCS mutual aid channel, or that it would be overwhelmed in a major incident that required multiple channels, or if multiple large incidents occurred simultaneously.

D. Nearly all interviewees voiced support for a regional common platform radio system. "Operability" problems with their existing radio systems, such as an insufficient number of radio channels and the lack of wide-area coverage, as well as interoperability were cited as reasons for supporting such a system.

E. Despite the nearly universal support for a regional common platform radio system, some interviewees expressed concern that newer technologies (digital and trunking, in particular) made operating and using the radio more troublesome. (RCC pointed out that numerous agencies have successfully made the transition to digital and/or trunking, including LAPD and the ICIS member agencies here in the Los Angeles area)

From the information garnered from the interviews, RCC distilled a list of six critical requirements for regional interoperability that must be met by public safety radio systems. The requirements are:

- *Identical, region-wide coverage footprints for all users.*
- *Unlimited Tactical Channel Capacity.*
- *Instantaneous Set-Up.*
- *Automatic Assignment To Tactical Channel.*
- *Emergency Trigger Must Function Everywhere.*
- *Minimal Training Requirements*

RCC then identified the type of radio system that is able to meet those needs: a regional shared (trunked) radio system.

1.4 Design of an Interoperable Radio System

RCC prepared conceptual designs describing how such a system could be constructed and the coverage and performance that could be expected. There were three conceptual designs: the first utilized the UHF frequency band for a regional voice radio system and the 800 MHz band for a regional mobile data system. The second utilized the 700/800 MHz band for regional voice and data, and the third proposed a UHF voice and 800 MHz data system for the City of Los Angeles only.

RCC evaluated each conceptual design on its ability to meet the identified requirements for interoperability, the radio coverage that could be obtained and the traffic-carrying capacity expected. RCC concluded that, were the City, the County, ICIS and certain other public safety entities to pool their UHF (470 MHz to 512 MHz) frequencies and utilize them in a regional shared trunked radio system, the greatest coverage, capacity, and ability to meet the requirements for interoperability would be obtained. In addition, these same entities would also pool their 800 MHz frequencies for use in a region-wide mobile data system. By "pooling" frequencies, RCC means that each entity would agree that all other participants could use their frequencies for transmitting and receiving, and that the entities would agree to allow their FCC licenses to be modified as needed to establish the frequencies at any or all of the antenna sites across the region, wherever they are required.

The performance of the resulting radio system is expected to be as follows: the voice system is expected to achieve coverage of over 95% of Los Angeles County, and coverage inside buildings in over 93% of the metropolitan area. The voice system is expected to support an estimated 30,000 concurrent users. The data system is expected to achieve coverage of over 94% of the county and support an estimated 17,600 concurrent users. Together, both systems will utilize 62 antenna sites, most of which are already in use by the City, the County, or other local government agencies. The cost estimates for this conceptual design range between a low of $484.8 million to a high of $604.6 million, including new mobile and portable radios, but not new MDCs (see table below).

	Low Estimate	High Estimate
Voice Radio System	$433.8 million	$545.3 million
Data Radio System	$51.0 million	$59.3 million
TOTALS	$484.8 million	$604.6 million

The conceptual designs are presented to validate the concept of a regional shared trunked radio system. RCC must stress that the designs presented are examples of how such a system might be constructed. Additional research and design effort, plus a significant amount of additional input from the project stakeholders, will be required to refine these designs and their cost and schedule estimates and to ensure that the system that is actually implemented meets all user needs.

1.5 Benefits of a Regional System

- All users of the system will have greater communications system capacity than they now have. More channels will be available for dispatch or tactical uses.
- All users will experience better coverage than they now have.
    - Within the City, the number of antenna sites in use will have increased from 22 to 33 (under the recommended conceptual design), improving building penetration and penetration into canyons.
    - Users will experience far fewer dead spots and areas of scratchy signals because of the overlapping coverage of the trunked cells. When the signal becomes weak, the radio will automatically switch to a cell with a better signal. Communications will automatically be maintained without the need to manually change channels.
- Interoperations with other public safety entities will be significantly improved.
    - All users have identical, region-wide coverage.
    - All users will have access to the same mutual-aid/tactical channels, without the need to patch channels together. A greater number of mutual-aid channels may be created than is now possible.

- Users can access the correct mutual aid/tactical channel immediately, prior to arriving at the scene of the incident, without waiting for new radios to be distributed or a patch to be set up.
- Training requirements for interoperability will be minimized because the radio used for interoperability is the same radio that is used everyday.

- Costs to operate and maintain redundant tower sites and duplicate infrastructures can be eliminated.

1.6 Governance and System Administration

A number of other agencies throughout the country have constructed regional radio systems similar to the one discussed above. Some entities have agreed to build separate radio systems and then tie them together so that users can roam between systems and remain in coverage (with no channel-changing or manual intervention) when they cross jurisdictional boundaries. The system constructed by the City of Richmond, Virginia and the Counties of Henrico and Chesterfield is such an arrangement. Each entity operates and maintains its own radio system, and holds title to the FCC licenses for the frequencies that it operates. Policies and procedures for interoperability are established by a joint governance board. Each entity pays a portion of the cost for maintenance of the common portion of the network, the network switch.

In the case of the City of Minneapolis and its surrounding counties (Anoka, Carver, Hennepin, Chisago, Dakota, Isanti, Ramsey, Scott and Washington), the Minnesota State Legislature created the Metropolitan Radio Board ("MRB") as a political subdivision with jurisdiction in the nine-county region, and vested it with the powers necessary to construct, operate and maintain a regional radio system. The State of Minnesota holds title to the FCC licenses for the frequencies used by the system. The MRB consists of 21 persons, seventeen of which are elected officials and the remainder are either state commissioners or are appointed by the MRB due to their particular area of expertise. The MRB is empowered to apportion costs, set operational and technical standards, policies and procedures, establish user priority levels, regulate and approve enhancements to the system, enter into contracts for construction, operations or maintenance, and to apply for and receive grants and issue bonds.

Due to the numerous public safety entities in the Los Angeles region, and the many overlapping jurisdictional boundaries, it would be very difficult to ask participating entities to each construct their own portion of the radio system and to tie those portions together with a common network switch, as the City of Richmond and its neighboring counties have done. If it were attempted to construct the system in this manner, coordination between the various sub-projects would be extremely difficult and it is likely to result in a large amount of duplicated effort and cost. RCC believes that a separate legal entity (similar in many respects to the MRB) should be formed to construct, own, operate and maintain the regional radio system. The entity should be governed by a board of representatives from the participating public safety agencies. The entity should be empowered to receive grant funding, apportion costs and levy fees, and enter into contracts for the construction, operation and maintenance of the radio system, as well as set operational and technical policies, procedures and standards. The entity should employ a project manager and a team of deputies to oversee the construction project and assure that the system is constructed for the greater good of all the participating agencies, and to ensure that the work is performed efficiently and without duplicated effort or cost. Upon project completion, the entity should employ trained and skilled individuals to administer, manage and maintain the radio system under the direction of the governing board.

1.7 Comparison With RCC's 2001 Report to Los Angeles County

In 2001, RCC presented a report to the County containing a recommendation for upgrades to the radio systems used by LASD and LACoFD. RCC believes that the previous recommendation to the County and the current recommendation are consistent for the following reasons:

- The report to the County and this report both recommend a digital trunked voice radio system.
- Both reports recommend that law enforcement and fire share a single radio system, although this report expands the recommendation to include LAPD, LAFD, LACoDHS and the other law enforcement and fire agencies within the region.

- Both reports recommend the continued use of UHF band frequencies for voice. This report differs from the previous report in that it is recommending the use of the 800 MHz band for a shared mobile data system. 800 MHz is being recommended primarily because the use of the 800 MHz band for data frees additional UHF frequencies for voice use.

- In 2001, RCC's cost estimate to the County for a trunked voice radio system was approximately $327 million. When the addition of other regional users is taken into account, this is fairly consistent with RCC's current estimate of a low of $484.8 million to a high of $604.6 million.

Some differences in the two reports are noted:

- In 2001, RCC's cost estimate to the County for a mobile data system was approximately $170 million, which is high compared to RCC's current estimate of $51.0 million to $59.3 million for an 800 MHz private data system. The difference is that RCC's previous report to the County included costs for more that just a private data system. It included costs to implement a multi-tiered solution consisting of a private mobile data system, plus commercial broadband wireless and a WLAN system, with a goal of bringing streaming video into the mobile environment. The goal of the current study is to bring about regional data interoperability so that certain databases, dispatching, text messaging and area-wide alerts may be shared among all users. Therefore, this report concerns itself with the private network only, and only accounts for the purchase of the infrastructure and mobile data modems. It does not account for the purchase of MDCs, mobile routers, commercial broadband or WiFi data modems for vehicles.

- The 2001 report to the County included a voice system design that required 118 antenna sites to achieve mobile coverage over 95% of the county. Of those, 36 were "primary" (high sites on mountaintops) and 82 were "fill-in" sites (low sites on rooftops or mounted on telephone poles). The recommended design in this report estimates that 62 sites are required to achieve mobile coverage over 95% of the county. All 62 sites are considered "primary". That is, they are high sites on mountaintops (or, in urban areas, sites on tall buildings such as the Los Angeles

City Hall). The design in this report uses no "fill-in" sites as defined in the 2001 report, nor was it constrained to use only County-owned sites or property. In the metro area, in-building coverage of the 62-site design will be superior to the old 118 site design due to the higher concentration of sites in the Los Angeles basin.

The balance of this document provides additional details supporting the conclusions presented here.

2.0 CURRENT INTEROPERABILITY ENVIRONMENT

RCC has reviewed those existing Mutual Aid/Automatic Aid agreements and other related documents pertaining to mutual aid communications that have been provided by the City. Please see Appendix B for a list of the materials reviewed.

2.1 Review Process

RCC has received and reviewed the Mutual Aid plan for LAFD, focusing especially on voice radio communications. In conjunction with reviewing the documentation, RCC conducted individual interviews with various first line responders to identify and clarify if any deviation exists between policy and practical application of communications at the response level in mutual aid situations.

Further, RCC has received and reviewed the California Office of Emergency Services Law Enforcement Mutual Aid Plan, and certain informal (letter) agreements between LAPD and other agencies for the mutual use of radio frequencies in instances where mutual aid communications is required.

RCC has also reviewed the Memorandum Of Understanding for participation in the Los Angeles Regional Tactical Communications System (LARTCS) and its Build-Out Document Interim Report.

2.2 Findings

2.2.1 Fire

California has developed a statewide Mutual Aid Plan entitled "Fire Fighting Resources of California Organized for Potential Emergencies", or FIRESCOPE. The FIRESCOPE plan divides the state into six mutual aid "regions." These

regions are intended to promote mutual aid response among communities of similar interest and are linked through the California Office of Emergency Services (OES). Los Angeles City and County both reside in FIRESCOPE Region One, which also includes the counties of San Luis Obispo, Santa Barbara, Ventura and Orange. Region One is further subdivided into Operational Areas, each having its own Operational Area Coordinator. Operational Areas generally correspond to counties, except for Los Angeles County. There are six Operational Areas contained within Los Angeles County, consisting of from two to thirteen municipalities/jurisdictions (certain jurisdictions, such as the Jet Propulsion Laboratory/NASA Fire Department, are included in the Operational Area even though they are not municipal entities). Under the plan, mutual aid requests are directed to the Operational Area Coordinator and are then routed to the appropriate agencies. If the incident is or appears to be developing to a magnitude such that it cannot be resolved with resources within the Operational Area, the request is elevated to the Regional Coordinator. Depending upon the magnitude of the incident, the request may be further elevated to the OES Fire and Rescue Coordinator for an inter-regional response. The Operational Area, Regional and OES Fire and Rescue Coordinators are made aware of any mutual aid responses being conducted at the level below them so that they may pre-plan for an elevated request or for other requests that may be initiated.

While FIRESCOPE addresses the need for interoperability of communications, it does not directly address how to accomplish this goal. OES has developed a statewide frequency plan for the High VHF (White Fire) and 800 MHz (FIREMARS) frequency bands, but these are primarily for the coordination of strike team responses throughout the state and not for specific incident command use. Indeed, each fire agency within the state has developed its own unique voice radio system based primarily upon local needs. In practical terms, this approach has led to the necessity of most fire departments having to devise means of "cross-banding" their radio systems to enable communication with neighboring jurisdictions and then only at the command level. The means to

accomplish the cross-banding range from the very simple (exchanging radios with the other jurisdictions) to the relatively complex (manual or automatic cross-band patching equipment installed in vehicles that are driven to the incident scene).

The Los Angeles Fire Department is surrounded by jurisdictions of various sizes and capabilities. Due to the Department's sheer size it is one of the region's primary sources of mutual aid assistance, second only to the Los Angeles County Fire Department. In addition to its mutual aid obligations under the FIRESCOPE plan, the Department has entered into formal Automatic Aid agreements with the United States Forest Service (Angeles National Forest) and the Cities of Beverly Hills, Santa Monica and Culver City. The Automatic Aid agreements permit requests for mutual aid to be routed directly between agencies at the operational level, without first requesting aid through the Operational Area or Regional Coordinator. Whether responding to Mutual Aid or Automatic Aid requests, the LAFD must adapt its communications systems to match those of one or more outside agencies that do not share common voice radio frequencies. In terms of frequency band utilization, the LAFD is essentially an "island" in the 800 MHz band, surrounded by other jurisdictions that reside primarily in the UHF band, with some residing in the High VHF band (USFS Angeles National Forest is a key agency operating in the High VHF Band). The effect of LAFD's isolation within the frequency spectrum has required a number of different workarounds, including the provision, on a limited basis, of multi-frequency band radio equipment in fire apparatus, the development of procedures for "cross-patching" frequencies through the use of ancillary communications equipment, receipt of radio equipment *from* an agency, and the provision of LAFD radios *to* an agency during mutual response incidents.

RCC recognizes the efforts of the LAFD and its surrounding fire response agencies to work toward an effective use of existing radio resources. However, the very limited ability to create "new" channels of communication (building

cross-patches and swapping of radios) during the most critical time of an incident (mobilization) can negatively affect fire ground operations.

2.2.2 Law Enforcement

The California OES has also developed a statewide Law Enforcement Mutual Aid Plan, similar to the FIRESCOPE Mutual Aid Plan, but with certain differences pertaining to law enforcement activities. Among the differences are: the definition of Operational Areas, the terminology used for several positions described by the Incident Command System (ICS) and a provision for "Day-to-Day Mutual Aid" that permits (within the bounds of their departmental policy) law enforcement officers to respond to requests for aid from neighboring jurisdictions without the formality of an official request or the pre-existence of an automatic aid agreement. The Plan divides the state into seven Regions, all of which are identical to the regions defined in the FIRESCOPE plan, except that Region One is divided into two sub-regions. Region 1 consists of the counties of Los Angeles and Orange, and Region 1-A consists of the counties of San Luis Obispo, Santa Barbara and Ventura. The Regions are then subdivided into Operational Areas. Each Operational Area corresponds to a county. The Operational Area Coordinator is the sheriff of that county. Under the Plan, mutual aid requests are directed to the Operational Area Coordinator, and then are directed to the appropriate agencies. If the incident is or appears to be developing to the magnitude such that it cannot be resolved with resources within the Operational Area, the request is elevated to the Regional Coordinator. Depending upon the magnitude of the incident, the request may be further elevated to the OES Law Enforcement Coordinator for an inter-regional response. The Operational Area, Regional and OES Law Enforcement Coordinators are made aware of any mutual aid responses being conducted at the level below them so that they may pre-plan for an elevated request or for other requests that may be initiated.

The California OES has developed a statewide mutual aid frequency plan in the High VHF, UHF and 800 MHz bands (CLEMARS), but, like the fire service,

each law enforcement agency has developed its own unique voice radio system based upon local needs.

The Los Angeles Police Department's primary radio system operates in the UHF band, alongside the Los Angeles County Sheriff's Department (LASD), Los Angeles County Fire Department (LACoFD), LAWA Police, Port of Los Angeles Police and numerous other public safety agencies within the region. LAPD has agreements with most of the surrounding law enforcement agencies permitting them to program the other agencies' radio frequencies into LAPD's radio equipment. This provision allows LAPD officers to communicate with other law enforcement agencies using the officer's normally assigned radio.

Despite the advantage of residing in a common frequency band with the majority of other law enforcement agencies, there are limitations. For example, federal agencies, such as the Federal Bureau of Investigation (FBI) and the United States Secret Service (USSS), operate almost exclusively in the High VHF band. LAPD must use other means to communicate with the FBI or USSS, such as swapping radios or cross-patching. These methods work fine for planned task force operations and visits by elected officials and dignitaries. However, their effectiveness during a large, unplanned and rapidly emerging event could be hampered due to a number of factors. For example, a large terrorism incident that occurs at multiple locations (similar to the London subway bombings) could make it very difficult to locate and distribute mutual aid radios to key personnel. It could also reduce the effectiveness of a cross-patch arrangement if the cross-patching were required over a very large area.

These issues have given rise to efforts by other agencies, in particular the Los Angeles County Sheriff's Department, to develop a regional cross-patching system to address this critical need.

2.3 Los Angeles Regional Tactical Communications System

The Los Angeles Area Regional Tactical Communications System (LARTCS), when fully built-out, will be a system of dedicated, countywide mutual aid frequencies in four frequency bands (Low VHF, High VHF, UHF and 800 MHz) that may be cross-patched

so that agencies in one band may communicate radio-to-radio with agencies in the other bands. The initial build of the system provides limited coverage, but funds have been identified and earmarked for a countywide system build-out. The current system was paid for by a federal grant and donations of equipment, and use of the system is free to participating agencies.

The current roster of participating agencies includes: Los Angeles County Sheriff's Department, Los Angeles County Fire Department, Los Angeles Police Department, Los Angeles Fire Department, Los Angeles Area Fire Chief's Association, Los Angeles Area Police Chief's Association, California Highway Patrol, California OES, California Army National Guard, and federal agencies USSS and FBI. Policy regarding LARTCS is set by an Executive Committee representing all participating agencies. The LASD is the administrator and maintainer of the system infrastructure. Dispatchers at the Sheriff's Communications Center are equipped to set up and knock down the patches. The policies contained in the LARTCS Memorandum of Understanding specify the means and procedures for use of the system.

The LARTCS system offers the potential for a significant improvement in interoperability between agencies in disparate frequency bands, when the system is fully built-out. However, the system will have limitations even then: LARTCS could be overwhelmed by multiple large incidents that each require multiple command or tactical channels and generate a high volume of radio traffic. In its "Build-Out Document Interim Report", the LARTCS committee acknowledges that it will never achieve the highest level of interoperability defined by the federal Department of Homeland Security's SAFECOM program, and states that the system is "envisioned as the interim interoperability solution, until a Standards-Based Shared system can be funded and built."

2.4 Summary of the Current Interoperability Environment

Compared to many other major metropolitan areas, the public safety agencies within Los Angeles County are in an enviable position with respect to interoperability. A number of simple to moderately complex interoperability processes and systems are already in use or planned for the near future, and the agencies enjoy a high level of mutual cooperation.

In RCC's opinion, a window of opportunity now exists for the planning and eventual implementation of a standards-based, shared system that will offer the highest level of interoperability and improved coverage for all agencies within the region that choose to participate.

3.0 SUMMARY OF INTERVIEWS WITH LOS ANGELES REGION PUBLIC SAFETY ENTITIES

RCC conducted over fifty interviews with the designated representatives of public safety agencies in the Los Angeles area, including LAFD, LAPD, Los Angeles General Services Police, Port of Los Angeles Police, LAWA Police, Los Angeles County Sheriff's Department (LASD), Los Angeles County Fire Department (LACoFD), Los Angeles County Department of Health Services (LACoDHS) and the police and fire departments of many of the Los Angeles area municipalities. RCC also interviewed the Presidents of the Los Angeles Area Police Chief's Association and the Los Angeles Area Fire Chief's Association (or their designees), and representatives of the Los Angeles Information Technology Agency (ITA) and the Los Angeles County Internal Services Department (ISD), the departments responsible for engineering and maintenance of the radio communications systems for Los Angeles City and Los Angeles County, respectively. The intent of the interviews was to determine the interoperability needs between LAPD and LAFD and the interviewed agencies, and the needs of each interviewed agency to interoperate with its neighbors. Although, due to time and scheduling constraints, RCC was unable to interview every public safety agency, we have provided a large, representative sample, and so we are confident that the information presented herein accurately reflects the needs and desires of the public safety community in the Los Angeles area. Please note that the interviewees were given the opportunity to review the summaries and approve them before they were included in this report.

3.1 Key Findings

RCC has developed a number of key findings:

A. Law Enforcement and Fire use interoperable communications differently in most situations.

- Law Enforcement: Interoperability is needed on an exception basis, rather than being routinely used. Situations requiring interoperability are generally infrequent and of short duration. Moreover, usually only one channel is needed except for major incidents.
- Fire: Interoperability is used routinely. Incidents demanding interoperability are frequent, of long duration, usually requiring multiple channels (based on the incident command structure of the particular incident).
- It is significant to point out that this disparity between police and fire has a profound effect on their outlook regarding both the urgency of the need and the degree of attractiveness of the available interoperability solutions.

B. Intra-service interoperability (Fire/Fire and Law Enforcement/Law Enforcement) was felt to be the greatest need. Fire/Law Enforcement interoperability is considered important but is required much less often.

- At major incidents, Law Enforcement/Fire interoperability was primarily accomplished at the command level, face-to-face at the command post.
- The greatest need for Law Enforcement/Fire radio interoperability would be a mass evacuation, where the police have significant involvement in controlling access to the effected area.
- Many smaller municipalities have little need to interoperate with LAPD or LAFD. Smaller police departments are more likely to request aid from LASD (there is often a Sheriff's station within the municipality or nearby), and many small cities contract with LACoFD to be their fire department or LASD for police services.
- Some smaller law enforcement agencies operating in the VHF band reported that they have little interoperability with LASD and

the surrounding cities that are in the UHF band (LASD has provided UHF mutual aid radios for some cities dispatch centers).

C. Opinions vary regarding the currently available interoperability solutions.

- All agreed that the "radio swap" concept left much to be desired.
- A number of agencies have implemented patch-type solutions, and several stated that they were adequate. However, many interviewees see such arrangements as being limited in their effectiveness, and a temporary solution at best.
- Communications vans with radio patching equipment are very useful, but cannot be deployed quickly enough to be of any benefit during the early stages of a rapidly developing incident. This is a particular issue for fire agencies.
- Indiscriminate patching or patching too many channels together can cause communications to grind to a halt due to congestion and interference.
- Some law enforcement agencies feel that the LARTCS (Los Angeles Regional Tactical Communication System) concept, when fully implemented, will provide sufficient interoperability capability for their needs (infrequent, short duration, single channel).
- Some law enforcement agencies feel that the use of the LARTCS system is "cumbersome". Some were concerned about delays and/or the possibility of denial when requesting a LARTCS mutual aid channel - as has actually been experienced in one large scale drill that was partially interrupted due to capacity limitations. Some of these concerns may be due to inadequate training, which is being addressed by LASD as part of the Phase Two LARTCS build-out.

- Fire agencies tended to feel that LARTCS is useful, but would be overwhelmed in a major incident. A major fire could require five, six or more channels for command, tactical and support purposes, and these channels would be needed for a long period of time. This type of scenario could potentially exhaust the capacity of LARTCS, and prevent it from being used for other incidents.
- State and federal agencies (California Highway Patrol, US Coast Guard, FBI, US Secret Service, etc.) mostly use channels in the VHF band and have no plans to change this practice. The LARTCS system will be needed to interoperate with them, even if other solutions are implemented.
- A number of police and fire agencies are considering joining the Interagency Communications Interoperability System (ICIS) group. The biggest deterrent seems to be the high cost. Another concern is the potential loss of control when joining a shared system. However, none of the interviewees that had already joined ICIS mentioned this as a problem.

D. Nearly all respondents voiced support for a countywide common platform radio system.

- Both law enforcement and fire agencies supported a common platform because it would increase radio coverage outside of their jurisdictions. For Law Enforcement, having this capability would mean that officers involved in vehicle pursuits that led far outside their home jurisdictions would still have communications with their dispatcher, and contact could be maintained with surveillance teams outside the jurisdiction, as well. For Fire, they would remain in coverage and maintain the emergency trigger functionality when responding to mutual aid incidents far outside of their jurisdiction. These advantages would apply to a mobile data system as well as voice.

- Fire agencies also supported a common platform because, in a great percentage of mutual aid responses, it would enable responders to talk together immediately, in the earliest stages of an incident when interoperable communications are needed the most urgently.
- Most Law Enforcement agencies, including LAPD and LASD, stated that they now have an insufficient number of radio channels for their needs. A common platform radio system could solve this problem.
- LAFD also reported that they sometimes run short of tactical channels when demand is heavy.
- The timing could be excellent for the implementation of a common platform radio system, because many agencies, large and small, (LASD and LACoFD in particular) have old legacy systems that they are considering replacing in the near future.
- The concept of a long-range plan for a dual-band 700 MHz/800 MHz system that was linked to surrounding counties was universally supported. The concept of a 700/800 MHz radio system was well received because agencies would not be called upon to contribute channels that they were already using. During a transition to a new system, continuing use of the existing systems would cause less impact on day-to-day operations, and provide a "fallback position" should a new system not initially work satisfactorily. However, the 700 MHz band is not yet available for use by public safety (it is now used by television broadcasters), and there is uncertainty whether the transition date of February 18, 2009 will remain firm. It may be much longer before the 700 MHz band is available for use.

- A short-range plan (three to five years) for a UHF common platform was widely supported by fire agencies, but less well received by law enforcement agencies, although most of the smaller police departments supported it. The two largest law enforcement agencies have either recently implemented an expensive UHF system (the LAPD voice system) or had immediate, urgent plans to upgrade their UHF system, which would not necessarily be compatible with a UHF common trunking platform concept (the LASD data system). However, Los Angeles County does have plans on the table for a consolidated digital trunked voice radio system for use by LASD and LACoFD.

- A UHF common platform radio system carries with it some inherent risks. The UHF channels are already in use and are, in many cases, very busy. The construction, testing and migration to a new, shared UHF system could have a negative impact to day-to-day operations, and it would be much more difficult to fall back to the old systems in the event of problems with the new system.

E. Opinions vary as to the difficulties in transitioning to higher-technology radio systems (digital and trunking). Digital audio sounds different than analog, and digital trunked radio systems also behave differently than analog systems, thus often confounding users.

- Several agencies were concerned about the channel access delay (typically ¼ to ½ second) that occurs with a trunked system. This is especially true with law enforcement agencies, particularly when considering tactical activities. However, some agencies already experience a similar delay with the Unit ID data burst that occurs at the beginning of every transmission. Some even felt that the trunking "grant tone" (three quick beeps that occur before a user begins speaking) gave them more confidence that the communication would go through the system.

- LAPD had difficulty in its transition from analog to digital because officers on the street initially did not accept it. Now that the officers have accepted digital, some within LAPD fear that another transition to trunking would encounter significant user resistance or create additional difficulty.
- Several other agencies (notably LASD and LACoFD) felt that the concerns and objections can be overcome with proper training and familiarization well before the system is put into daily operation.
- Despite these concerns (and many of the concerns are shared by public safety entities across the nation) the federal Department of Homeland Security has decreed that the APCO Project 25 digital radio platform is the only one that will be eligible for DHS grant funding.

3.2 Detailed Findings

3.2.1 The Incident Command System

The Incident Command System (ICS) is a formalized structure and generalized procedures for managing public safety incidents. It is scalable and therefore applies to all incidents, large and small, and to Law Enforcement, Fire and Emergency Medical services. The use of the ICS was codified and made California law in 1996 (the Standardized Emergency Management System, or SEMS). In 2003, President Bush created the National Incident Management System (NIMS), based on ICS, by presidential order.

RCC received a valuable tutorial on incident management structure from Assistant Chief Mike Fulmis of LAFD. He used an example of a terrorist bombing of the Los Angeles Metro subway, similar to the recent attacks in London. Such an incident might require responses from LAFD, LAPD, LASD, FBI, MTA, LA County Dept. of Health Services, and possibly the military, LA City Parks & Recreation Dept. (for evacuation center setup), and the LA Unified School District (if the evacuation center is set up at a school). It is likely that the Incident Commander in charge of the incident would be a "unified

command" consisting of LAFD, LAPD and LASD. The ICS organization chart for such an incident might look like this:

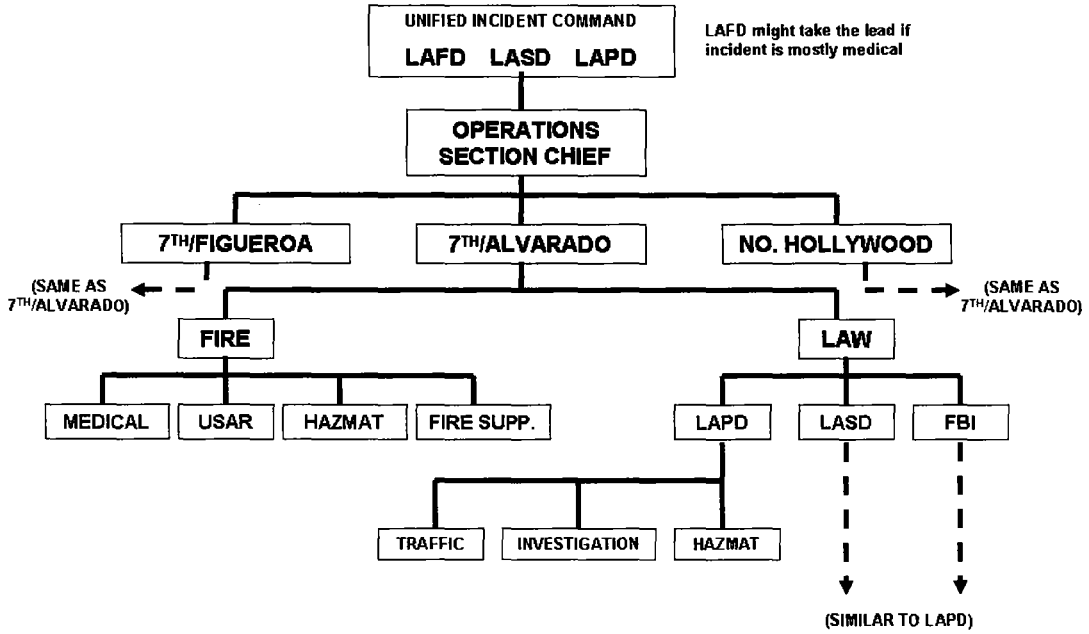


Figure 1 - Possible ICS Organization Chart

Each of the responding entities need to have timely and reliable communications between themselves and other entities on-scene. Ideally, all HAZMAT teams would be on the same radio channel, all fire suppression teams on the same radio channel, etc. From a radio communications perspective, the organization would look like this:

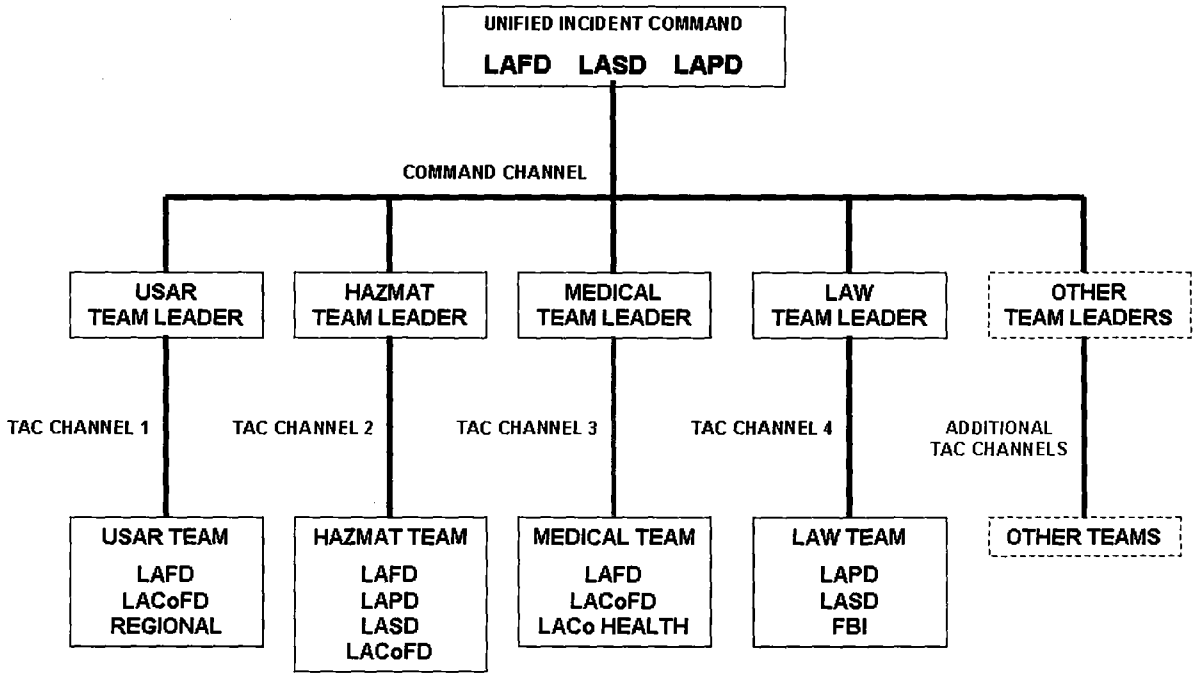


Figure 2 - Organization Chart Viewed From A Communications Perspective

A large incident, such as the one diagrammed above, places a heavy burden on the available tactical radio channels. If multiple, unrelated incidents were to occur simultaneously, communications could become severely degraded. If the same tactical channels are needed at multiple incidents, congestion and interference would almost certainly result.

3.2.2 Fire

All fire service interviewees stressed how often they interoperate with other fire departments, and how heavily they rely on the Incident Command System on a daily basis.

The two largest fire agencies, LACoFD and LAFD, are spending or are planning to spend large amounts of money to upgrade or replace their existing radio systems. LACoFD's radio equipment was installed nearly twenty years ago and is becoming impossible to maintain. Their existing VHF equipment is incompatible with new radio equipment that is being purchased by the California Division of Forestry (CDF) and the United States Forest Service

(USFS), two entities that LACoFD interoperates with regularly. LAFD's 800 MHz voice system and its UHF mobile data system are also out of date, and a program of upgrades is underway. Some smaller municipalities also stated that their legacy radio systems are old, hard to maintain and need replacement.

A typical mutual aid scenario is a brush fire. For example, a large brush fire in the Mutual Threat Zone (MTZ) in the hills above the San Fernando Valley will bring together teams from LAFD, LACoFD, Glendale FD, Burbank FD and the US Forest Service. Out of this group, LAFD operates at 800 MHz, LACoFD operates at UHF for command and VHF for tactical, Glendale and Burbank operate at UHF, and the USFS operates at VHF. This means that in the first minutes of the fire response when swift, coordinated action is critical, firefighters are spending time coordinating their communications by swapping and checking portable radios and looking for the correct frequency on their interoperability mobile radios. Once a command post has been set up and communications have been established, firefighting teams often are not on the same channel as one another. For tactical communications, the LAFD team may be using their 800 MHz radios in direct mode, while Glendale and Burbank may be doing the same with its UHF radios, and the teams cannot talk directly to each other. This lack of interoperability can be hazardous when conditions are changing from moment to moment. For example, a wind shift may cause the fire to threaten one of the teams from an unexpected direction. Since the teams are not on a common channel, a nearby team cannot warn the other team directly. Instead, the warning must go up to the command post and be relayed back down to the team in danger. This limitation can delay the warning message anywhere from seconds to minutes, increasing the chance that the firefighters could be injured or killed. In some ways, this situation can be compared to that of the police and firefighters inside the World Trade Center in the moments before the towers collapsed.

An additional risk is that the firefighting teams in a mutual aid response may be out of coverage of their primary radio system, meaning that they have lost the emergency trigger functionality. A firefighter in trouble cannot simply push the emergency button on their radio to signal for help. In brush fire areas, all radios may be operating in the direct mode and the firefighter, who may be crouching inside a portable protective shelter (a metallic foil bag that insulates the firefighter from heat but attenuates radio signals) may have difficulty being heard by the command post or other firefighters.

Firefighters' lack of familiarity with the many agencies' different radios limits their effective use and takes additional time away from firefighting activities. When swapping radios with other departments, each department's radio differs from every other department's radio in some manner. Radios may look and operate differently, with unfamiliar controls and displays, and the various channels and zones that must be selected may not be in the same positions on the selectors. Many radios do not have all the other channels of the particular band programmed into the radio, so the user must know to select the appropriate radio. One Battalion Chief said that he often has to personally set up a radio before he gives it to someone. Moreover, depending upon where one is in the national forest, one needs to know the appropriate PL tone to send to activate the correct Forest Service repeater. Not everyone is fully trained on how to do this. Changing PL tones requires familiarity with the surrounding geography, which poses a problem when a large incident brings in people from diverse areas. Additionally, LAFD does not have GPS/mapping software in the fire vehicles, which exacerbates the problem.

Smaller municipalities that do not border LA City generally need interoperable communications also. Some cities contract with LACoFD.

The Long Beach Fire Department (LBFD) requires interoperable communications with Orange County Fire Authority (OCFA), due to their proximity and the level of joint activities that occur. OCFA uses an 800 MHz trunked radio system, and have provided LBFD with 800 MHz trunked portable

radios for interoperability purposes. In addition, LBFD has an automatic aid agreement with LAFD, and is in possession of LAFD radios as well.

LACoFD also requires interoperable communications with Orange County, primarily because it has recently received a contract to provide fire service to the City of La Habra.

Fire departments generally reported that their greatest need was to have interoperable communications with other fire departments. However, communications with law enforcement was still considered very important. Of particular concern is the ability to communicate during a mass evacuation. However, inter-service communications regularly occurs in the following situations: A barricaded suspect, medical emergencies, shootings (especially officer-involved), aircraft emergencies (there are five large airports in the greater Los Angeles area, LAX, Burbank, Van Nuys, Long Beach and Ontario, and many smaller airports), bombings and traffic situations. In shooting incidents where there is a chance that firefighters and rescue crews may themselves be shot at, the police channel is monitored until an "all-clear" message is sent, meaning it is safe for crews to go in to treat and rescue victims, police officers and suspects. Deputy Chief Dennis Keane of LAFD estimates that LAPD and LAFD jointly respond to calls an average of 100 times per day, although not all of these calls require communications interoperability.

None of the fire agencies are satisfied with their current state of interoperability. The swapping of radios is used extensively, but it is viewed as a "necessary evil". As noted above, it takes up time in the critical early stages of a fire, and usually does not succeed in providing radios to everyone that has a need for one.

Fire agencies generally view patch-type interoperability solutions such as LARTCS and mobile communications vans equipped with ACU-1000 systems as useful, but require too much time to be deployed to play a role in the critical early stages of a fire. Deployment of a communications van typically takes several hours between the request and the time that they are on-scene, configured and ready to go. Other limitations exist: Experience has shown that

you can have too much of a good thing. Indiscriminate patching or patching of too many channels together can cause communications to grind to a halt due to congestion and interference. This was proven to LAFD and others during several drills held when the communications vans were first purchased. Captain Kevin Nida of LAFD recommended that patch configurations be pre-planned for a variety of incident types. This would both save time when setting up the patch, and also prevent indiscriminate patching from causing congestion and interference.

In addition, there is only so much space on the roof of a communications van. Consequently, antennas may be installed much closer together than would normally be permitted. This results in interference between the van's radios. To prevent this from happening, only one patch per frequency band (one for VHF, one for UHF, etc.) may be allowed per van.

The use of LARTCS requires making contact with the Sheriff's Communications Center (SCC), requesting that LARTCS be set up, waiting for the setup to be completed and then receiving a go-ahead from the SCC. The perception that the LARTCS setup as being too slow a process may be biased due to the fact that, to date, there has been very limited training on the use of the system (LASD plans to remedy that in the Phase Two buildout process by offering training and a permanently-assigned LARTCS liaison). However, the fire service needs a solution that can be set up almost instantaneously, as they are unable to change channels easily once they are dispatched. Fire incidents are typically assigned a tactical channel at the time of dispatch. The firefighters set their radio equipment to the correct channel before they suit up in their firefighting gear. Once suited up, it is difficult for the firefighter to reach the radio to change channels. Once the firefighter is on-scene and actively fighting a fire, changing channels is a safety hazard, as the firefighter would have to divert their attention from the fire and un-strap or remove some safety equipment in order to reach the radio and change channels. The LARTCS system would be considerably more effective for the fire service if the fire dispatchers were permitted to autonomously set up the patches, or better yet,

patches were automatically set up via the fire department's CAD system. LARTCS is also encumbered by the fact that the Phase One buildout has limited coverage.

Fire agencies, typically having a need for multiple tactical channels during an incident, fear that LARTCS does not have enough channel capacity to handle a large incident, let alone multiple incidents. An example was cited of a recent drill (with federal, state and local participants) where LARTCS was being employed. Unfortunately, its limited capacity forced the Sheriff's Department to terminate the use of LARTCS for the drill in favor of a surveillance operation it was conducting. The occurrence demonstrated that LARTCS has some significant limitations. In the view of the fire service, the system may be conceptually attractive and theoretically sound, but LARTCS cannot serve as the ultimate interoperability solution.

Fire agencies universally supported the concept of a common platform radio communications system. Since their short-term needs are critical, they support a system in the UHF band, and those that currently use UHF are willing to donate their frequencies to it. A dual-band 700 MHz/800 MHz solution was also supported, but, due to the uncertainty surrounding the establishment of February 18, 2009 as the firm date for the transition to digital broadcast television and the abandonment of 700 MHz spectrum by television broadcasters, the fire agencies view it only as a possible long-range (fifteen to twenty years) plan, and continue to press for a solution to their critical short-term needs.

Many fire agencies have or are considering joining the Interagency Communications Interoperability System (ICIS). ICIS is a Joint Powers Authority that operates a UHF trunked radio system that is widely regarded as the model for a larger, countywide radio system. ICIS originally covered the San Fernando Valley, but has been expanding outward: Culver City, Pomona, Montebello and Beverly Hills are in the process of joining ICIS, and the communities of Alhambra, Arcadia, La Verne, Claremont and West Covina are

investigating the possibility. However, a major obstacle preventing many communities from joining ICIS to date has been cost.

3.2.3 Law Enforcement

One of the complaints common to most of the Law Enforcement interviewees was the lack of a sufficient number of radio channels. LAPD and LASD both stated this was a problem. A number of smaller police departments also reported this problem. In the case of LAPD, more police stations are being built or are planned for the near future. Each one requires an exclusive dispatch channel and a channel for direct-mode ("talkaround"). When the last station was opened, frequencies were taken from other, less critical LAPD departments and re-allocated to the new station because there are no additional frequencies available. The Sheriff's Department stated that their tactical channels are shared with others and they are not always available. The LA City General Services Police Department currently operates on the City's 800 MHz trunked radio system, but desires to move to a UHF channel so that they may more easily interoperate with LAPD, but no frequencies are available. Smaller police departments often had only a dispatch channel but no exclusive tactical channels.

Mutual aid responses for law enforcement agencies tend to be less frequent and shorter in duration than for fire agencies, and they generally only need one channel at a time. Cmdr. Bob Sedita of LASD related an incident where LARTCS was used that is fairly typical of a law enforcement mutual aid response: A particularly violent armed robbery occurred in Ventura County. The Ventura County Sheriff put out a crime broadcast with a description of the vehicle. A LASD unit in Westlake Village spotted the vehicle. The deputy asked for assistance, but the nearest LASD unit was ten minutes away. The SCC contacted Ventura County dispatch and found that a Ventura County unit was just 1.5 minutes away. The Ventura County unit was dispatched, and SCC set up a LARTCS patch so the two units could communicate directly. The two units coordinated and apprehended the suspect.

LAPD reported that it routinely interoperates with LASD since there are numerous unincorporated areas within and around the city. All of LAPD's radios are already programmed with the LASD channels and the channels of the bordering cities. In addition, one UHF channel (the LAPD ACCESS channel) remains wideband analog and is used as a "hailing frequency" for other agencies that come into Los Angeles and need to communicate with LAPD. The Los Angeles General Services Police have one of their trunked talkgroups permanently patched to this channel for interoperability purposes. LAPD has also provided UHF portable radios to LAFD for communications with LAPD, one radio for each piece of apparatus or chief's vehicle. In LAPD's view, this system works quite well. The only problem noted by LAPD was that when LAFD crews are moved up from a different area to cover for a crew that has been dispatched elsewhere, the new crew sometimes did not know which LAPD channel to call on.

Some smaller law enforcement agencies operating in the VHF band reported that they have little interoperability with LASD and the surrounding cities that are in the UHF band. In some cases, but not all, the city has a control station for the Sheriff's UHF mutual aid channels installed in its dispatch center.

When responding to requests for mutual aid, there are a number of operational issues which, if the responder is unaware, can be a significant problem. For instance, commonality of terminology is an important issue. LASD and the California Highway Patrol (CHP) have totally opposite meanings for the terms "officer needs backup" and "officer needs assistance". To one, "assistance" means lights and siren, and "backup" means "whenever you get there". To the other, the meanings are reversed. This could lead to problems in a critical situation where a quick response is needed.

In general, law enforcement agencies stated that they had less of a need for interoperable communications with fire departments than the fire departments had to communicate with them.

Law enforcement agencies generally expressed more satisfaction with their current state of interoperability than did the fire agencies. Sgt. Curt Miles of LAPD's ECCCS Division stated that LAPD rarely requested mutual aid, and also stated that LARTCS is "the direction we want to go" for interoperable communications.

Not all law enforcement agencies agreed with Sgt. Miles. Some interviewees felt that the use of LARTCS was slow or "cumbersome", and others expressed concern about its capacity. These interviewees felt that LARTCS was fine for planned events, but could fall short in a real major incident.

For large incidents of long duration, communications vans with patching equipment were viewed as a good alternative. Both LAPD and LASD have vans available, and some smaller agencies, such as Alhambra PD, are looking into purchasing them. According to NIMS requirements, a "Communications Unit Leader" needs to be dispatched along with the communications van, and incident commanders need training in how the Communications Unit Leader can assist them in managing incident communications. Dispatching a technician instead of a Communications Unit Leader is not sufficient.

All interviewees supported the concept of a common platform radio communications system in the 700/800 MHz band. However, small law enforcement agencies were more likely to support a UHF band system, while the two major law enforcement agencies, LAPD and LASD, were reluctant to support it. LAPD had numerous concerns: the first has to do with their experience in making the transition from an analog to a digital radio system. LAPD had difficulty in its transition from analog to digital because they were not fully expecting or prepared for the differences between the two. Digital and analog radio systems sound and behave differently and the officers on the street initially did not like digital. To them, the audio sounded "robotic." Even more important, the officers discovered that they could no longer switch to direct-mode ("talkaround") if they suddenly found themselves in an area where the repeater couldn't reach. When the officers tried to use direct mode, they found

that it completely prevented other officers in the vicinity from hearing the dispatcher if the dispatcher tried to transmit at the same time the officer in direct mode was talking. With the old analog system, both the dispatcher and the officer in direct mode would have been heard, even if they were somewhat garbled. An acceptable compromise was reached by moving the direct mode communications to a different frequency from the dispatch channel, although now the officers in direct mode cannot hear their dispatcher until they go back to the dispatch channel. Now that the officers have uneasily accepted digital, LAPD fears that a transition to a trunked radio system, especially so soon after the first transition, would stir up more trouble. Second, the system they now have is too new and cost too much to replace it this soon. Sgt. Miles gave his estimate of $200 million to convert the both LAPD and LAFD to a trunked radio system.

LASD stated that their highest priority was to replace their UHF mobile data system. The system now in place is almost twenty years old and is no longer supported by the manufacturer. Replacement parts are scarce. LASD relies heavily on their mobile data system for dispatching and other uses. They rarely use voice for routine dispatches, and the voice radio system would be severely strained if the data system failed. However, LASD also stated that one of the other high-priority projects was to construct a new digital trunked voice radio system for both LASD and LACoFD to share.

A number of smaller police departments stated that they were considering joining ICIS. As with the Fire agencies, cost is an obstacle. However, the benefits of a common platform radio system are very attractive and that alternative needs to be explored.

Cmdr. Sedita of LASD commented that, whatever type of radio system was implemented, incident communications need to be isolated so the incident doesn't consume an excessive amount of resources. The rest of the county still needs to maintain its routine communications and must not be affected by the

incident. The intent is to create an incident network "communications bubble" that is self-contained to the greatest extent possible.

3.2.4 Emergency Medical/Rescue

According to the Los Angeles County Department of Health Services (LACoDHS), about 85% of all Fire Department calls are EMS related.

The Los Angeles County EMS Agency (a division of LACoDHS) coordinates the use by hospitals of the MED (medical) channels in the UHF band, among other duties. There are currently contracts with 21 hospitals operating the UHF MED channels. The system consists of primary base stations at hospitals (for local coverage) and backup stations on mountaintops for wider area coverage. The conventional analog channels are reused in different areas of the county through the use of squelch ("PL") tones. However, The UHF MED radio system is composed of older equipment, and much of it does not have spare parts available. Over the recent past, 15 hospitals have discontinued use of the system. It is typical for hospitals to come and go, but now there is a concern that from 50% to 75% of the calls to hospitals from paramedics are made via cell phones, which have a high probability of not being available in a major emergency. The EMS Agency is weighing its options to upgrade the MED system in order to reduce the reliance on cell phones and provide a robust system in the event of a major disaster. Some of the options being weighed are:

- New analog radio equipment (upgradeable to narrowband and digital) at each hospital to cover that hospital's primary service area only;
- A digital conventional narrowband system that is simulcast to cover the entire county; or
- A trunked digital narrowband system with countywide coverage.

Note that the FCC has already authorized the splitting of the MED channels. Conversion to narrowband would enable an additional ten channels to be utilized. Although it is not specifically permitted by the FCC, it may be possible through a waiver of existing rules to permit these channels to be included as part

of a larger public safety trunked radio system. RCC recommends that this possibility be discussed with an attorney that specializes in FCC matters.

Telemedics are not currently used, but may be in the future. Currently, the only mobile data in use is for after patient care.

3.3 Mobile Data Systems

LAFD, LAPD and LASD all rely heavily on their mobile data systems for dispatching and other uses. LAWA Police, the Port of Los Angeles Police, and a number of smaller municipalities also rely on mobile data systems. LAFD, LAPD and LASD have multiple-channel systems dedicated for their use. LAWA Police and some smaller agencies have single dedicated data channels. The Port of Los Angeles Police have a dedicated channel but share the system with the City of Inglewood. Other smaller agencies are using GPRS or other commercial networks.

As noted above, LASD rarely uses the voice system for dispatching routine calls, and typically handles 60,000 data messages per day. LASD's data system operates in the UHF band. It was originally manufactured by Electrocom, which has since been re-named IP Mobilenet. Cmdr. Sedita stated that LASD has received extremely good service from IP Mobilenet. They have diligently assisted LASD in keeping the existing system running, even though they no longer manufactured parts for it. New technology from IP Mobilenet will boost the data speed of 32 kilobits per second (kbps), but an upgrade that will boost the speed to 64 kbps will be available in a few months. Even so, LASD envisions that this will not be adequate to transfer larger data files such as mug shots, fingerprints and video. To accommodate these and other future applications, a broadband wireless data service from a commercial provider will be needed. The commercial service will not replace the private data network, merely supplement it. Critical dispatch data will still be sent over the private network, because the commercial network is not likely to be as reliable as the private network.

LAPD has much the same outlook on mobile data as LASD. LAPD also does much of its dispatching via the data system. The LAPD data network is a Motorola RD-LAP system with a data speed of 19.2 kbps and operates in the 800 MHz band. LAPD's Chief Information Officer, Tim Riley, stated that the system is very robust, with good citywide

coverage. The system is only a few years old. However, it is becoming clear that officers require access to the same applications in their vehicles that they get while in the station (report forms, access to records, etc.), and that will require a significant amount of bandwidth. LAPD might entertain an upgrade to Motorola's new High Performance Data (HPD) system (which provides data speeds of up to 96 kbps), but Mr. Riley is concerned that there might not be a significant enough return to justify that investment. New RD-LAP Vehicular Radio Modems (VRMs) cost $2,500 to $3,000 each. To replace VRMs in 1500 vehicles would cost up to $4.5 million. Even then, an increase in speed to 96 kbps will not eliminate the need for a commercial high speed data solution. Sprint's EV/DO solution is being considered. Costs are $60 per month per terminal for unlimited access, and Sprint provides the wireless card for free. Sprint coverage is mostly within the City only, so it is likely that more than one network will be necessary, and a switch (like Datamax, PadCom or Data Motion) to switch between networks based on coverage or congestion, which would drive up costs. In any case, LAPD's private network will be maintained in some form and used to transmit the most crucial dispatch data, with the commercial networks used for supplementary data, photos, fingerprints, etc. Other possible solutions are being investigated, such as Wi-Fi hot spots at stations to download large files or to update software in the mobile computer, and 4.9 GHz mesh networks. Again, these solutions would not replace the RD-LAP or commercial high speed networks, and would be used for supplemental purposes.

The LAFD mobile data network is a Motorola RD-LAP system, operating at a data speed of 19.2 kbps in the UHF frequency band. LAFD. like LAPD and LASD, is considering the use of broadband commercial wireless networks for higher bandwidth applications, such as mapping and access to databases. Mapping in particular is seen as an urgent priority by many LAFD personnel, especially those that respond to incidents in brush fire country.

LAFD feels strongly that interoperability and the common platform concept should extend to mobile data systems as well. The advantage of extended coverage is just as critical for data communications as it is for voice, especially now that data is relied on for dispatching. The sharing of data and text messaging between agencies is another

important advantage that also would be achieved by implementing a common platform for mobile data.

3.4 Computer-Aided Dispatch Systems

The Los Angeles Area Fire Chiefs are in agreement with respect to developing a regional approach to dispatching based on six centers (Verdugo, Long Beach, Downey, LA County, LA City, and South Bay), with a common CAD system, or CAD systems networked together. This is seen as an important step in reducing response times. For example, LAFD may receive a call for service, but the fire station that would normally respond is already out on a call. The next nearest LAFD station may be much farther than a Glendale fire station. In that case, the Glendale station would automatically receive the call, rather than the LAFD station.

LAPD is in the process of implementing a new Motorola PrinTrak CAD system. LAWA Police are in the process of purchasing a new Motorola CAD system, and there have been discussions about linking it to LAPD's system. The Port of Los Angeles Police are in the process of replacing their dispatch consoles. They are also considering joining with the City of Inglewood in purchasing a new Tiburon CAD system.

3.5 Common Threads

A number of common threads are present in many of the interviewee's responses:

1. Whether it was intended or not, a number of entities are converging on a UHF trunked radio system solution for voice. These agencies are LASD, LACoFD, the current and future ICIS cities and possibly LACoDHS.
2. ICIS is regarded as the model for a common countywide system. If ICIS could be expanded at a reasonable cost, many more cities would probably join. Whether the ICIS governance model is appropriate for the rest of the city and county agencies can only be determined by the agencies themselves.
3. A number of agencies have an immediate need to replace their old legacy systems.

4. Despite the fact that the LARTCS system has proven its effectiveness in a number of situations, there seems to be a fairly general acknowledgement that it has limitations, and a more comprehensive solution is also needed. This was even acknowledged by the LARTCS committee, who stated in their "Build-Out Document Interim Report" (which RCC reviewed in the process of developing the last report) that the system is "envisioned as the interim interoperability solution, until a Standards-Based Shared system can be funded and built."

5. Even though the interoperability needs for law enforcement agencies and fire agencies differ, all agencies would benefit from a common platform radio communications system because of the improved coverage and the large number of new channels (trunked talkgroups) that it would provide.

Please see Appendix C for detailed notes of each interview.

4.0 NEEDS ANALYSIS

As stated in the previous section, RCC conducted fifty interviews with members of public safety agencies in the Los Angeles area. RCC then analyzed the interviews and compiled a consolidated list of the most pressing needs expressed by the various agencies.

4.1 Needs and Issues - Key Findings From the Interviews

The following is an abbreviated list of the key findings from the Interview Findings Report:

- *Law Enforcement Interoperability* is needed on an exception basis, rather than being routinely used. Uses of interoperability are generally infrequent, short duration, and usually only one channel is needed except for major incidents.

- *Fire Interoperability* is used routinely. Uses of interoperability are frequent, long duration, with multiple channels needed based on the incident command structure of the particular incident.

- *Coverage of an agency's primary radio system is a major issue for both Law Enforcement and Fire.* For Fire, greater coverage would mean they would remain in coverage and maintain the emergency trigger functionality when

responding to mutual aid incidents far outside of their jurisdiction. For Law Enforcement, greater coverage would mean that officers involved in vehicle pursuits that led far outside their home jurisdiction would still have communications with their dispatcher, and contact could be maintained with surveillance teams outside the jurisdiction, as well. These advantages would apply to a mobile data system as well as voice.

- *Radio coverage is a major issue effecting interoperability.* Coverage is a major factor that greatly complicates the implementation of patch-type solutions. For example, one of LAFD's 800 MHz channels cannot simply be patched to one of LACoFD's UHF channels to form a command channel because their coverage footprints are different, and either or both may not have good coverage at the incident scene.

- *A shortage of available frequencies is a serious issue for both Law Enforcement and Fire.* LAPD, LAFD, LASD and numerous smaller jurisdictions stated that they needed more channels and none were available.

- *The currently available interoperability solutions are useful but are not sufficient.* The process of swapping radios is inefficient. Distributing radios at an incident scene consumes time that could be better spent managing the incident. The use of multiple frequency bands makes shared channels useful for many, but not all agencies. Even for the agencies within a particular frequency band, differing coverage footprints limit the effectiveness of the shared channel concept. Patch-type solutions such as communications vans and LARTCS are not available immediately upon dispatch of an incident and are thus not useful for many new or rapidly developing incidents. Plus, a large incident may require more tactical channels than could be provided using patch-type solutions.

- *Emergency trigger functionality is lost in many mutual aid scenarios.* Emergency trigger functionality is lost when a user is outside of their primary radio system's coverage footprint, or when using another agency's radio.

- *More training and familiarization is needed for all users.* When swapping radios with other agencies, lack of familiarization with the other agency's radio causes delays in setting up communications and hence time is lost that could be better spent managing the incident. Thorough user training and familiarization was cited by LASD as a requirement for Phase II of the LARTCS buildout.

4.2 Interoperability Defined

The Department of Homeland Security, through its SAFECOM wireless communications technology program, has defined an "interoperability continuum." The continuum takes into account more than just technology: it deals with operating procedures, training, governance, frequency of use, as well as technology. The various levels of interoperability between public safety agencies are shown graphically in the chart below. Since this report deals mainly with issues of technology, we will limit this section to a description of the five levels of technology interoperability.

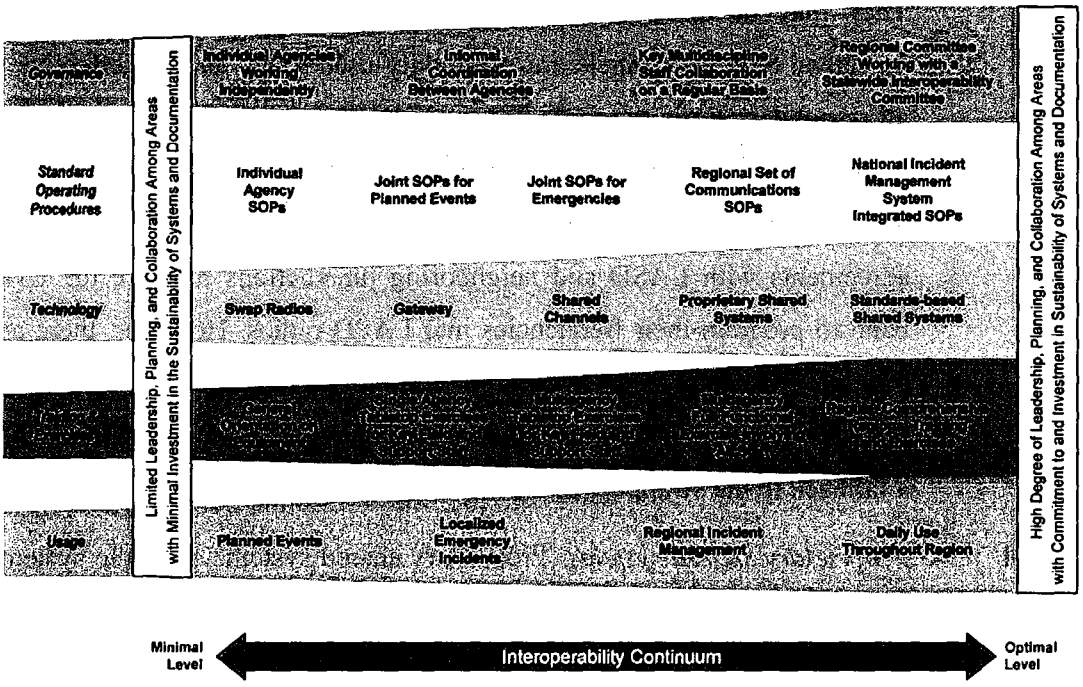


Figure 3 - The SAFECOM Interoperability Continuum

The five levels are:

Level 1: *Swapping of Radios;* Radio swapping is the "lowest common denominator" of interoperability. If there is no other way to talk to the other agency, give them one of your radios. This is the level of interoperability most of the Los Angeles area fire departments normally use.

Level 2: *Gateways or Patch-type Solutions;* Patch-type solutions are very useful in a number of situations, provided that: 1) They can be set up quickly enough, and 2) The channels being patched together both have good coverage at the incident scene. Patch-type solutions are spectrally inefficient because two or more channels are required to transmit a single message. Both LARTCS and the communications vans are patch-type solutions.

Level 3: *Shared Channels;* Generally, shared channels are mutual aid channels. They may be direct mode (simplex, radio-to-radio) or they may use repeaters. Shared channels are commonly used today and are effective if all responders are in the same frequency band. In some cases, neighboring jurisdictions have made agreements whereby they are permitted to program each other's channels into their radios. For example, LAPD has agreements with LASD and neighboring jurisdictions that use the UHF band to program their frequencies into LAPD radios. However, there are multiple frequency bands in common use in the Los Angeles area, limiting the effectiveness of the shared channel concept. This, then, requires either a fallback to the swapping of radios, or the use of patch-type solutions.

Level 4: *Proprietary shared systems;* Proprietary shared systems are radio systems that are built to accommodate multiple user groups (or jurisdictions) and have wide coverage, but use proprietary technology so that users cannot competitively bid equipment purchases because one manufacturer's radio will not work with another manufacturer's infrastructure. Motorola's SmartZone and M/A-COM's EDACS and Open Sky are examples of

proprietary technologies commonly used for shared radio systems. Unfortunately, the technology that promises to be a true standards-based radio system has not yet reached that state of development. The state of development of the APCO Project 25 trunked radio standards is such that, for example, a M/A-COM P25 radio is not certified to work correctly with a Motorola P25 infrastructure, due to a lack of testing standards and a program to accomplish the testing. While there is some independent testing going on, there is no organization or laboratory that is responsible for certification. Nor can a M/A-COM and a Motorola radio infrastructure be linked together so that users of either system may roam into the coverage of the other and be guaranteed that communications will be maintained. A Telecommunications Industry Association (TIA) committee is charged with developing certification standards and a standard for an Inter-Sub-System Interface (ISSI), with completion scheduled for 2006. Of course, additional time will be required for manufacturers to actually develop and produce the interface. Therefore, even though at the moment Project 25 trunked systems are still categorized proprietary shared systems, progress is being made to take them to the next level.

Level 5: *Standards-Based Shared Systems:* A true standards-based shared system will be designed to accommodate multiple user groups or jurisdictions, have wide coverage, the equipment will have undergone a rigorous, independent certification process to ensure that any manufacturer's radio will work correctly with any other manufacturer's infrastructure and that competing manufacturer's infrastructures may be linked together so that users may roam seamlessly between them. A current example of a standards-based system is the TETRA (TErrestrial Trunked RAdio) trunked radio technology, which is available almost anywhere in the world except the United States and Canada. The TETRA suite of standards (promulgated by ETSI, the European equivalent of the TIA) contains standards for the testing of cross-manufacturer functionality and the linking of systems. The cross-manufacturer testing has led to a remarkably

high level of acceptance of the TETRA technology, a large number of competitive offerings, and a dramatic reduction in the price of equipment. A full-featured TETRA trunked portable radio is available in Europe for the equivalent of about $1,200 US. Compare this to an APCO Project 25 trunked portable radio, with fewer features, costing from $3,500 to $5,000 US. Coincidentally, and rather ironically, Motorola is the world's largest-selling manufacturer of TETRA radio equipment.

4.3 Evaluation of Current Interoperability Solutions

4.3.1 Level 1 - Radio Swapping

Radio swapping is the main interoperability tool used by Los Angeles area fire departments. Large fire agencies (LAFD, LACoFD, CDF and USFS) all maintain a cache of radios that can be distributed to other fire agencies at a large incident. LAPD has provided its UHF radios to LAFD. LAFD has provided its 800 MHz radios to Long Beach and others. LASD has installed control stations for its mutual aid channels in many smaller jurisdictions' control centers.

While this method provides some interoperability, distributing the radios is time consuming and rarely succeeds in putting a radio in the hands of everyone that needs one. In particular, firefighters fighting large brush fires are rarely equipped with radios that will allow them to monitor a common tactical channel. Additionally, there is no emergency trigger function available when swapping radios. Especially in light of today's environment, with its terrorism fears and the looming possibility of a major earthquake or other natural disaster, public safety agencies would like very much to move past Level 1 interoperability and on to something less time consuming, and more effective.

4.3.2 Level 2 - Gateways and Patch-Type Solutions

LARTCS and the communications vans with ACU-1000 patching systems installed that have been purchased by many agencies are examples of gateway solutions. Patch-type solutions are particularly effective for long-term incidents where multiple agencies will be working together for an extended period of time. Due to the length of time required to set up a patch, they are less suitable

for brand-new or rapidly developing incidents. It is a particular problem for Fire agencies, as they are typically assigned a tactical channel at the time of dispatch. The firefighters set their radio equipment to the correct frequency before they suit up in their firefighting gear. Once suited up, it is difficult for the firefighter to reach the radio to change channels. Once the firefighter is on-scene and actively fighting a fire, changing channels can be a safety hazard, as the firefighter would have to divert their attention from the fire and un-strap or remove some safety equipment in order to reach the radio and change channels. The LARTCS system would be considerably more effective for the fire service if the fire dispatchers were permitted to set up their own patches, or better yet, patches were automatically set up via the fire department's CAD system. Of course, this scenario assumes that all coverage discrepancies have been resolved.

Certain patch systems may exhibit a slight time delay between the time that a message is received by the patch and the time the message is re-transmitted on the patched channel(s). The delay manifests itself as missing syllables or a missing word at the beginning of the message. Users that are familiar with the system are able to compensate for the delay and communicate without difficulty. Unfamiliar users may experience difficulties using the system. It is important that all users receive training and familiarization before using patch-type interoperability solutions.

4.3.3 Level 3 - Shared Channels

A number of agencies already have agreements with other agencies to program each other's radio channels into their radios. This is an extremely convenient method: another agency may be contacted by the simple click of the channel selector knob. Unfortunately, it only works when the agencies are all operating in the same frequency band. This is not the case in the Los Angeles area: agencies use the VHF, UHF and the 800 MHz bands. In addition, depending on the agreements between the agencies, the location of the user, and the types of radios utilized, the emergency trigger function may not function when a user switches to a mutual aid channel or the channel of another agency.

Another drawback to this approach is that the coverage footprint of a shared mutual aid channel usually differs from that of the user's primary radio system. An LAPD officer on a high-speed vehicular pursuit may travel far outside of the LAPD radio system's coverage. The officer may be within coverage of one of the LASD mutual aid channels, but even these have differing coverage from one another and the officer may go in and out of coverage of these channels as well. A single officer in a vehicle may not even be able to change radio channels without risking the loss of control of their vehicle. The overall result is that the officer is usually cut off from radio communications when on a pursuit outside of their primary jurisdiction. LAPD's dispatchers stated that air units can reach LAPD's radio system far beyond the range of a vehicle, and that the air units will report on the chase and allow them to keep track of the pursuit. However, they also stated that sometimes their only source of information is the television news. The best solution to this problem would be to extend the coverage of LAPD's radio system out as far as possible, so the officer could maintain contact with their dispatcher without the need to change channels. Other agencies joining the pursuit could then switch to the LAPD channel, monitor the chase and communicate with the LAPD officer directly if necessary. Another potential solution would be to have a radio with an enhanced scanning capability in the officer's vehicle, that would automatically find a mutual aid channel with good coverage, change the channel, and notify the dispatcher so that they may switch to the mutual aid channel to maintain contact with the officer.

Depending on the location of the user, and the types of radios utilized, the emergency trigger function may not operate when a user switches to a patched channel.

4.3.4 Level 4 - Proprietary Shared Systems

The Interagency Communications Interoperability System (ICIS) is an example of a Level 4 proprietary shared system. It is a trunked radio system operating in the UHF band, and uses Motorola's proprietary SmartZone technology. The ICIS system is in operation (Glendale and Burbank have completed their

portions of the system) but is still under construction. It is designed to be shared by multiple municipalities and agencies. As of today, the major ICIS participants are the cities of Glendale, Burbank, Montebello, Beverly Hills, Torrance and Pomona. The cities of El Segundo and Culver City have contributed to the ICIS implementation and are planning to join. Other cities that subscribe to the ICIS service but are not members of the ICIS board are the City of San Marino, the San Fernando Police Department and the Glendale Community College Police Department. Other cities are considering joining the network as well.

The ICIS coverage area is divided into several "cells", each roughly corresponding to the coverage footprint of an individual municipality's radio system. The cells are then linked together to form a composite coverage footprint. Any user may roam anywhere within the composite footprint and remain in contact with their dispatch center. Each agency has an number of trunked talkgroups for their exclusive use, which are distributed among the various user groups within that agency. A police department, for example, might have exclusive talkgroups for dispatch, tactical, traffic, narcotics, SWAT, etc. In addition, there are a number of tactical talkgroups that are available to all agencies on a shared basis, which are used for inter-agency communications and mutual aid during an incident. Each agency also has an emergency trigger that will function anywhere in the composite coverage footprint.

From an interoperability standpoint, ICIS has many advantages over the lower-level systems. In this case, all ICIS member agencies have the same coverage footprint, eliminating the problems with coverage differences that may be found with gateway solutions. There is no need to swap radios, since the agencies share the same system and may move to the shared tactical talkgroups simply by turning the channel selector knob on their radio. The availability of the interoperability channel is immediate. Users receiving a mutual aid dispatch can immediately switch to the tactical channel without having to wait for the channel to be set up. Since interoperability is achieved via the user's primary radio, little or no additional technical training is required. While there is a limit

on the number of talkgroups that may be created within a trunked system, that number is quite high. For all practical purposes, the system can provide as many channels (talkgroups) as are needed.

Many of the agencies that RCC interviewed pointed to the ICIS system as a model for what they believed would be an ideal county-wide radio system to be shared by all public safety agencies within Los Angeles County.

4.4 Needs Analysis Summary

4.4.1 Identified Needs

RCC has identified the following needs that should be fulfilled by a next-generation interoperability solution:

- *Ubiquitous Coverage.* The solution will be required to provide coverage throughout Los Angeles County (and beyond, if possible). The coverage footprint for every agency should be identical and as wide an area as possible.
- *Unlimited Tactical Channel Capacity.* The solution will be required to dedicate as many channels as necessary to an incident (or to multiple incidents), with no limit on the number of radio users that may be assigned to a channel. Ideally, the system will confine the tactical channel usage to a limited area around the incident scene, preventing the incident from impacting routine communications or other incidents by consuming communications resources that are far removed from the incident scene.
- *Instantaneous Set-Up.* The solution will be required to set up interoperability immediately at the time of dispatch. A CAD system interface will be required so that any dispatch center requesting mutual aid may assign a tactical channel to an incident that is immediately accessible by all responders.
- *Automatic Assignment To Tactical Channel.* The solution will be required to have the capability of automatically assigning individual radios to a tactical channel and then changing the channel of the radio without manual

intervention by the user. This capability would be used in very limited circumstances, such as a high-speed pursuit by law enforcement. For example, it could be used to move an officer in a pursuing vehicle to a tactical channel without the officer taking their hands off the wheel and risking loss of control of the vehicle.

- *Emergency Trigger Must Function Everywhere.* The solution will be required to maintain the emergency trigger functionality, no matter where the user is located, and no matter what channel they currently have selected. The emergency trigger alarm shall be routed to the appropriate dispatch center for that user.

- *Minimal Training Requirements.* Ideally, the interoperability solution will operate identically to the user's primary radio system, meaning that little or no additional technical training is required. Training in operational policies and procedures will still be necessary.

4.4.2 Potential Solutions

The only potential solution that fulfills the above requirements is a Level 4 or Level 5 trunked radio system with countywide coverage (or greater), that is shared by all radio users in Los Angeles County. The trunked system should be supplemented by LARTCS or a LARTCS-like patch solution so that users that must remain in other frequency bands (such as CHP, CDF, USFS, US Coast Guard, FBI, US Secret Service, etc.) may be patched to an appropriate tactical talk group when participating in an incident.

- The trunked system will provide identical, countywide coverage for all radio users. Everyone's radio will work everywhere (Direct mode will still be available for use in deep canyons and the minor dead spots that will always exist).

- Due to a trunked system's ability to have many more talkgroups than there are actual radio frequencies, all users can be provided with the number of channels they require for routine communications, plus a very large number of shared tactical channels for incident use.

- The trunked system may be interfaced to multiple CAD systems, permitting the assignment of shared tactical channels at the time of dispatch or a request for mutual aid. Anyone responding to the incident will simply switch their radio to the assigned tactical channel and immediately be on the same channel as all other responders. Incident Commanders may request additional tactical channels as required.

- Today's trunked systems are capable of forcing a radio to a particular talkgroup without manual channel switching by the user. This would be valuable if needed to move a high-speed pursuit off of a dispatch channel and onto a tactical channel without forcing the officer to take their hands off the wheel.

- Given that all users would be within the coverage footprint of their primary radio system at all times, the emergency trigger would function everywhere. The only exception might be down in a deep canyon or other dead spot where direct mode was being used.

- Since interoperability will be achieved via the user's primary radio, little to no additional technical training will be required to use it successfully. The user will already be very familiar with the operation of the radio because they use it every day.

4.4.3 Possible Trunked Radio System Scenarios

Below, RCC describes two scenarios for constructing a countywide shared trunked radio system in the short term (3-5 years):

800 MHz Scenario

Between the City of Los Angeles and the County of Los Angeles, the two entities control 127 800 MHz frequencies. Other jurisdictions within the county control at least 27 more. This could be sufficient to construct a countywide shared trunked radio system for voice at 800 MHz, with a shared mobile data system constructed in the UHF spectrum. Less critical users that were using 800 MHz for voice would also be moved down to the UHF spectrum. When the 700 MHz band becomes available in the future, an additional 120 channels (12.5

kHz bandwidth) could be added to the system. Mobile data could then be moved to 700/800 MHz as well, to take advantage of the 700 MHz wideband data channels.

The main advantage to initially constructing the shared system at 800 MHz is that the surrounding counties all operate shared systems at 800 MHz. Depending on the manufacturer selected, the Los Angeles area system could be networked with the neighboring counties' systems, creating an extended network that covers much of Southern California.

UHF Scenario

Between the City of Los Angeles and the County of Los Angeles, the two entities control 258 narrowband (12.5 kHz bandwidth) frequency pairs in the UHF band. This may be sufficient to construct a countywide shared trunked radio system for voice at UHF. ICIS and other users control at least 143 more. With this many frequencies, it may also be sufficient to construct a countywide mobile data system at UHF, as well. Alternatively, mobile data could be moved to 800 MHz. Between LAFD and LAPD and the Port of Los Angeles there are twenty-nine 800 MHz channels, which could be sufficient to construct a countywide mobile data system at 800 MHz. Non-public safety users that are now assigned to the 800 MHz trunked systems operated by the City of Los Angeles and the County of Los Angeles will remain where they are.

The primary advantage to initially constructing the shared system at UHF is the larger pool of frequencies, and the fact that LAPD has a considerable amount of relatively new UHF infrastructure. It might be possible to upgrade LAPD's existing infrastructure instead of replacing it, potentially resulting in a large cost savings. The existing UHF shared trunked system in the Los Angeles area, ICIS, might also be modified and incorporated in some manner without requiring a complete system replacement. As described in the discussion of proprietary and standards-based trunked radio systems (Interoperability Level 4 and Level 5), a true standards-based shared radio system does not yet exist. Therefore, incorporation of ICIS (without modification) and re-use of existing LAPD infrastructure would demand that Motorola be the selected vendor.

5.0 CONCEPTUAL DESIGNS FOR AN INTEROPERABLE RADIO SYSTEM

In the previous section, RCC identified the following requirements that should be fulfilled by a next-generation interoperability solution. These critical requirements have driven the conceptual designs, and the critical requirements were, in turn, driven by the needs expressed by public safety radio users that were captured in the Interview Summary Report.

The critical requirements are:

- *Ubiquitous Coverage.* The solution will be required to provide coverage throughout Los Angeles County (and beyond, if possible). The coverage footprint for every agency should be identical and cover as wide an area as possible. An identical coverage footprint for every agency means that there will be no constraints on interoperability due to differences in radio coverage. Wide-area coverage means that users will not move out of radio coverage when they are assigned to mutual-aid incidents or are involved in pursuits that take them outside their jurisdiction.

- *Unlimited Tactical Channel Capacity.* The solution will be required to dedicate as many channels as necessary to an incident (or to multiple incidents), with no limit on the number of radio users that may be assigned to a channel. Ideally, the system will confine the tactical channel usage to a limited area around the incident scene, preventing the incident from impacting routine communications or other incidents by consuming communications resources that are far removed from the incident scene.

- *Instantaneous Set-Up.* The solution will be required to set up interoperability immediately at the time of dispatch. A CAD system interface will be required so that any dispatch center requesting mutual aid may assign a tactical channel to an incident that is immediately accessible by all responders.

- *Automatic Assignment to Tactical Channel.* The solution will be required to have the capability of automatically assigning individual radios to a tactical channel and then changing the channel of the radio without manual

intervention by the user. This capability would be used in very limited circumstances, such as a high-speed pursuit by law enforcement. For example, it could be used to move an officer in a pursuing vehicle to a tactical channel without the officer taking their hands off the wheel and risking loss of control of the vehicle.

- *Emergency Trigger Must Function Everywhere.* The solution will be required to maintain the emergency trigger functionality, no matter where the user is located, and no matter what channel they currently have selected. The emergency trigger alarm shall be routed to the appropriate dispatch center for that user.

- *Minimal Training Requirements.* Ideally, the interoperability solution will operate identically to the user's primary radio system, meaning that little or no additional technical training is required. Training in operational policies and protocols will still be necessary.

The current systems in use by agencies in the Los Angeles region (with the exception of LACoFD and LASD) cover the agency's jurisdiction and a relatively short distance beyond, and do not provide region-wide coverage. LACoFD and LASD have conventional repeaters on mountaintops, buildings and other structures throughout the county, but there is no network switch interconnecting them, and so the coverage is not seamless. Manual intervention by the user is necessary to maintain coverage when moving throughout the region. Each agency's coverage footprint differs, and because of that, the radio systems generally cannot be patched together to provide mutual-aid interoperability. Interoperability may be achieved if the agency providing the mutual aid is able to switch to the frequency of the agency requesting mutual aid, but this is not always possible because agencies often operate in different frequency bands. Simulcast technology may allow an agency to extend the coverage of their radio system beyond their jurisdictional boundaries, but the limitations of simulcasting prevent agencies from extending their coverage to everywhere they might travel during a pursuit or while providing mutual aid. Frequencies set aside for mutual aid use suffer the same problems of wide-area coverage: simulcasting only gets you so much coverage, and no more. Plus,

conventional solutions such as the ones mentioned above all require manual intervention by the user, such as switching the channel or obtaining a different radio altogether. A law enforcement officer involved in a pursuit can't risk being distracted or take their hands off the wheel to change channels. Other problems likely to happen when invoking conventional interoperability solutions include:

- Loss of emergency trigger functionality;
- Poor or no communications due to the user's unfamiliarity with the operation of the radio or with radio protocols;
- Loss of communications because of the user's inability to change to the proper channel, as when in a pursuit, or after a firefighter has begun actually fighting a fire (the radio may be underneath layers of personal protective equipment that cannot be removed).

Another problem is one of capacity: A major incident may require that a number of tactical channels be assigned. Given that a great many of the public safety agencies that were interviewed complained of having too few channels available, it is unlikely that a sufficient number of mutual aid/tactical channels could be aggregated to provide enough capacity to manage more than one large incident in the metropolitan area.

A solution to all these problems does exist: a trunked radio system that is shared by all the public safety agencies within the region. In fact, a regional trunked radio system meets all the critical requirements stated earlier in this section. A regional trunked radio system:

- *Provides wide-area coverage and an identical footprint for all users.* A trunked system is capable of region-wide coverage despite the limitations of simulcasting. The system is divided into "cells" that cover a specific area within the region. A cell may be a single "monocast" antenna site, or may consist of a cluster of simulcast sites. As a user moves ("roams") out of the coverage of one cell and into the coverage on another, the trunked system commands their radio to switch to the frequencies of the new cell. No manual intervention by

the user is required, and the user probably will not be able to tell that they have switched to a different cell.

- *Can provide a dramatic increase in the number of available channels, allowing for a large number of mutual aid/tactical channels that may be assigned to incidents.* In a conventional radio system (the type currently used by nearly all public safety agencies in the Los Angeles region), one frequency equals one channel. By pooling frequencies in a trunked radio system, one frequency can equal many channels. Each trunked channel is separate and exclusive to each user group, just like a conventional channel. One user group does not normally hear another user group's transmissions.

- *Can set up common mutual aid/tactical channels immediately.* In fact, the channels are already set up, awaiting assignment by a dispatcher. It will not be necessary to contact a "system manager" to have them set up the mutual aid channel. A CAD system interface or another suitable means of keeping track of mutual aid channel assignments will be required to prevent unintentional duplicate assignments.

- *Can move users to mutual aid channels automatically, without user intervention.* This may be accomplished through pre-defined disaster plans, or as needed to move individual radio users, such as a officer involved in a high-speed pursuit, to a common mutual aid channel. A CAD system interface is the preferred method of invoking this function.

- *Permits emergency trigger functionality anywhere in the coverage of the system.* Users will not lose their emergency trigger when they venture outside their jurisdiction.

- *Will require minimal training in order to use the interoperability features.* Since the radio used for interoperability is the same radio that is used for day-to-day operations, little training on radio operation will

be required. Training on operational policies and protocols will still be necessary.

A regional trunked radio system might be implemented in a number of different ways, examples of which are discussed at length in the next section.

5.1 General Design Methodology

This section contains three sample "conceptual" system designs that will demonstrate the viability of the regional trunked radio system concept. These designs do not necessarily represent the best ways or the only ways that a system of this type could be constructed. The budgetary cost estimates for each design include certain assumptions that may or may not accurately reflect actual conditions. For example, making a visit to every potential antenna site was beyond the scope of this project, and therefore RCC is unable to provide an exact estimate for each site for improvements to the tower, equipment shelter and emergency generator. However, a certain amount of money was included in each antenna site's budget to account for these needs. RCC assumes that some sites will need more and some sites will need less, and hopes that the total amount allocated for those needs will closely approximate the total amount that will actually be required. Additional research and design effort, plus a significant amount of additional input from the project stakeholders, will be required to refine these designs and their cost and schedule estimates and to ensure that the system that is actually implemented meets all user needs.

Note: For definitions of technical terms and acronyms, please see Appendix A.

5.1.1 Choice Of Technology

All conceptual designs are built upon the APCO Project 25 ("P25") trunked system platform for these reasons:

- A trunked system is called for in order to satisfy the critical requirements specified previously.
- The P25 suite of standards, although incomplete, have resulted in a selection of products that may be interchanged to a limited degree. Major manufacturers are now guaranteeing that their mobile and

portable radios will work with other manufacturer's infrastructure. This means that outside agencies with P25 radios in the correct frequency band will be able to interoperate with Los Angeles region radio users *through the LA regional radio system.* This also means that competitive procurements for mobile and portable radio equipment is possible, resulting in lower costs. P25 standards for interconnection of different manufacturer's P25 radio infrastructures ("Inter Sub-System Interface" or "ISSI"), and P25 compliance verification testing are due to be completed in 2006.

- When complete, the P25 suite of standards will provide for interchangeability (and competitive procurement) of base stations/repeaters and dispatch consoles. That is, these items may be competitively procured separately and integrated into an existing infrastructure, no matter which manufacturer initially supplied the infrastructure. These standards are in progress, but there is no timeframe for completion.

- The P25 Common Air Interface ("CAI") Phase 2 Time Division Multiple Access ("TDMA") standard is also due to be completed within 2006. The TDMA standard will potentially more than double the traffic-carrying capacity of systems using the existing Phase 1 CAI standard. Although the standard is not complete, RCC expects that, by the time the Los Angeles Regional system is being procured, equipment that will be purchased will be software upgradeable to Phase 2, if not already Phase 2 compliant. Users with Phase 1 only equipment will still be supported by systems equipped for Phase 2 operation. Radio equipment purchased today for immediate needs probably will not be software upgradeable to Phase 2 TDMA, but will still be usable with a Phase 2 infrastructure..

- Trunking technologies other than P25 are proprietary to a specific manufacturer and cannot offer interchangeability of components and the opportunity for competitive procurement after the initial purchase is

made. Therefore, as part of the conceptual design, RCC is proposing to upgrade ICIS to P25 and then integrate it into the regional system.

- Federal funding is being provided for P25 systems almost exclusively. A showing of the extreme need for an alternative technology is required to obtain funding for non-P25 systems.

For the reasons stated above, RCC believes that P25 is the only choice for a regional trunked radio system.

5.1.2 Antenna Site Selection

To obtain the necessary details of existing antenna sites (latitude, longitude, structure and antenna height, etc.), RCC relied primarily on FCC license records and on information provided by interviewees. In these conceptual designs, RCC endeavored to select antenna sites that were already in use by the County or the City. In some cases, the City, the County and one or more municipalities had separate antenna sites in close proximity with one another. In these cases, RCC selected the site that appeared to have the best coverage. Where there were no existing City or County sites, or where the existing sites did not provide the needed coverage, other sites were investigated and selected in this order of preference:

- Existing sites operated by other governmental entities.
- Existing sites operated by private entities (i.e., tower companies or commercial wireless carriers).
- Undeveloped sites on County or City land.
- Undeveloped sites on other property.

By primarily using existing antenna sites, a level of confidence was obtained that the basic utility requirements for operation of a radio facility (power and telecommunications) were available at those locations. RCC also endeavored to use realistic antenna heights, in recognition of the obstacles that are posed when attempting to increase the height of existing structures or construct new

structures. In nearly all cases, the antenna heights used in the design do not exceed the heights of existing antennas specified on the corresponding licenses for that location. A master list of all antenna sites that were included or were considered for inclusion in the conceptual designs (including geographic coordinates, ground elevation, antenna height and the FCC license the information was derived from) is contained in Appendix D.

5.1.3 Coverage and Capacity

In preparing these conceptual designs, RCC had 3 coverage goals: 1) Maximize portable on-street coverage across Los Angeles County, 2) Maximize in-building coverage in the metro area, and 3) Minimize dead spots in canyons. Since we are in a situation with a limited, fixed number of frequencies, the coverage will effect capacity. RCC attempted to achieve a balance between the two. The highest capacity would be achieved if each of the pooled frequencies were simulcast across the entire region. Of course, that is impossible for the reasons discussed previously. Therefore, the region was broken down into "cells" covering a specific area. Each cell consists of one or more antenna sites. Multiple sites serving the same cell use simulcasting to achieve the needed coverage. This results in less overall system capacity than if all frequencies were simulcast everywhere, but still results in adequate capacity with room for future growth. In general, capacity follows these equations (for a fixed number of available frequencies):

More simulcast cells & fewer single site cells = fewer cells = greater overall capacity

Fewer simulcast cells & more single site cells = more cells = less overall capacity

The grouping of sites into cells was driven primarily by how well the sites simulcast, a criterion that depends heavily on the physical distance between sites (under some conditions, the maximum separation between sites in a digital system can be only six miles), terrain, the antenna used, and to a lesser extent, transmitter power and other factors. The site/cell groupings do not take beat boundaries or agency service areas into account. As users travel within the region, it is likely that they will cross cell coverage boundaries, or perhaps they

will move into a canyon that is a dead spot for Cell A but is covered by Cell B. When this happens, the user's radio will be automatically commanded to change frequency to that of the new cell. If a radio conversation is in progress, the user probably will not notice that the radio has changed frequency. Users, unless specifically prohibited by the system administrator, will be able to roam from cell to cell throughout the region, still maintaining communications with other users on their channel without having to change the radio's channel selector. Because of this feature, users will experience exceptionally good coverage because they will not have the signal fade out or have to manually change channels when they travel into what were formerly dead areas for the channel they normally use.

There is a considerable amount of overlap of the footprints of adjacent cells in the Los Angeles metropolitan area, and in the Lancaster/Palmdale area. This is deliberate, because of the dead area fill-in coverage it provides, and with the intent that a failure of one complete cell will have a relatively minor impact on the users within that cell's footprint. For instance, if Cell A fails completely, Cell A users will automatically revert to adjacent Cell B and Cell C, both of which have overlapping coverage in Cell A's footprint. Users will notice that the coverage is diminished, but communications will not be completely lost.

Unfortunately, the automatic roaming from cell to cell and the overlapping cell coverage footprints introduce certain challenges of their own. At any given moment, some number of users that are assigned primarily to Cell A will actually be communicating on Cell B or Cell C. This may be the result of the cell coverage footprints not conforming to the user's beat boundary or service area, or it may be that the user roamed over to the adjacent cell when they were momentarily in one of Cell A's dead spots. Whatever the reason, the result is that Cell B is now carrying some of Cell A's traffic. This results in a reduction in the overall capacity of the system, compared to what it would be if all traffic could be isolated to single cells. Please note that this reduction in overall capacity is not a critical flaw in the system. Instead, it is factor that must be incorporated into the design process. RCC has worked with a number of clients

that have experienced this phenomenon, and has also worked with the vendors to mitigate the problems. The conceptual designs presented here assume that 2/3 of all traffic will be multi-cell, and the capacity estimates reflect this.

The cellular concept also can prevent a major incident from causing disruption to routine communications in other parts of the region. Incident communications will be isolated to a small number of cells (the incident cell and some of the adjacent cells), but will not use up system capacity in other areas. Therefore, routine communications for areas not involved in the incident can continue normally, without having to observe radio silence in order to reserve capacity for incident communications. However, users will have to maintain radio discipline, and not be tempted to listen in on incident communications if they are not personally involved. Doing so would exacerbate the multi-cell traffic issue described in the preceding paragraph. It is also possible to prevent uninvolved radio users from listening in through careful management of how mutual aid channels are defined and assigned to incidents.

Voice system capacity was determined by calculating the capacity of each cell using the Erlang C traffic model. The Erlang C model is specifically suited for trunked radio systems, because of the manner in which trunked systems manage user contention. In the event that all of the repeaters are in use when a user presses their push-to-talk button ("PTT"), that user is briefly placed in a queue until one of the repeaters becomes free. In a well designed system, queuing only occurs when there is an unusually high volume of traffic, and even then the length of time a user waits in queue is normally very short, less than one second. The Erlang C model allows system design engineers to determine the system capacity (measured in Erlang units) by specifying the number of voice repeaters in the cells, the probability that a user will be placed in queue during a very busy period (the "Grade of Service", or "GoS"), the length of an average transmission, and the length of time the user will spend in the queue waiting for a free repeater. The parameters used by RCC are a GoS of 0.05 (during the busiest periods, 1 of every 200 PTTs will result in being placed in queue), and a queue delay of 1 second. The number of voice repeaters equals the number of

frequencies assigned to each cell, minus one (one repeater is reserved for control signaling and doesn't carry voice traffic). The resulting cell capacity (in Erlang units) was divided by 0.003 (the average traffic generated by a police officer on patrol equals 0.003 Erlang) to arrive at the total number of users that cell would independently support. This number was then divided by 3 to account for multi-cell calls. To obtain the total capacity of the overall system during the busiest period and under the specified conditions, the number of users supported by each cell were summed.

The capacity estimates for each conceptual design are defined in the sections that describe each design option in detail. Please note that the number of frequencies assigned to each cell and therefore the system's capacity estimates are based on RCC's assumptions of the traffic volume each cell must carry. Verification of actual traffic volumes are beyond the scope of this project and should be performed during the next phase of the design process. For comparison purposes, RCC's report to the County of Los Angeles indicated that the County would require 43 frequency pairs if LASD and LACoFD jointly constructed a countywide trunked radio system. Also, details of several other regional trunked radio systems across the country are contained in Appendix H.

5.1.4 Coverage Maps

Coverage predictions were prepared using RCC Consultants' own ComSite Design™ wireless engineering software. The coverage maps identify four levels of coverage, interpreted as four signal strength levels. The basic level of coverage is mobile outdoor coverage, with a signal strength sufficient to achieve a Delivered Audio Quality (DAQ) of 3.4 with a reliability factor of 95%. DAQ 3.4 means "Speech understandable with repetition only rarely required. Some noise/distortion.", as defined in TIA/EIA Telecommunications Systems Bulletin TSB88-B, "Wireless Communications Systems - Performance In Noise and Interference-Limited Situations - Recommended Methods For Technology-Independent Modeling, Simulation, and Verification," September 2004. For Project 25 radio equipment, this equates to a signal level of -105 dBm, using a

quarter-wave mobile antenna and with a transmitter output power of 25 Watts at UHF, or 15 Watts at 700/800 MHz. These mobile transmitter power outputs were selected instead of a higher power for two primary reasons: 1) The overall system is being designed to achieve portable radio coverage and a higher power is not necessary, and 2) the system is designed for frequency re-use, and it is possible that high-power mobile radios in use in one area of the region could cause interference in another area. That is, a particular frequency may be in use at multiple areas within the region, and to prevent interference it is necessary to maintain mobile transmitter power at the level required to achieve the desired performance and no more.

The next level of signal strength is the level sufficient to achieve DAQ 3.4 using a portable radio outdoors ("on-street"). When calculated by the method recommended in TSB-88, the portable radio also requires a signal level of -105 dBm. However, the portable radio has a much less efficient antenna than the mobile radio, is subject to shielding by the user's body when operated in a belt carrying case with a remote speaker/microphone, and has a transmitter power output of only four Watts. This means that, due to the above factors, a portable radio, used on-street in a belt carrying case needs a substantially higher signal level than a mobile radio to achieve DAQ 3.4 audio quality. The exact signal level varies depending on the frequency band and whether you are modeling talk-out (repeater to field unit) or talk-back (field unit to repeater). Therefore, the exact signal levels used for each coverage map are defined in the sections that describe each design option in detail.

The next level of signal strength is the level sufficient to achieve DAQ 3.4 using a portable radio inside a "residential" building. Due to differences in construction materials, type and number of windows and other factors, it is impossible to define a "typical" building in terms of signal penetration losses. Therefore, RCC has arbitrarily defined a "residential" building as one having 10 dB or less of building penetration loss. So, the signal level required for DAQ 3.4 audio quality when using a portable radio inside a "residential" building is 10 dB greater than that for a portable radio on-street.

The final level of signal strength modeled in these conceptual designs is the level sufficient to achieve DAQ 3.4 using a portable radio inside a "commercial" building. Again, it is impossible to define a "typical" building, so RCC has arbitrarily defined a commercial building as one having between 10 dB and 20 dB of building penetration loss. Therefore, the signal level required for DAQ 3.4 audio quality when using a portable radio inside a "commercial" building is 20 dB greater than that for a portable radio on-street.

RCC acknowledges that there are likely to be buildings having more than 20 dB of penetration loss. If these buildings are in close proximity to an antenna site, the high signal strength may overcome the building penetration loss and good coverage will be achieved throughout the building. Above-ground floors of high-rise buildings probably will fall in this category. Otherwise, if in-building coverage is necessary for the particular building, an amplifier system will be required. These buildings will have to be identified and analyzed on a case-by-case basis, which is beyond the scope of this project and should be done as part of the detailed technical design process. To account for coverage within these structures, RCC has included in the designs a number of in-building amplifier systems to "pipe" signals into and out of buildings that have high penetration loss.

5.1.5 Airborne Operations

Radio systems are usually designed for the use of users in land vehicles or on foot at ground level. Airborne operation in helicopters or fixed-wing aircraft pose a special challenge because the aircraft fly at heights far higher than the system was designed for. At these heights, received signal strengths are dramatically increased from that found at ground level. Simulcast systems and systems with frequency re-use experience problems because the airborne mobile can receive signals in the air that it cannot receive on the ground, and was not intended to receive. Interference and loss of communications is the result. Therefore, certain sites in each design are specifically set up as non-simulcast, single site (monocast) sites with no reuse of their frequencies, or as a simulcast

cell where the sites are less than six miles apart (a situation which avoids simulcast distortion problems) and no frequency re-use. Airborne mobiles will be restricted to those sites only. This will allow an airborne mobile to have full trunking functionality without experiencing interference.

5.2 Regional UHF Voice System

This design assumes that the UHF band (470 MHz through 512 MHz) frequencies now in use by LA City, LA County, ICIS and others will be split (converted to narrowband 12.5 kHz bandwidth) and contributed to the frequency pool. Frequencies in the UHF sub-band 470 MHz through 512 MHz are needed, because there is a legal mechanism to obtain frequency exclusivity in this sub-band. In other words, these frequencies may be licensed so that there will be no unanticipated co-channel interference. The other UHF sub-band, 450 MHz to 470 MHz, has no provision for exclusivity. A breakdown of the frequency pool is as follows:

Licensee	Number of Frequency Pairs
Los Angeles (City) Police Dept.	112 Narrowband (NB)
Los Angeles (City) Fire Dept.	4 Wideband (WB) (8 equivalent NB)
Los Angeles Sheriff's Dept.	55 WB (110 equivalent NB)
Los Angeles County Fire Dept.	14 WB (28 equivalent NB)
ICIS Member Cities	46 WB (92 equivalent NB) 32 NB
City of Santa Monica	7 WB (14 equivalent NB)
City of Long Beach	2 WB (4 equivalent NB) 1 NB
TOTAL	401 NB frequency pairs

Additional frequencies may be contributed by the Los Angeles County Department of Health Services (20 NB MED frequency pairs). However, these frequencies are a set-aside by the FCC for hospital use, and a waiver of FCC Rules may be required before they may be used in the regional trunked radio system. These frequencies were not considered in the frequency plan. Other municipalities may contribute up to 32 additional wideband and 25 additional narrowband 470 MHz - 512 MHz frequencies (see Appendix E). However, they have not been included in this conceptual design. Contributions by other agencies of 450 MHz - 470 MHz sub-band frequencies should be accepted and used for direct-mode and geographically limited special purposes.

Of the 401 available frequency pairs, 51 of the pairs will be split into individual frequencies, providing 102 frequencies for direct-mode use. The remaining 350 frequency pairs will be grouped in groups of five, providing 70 groups to be assigned to the trunked cells. This conceptual design utilizes a total of 62 antenna sites, grouped into 30 cells. The sites were selected using the criteria stated in Section 5.1.

The sites and their assigned frequency groups are identified below:

Cell	Assigned Freq. Groups	Cell Name	Site Names	Cell Type
1	1,2,3,4,5,6	So. Bay/Harbor	San Pedro Hill Rancho Palos Verdes Palos Verdes Estates	30 repeater simulcast
2	60,61	So. San Pedro	Fire Station 101	10 repeater standalone
3	13,14	Catalina	Tower Peak Black Jack Peak Dakin Peak	10 repeater simulcast
4	66,67,68	Far West	Castro Peak	15 repeater standalone
5	60,61	Decker Canyon	Decker Canyon	10 repeater standalone
6	62,29	Encinal Canyon 1	Encinal 1	10 repeater standalone
7	56,30	Encinal Canyon 2	Encinal 2	10 repeater standalone
8	27,28	Carillo State Beach	Carillo	10 repeater standalone
9	53,54,55	Topanga	Saddle Peak Green Mtn. Topanga	15 repeater simulcast
10	45,46,47,48,49,50	West LA	100 Wilshire Century Plaza West LA Fire Station 69	30 repeater simulcast
11	51,52,69	Sepulveda Pass	San Vincente Peak Beverly Glen	15 repeater simulcast
12	39,40,41,42,43,44	Southwest LA	Baldwin Hills LA Co Fed Ex Southwest PD	30 repeater simulcast
13	15,16,17,18,19,20	Hollywood	Mt. Lee Beverly Hills Rexford Dr. Walker Drive West Hollywood Adams Hill Tower Bldg.	30 repeater simulcast
14	21,22,23,24,25,26	Downtown/East LA	LA City Hall 1277 Eastern Elysian Park Mt. Washington KSKQ	30 repeater simulcast
15	7,8,9,10	Mt. Disappointment	Mt. Disappointment	20 repeater standalone

16	15,16,17,18	Johnstone Peak	Johnstone Peak	20 repeater standalone
17	60,61,62	Pomona	San Dimas	15 repeater simulcast
			Walnut	
			Pomona 2	
18	57,58,59	Southeast County	Hacienda Heights	15 repeater standalone
19	63,64,65	Puente Hills	Puente Hills Nike	15 repeater standlone
20	27,28,29,30,31,32	East Valley	Mt. Lukens LA Co	30 repeater simulcast
			Verdugo Peak LA Co	
			Mt. Thom	
			San Augustine	
			Sunland	
21	33,34,35,36,37,38	W. Valley/Santa Clarita	Oat Mountain Nike LA Co	30 repeater simulcast
			West Valley PD	
22	15,16,17,18	Magic Mountain	Magic Mountain	20 repeater standalone
23	13,14	Castaic	Whittaker Ridge	10 repeater simulcast
			San Francisquito Cyn.	
24	1,2	Gorman	Frazier Peak	10 repeater simulcast
			Bald Mountain	
25	53,54	Antelope Valley	Burnt Peak	10 repeater simulcast
			Portal Ridge	
26	55,56,70	Palmdale	Mt. McDill	15 repeater simulcast
			Hauser Peak	
27	3,4	Soledad Pass Fill-In	Vincent	10 repeater standalone
28	5,6	Lancaster Fill-In	West Lancaster	10 repeater standalone
29	11,12	East County	Lower Blue Ridge	10 repeater standalone
30	13,14	Blue Rock	Blue Rock	10 repeater standalone
			62	TOTAL SITES

Each cell is assigned a minimum of 10 frequencies. Cells located in the greater Los Angeles metropolitan area are assigned proportionately more than cells that cover sparsely populated areas. Fill-in sites that cover a small geographic area are given the minimum of 10 frequencies. Cells that cover the heart of the metropolitan area are assigned the maximum of 30 frequencies. In earlier trunking technologies, 28 frequencies was the maximum number of frequencies that could be managed using a single control channel (the repeater that is reserved for control signaling). However, this no longer applies, due to the higher data speed of the P25 control channel.

This system design is expected to support 30,095 concurrent users during the busiest periods. The overall capacity estimates were calculated as indicated in the following table:

Type of Cell	Capacity (Erlangs)	Users Supported	Multi-Cell Factor	Factored # of Users	# of Cells in Region	Total # of Users
10 - Repeater	4.80	1,600	0.33	528	13	6,864
15 - Repeater	8.77	2,923	0.33	964	8	7,712
20 - Repeater	13.04	4,343	0.33	1,433	2	4,299
30 - Repeater	20.16	6,720	0.33	2,217	7	15,519
				TOTALS >	**30**	**30,095**

The capacity that can be expected in the greater metropolitan area was calculated as indicated below:

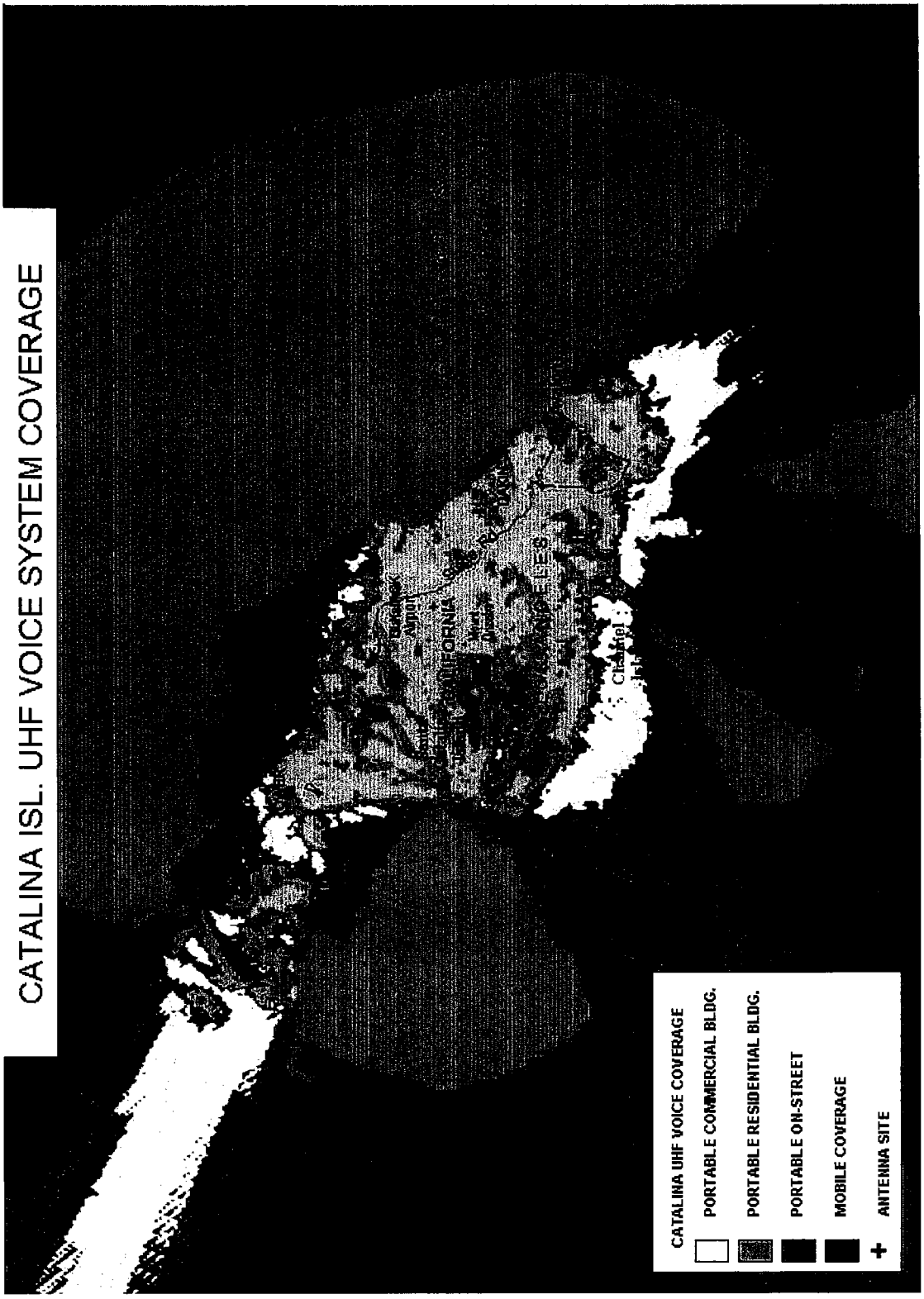
Type of Cell	Capacity (Erlangs)	Users Supported	Multi-Cell Factor	Factored # of Users	# of Cells Metro Area	Total # of Users
10 - Repeater	4.80	1,600	0.33	528	1	528
15 - Repeater	8.77	2,923	0.33	964	3	2,892
20 - Repeater	13.04	4,343	0.33	1,433	3	4,299
30 - Repeater	20.16	6,720	0.33	2,217	7	15,519
				TOTALS >	**14**	**23,238**

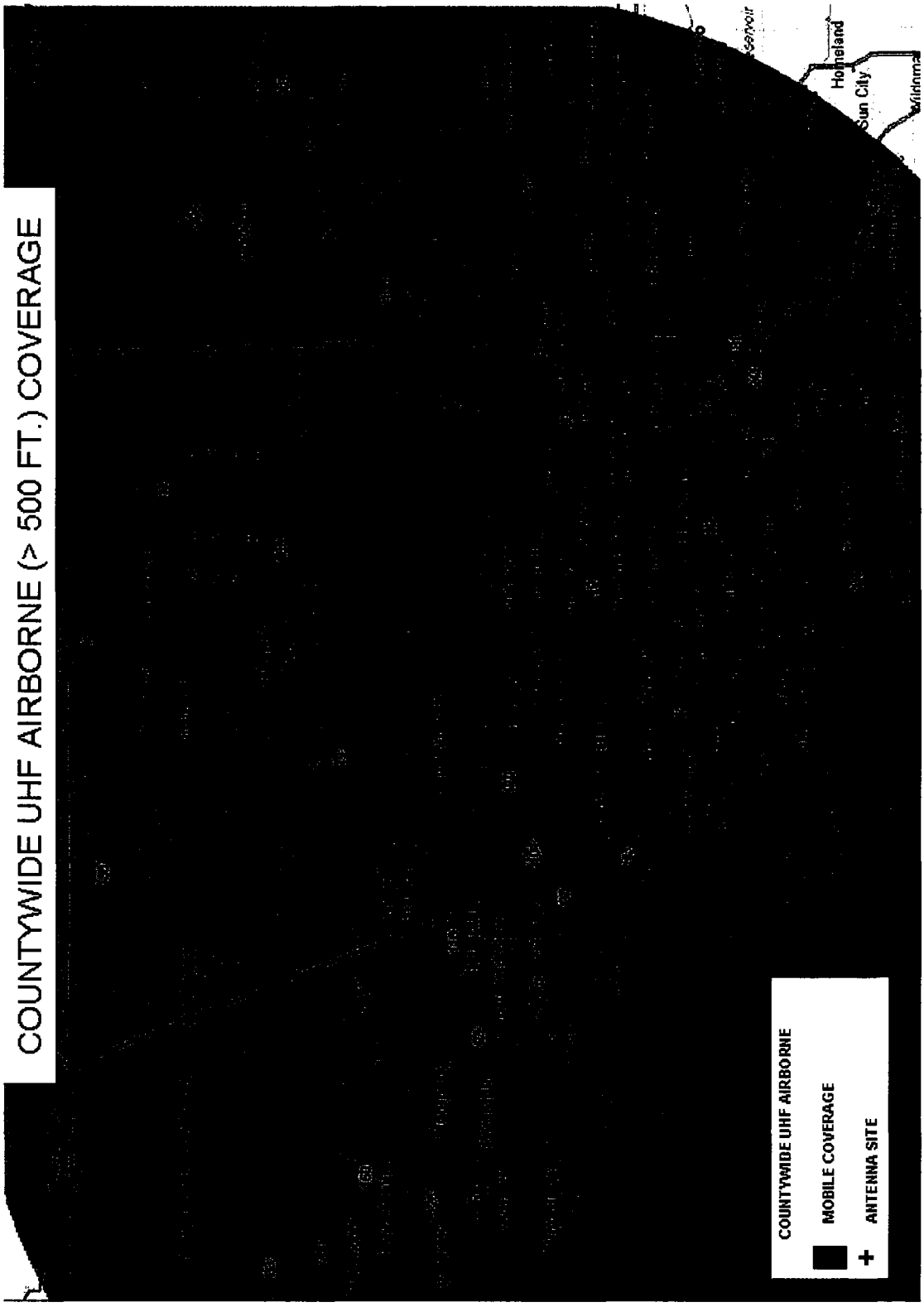
In the event of a large incident or another major event that brings about a large, multi-agency response, RCC recommends that standby repeaters be installed at each site. These standby repeaters are to prevent overloading of a particular cell. The standby repeaters would be activated upon the command of the system administrator if it were determined that a large volume of traffic was overloading the cell. These repeaters would be tuned to frequencies that are normally used by other non-adjacent cells. Better yet, they would be frequency-agile and able to tune to any of the other frequencies. These frequencies would be de-activated in the original cells when a standby repeater is activated. This would result in a temporary reduction in capacity of the other cells, but, assuming the other cells were not themselves excessively busy, it would not effect routine communications, and additional capacity could be added to cells that need it.

On the following pages are maps indicating the predicted coverage of the Regional UHF Voice System. The maps indicate talk-back (field unit to repeater) coverage as that is the limiting case. Four levels of coverage (signal strength) are indicated:

Coverage Category	Signal	Conditions
Mobile On-Street	-105 dBm	1/4-wave mobile whip, 25W TX output
Portable On-Street	-86 dBm	1/4-wave port. whip, 4W TX, belt case
Port. In Residential Bldg.	-76 dBm	1/4-wave port. whip, 4W TX, belt case, 10 dB bldg. loss
Port. In Commercial Bldg.	-66 dBm	1/4-wave port. whip, 4W TX, belt case, 20 dB bldg. loss


REGIONAL UHF VOICE SYSTEM COVERAGE
REGIONAL UHF VOICE COVERAGE
PORTABLE COMMERCIAL BLDG.
PORTABLE RESIDENTIAL BLDG.
PORTABLE ON-STREET
MOBILE COVERAGE
ANTENNA SITE
Frazier Park
Mount Pinos
Los Padres National Forest
Ojai
Mira Monte
Santa Paula
Ventura
Oxnard
Camarillo
Thousand Oaks
Malibu
Agoura Hills
Calabasas
Woodland Hills
Encino
Tarzana
Reseda
Van Nuys
Sherman Oaks
Studio City
Hollywood
Burbank
Glendale
Pasadena
Alhambra
Monterey Park
Montebello
Pomona
Claremont
La Verne
San Dimas
Glendora
Azusa
Duarte
Arcadia
Monrovia
Sierra Madre
Altadena
La Cañada Flintridge
La Crescenta
Tujunga
Sunland
Lake View Terrace
Pacoima
San Fernando
Mission Hills
Northridge
Chatsworth
Simi Valley
Moorpark
Fillmore
Piru
Santa Clarita
Valencia
Newhall
Saugus
Castaic
Lake Castaic
Pyramid Lake
Gorman
Lancaster
Palmdale
Littlerock
Pearblossom
Crestline
Lake Arrowhead
Running Springs
Big Bear Lake
San Bernardino National Forest
Redlands
Yucaipa
Calimesa
Beaumont
Banning
Cabazon
Morongo Valley
Yucca Valley
Joshua Tree
Twentynine Palms
Desert Hot Springs
Palm Springs
Cathedral City
Rancho Mirage
Palm Desert
Indian Wells
La Quinta
Indio
Coachella
Thermal
Mecca
Salton Sea
Perris
Hemet
San Jacinto
Lake Elsinore
Canyon Lake
Sun City
Menifee
Wildomar
Murrieta
Temecula
Lake Skinner
Lake Perris
Lakeland Village
Homeland
Romoland
Winchester
Aguanga
Anza
Idyllwild
Hemet Reservoir
Diamond Valley Lake
Lake Mathews
Lake Elsinore
Lake Matthews
Riverside
Corona
Norco
Eastvale
Jurupa Valley
Mira Loma
Ontario
Chino
Chino Hills
Rancho Cucamonga
Upland
Fontana
Rialto
Colton
Grand Terrace
Loma Linda
Highland
San Bernardino
Big Bear City
Lake Gregory
Crestline
Lake Arrowhead
Running Springs
Big Bear Lake
Fawnskin
Baldwin Park
West Covina
Irwindale
Azusa
Glendora
Covina
La Puente
Hacienda Heights
Whittier
La Habra Heights
La Mirada
Norwalk
Santa Fe Springs
Pico Rivera
Downey
Bellflower
Paramount
Lakewood
Long Beach
Signal Hill
Cerritos
Artesia
Hawaiian Gardens
Lynwood
Compton
Carson
Gardena
Hawthorne
Inglewood
Culver City
Beverly Hills
Santa Monica
Venice
Marina del Rey
Playa del Rey
Westchester
Los Angeles International Airport
Manhattan Beach
Hermosa Beach
Redondo Beach
Torrance
Rancho Palos Verdes
Palos Verdes Estates
Rolling Hills Estates
Rolling Hills
Lomita
San Pedro
Wilmington
Harbor City
Long Beach
Catalina Island
Avalon
Two Harbors
Santa Catalina Island
Channel Islands National Park
Anacapa Island
Santa Cruz Island
Santa Rosa Island
San Miguel Island
Santa Barbara Island
Pacific Ocean
Santa Barbara Channel
Port Hueneme
Point Mugu
Naval Base Ventura County
Point Mugu State Park
Leo Carrillo State Park
Malibu Lagoon State Park
Topanga State Park
Will Rogers State Historic Park
Griffith Park
Los Angeles River
Arroyo Seco
Rio Hondo
San Gabriel River
Santa Ana River
Puente Hills
Chino Hills State Park
Prado Flood Control Basin
Prado Regional Park
Santa Ana Mountains
Cleveland National Forest
Orange County
Irvine
Lake Forest
Mission Viejo
Laguna Niguel
Dana Point
San Clemente
San Juan Capistrano
Aliso Viejo
Laguna Hills
Laguna Woods
Laguna Beach
Huntington Beach
Seal Beach
Newport Beach
Costa Mesa
Fountain Valley
Westminster
Garden Grove
Stanton
Cypress
La Palma
Buena Park
Anaheim
Orange
Tustin
Santa Ana
Placentia
Yorba Linda
Brea
Fullerton
La Habra
Whittier
Diamond Bar
Walnut
Rowland Heights
Hacienda Heights
La Puente
Industry
San Dimas
La Verne
Claremont
Pomona
Chino
Chino Hills
Norco
Corona
Eastvale
Jurupa Valley
Riverside
Mira Loma
Ontario
Rancho Cucamonga
Upland
Fontana
Rialto
Colton
Grand Terrace
Loma Linda
Highland
San Bernardino
Redlands
Yucaipa
Calimesa
Beaumont
Banning
Cabazon
Morongo Valley
Yucca Valley
Joshua Tree
Twentynine Palms
Desert Hot Springs
Palm Springs
Cathedral City
Rancho Mirage
Palm Desert
Indian Wells
La Quinta
Indio
Coachella
Thermal
Mecca
Salton Sea
Perris
Hemet
San Jacinto
Lake Elsinore
Canyon Lake
Sun City
Menifee
Wildomar
Murrieta
Temecula
Lake Skinner
Lake Perris
Lakeland Village
Homeland
Romoland
Winchester
Aguanga
Anza
Idyllwild
Hemet Reservoir
Diamond Valley Lake
Lake Mathews
Lake Elsinore
Lake Matthews


CATALINA ISL. UHF VOICE SYSTEM COVERAGE
CATALINA UHF VOICE COVERAGE
PORTABLE COMMERCIAL BLDG.
PORTABLE RESIDENTIAL BLDG.
PORTABLE ON-STREET
MOBILE COVERAGE
ANTENNA SITE


COUNTYWIDE UHF AIRBORNE (> 500 FT.) COVERAGE
Hopeland
Sun City
COUNTYWIDE UHF AIRBORNE
MOBILE COVERAGE
ANTENNA SITE

RCC estimates that this design achieves mobile coverage over 95% of the county, portable on-street coverage over 85% of the county, and in-building coverage over 74% of the county and 93% of the metropolitan area. Cost estimates for this option range between a low of $484.8 million to a high of $604.6 million.

5.3 Regional 700/800 MHz Voice System

This design assumes that the 800 MHz band frequencies now in use by LA City, LA County, and others, and the 700 MHz frequencies that have been assigned to Los Angeles region users will be contributed to the frequency pool. A breakdown of the frequency pool is as follows:

Licensee	Number of Frequency Pairs
Los Angeles City	69 800 MHz frequency pairs
Los Angeles City	34 700 MHz frequency pairs (12.5 kHz)
Los Angeles County	68 800 MHz frequency pairs
Los Angeles County	70 700 MHz frequency pairs (12.5 kHz)
ICIS Member Cities	7 800 MHz frequency pairs
Port of Los Angeles	1 800 MHz frequency pair
City of Pomona	4 700 MHz frequency pairs (12.5 kHz)
City of Santa Monica	1 800 MHz frequency pair
City of Long Beach	2 800 MHz frequency pairs
TOTAL	256 frequency pairs

Other municipalities may contribute up to 14 additional 800 MHz frequencies (see Appendix E) and 12 additional 700 MHz frequencies. However, they have not been included in this conceptual design.

Of the 256 available frequency pairs, 31 of the pairs will be split into individual frequencies, providing 62 frequencies for direct-mode use. The remaining 225 frequency pairs will be grouped in groups of five, providing 45 groups to be assigned to the trunked cells. This conceptual design utilizes a total of 80 antenna sites, grouped into 32 cells. The sites were selected using the criteria stated in Section 3.1.

The sites and their assigned frequency groups are identified below:

Regional 700/800 MHz Voice System Frequency Allocation (Groups of 5 Frequencies)

Cell	Assigned Freq. Groups	Cell Name	Site Names	Cell Type
1	1,2,3,5	So. Bay/Harbor	San Pedro Hill LA Co Rancho Palos Verdes Palos Verdes Estates	20 rptr simulcast

2	38	South San Pedro	Fire Station 101	5 rptr simulcast
			San Pedro City Hall	
3	29,27	Long Beach	Signal Hill	10 rptr standalone
4	7	Catalina	Tower Peak	5 rptr simulcast
			Black Jack Peak	
			Dakin Peak	
5	8	Far West	Castro Peak	5 rptr simulcast
			Agoura Hills	
6	6	Zuma Beach	Zuma Beach	5 rptr simulcast
			Decker Canyon	
			Encinal 1	
			Encinal 2	
			Carillo	
			Sherwood	
7	42,43	Topanga	Saddle Peak	10 rptr simulcast
			Green Mtn.	
			Malibu	
			Topanga	
8	39,40,41	West LA	100 Wilshire	15 rptr simulcast
			Century Plaza	
			West LA	
			Fire Station 69	
			Santa Monica Water Tank	
9	32,44	Sepulveda Pass	San Vicente Peak	10 rptr simulcast
			Beverly Glen	
			Sepulveda 2	
10	33,34,35	Southwest LA	Baldwin Hills	15 rptr simulcast
			Fed Ex	
			Southwest PD	
11	24,25,26,44	Hollywood	Mt. Lee	20 rptr simulcast
			Beverly Hills Rexford Dr.	
			Walker Drive	
			West Hollywood	
			Adams Hill	
			Tower Bldg.	
12	21,22,23,45	Downtown/East LA	LA City Hall	20 rptr simulcast
			1277 Eastern	
			1401 W. 6th Street	
			Elysian Park	
			Mt. Washington	
			KSKQ	
13	4	Montebello	Montebello	5 rptr standalone
14	28,36,37	Mt. Disappointment	Mt. Disappointment	15 rptr standalone
15	12,13,14	Johnstone Peak	Johnstone Peak	15 rptr standalone
16	9,10,11	Pomona	San Dimas	15 rptr simulcast
			Walnut	
			Pomona 1	
			Pomona 2	
17	30,31	Southeast County	Whittier	10 rptr simulcast

			Hacienda Heights	
18	32,44	Puente Hills	Puente Hills	10 rptr standalone
19	18,19,20	East Valley	Mt. Lukens LA Co	15 rptr simulcast
			Verdugo Peak LA Co	
			Mt. Thom	
			San Augustine	
			Mirador	
			Sunland	
			Fire Station 74	
21	15,16,17	West Valley/Santa Clarita	Oat Mountain Nike LA Co	15 rptr simulcast
			Sylmar	
			West Valley PD	
22	39	East Santa Clarita	Sulphur Springs USD	5 rptr standalone
23	9,10,11	Magic Mountain	Magic Mountain	15 rptr standalone
24	12	Castaic	Whittaker Ridge	5 rptr simulcast
			San Francisquito Cyn.	
25	13	Gorman	Frazier Peak	5 rptr simulcast
			Bald Mountain	
26	7	Antelope Valley	Burnt Peak	5 rptr simulcast
			Portal Ridge	
27	3	Palmdale	Mt. McDill	5 rptr simulcast
			Hauser Peak	
28	14	Soledad Pass Fill-In	Vincent	5 rptr standalone
29	6	Lancaster Fill-In	West Lancaster	5 rptr standalone
30	15	East County	Lower Blue Ridge	5 rptr simulcast
			Frost Peak	
31	5	Table Mountain	Table Mountain	5 rptr standalone
32	4	Blue Rock	Blue Rock	5 rptr standalone
			80	TOTAL SITES

Each cell is assigned a minimum of 5 frequency pairs. Cells located in the greater Los Angeles metropolitan area are assigned proportionately more than cells that cover sparsely populated areas. Fill-in sites that cover a small geographic area are given the minimum of 5 frequency pairs. Cells that cover the heart of the metropolitan area are assigned a maximum of 20 frequencies. This system design is expected to support 17,918 concurrent users during the busiest periods. The overall capacity estimates were calculated as indicated in the following table:

Type of Cell	Capacity (Erlangs)	Users Supported	Multi-Cell Factor	Factored # of Users	# of Cells in Region	Total # of Users
5 - Repeater	1.43	477	0.33	157	15	2,355
10 - Repeater	4.80	1,600	0.33	528	5	2,640
15 - Repeater	8.77	2,923	0.33	964	3	2,892
20 - Repeater	13.04	4,343	0.33	1,433	7	10,031
				TOTALS >	**30**	**17,918**

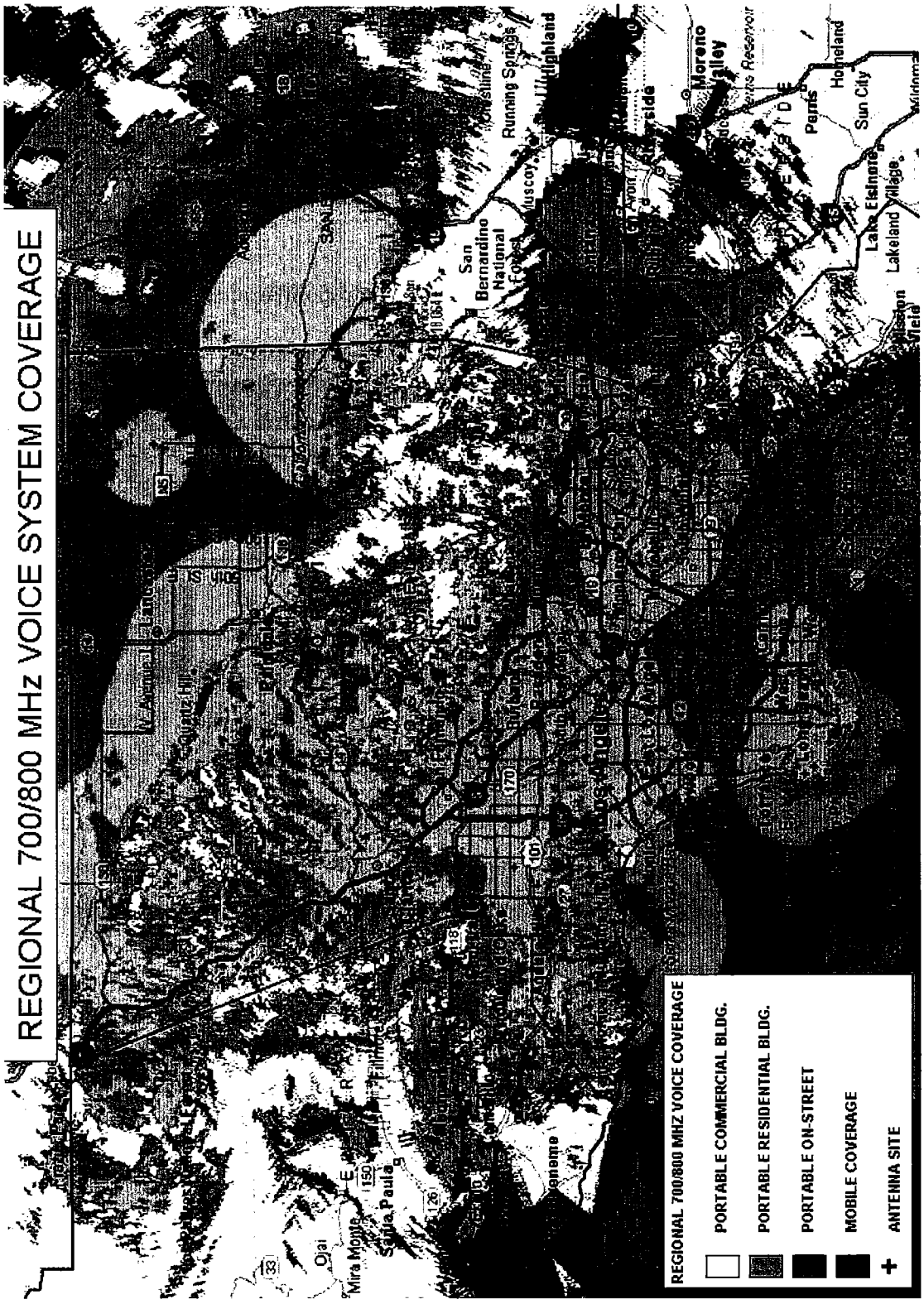
The capacity that can be expected in the greater metropolitan area was calculated as indicated below:

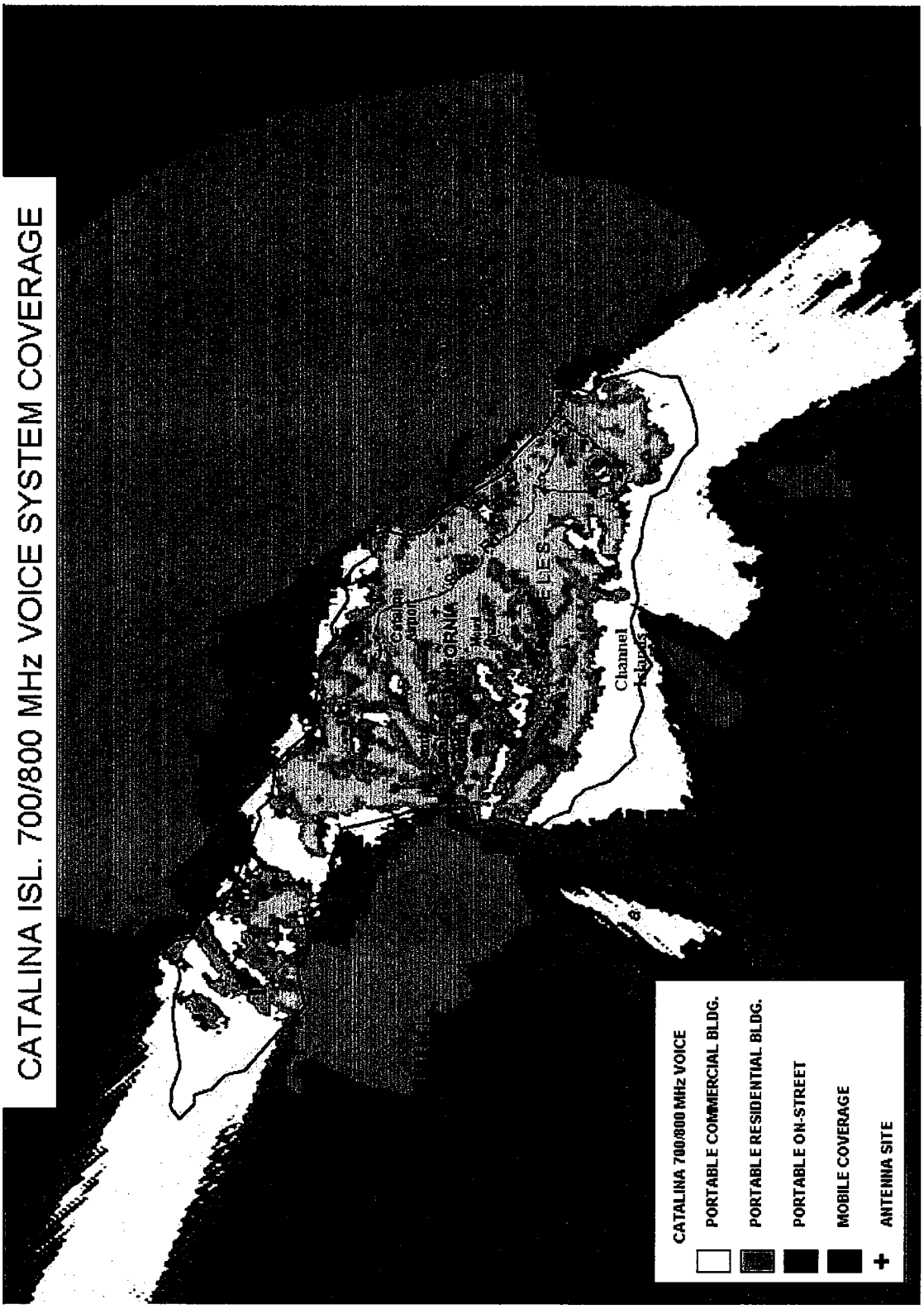
Type of Cell	Capacity (Erlangs)	Users Supported	Multi-Cell Factor	Factored # of Users	# of Cells Metro Area	Total # of Users
5 - Repeater	1.43	477	0.33	157	1	157
10 - Repeater	4.80	1600	0.33	528	3	1,584
15 - Repeater	8.77	2923	0.33	964	3	2,892
20 - Repeater	13.04	4343	0.33	1433	7	10,031
				TOTALS >	**14**	**14,664**

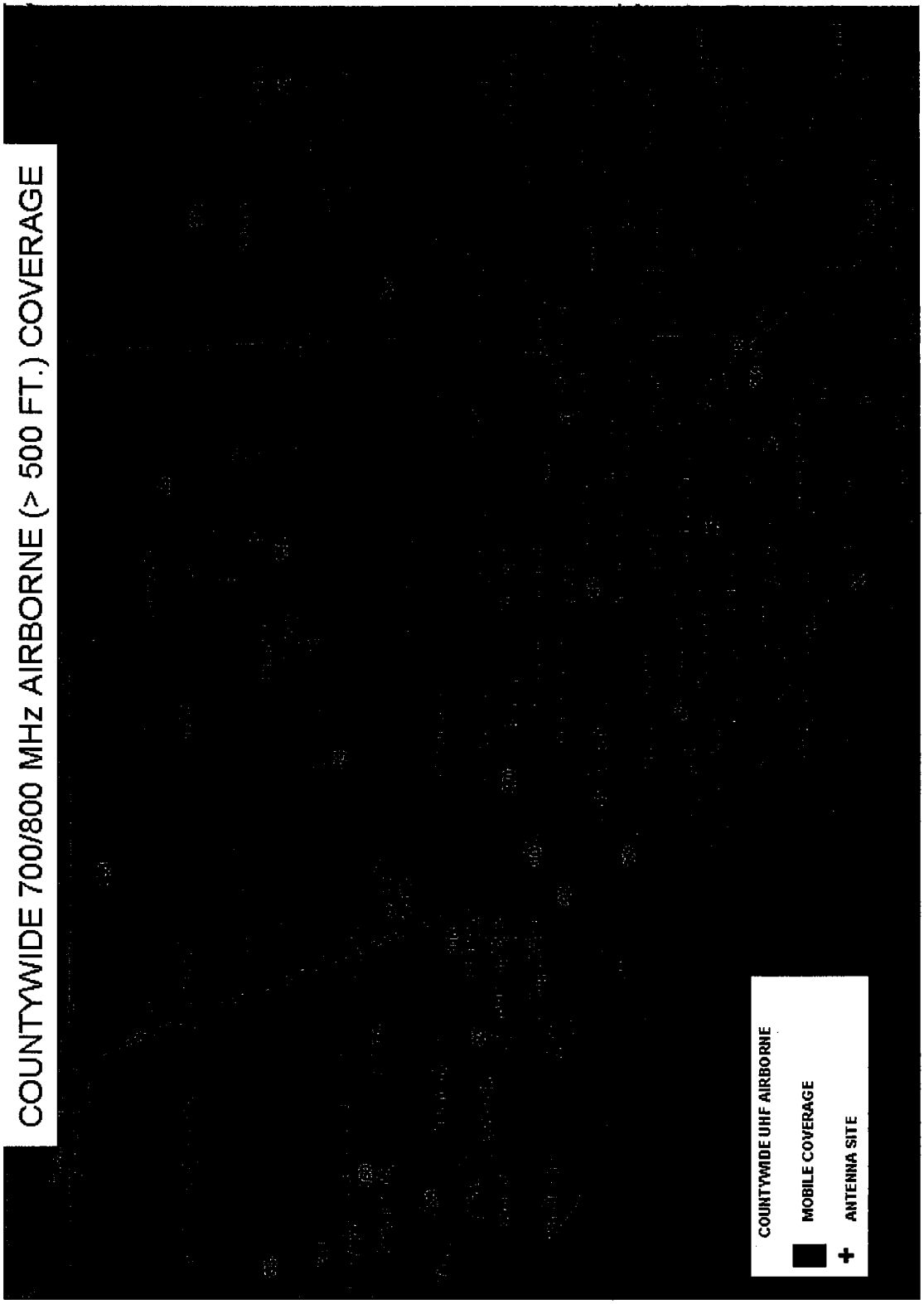
In the event of a large incident or another major event that brings about a large, multi-agency response, RCC recommends that standby repeaters be installed at each site. These standby repeaters are to prevent overloading of a particular cell. Please see the description of the standby repeater concept in the preceding section.

On the following pages are maps indicating the predicted coverage of the Regional 700/800 MHz Voice System. The maps indicate talk-back (field unit to repeater) coverage as that is the limiting case. Four levels of coverage (signal strength) are indicated:

Coverage Category	Signal	Conditions
Mobile On-Street	-105 dBm	1/4-wave mobile whip, 15W TX output
Portable On-Street	-83 dBm	1/4-wave port. whip, 3W TX, belt case
Port. In Residential Bldg.	-73 dBm	1/4-wave port. whip, 3W TX, belt case, 10 dB bldg. loss
Port. In Commercial Bldg.	-63 dBm	1/4-wave port. whip, 3W TX, belt case, 20 dB bldg. loss


REGIONAL 700/800 MHz VOICE SYSTEM COVERAGE
REGIONAL 700/800 MHZ VOICE COVERAGE
PORTABLE COMMERCIAL BLDG.
PORTABLE RESIDENTIAL BLDG.
PORTABLE ON-STREET
MOBILE COVERAGE
ANTENNA SITE
Moreno Valley
Perris
Sun City
Homeland
Lake Elsinore
Lakeland Village
Running Springs
Highland
San Bernardino National Forest
Ojai
Santa Paula
Mira Monte


CATALINA ISL. 700/800 MHz VOICE SYSTEM COVERAGE
CATALINA 700/800 MHz VOICE
PORTABLE COMMERCIAL BLDG.
PORTABLE RESIDENTIAL BLDG.
PORTABLE ON-STREET
MOBILE COVERAGE
ANTENNA SITE
Channel Islands


COUNTYWIDE 700/800 MHz AIRBORNE (> 500 FT.) COVERAGE
COUNTYWIDE UHF AIRBORNE
MOBILE COVERAGE
ANTENNA SITE

RCC estimates that this design achieves mobile coverage over 93% of the county, portable on-street coverage over 85% of the county, and in-building coverage over 74% of the county and 95% of the metropolitan area.

Implementation of a regional 700/800 MHz public safety voice radio system will require that City and County non-public safety users that are using the existing 800 MHz frequencies be relocated. Since City and County public safety users will be vacating the UHF spectrum in favor of 700/800 MHz, the non-public safety users will be re-located to the UHF spectrum being vacated. RCC has prepared a conceptual design of a regional UHF trunked system, providing mobile coverage only, for the non-public safety users.

The non-public safety system would consist of 13 non-simulcast sites grouped into 13 cells. The frequency pool would consist of 390 frequencies. Each site/cell would be assigned 30 frequencies. The sites and their frequency assignments are identified below:

Regional UHF Non-Public Safety Voice SystemFrequency Allocation (78 Groups of 5 Channels)

Mobile Coverage Only

Cell	Assigned Freq. Groups	Site/Cell Name	Cell Type
1	1,2,3,4,5,6	San Pedro Hill	30 rptr standalone
2	7,8,9,10,11,12	Black Jack Peak	30 rptr standalone
3	13,14,15,16,17,18	Castro Peak	30 rptr standalone
4	19,20,21,22,23,24	San Vincente Peak	30 rptr standalone
5	25,26,27,28,29,30	Johnstone Peak	30 rptr standalone
6	31,32,33,34,35,36	Puente Hills	30 rptr standalone
7	37,38,39,40,41,42	Mt. Lukens	30 rptr standalone
8	43,44,45,46,47,48	Oat Mountain Nike LA Co	30 rptr standalone
9	49,50,51,52,53,54	Magic Mountain	30 rptr standalone
10	55,56,57,58,59,60	Whittaker Ridge	30 rptr standalone
11	61,62,63,64,65,66	Bald Mountain	30 rptr standalone
12	67,68,69,70,71,72	Mt. McDill	30 rptr standalone
13	73,74,75,76,77,78	Lower Blue Ridge	30 rptr standalone
		13	TOTAL SITES

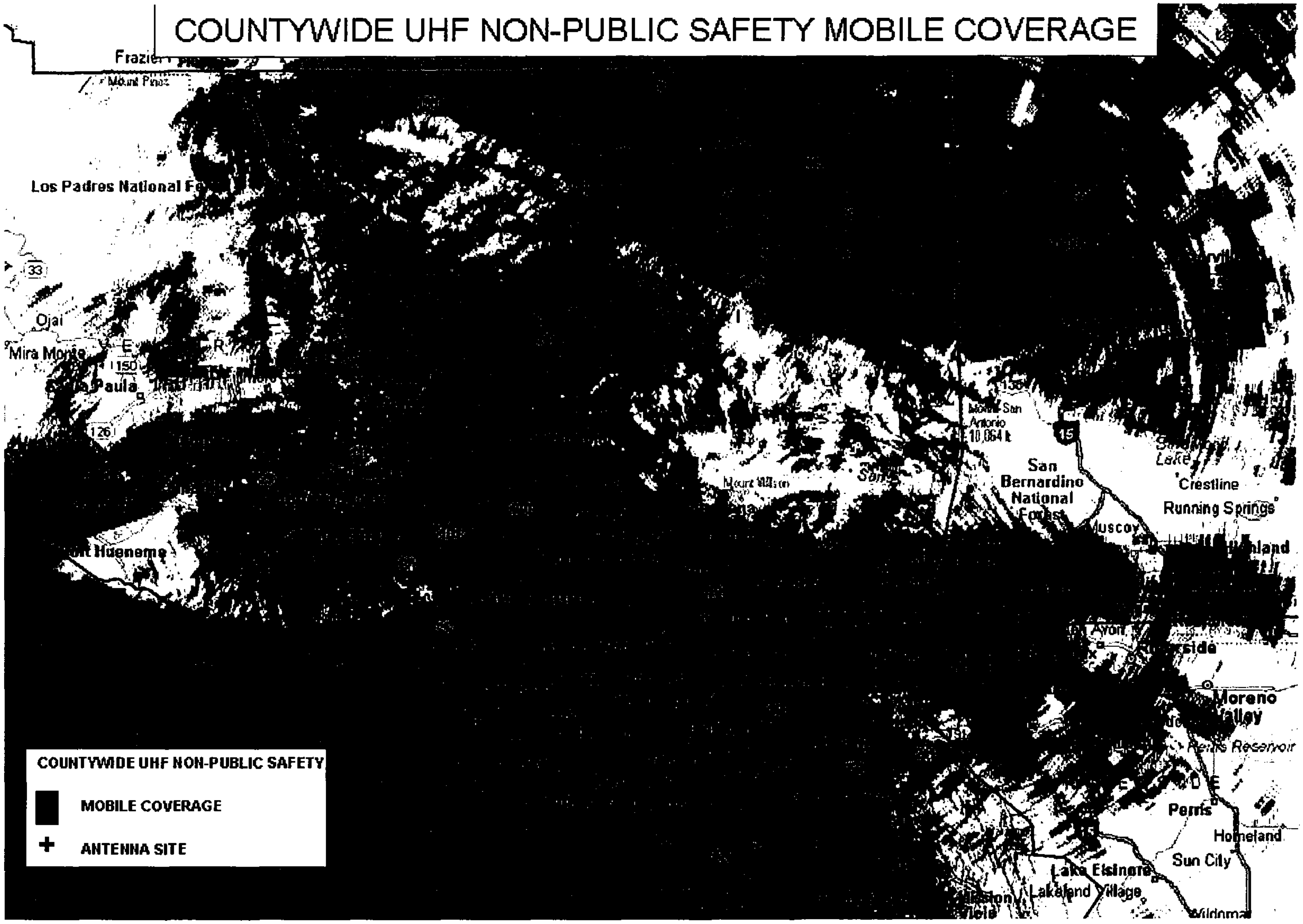
The system would be controlled by a master controller that would allow user to roam between cells across the region, the same as for the public safety systems. Capacity for the non-public safety is estimated in the table below:

Type of Cell	Capacity (Erlangs)	Users Supported	Multi-Cell Factor	Factored # of Users	# of Cells in Region	Total # of Users
30 - Repeater	20.16	6,720	0.33	2,217	13	28,821
				TOTALS >	**13**	**28,821**

On the following pages are maps indicating the predicted coverage of the Regional UHF non-public safety voice system. The maps indicate talk-back (field unit to repeater) coverage. One level of coverage (signal strength) is indicated:

Coverage Category	Signal	Conditions
Mobile On-Street	-105 dBm	1/4-wave mobile whip, 25W TX output

COUNTYWIDE UHF NON-PUBLIC SAFETY MOBILE COVERAGE



RCC estimates that this design achieves mobile coverage over 91% of the county and 99% of the metropolitan area.

Cost estimates for this option (including the non-public safety system) range between a low of $574.5 million to a high of $704.5 million.

5.4 Regional 800 MHz Data System

This design assumes that the 800 MHz band frequencies now in use by LAPD, LAFD and the Port of Los Angeles, ICIS members and the City of Long Beach will be contributed to the frequency pool. A breakdown of the frequency pool is as follows:

Licensee	Number of Frequency Pairs
Los Angeles (City) Police Dept.	10 frequency pairs
Los Angeles (City) Fire Dept.	18 frequency pairs
Port of Los Angeles	1 frequency pair
ICIS Member Cities	7 frequency pairs
City of Long Beach	2 frequency pairs
TOTAL	38 frequency pairs

Other municipalities may contribute up to 14 additional 800 MHz frequencies (see Appendix E). However, they have not been included in this conceptual design. Individual frequencies may be re-used at multiple sites. This system design utilizes 21 antenna sites. The sites and their assigned frequency groups are identified below:

Regional 800 MHz Data System

Site #	Assigned Freq.	Site Name	# of Freqs
1	1,13,15,30	San Pedro Hill	4
2	16	Black Jack Peak	1
3	3	Castro Peak	1
4	14	Decker Canyon	1
5	5	Saddle Peak	1
6	6	Topanga	1
7	7,19,22,31	Walker Drive	4
8	8,18,20,32	Mt. Disappointment	4
9	9,6,29,33	Johnstone Peak	4
10	10,17,4,34,38	Mt. Lukens	5
11	11,21,2,35,37	Oat Mountain Nike LA Co	5
12	12	Magic Mountain	1
13	13	Whittaker Ridge	1
14	14	Frazier Peak	1
15	15	Bald Mountain	1
16	16	Burnt Peak	1

17	17	Portal Ridge	1
18	6,36	Mt. McDill	2
19	19,30	Hauser Peak	2
20	21,37	Lower Blue Ridge	2
21	22	Table Mountain	1
		21	SITES

Each site is assigned a minimum of 1 frequency pair. Sites located in the greater Los Angeles metropolitan area are assigned up to five frequency pairs.

The new high-speed (64 kbps - 96 kbps) data systems are expected to be able to support approximately 400 concurrent users per frequency pair. This is a rough estimate as RCC has not been able to obtain firm capacity data from the manufacturers. This system design is expected to support 17,600 concurrent users during the busiest periods, 10,800 in the metropolitan area.

On the following pages are maps indicating the predicted coverage of the Regional 800 MHz Data System. The maps indicate talk-out (repeater to field unit) coverage as that is the limiting case. One level of coverage (signal strength) is indicated:

Coverage Category	Signal	Conditions
Mobile On-Street	-115 dBm	1/4-wave mobile whip, 15W TX output

-115 dBm was used as the target signal level as this is a typical receiver sensitivity for a 5% Bit Error Rate ("BER"). The maps represent a 95% reliability factor.


REGIONAL 800 MHz DATA SYSTEM COVERAGE
REGIONAL DATA COVERAGE
MOBILE COVERAGE
ANTENNA SITE
Ojai
Mira Monte
Santa Paula
San Bernardino National Forest
Running Springs
Muscoy
Redlands
Moreno Valley
Perris
Homeland
Sun City
Lake Elsinore
Lakeland Village

RCC estimates that this design achieves mobile coverage over 94% of the county, and 99% of the metropolitan area.

5.5 UHF Voice System For Los Angeles City Only

This design assumes that the UHF band (470 MHz through 512 MHz) frequencies now in use by LAPD and LAFD will be split (converted to narrowband 12.5 kHz bandwidth) and contributed to the frequency pool. Frequencies in the UHF sub-band 470 MHz through 512 MHz are needed, because there is a legal mechanism to obtain frequency exclusivity in this sub-band. In other words, these frequencies may be licensed so that there will be no unanticipated co-channel interference. The other UHF sub-band, 450 MHz to 470 MHz, has no provision for exclusivity. A breakdown of the frequency pool is as follows:

Licensee	Number of Frequency Pairs
Los Angeles (City) Police Dept.	112 Narrowband (NB)
Los Angeles (City) Fire Dept.	4 Wideband (WB) (8 equivalent NB)
City of Santa Monica Fire Dept.	3 WB (6 equivalent NB)
TOTAL	126 NB frequency pairs

Of the 126 available frequency pairs, 26 of the pairs will be split into individual frequencies, providing 52 frequencies for direct-mode use. The remaining 100 frequency pairs will be grouped in groups of five, providing 20 groups to be assigned to the trunked cells. This conceptual design utilizes a total of 26 antenna sites, grouped into 8 cells. The sites were selected using the criteria stated in Section 3.1. The sites and their assigned frequency groups are identified below:

LA City Only UHF Voice System (20 Groups of 5 Frequency Pairs)

Cell	Assigned Freq. Groups	Cell Name	Site Name	Cell Type
1	1,2,3	So. Bay/Harbor	San Pedro Hill Fire Station 101	15 rptr simulcast
2	4,5	West LA	100 Wilshire Century Plaza West LA Fire Station 69	10 rptr simulcast
3	6	Sepulveda Pass	San Vicente Peak Beverly Glen Green Mountain	5 rptr simulcast

4	7,8	Southwest LA	Baldwin Hills Fed Ex Southwest PD	10 rptr simulcast
5	9,10,18	Hollywood	Mt. Lee KYSR Adams Hill	15 rptr simulcast
6	11,12,17	Downtown/East LA	LA City Hall 1401 W. 6th Street Elysian Park Mt. Washington KSKQ	15 rptr simulcast
7	13,14,19	East Valley	Mt. Lukens Verdugo Peak LA City Sunland	15 rptr simulcast
8	15,16,20	West Valley/Santa Clarita	Oat Mountain LA City Sylmar (RX Only) West Valley PD (RX Only)	15 rptr monocast w/ multiple receivers
			26	TOTAL SITES

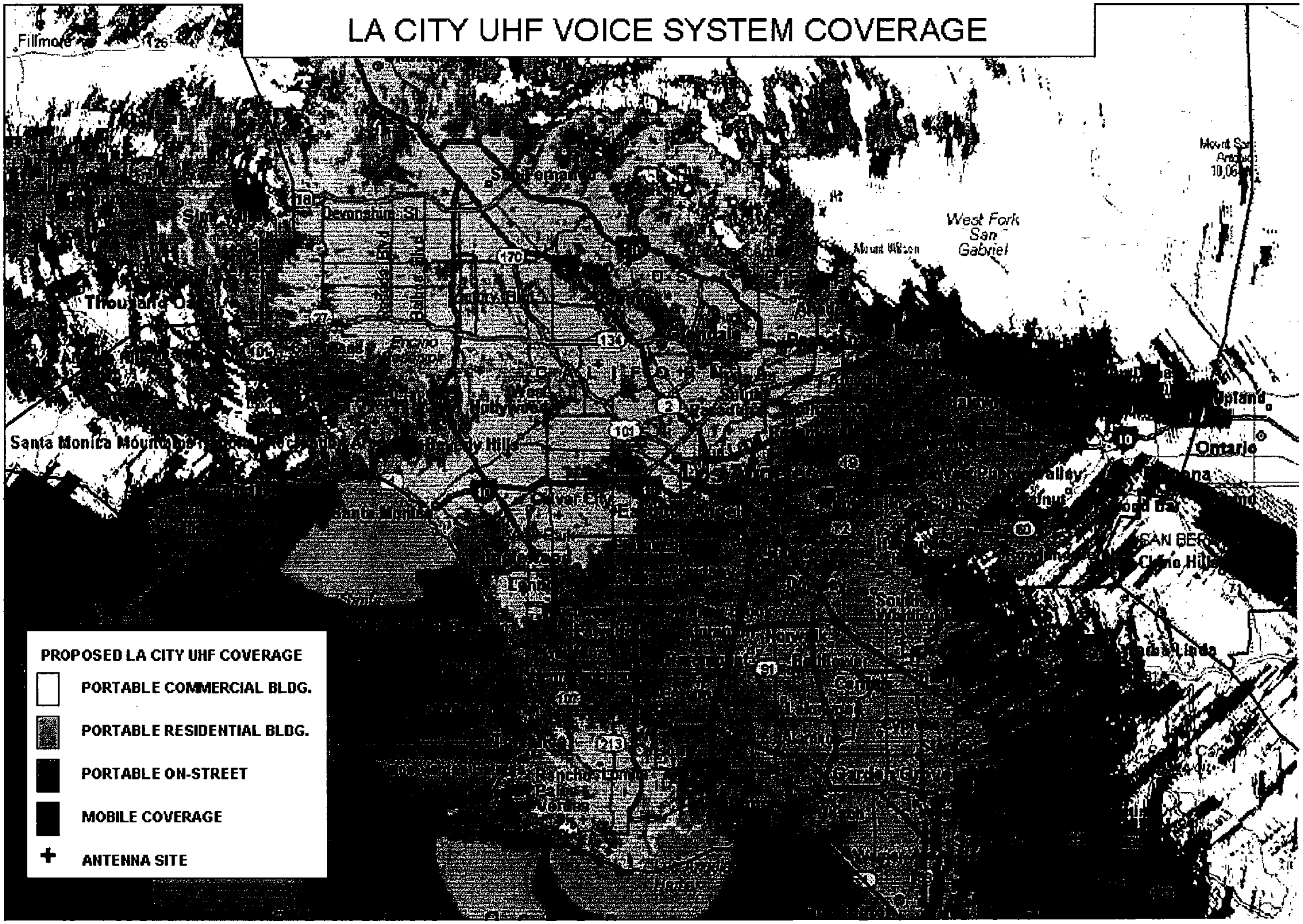
This system design is expected to support 6,033 concurrent users during the busiest periods. The overall capacity estimates were calculated as indicated in the following table:

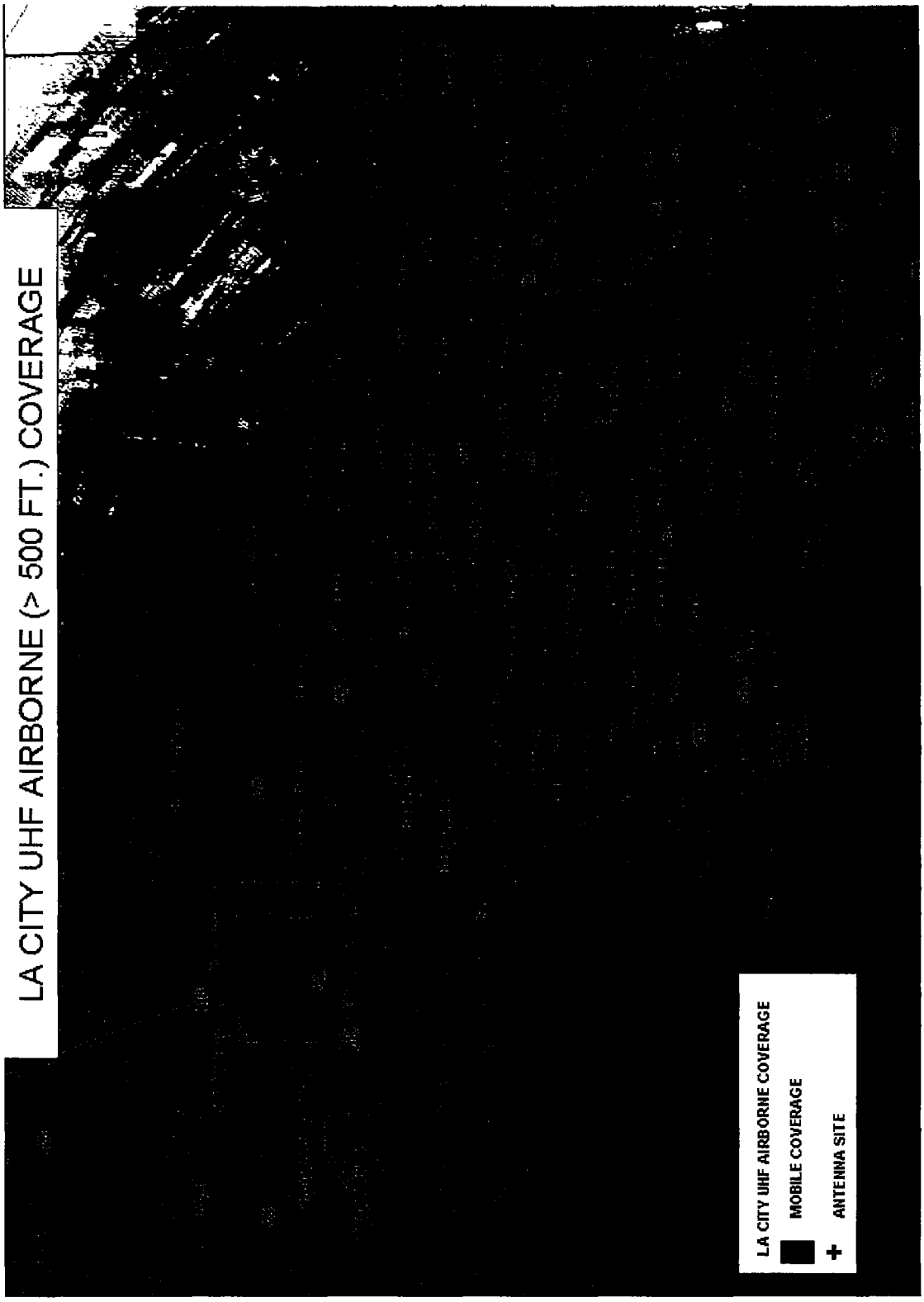
Type of Cell	Capacity (Erlangs)	Users Supported	Multi-Cell Factor	Factored # of Users	# of Cells in City	Total # of Users
5 - Repeater	1.43	477	0.33	157	1	157
10 - Repeater	4.80	1,600	0.33	528	2	1,056
15 - Repeater	8.77	2,923	0.33	964	5	4,820
				TOTALS >	**8**	**6,033**

In the event of a large incident or another major event that brings about a large, multi-agency response, RCC recommends that standby repeaters be installed at each site. These standby repeaters are to prevent overloading of a particular cell. Please see the description of the standby repeater concept in Section 3.2.

On the following pages are maps indicating the predicted coverage of the LA City UHF Voice System. The maps indicate talk-back (field unit to repeater) coverage as that is the limiting case. Four levels of coverage (signal strength) are indicated:

Coverage Category	Signal	Conditions
Mobile On-Street	-105 dBm	1/4-wave mobile whip, 25W TX output
Portable On-Street	-86 dBm	1/4-wave port. whip, 4W TX, belt case
Port. In Residential Bldg.	-76 dBm	1/4-wave port. whip, 4W TX, belt case, 10 dB bldg. loss
Port. In Commercial Bldg.	-66 dBm	1/4-wave port. whip, 4W TX, belt case, 20 dB bldg. loss


LA CITY UHF VOICE SYSTEM COVERAGE
Fillmore
Devonshire St
West Fork San Gabriel
Mount Wilson
Encino
Santa Monica Mountains
Culver City
Upland
Ontario
Chino Hills
PROPOSED LA CITY UHF COVERAGE
PORTABLE COMMERCIAL BLDG.
PORTABLE RESIDENTIAL BLDG.
PORTABLE ON-STREET
MOBILE COVERAGE
ANTENNA SITE


LA CITY UHF AIRBORNE (> 500 FT.) COVERAGE
LA CITY UHF AIRBORNE COVERAGE
MOBILE COVERAGE
ANTENNA SITE

5.6 800 MHz Data System For Los Angeles City Only

This design assumes that the 800 MHz band frequencies now in use by LAPD, LAFD and the Port of Los Angeles will be contributed to the frequency pool. A breakdown of the frequency pool is as follows:

Licensee	Number of Frequency Pairs
Los Angeles (City) Police Dept.	10 frequency pairs
Los Angeles (City) Fire Dept.	18 frequency pairs
Port of Los Angeles	1 frequency pair
TOTAL	29 frequency pairs

This system design utilizes 8 antenna sites. The sites and their assigned frequency groups are identified below:

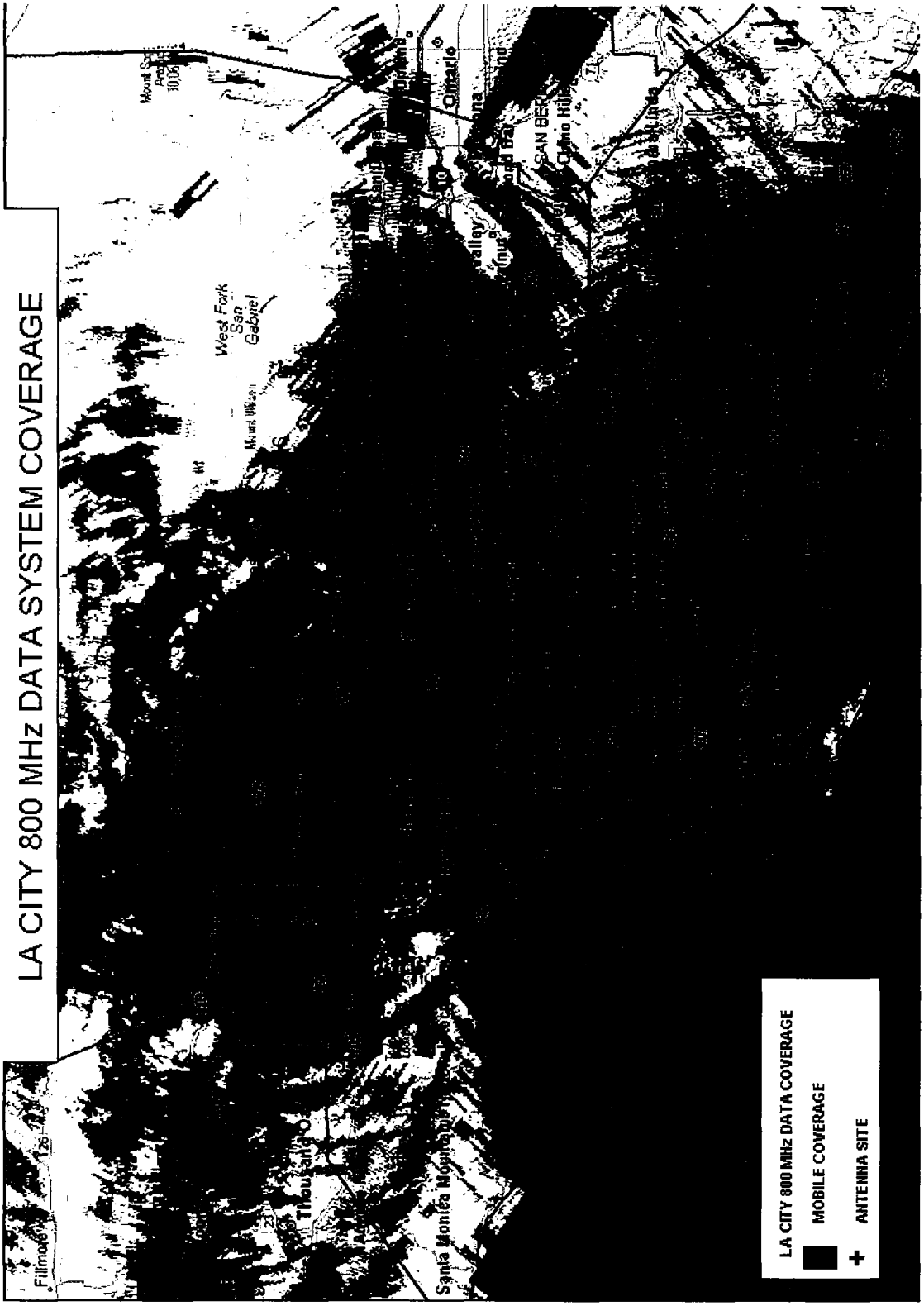
LA City Only 800 MHz Data System

Site #	Assigned Freq. Pairs	Site Name	# of Freqs
1	2,3,4,29	San Pedro Hill	4
2	5,6,7,8	Mt. Lukens	4
3	9,10,11,12	Oat Mtn.	4
4	13,14,15,16	Mt. Lee	4
5	17,18,19,20	San Vicente	4
6	21,22,23,24	Beverly Glen	4
7	1	Fed Ex	1
8	25,26,27,28	Century Plz.	4
		8 SITES	

The new high-speed (64 kbps - 96 kbps) data systems are expected to be able to support approximately 400 concurrent users pre frequency pair. This is a rough estimate as RCC has not been able to obtain firm data from the manufacturers. This system design is expected to support 11,600 concurrent users during the busiest periods.

On the following pages are maps indicating the predicted coverage of the LA City Only 800 MHz Data System. The maps indicate talk-out (repeater to field unit) coverage as that is the limiting case. One level of coverage (signal strength) is indicated:

Coverage Category	Signal	Conditions
Mobile On-Street	-115 dBm	1/4-wave mobile whip, 15W TX output


LA CITY 800 MHz DATA SYSTEM COVERAGE
LA CITY 800 MHz DATA COVERAGE
MOBILE COVERAGE
ANTENNA SITE
Fillmore
Thousand Oaks
Santa Monica Mountains
West Fork San Gabriel
Mount Wilson
Ontario
SAN BER

Cost estimates for this option range between a low of $182.1 million to a high of $229.3 million.

5.7 Recommendation

Obviously, RCC must recommend one of the two regional solutions, as only the regional solutions satisfy the identified requirements for interoperability. The regional solutions also eliminate many "operability" problems that are experienced with the current systems, such as the loss of communications when an officer leaves their jurisdiction during a pursuit, or firefighters are dispatched to a mutual aid incident. Even more important is the fact that the federal government is encouraging the implementation of regional shared systems and may deny funding for radio systems that do not meet that criterion.

As to the choice of frequency band, in the final analysis RCC must recommend Conceptual Design #1, the UHF voice and 800 MHz data radio system. The primary reasons are: 1) Better coverage for the voice radio system using fewer antenna sites, resulting in a lower cost than a 700/800 MHz system; 2) A greater number of available frequencies, resulting in higher capacity than the other designs; and 3) The UHF frequencies are already available, meaning that a regional radio system project may begin immediately. The 700 MHz frequencies needed to make a 700/800 MHz system viable will not be available until at least February of 2009, meaning that there will be a substantial delay before a 700/800 MHz project could even begin.

5.8 Migration Plans

Migration from the existing systems to the new system is complicated by the fact that the frequencies are all currently in use, except for the 700 MHz band frequencies. This will require that users be migrated in relatively small groups. If the 700/800 MHz voice system option is chosen, the construction of the public safety and the non-public safety systems will have to occur in parallel, and users will have to be migrated off of their old system in order to make room for the new system's users. Additionally, the immediate needs of the users must be accounted for (see Section 6.2 of this report). In particular, the LASD has a critical need to replace its outdated mobile data system. The final migration plan is expected to be quite complex, and a number of technical and administrative

decisions will be required. However, RCC suggests that the implementation of the voice and data systems generally proceed in this manner:

Construct Temporary Mobile Data System for LASD

Step 1 Split the current Sheriff's UHF wideband data system frequencies into two narrowband frequencies.

Step 2 Install P25 base stations on half of the newly-created narrowband frequencies and set them up as a P25 (9600 bps) data network.

Step 3 Install P25 mobile radios in Sheriff's vehicles and program and connect them as mobile data modems.

Step 4 Begin using the P25 mobile data network until the new 800 MHz data network is ready. The P25 mobile radios may then be re-programmed for use as voice radios on the new UHF voice network when it is ready.

New Voice System

Step 1 Construct as much of the infrastructure as possible while leaving the old infrastructure in place. The remaining half of the newly created narrowband frequencies made from the former wideband LASD data frequencies may be used as an initial pool of frequencies for the new infrastructure. It is possible that, due to space constraints, frequency assignment issues, and other constraints, it will not be possible to fully construct the infrastructure before beginning migration of the first users. This may mean that cells initially do not have their full complement of repeaters. This is acceptable as the cells will be initially lightly loaded.

Step 2 Install new mobile radios and issue new portable radios to the first users to be migrated. The new radios will contain temporary programming that gives the user access to their new channels on the trunked system, plus the conventional frequencies they use for interoperation with other users not on the new system. RCC believes it is advisable to choose administrative or other non-first-responder user groups to be the first users to be migrated.

Step 3 Train the first new users on the use of the new radio system.

Step 4 Turn the new system on and the old system(s) off. Instruct the new users to begin using the new system. Since the new system has pooled several user group's old frequencies into a trunked system, there will be excess capacity with which to add additional users.

Step 5 Install new mobile radios and issue new portable radios to the next group of users to be migrated.

Step 6 Train the next group of users.

Step 7 Turn off the old radio system(s) of the next user group. Instruct the users to begin using the new system.

Step 8 Add the old frequencies of the user group to the trunked system and turn them on, adding more capacity to the trunked system.

Step 9 Repeat Steps 5 through 8 until all users have been migrated.

Step 10 Re-program all mobile and portable radios to remove the old systems' frequencies.

Data System

The data system migration should be done in parallel but lagging behind the voice system implementation.

Step 1 Construct the new 800 MHz data system to the extent possible (given whatever constraints there may be) but leave the system off until the LAFD users have been at least partially migrated to the voice system. This will free several 800 MHz channels for the new data users.

Step 2 Begin installing new mobile data modems in vehicles that are used primarily within the coverage footprint of a particular site. Leave the old data modems in place, and temporarily use both through a mobile router or a PADCOM-type device. It may also be desired to install a commercial high-speed wireless modem at this time as backup.

Step 3 When all users in the coverage footprint are migrated, turn off the old data channel. Begin installing new mobile data modems in vehicles primarily assigned to the coverage area of an adjacent site.

Step 4 Repeat Steps 2 and 3 until all users are migrated. Remove the old mobile data modems and re-program the mobile routers.

6.0 REGIONALIZATION ISSUES AND GOVERNANCE

In this report, RCC is recommending that public safety agencies within Los Angeles County jointly construct a regional shared trunked radio system for voice in the UHF band, and a regional shared mobile data system in the 800 MHz band.

6.1 RCC's 2001 Report to Los Angeles County

In a previous report (2001) to the County of Los Angeles, RCC made similar recommendations to LACoFD and LASD. RCC believes that the previous recommendation to the County and the current recommendation are consistent for the following reasons:

- The report to the County recommended a digital trunked voice radio system consisting of multiple trunked cells and frequency re-use, much like the conceptual designs presented in this report.
- The report to the County recommended that the Sheriff and County Fire share the voice and data radio systems. This report makes the same recommendation, although it has been expanded to include LAPD, LAFD, LACoDHS and the other law enforcement and fire agencies within the region.
- The report to the County recommended the continued use of UHF band frequencies for voice. This report makes the same recommendation. This report differs from the previous report in that it is recommending the use of the 800 MHz band for a shared mobile data system. 800 MHz is being recommended primarily because the use of the 800 MHz band for data frees additional UHF frequencies for voice use.

- The report to the County only considered the County's existing resources, which consist of 69 wideband UHF frequencies and a number of antenna sites located throughout the county. RCC's report stated that this was more than sufficient to construct a trunked system that would meet the County's needs. Now, in 2006, with the availability of a mature narrowband technology (Project 25), the County's frequency resources may be split (as the City of Los Angeles has done), doubling the amount of available frequencies. Add to that the frequencies used by the City of Los Angeles, ICIS and others, making a total of 401 potentially available frequency pairs. RCC's conceptual design utilizing this number of frequencies would be expected to support a total of over 30,000 concurrent users, well above the number of police, firefighters and emergency medical personnel that now use the existing systems.
- Both the County and the City will have greater communications system capacity than they now have. More channels will be available for dispatch or tactical uses.
- All users will experience better coverage than they now have.
    - For LAPD and LAFD, the number of antenna sites in use within their jurisdiction will have increased to 33 (from 22 for LAPD and 9 for LAFD), improving building penetration and penetration into canyons.
    - Users will experience far fewer dead spots and areas of scratchy signals because of the overlapping coverage of the trunked cells. When the signal becomes weak, the radio will automatically switch to a cell with a better signal. Communications will automatically be maintained without the need to manually change channels.
- In 2001, RCC's cost estimate to the County for a trunked voice radio system was approximately $327 million. When the addition of other regional users is taken into account, this is fairly consistent with RCC's current estimate of a low of $433.8 million to a high of $545.3 million.

Some differences in the two reports are noted:

- In 2001, RCC's cost estimate to the County for a mobile data system was approximately $170 million, which is high compared to RCC's current estimate of $51 million to $60 million for an 800 MHz private data system. The difference is that RCC's previous report to the County included costs for more that just a private data system. It included costs to implement a multi-tiered solution of private data, commercial broadband wireless and a WLAN system, with a goal of bringing streaming video into the mobile environment. The goals of the current study are to bring about regional data interoperability so that certain databases, dispatching, text messaging and area-wide alerts could be shared. Therefore this report concerned itself with the private network only, and only accounts for the purchase of the mobile data modems. It does not include the purchase of MDCs for vehicles.

- The 2001 report to the County included a voice system design that required 118 sites to achieve mobile coverage over 95% of the county. Of those, 36 were "primary" (high sites on mountaintops) and 82 "fill-in" sites (low sites on rooftops or mounted on telephone poles). The recommended design in this report estimates that 62 sites are required to achieve mobile coverage over 95% of the county. All 62 sites are considered "primary". That is, they are high sites on mountaintops (or, in urban areas, sites on tall buildings such as the Los Angeles City Hall). The design in this report uses no "fill-in" sites as defined in the 2001 report, and was not constrained to using County-owned sites or property. In the metro area, in-building coverage of the 62-site design will be superior to the old 118 site design due to a higher concentration of sites in the Los Angeles basin. In addition, in the process of preparing this report, RCC had the opportunity to "calibrate" its propagation model against the actual coverage experienced by Los Angeles City radio users. This resulted in coverage predictions that are less conservative than the 2001 report, but are more likely to reflect the true coverage that would be experienced by the users of the system.

6.2 Immediate Needs That Impact the Regional Solution

A number of agencies require immediate action in order to maintain their radio communications systems. The actions they take could either enhance or hinder the funding and/or implementation of a regional shared trunked radio system. Agencies that must purchase UHF voice radio equipment prior to the implementation of the regional network should endeavor to purchase equipment that is capable of (or is easily upgradeable to) Project 25 Phase 1 (FDMA) trunking operation.

LASD has an immediate need to replace its mobile data system. Its existing system operates at only 4800 bps, and replacement parts are no longer supplied by its manufacturer, IP Mobilenet of Irvine, California. The need is so critical that LASD fears that the failure of one part of the system would place an overload on the remainder of the system, causing the entire system to crash in a domino effect. Obviously, this situation cannot continue. The quickest way to solve the immediate problem is to merely replace the old UHF-band system with new equipment and continue using the same UHF frequencies as before. However, this would mean a multi-million dollar investment in a UHF data system when the recommendation for a regional data system specifies the use of the 800 MHz band.

At this time, there appears to be two potential solutions to this problem:

1. *Acquire a sufficient number of 800 MHz frequencies to immediately begin construction of a mobile data system for LASD.* It may require as little as one pair of frequencies that could be licensed countywide, if a technology were used that permitted a single frequency to be re-used at adjacent sites, such as IP Mobilenet's offering. There appear to be 800 MHz frequencies available for lease or purchase (according to one vendor), or frequencies might be borrowed from the County's or the City's 800 MHz non-public safety trunked radio systems, or frequencies might be found that could be short-spaced with other existing users. If LAPD were to agree to cooperate, their ten 800 MHz frequencies would be an excellent starting point. Later, as LAFD was migrated to the new UHF voice system, its eighteen 800 MHz frequencies could be added to the data system and additional regional data users could then be migrated to it.

2. *LASD purchases UHF Project 25 mobiles and base stations and uses the P25 data facility as a temporary mobile data system.* This would provide an immediate doubling of data speed/capacity and eliminate reliability worries. Later, when the regional 800 MHz data system is established, the UHF radios would be converted to voice use and new 800 MHz mobile data modems would be installed in Sheriff's vehicles.

6.3 Other Regional Systems in the United States

The case studies presented here are not intended to be an exhaustive list of partnerships. Instead, they are intended to show the diversity of arrangements, such that the Los Angeles area can "pick and choose" among the various possibilities, ensure all relevant factors are considered, and decide on an agreement or a set of agreements that will work best. The first example, the Minneapolis Metro Area, is described in more detail, as this system probably comes closest to the scope of a Los Angeles County Regional shared system and there was a significant amount of useful information available. The table in Appendix H lists technical details of several shared trunked systems in the United States. However, technical details are not the major focus of this section. The variety of differences in the agreements is the primary topic being illustrated.

6.3.1 Minneapolis/Saint Paul Metropolitan Area, Minnesota

The Minneapolis/St. Paul metropolitan area covers nine counties (Anoka, Carver, Hennepin, Chisago, Dakota, Isanti, Ramsey, Scott and Washington). The Minnesota State Legislature created the Metropolitan Radio Board ("MRB") in 1995 as a political subdivision with jurisdiction in the nine-county region, and vested it with the powers necessary to construct, operate and maintain a regional radio system. The MRB sunset as of June 30, 2005, and its authority has been transferred to the Metropolitan Emergency Services Board. The Metropolitan Emergency Services Board was established by Joint Powers Agreement for the purpose of overseeing the 9-1-1 system in the metropolitan area of Minneapolis/St. Paul. Its Board consists of commissioners from the counties of Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington

and a council person from the City of Minneapolis. The Technical Operations Committee (TOC) continues their monthly meetings.

The Metropolitan Radio Board (MRB) was a policy-making body made up of 21 people representing counties and cities from throughout the Minneapolis-St. Paul metro area. Seventeen of the 21 members are elected officials and the remainder are either state commissioners or are appointed by the MRB due to their particular area of expertise. The statute creating the Board defines the membership and the appointing authority for each seat on the Board. The MRB's purpose was to set standards for and to govern the construction and operation of an 800 MHz digital trunked public safety radio system to serve the Minneapolis-St. Paul metropolitan area. The agencies participating include the State of Minnesota, including the State Patrol and other offices within the Department of Public Safety, the Department of Transportation, and the Department of Natural Resources; Hennepin County, including the Sheriff's Department, Hennepin County Medical Center and many other county departments; Carver County; the Cities of Minneapolis and Richfield; Metro Transit and Metro Mobility; Anoka County and the City of Edina; Ramsey County and the City of St. Paul; Cities of Bloomington and Hopkins; Isanti County and the Cities of Maplewood, Minnetonka, St. Louis Park and White Bear Lake; the Metropolitan Airports Commission and several medical transportation companies. Lakes Region EMS has opted to join the system as a subscriber. The State of Minnesota has plans to expand the radio system throughout the entire state, on a region-by-region basis.

To join the radio system (known as the Allied Radio Matrix for Emergency Response, or "ARMER"), a local governing body must first vote to participate by resolution and submit a letter to the Board together with the text of the resolution. The agency must then develop a technical plan with engineering specifications and submit it to Board. To expedite this process and to provide assistance, the Board's engineering consultant will work with the local entity to develop the technical plan. When completed, the plan is reviewed by the Board's Technical Operations Committee (TOC). The TOC will make a

recommendation to the full Metropolitan Radio Board, which will then act on the request to join.

The construction of the first segment of the system cost about $36 million. Funding came from a variety of sources. $3 million came from general obligation bonds issued by the Metropolitan Council on behalf of the Metro Transit system. $15 million came from the State of Minnesota—half from the state's highway fund (which was appropriated by the legislature) and half from state general obligation bonds. The Metropolitan Radio Board raised $13.3 million by issuing revenue bonds backed by a 4-cent-per-month appropriation from the 9-1-1 surcharge on telephone lines (in 2002 the legislature increased the Board's share to five and one-half cents, effective July 1, 2004). The remainder, $4.7 million, was generated through interest earnings and 9-1-1 revenues in excess of what was needed for debt service. Later additions to the system were paid from capital improvement funds financed by local property taxes. Hennepin County's subsystem cost approximately $20 million and the City of Minneapolis' subsystem cost approximately $6 million. Carver County and Metro Transit each spent approximately $2.5 million. Approximately $68 million has been spent to date.

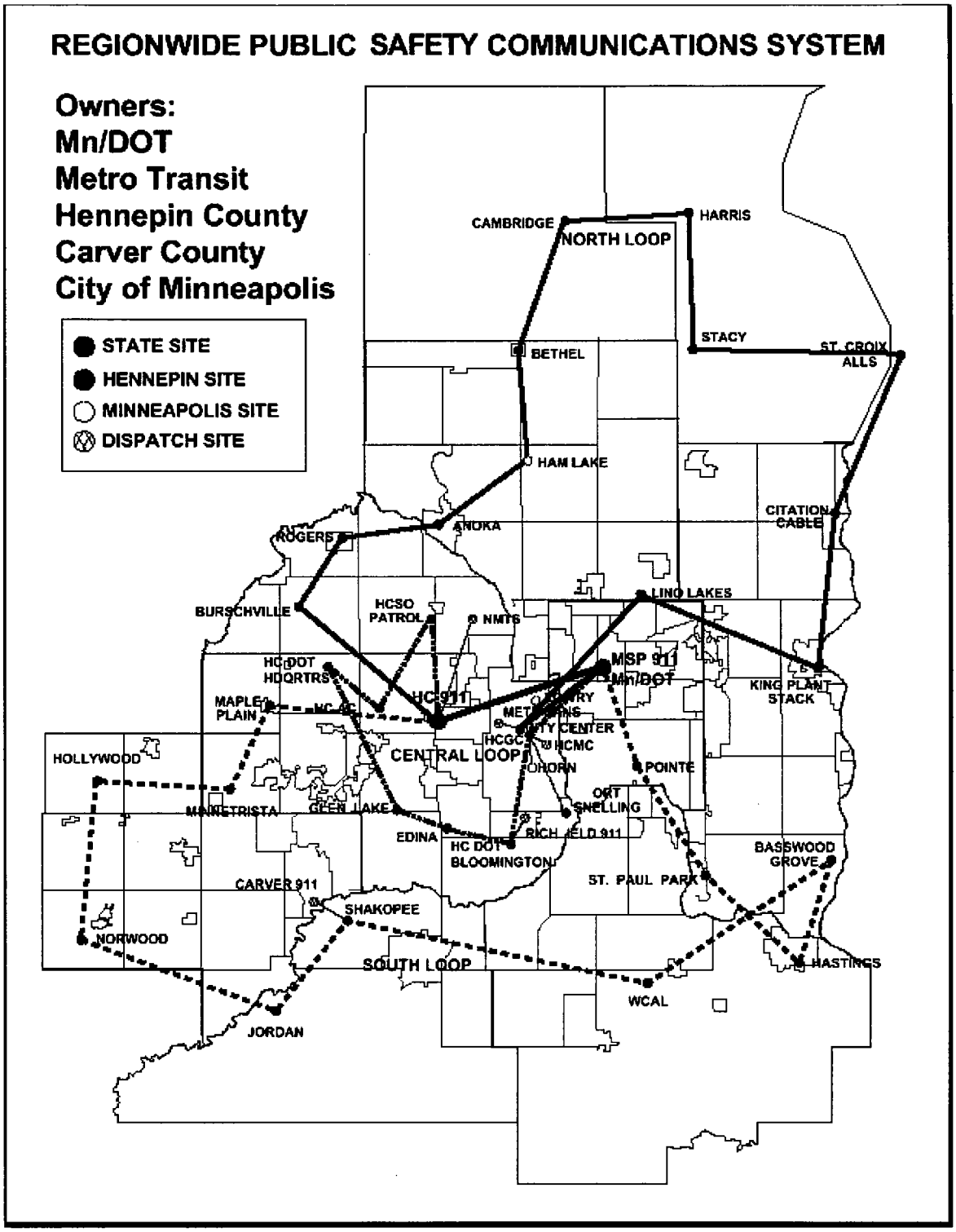


Figure 4 - ARMER System Map

In addition to the Board itself, there are also Technical Operations and System Management committees. These committees meet about once a month, offset from each other by about 2 weeks. These committees have developed a number of standards and procedures, including:

- *Agency Roles in Operational Management of the System* - Network Management, Database Management & Maintenance, Names & Naming Standards, Security, Variances & Waivers, Subscriber Radio Standards, Moves, Additions & Changes, Configuration Approval and Training.
- *Radio Operations* - Allocation of IDs and Talk Groups, Console Naming, Fleetmap Standards, Shared (Mutual Aid/Tactical) Talk Groups, Talk Group & Radio User Priorities, Subsystem (Cell) Roaming, Scanning, Telephone Interconnect, Private Calling, Multigroup Calling, Use of Emergency Trigger, Logging Recorder Port Assignments, Interoperability with ITAC/ICALL and other outside radio systems, Use of Control Stations and Patch Systems.
- *Agency Maintenance Plans* - Preventive Maintenance, Recordkeeping Requirements, Spare Parts & Components, Equipment Configuration & Programming, Repair Standards, Outage Responsibility, Notification of Maintenance Activities.
- *System Access* - Media Access, Disaster Relief Access, Hospital Access.
- *Cost Structure* - Administrative User Fees, Site Lease, Property Insurance, and Utilities Costs, Entry Costs for New Participants, Prioritizing Capital Spending, Aid & Grants to Local Units of Government.
- *Audit/Monitoring Processes* - Response to Non-Compliance, Appeals Process.

The statutes authorizing the Metropolitan Radio Board are included in this document as Appendix I. Other information regarding this system, including a lessons learned APCO presentation, are available on the MRB website at http://www.metroradioboard.org.

6.3.2 Orange County, California

The Orange County system includes virtually every Orange County and City agency in Orange County. It is an 800 MHz Motorola SmartZone (proprietary) trunked radio system. Orange County organized virtually every County and City organization into their agreement prior to the radio system being implemented. The Joint Agreement document can be found in Appendix J.

6.3.3 Interagency Communications Interoperability System, California

The ICIS system, a joint project between several cities in Los Angeles County, is an example most agencies in the Los Angeles area are familiar with. The JPA governing their shared, UHF Motorola SmartZone (proprietary) digital/analog trunked radio system is also provided as an attachment to this report. The agreement is structured so that each agency owns their own repeater and radio equipment, and the JPA governs primarily the connectivity and control infrastructure. ICIS has enjoyed steady growth in both the radio system infrastructure and member agencies for the past several years. The ICIS Exercise of Powers is attached to this report, in Appendix K.

7.0 NEXT STEPS

RCC's vision for this project includes additional steps that must be accomplished before a regional radio system can become a reality:

7.1 Establish A Governing Body

An inter-governmental agreement, Joint Powers Authority (JPA) or another type of corporate entity must be formed to procure the system, manage the project and manage the operation of the system in a manner that is fair and equitable to all parties. Some of the functions that could be performed by the governing body are:

- Raise funds, apportion costs and levy fees.
- Establish a project charter and staff the project.
- Manage the installation of the system.
- Staff a maintenance force and manage contracts for supplies and services needed to operate the system.

- System administrative functions, database management, establish operating policies and procedures.
- Arbitrate disputes between the members.

7.2 Detailed Technical Design and Specification Development

This conceptual design document has laid a foundation and provided examples of how a regional system could be constructed, and provided budgetary cost estimates for the purpose of obtaining funding. However, there is still a tremendous amount of in-depth research and design work left to do before system implementation can begin. For instance, the amount of traffic generated by each participating agency should be measured and verified in order to validate the frequency plan and ensure that the finished system will provide sufficient capacity. Proposed antenna sites (including alternates) and dispatch centers must be surveyed to determine exactly what site development work will be required and how much it will cost. Decisions must be made by the consortium members regarding site selection. A number of other details need to be addressed in this manner.

The result of the detailed technical design process will be a very accurate picture of the coverage, capacity, functionality, maintainability and cost of the new system. *RCC does not recommend leaving these details to the vendors.* It is not in the consortium's best interest to proceed with a procurement until the detailed technical design is done. Without it, it will be nearly impossible to judge whether a particular vendor is proposing a good system design. In addition, the final cost estimate will be very close to the actual amount that must be expended. If the project is found to be under-funded, RCC recommends that the project be held until additional funding can be obtained. Changing the system design (by eliminating sites, frequencies or features) due to a lack of full funding will result in poor coverage, poor capacity (probably both) and EXTREME user dissatisfaction.

Once the detailed technical design is completed and full funding is obtained, a Request For Proposals may be developed to procure the system.

7.3 Procurement

RCC recommends procuring the system as a turnkey project, to eliminate potential poor coordination and disputes between contractors that will result in cost escalation, delays, poor system performance and warranty administration problems.

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Appendix A - Definitions And Abbreviations Used In This Document

AC	Alternating Current
AGC	Automatic Gain Control
AGL	Above Ground Level
ALI	Automatic Location Identification
AMSL	Above Mean Sea Level
ANI	Automatic Number Identification
ASCII	American Standard Code for Information Interchange
AVL	Automatic Vehicle Location
AWG	American Wire Gauge
BOCA	Building Officials and Code Administrators
BPS	Bits per Second
C&C	Command and Control
CCE	Console Central Electronics
CAD	Computer-Aided Dispatch
CDF	California Division of Forestry
CHP	California Highway Patrol
CO	Central Office (telephone switching center)
COUNTERPOISE	A network or radial system of wires below grade used to couple lightning energy to ground
CONTROL STATION	Fixed radio, typically used by dispatchers to eliminate wire line control of a base station or repeater
CPS	Characters per Second
CPU	Central Processing Unit
CRT	Cathode Ray Tube (video display device)
CTCSS	Continuous Tone Coded Squelch Systems
DAQ	Delivered Audio Quality
dB	Decibel
dBm	Decibels referenced to one milliWatt.
DESKTOP REMOTE CONTROL UNIT	Small Dispatcher console setting on desktop, Not a full dispatch console

DHS	Department of Homeland Security
DMS	Data Management System
DOWNLINK	See TALK-OUT
DS-0	56 kilobit or 64 kilobit per second (one digital voice channel) data stream per telephone company specifications
DS-1	1.544 megabit per second data stream (24 multiplexed digital voice channels) per telephone company specifications
DS-3	44.736 megabit per second data stream (28 multiplexed DS-1 data streams) per telephone company specifications
DTMF	Dual-Tone Multi-Frequency (touch-tone)
EIA	Electronics Industry Association
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
ERLANG	A unit of measure of the capacity of a telecommunications system. One Erlang is equivalent to one communications path (radio channel, telephone line) that is 100% busy for one hour. For example, a telephone line that is in use a full sixty minutes out of an hour has carried one Erlang of traffic. If the same telephone line carried three ten-minute calls in one hour, it has carried 0.5 Erlang of traffic. A group of three radio channels that carried fifteen minutes of traffic each in one hour would have carried a total of 0.75 Erlang of traffic.
ERP	Effective Radiated Power
E-9-1-1	Enhanced 9-1-1
F	Fahrenheit
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FCC	Federal Communication Commission
FEMA	Federal Emergency Management Agency
FIXED EQUIPMENT	Radio towers and antenna systems, equipment shelters, repeaters, base stations, consoles, controllers, microwave, etc.
GHz	Gigahertz
GPS	Geo-Positioning Satellite
HANDHELD RADIO	Portable Radio

HSMO	High Stability Master Oscillator
HVAC	Heating, Ventilating, and Air Conditioning
Hz	Hertz
I/O	Input/Output
ICIS	Interagency Communications Interoperability System
ID	Identifier, identification of a specific radio unit
IM	Intermodulation
INTERMODULATION	The process whereby two signals mix and create a third, fourth or more additional signals ("intermodulation products").
IP	Internet Protocol
JPA	Joint Powers Authority
kbps	kilobits per second
kHz	kiloHertz
LACoDHS	Los Angeles County Department of Health Services
LACoFD	Los Angeles County Fire Department
LADWP	Los Angeles Department of Water & Power
LAFD	Los Angeles (City) Fire Department
LAPD	Los Angeles (City) Police Department
LASD	Los Angeles (County) Sheriff's Department
LAWA	Los Angeles World Airports
LAX	Los Angeles International Airport
LCD	Liquid Crystal Display
LPI	Lightning Protection Institute, Harvard, IL
MDC	Mobile Data Computer
MDM	Mobile Data Modem
MDT	Mobile Data Terminal
MHz	Megahertz
MOBILE RADIO	Two-way radio designed to be installed in an automobile, truck, van, boat or aircraft.
MODEM	Modulator/Demodulator, used to link computer equipment
MPH	Miles per hour
MUX	Audio or data multiplexer

NEMA	National Electrical Manufacturer's Association
NENA	National Emergency Number Association
NFPA	National Fire Protection Association
NPSPAC	National Public Safety Planning Advisory Committee
NTP	Notice To Proceed
OSHA	Occupational Safety and Health Administration
PA	Public Address
PD	Police Department
PS	Public Safety
PABX	Private Automatic Branch Exchange
PMO	Project Management Office
PSAP	Public Safety Answering Point
PTT	Push to Talk
RCV, RCVR, RX	Receive, Receiver
RF	Radio Frequency
RFI	Radio Frequency Interference
RFP	Request For Proposal
SITE	Antenna site.
SYSTEM ACCESS TIME	The time interval between PTT and assignment of a radio channel allowing a conversation to begin.
TALK-BACK	Radio communications originating with the field user and received by a base station or repeater.
TALK-OUT	Radio communications originating at the base station or repeater and received by a field user.
TCP	Transmission Control Protocol
TIA	Telecommunications Industry Association
TNRD	Transmitter Noise and Receiver Desensitization
TSB-88	TIA/EIA Telecommunications Systems Bulletin TSB88-B, "Wireless Communications Systems - Performance In Noise and Interference-Limited Situations - Recommended Methods For Technology-Independent Modeling, Simulation, and Verification," September 2004.
TX	Transmit
UDP	User Datagram Protocol

UPLINK	See TALK-BACK
UPS	Uninterruptible Power Supply
USCG	United States Coast Guard
USFS	United States Forest Service
USSS	United States Secret Service
VAC	Volts Alternating Current
VDC	Volts Direct Current
VSWR	Voltage Standing Wave Ratio
W	Watts
WBS	Work Breakdown Structure
XMIT	Transmit
XMTR	Transmitter

Appendix B - Mutual Aid Agreements and Other Materials Reviewed by RCC to Assess the Current Mutual Aid Environment

"Mutual Aid Region 1 Operational "Area "A" Guide Book" (Fire).

California Office of Emergency Services, "Fire Service & Rescue Mutual Aid Plan".

"Operational Area "A" Local Operational and Automatic/Mutual Aid Agreements" (Fire).

FIRESCOPE, "Field Operations Guide" June 2004.

California Office of Emergency Services, "Law Enforcement Mutual Aid Plan", 2003 edition.

California Office of Emergency Services, "Law Enforcement Guide for Emergency Operations" ("Redbook"), January 1999.

Los Angeles Regional Tactical Communications System, Memorandum of Understanding (MOU).

Los Angeles Regional Tactical Communications System, "Build-Out Document Interim Report."

United States Department of Homeland Security, "National Incident Management System", March 1, 2004.

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CITY OF LOS ANGELES
Radio Communications Interoperability Project

Interview with Alhambra Police Department

Date: September 28, 2005, 2:30 pm

Attending: Lt. Elliot Kase
Dave Skorhema
Scott Johnson, RCC Consultants

Location: Tele-Conference

Lt. Kase indicated the Alhambra radio system consists of a single site, UHF mixed mode (analog/digital) system that is about 6-7 years old. The city area is about 7 mi^2. They are currently obtaining budgetary figures for potentially joining the ICIS system in the future. The delay experienced when initiating a trunked call is not expected to be an issue, as training and familiarity with the adjustment from a conventional radio system could overcome this concern. A countywide regional system would be an attractive alternative, provided the budgetary outlay and system control issues could be worked out satisfactorily.

LARTCS has been used for events, but not for a time critical emergency situation. In-building coverage is sometimes an issue (many buildings do not have BDA's), but in general coverage is okay. Capacity is also adequate for the police force. The radios have also been programmed with channels from neighboring agencies to provide interoperability. Alhambra will soon be obtaining a command vehicle, which will have interoperability capabilities, although the exact configuration has not been finalized.

Monterey Park, a neighbor to the south, uses VHF radios, but their officers also have UHF radios to provide interoperability with Alhambra and other UHF users.

Mobile data has been used for about 2 years, over a GPRS system. The software platform is from the West Covina Service Group, which provides the service for about 14 communities in the Los Angeles area, and for several other agencies across the country. AVL (automatic vehicle location) is included. Currently, the mobile data system is used primarily to obtain text information. In the future, it is desired to be able to submit reports from the field, as well as download mug shots, fingerprints, etc. The city is considering high speed "hot spots", to download larger files.

Interview with Baldwin Park Police Department

Date: September 12, 2005, 3:00 pm

Attending: Officer Rick Villines
Scott Johnson, RCC Consultants
Tony Busam, RCC Consultants

Location: Baldwin Park Police Station, 14403 E Pacific Ave.

Officer Rick Villines indicated a new Motorola system has recently been installed. It is a 16 channel (16 repeated, 16 direct channels) mixed mode analog/digital system, supporting an 80 person department.

The channels are:
BP PD 1 & 2
BP School Police
Irwindale PD
West Covina PD
Arcadia PD
Sheriff's Communications Center
LASD (5 channels, including Bomb, SWAT, homicide)
CLEMARS (2 channels)
El Monte PD 1 & 2

Special Response Unit needs to add SWAT to their radios. Interoperability channels could be added to radios in the future. Can scan County Fire channels (there is no Baldwin Park City Fire Department, contract with LA County).

Coverage issues are present on the other side of Kellogg Hill. Would like to have encryption. The current radio system transmits the radio ID, but user must wait 1-1.5 seconds for the data to be transmitted at the beginning of the conversation, most officers use ear jacks to prevent information tone from being heard by others. Trunked radios would be welcomed, as a shorter wait period of ¼-½ second would be an improvement to the current situation.

CITY OF LOS ANGELES
Radio Communications Interoperability Project

Interview with Bell Gardens Police Department

Date: September 29, 2005, 3:00 pm

Attending: Kathy Salgado
Scott Johnson, RCC Consultants

Location: Tele-Conference

Ms. Salgado indicated Bell Gardens Police currently uses a 2 channel analog UHF radio system. The capacity and coverage is adequate in their city limits. They are currently upgrading the dispatch consoles to Motorola Gold Elite and will also have advanced 911 capabilities.

They can currently patch VHF and UHF channels together.

Bell Gardens is not involved in LARTCS, they use the telephone when needed to contact others, which does not often occur.

Interview with Beverly Hills Fire Department

Date: November 3, 2005, 7:40 am

Attending: Captain Steve Vance
Scott Johnson, RCC Consultants

Address: Tele-Conference

Captain Vance indicated Beverly Hills is relatively small geographically (about 5¼ mi^2), but has hillside terrain in the northern end of the city, making coverage in the canyons quite challenging. The highest peaks are around 1000 feet high. There are 32 high-rise buildings in the city, making in-building coverage important.

They currently operate a 25 year old, 2 channel UHF analog single site system from Walker Drive, with a backup site at the Civic Center. However, the backup location does not provide as much coverage as the Walker Drive location. Walker Drive is one of the highest locations in the City, which makes for a good site location. There are also 8 voted receivers inside and outside city limits to improve "talk-in" coverage.

Beverly Hills is currently building a new, $8 Million simulcast UHF Mixed Mode (trunked/conventional, digital/analog) system that will use the 2 existing transmitter sites with the potential of procuring a third site at Beverly Glen. The system is scheduled for completing in September 2006. However, the 3rd site is in Los Angeles city limits, making the site difficult to build on. Addressing the concerns with homeowners groups along with LAFD-ITA concerns about radio interference are posing significant delays. Even before the 3rd site is implemented, coverage is expected to improve, especially in-building coverage in high-rise buildings. The new system will have 6 trunked channels, 2 conventional channels, and 4 direct channels. A separate emergency trigger channel for both conventional and trunked channels will be part of the new system. FD and PD will be joining the ICIS radio group.

Beverly Hills does not use LARTCS, they view it as unnecessary and are not very familiar with how the system works. As far as a countywide radio system, there were 2 comments. First, Captain Vance stated "I think it's necessary." He also would welcome a countywide system to reduce his workload in managing their own radio system, indicating his plate is very full with critical projects, and considers a radio system to be one of many others that also demand his time.

Beverly Hills FD does not currently use mobile data, but they are looking at potentially adding this capability once this system is proven reliable through field-testing by the PD.

Interview with Burbank Police Department

Date: September 26, 2005, 10:30 am

Attending: Lt. Bruce Speirs
Dennis Gibbons
Jim Floyd
Scott Johnson, RCC Consultants

Location: Tele-Conference

Burbank recently joined ICIS. The Police Department is currently using the system, with the Fire Department planning to transition within about 6 months, and Public Works over the next year or so. Fire (using the Verdugo system) and Public Works currently use conventional radios.

A channel in the UHF conventional band was also maintained for interoperability, especially with the Los Angeles County Sheriff. However, the channel selected, in order to be able to be added to the Sheriff's radios, does not operate in the mandatory Burbank in-building coverage areas. Therefore, interoperability in these areas is not as likely to be available compared to the ICIS trunked system channels.

There has been significant improvement in coverage with the new, mixed mode (digital/analog) system. Dispatch still has analog capabilities as well, as many others in the area do not yet use digital formatted radios. Many of the digital talk groups are also encrypted, such as talk groups for records, narcotics, and other sensitive information related areas.

LARTCS was used more often with the previous radio system, as the coverage with the ICIS system is much more extensive. However, LARTCS is still tested on a routine basis and available when needed. However, the ICIS system is much more desirable, as the officers do not have to request a channel, which distracts them from the task at hand, as well as the delay in obtaining the mutual aid channel during a time critical evolution, such as a vehicular chase. The patch channel is for LAPD as well as LA Sheriff. The patch channel does not work as well in buildings, but this is not its primary function. It is a gateway to the Burbank radio system and is most likely to be used from the officer's car.

The short time delay to be assigned a channel using the trunked system was initially an issue with some of the officers, but training and use of the system over time has minimized this concern. Also, there is some complaint about the digital radios sounding as if the users are "under water", (also commonly described as a "tinny", metallic, or robotic sound), but time and usage have also minimized this concern.

Police use an 800 MHz channel for data, although they are considering a movement to a UHF channel in the near future.

Interview with Claremont Police Department

Date: September 29, 2005, 2:00 pm

Attending: Capt. Paul Cooper
Scott Johnson, RCC Consultants

Location: Tele-Conference

Captain Cooper indicated the City has a 3 channel, analog, UHF T-Band conventional radio system. They have applied for 2 more channels, which are needed because of capacity issues. Located in the far eastern region of Los Angeles County, Claremont works regularly with agencies in neighboring San Bernardino County. In fact, there are even 3 repeaters in San Bernardino to improve communications during times when interoperability is needed.

Claremont is capable of providing console patching for VHF low/high band, UHF, and 800 MHz channels. They also have an ACU-1000 provided by the Los Angeles County Sheriff's Department so Claremont can assist with linking the San Bernardino 800 MHz trunked system into Los Angeles County and vice versa. Claremont also provides patching for other agencies in the area as requested. Claremont supports the LARTCS system, but has not really had the opportunity or need arise to utilize the system because of their existing patching capabilities.

All new radios being purchased are capable of being upgraded to work on a trunked infrastructure. They noted nearby Pomona is going to join ICIS, which will make this alternative more attractive to Claremont, although their preference is to see a Countywide system maintained by the Sheriff's department, similar to systems in place in Orange an San Bernardino Counties.

Claremont uses a UHF channel for mobile data, and share the system with La Verne. The mobile data system is planned on being upgraded or replaced in about 2 years or so.

Interview with Culver City Fire Department Telecomm Division

Date: October 24, 2005, 9:30 am

Attending: Capt. Tom Murphy, Culver City FD, Interim Telecomm Supervisor
Scott Johnson, RCC Consultants

Location: Tele-Conference

Capt. Murphy indicated Telecomm Division of the Culver City Fire Department provides radio support for all city Departments/Divisions, including both the Police and Fire Departments. Currently, a 6 channel analog trunked system is used, along with 3-4 conventional channels. Soon, Culver City will be transitioning to the ICIS network, which will be a dual mode (analog/digital) system. At this time, only Police and Fire radios are going to be upgraded for ICIS compatability (SmartZone). This will allow the Culver City public services and personnel from other City agencies to continue to use their analog trunked radios. The Police Department already uses some encrypted radios, and will probably continue and expand this practice when converting to the new ICIS infrastructure.

Culver City does not currently use mobile data in a production environment, but they are currently investigating a Motorola mesh network. The Police are also running a mobile data pilot project that is being evaluated by a few supervisory personnel over a commercial GPRS network.

The bus system is planning on using a UHF conventional channel for AVL and other data applications.

Culver City is aware of the LARTCS, and has the LARTCS Mutual Aid frequencies programmed into the Police radios, but does not use the system on a regular basis.

Culver City Fire carries 800 MHz LA Fire radios, as Los Angeles is a neighbor on 3 sides of Culver City, and there are numerous communications between the cities. Culver City would support a regional radio system that covers the entire county. Capt. Murphy responded that it "would be great".

Interview with Downey Fire Department

Date: October 12, 2005, 9:30 am

Attending: B/C Jeff Turner
Scott Johnson, RCC Consultants

Location: Tele-Conference

Chief Turner indicated the Downey Fire Department currently has a one-channel VHF analog repeated system, with a second direct channel. They are in the process of converting the direct channel to become a repeated channel, which will enable the FD to have one channel for dispatch and the other for response. The longer-range plan is to convert to UHF, potentially by joining the ICIS consortium. Downey's primary reason for changing to UHF is to enable better interoperability with the numerous UHF band agencies in the area.

Downey Fire also dispatches for Santa Fe Springs, Montebello, and Compton. As Montebello has made the decision to join ICIS and is currently implementing the trunked ICIS technology in their city, there is even more incentive for Downey to follow this plan. Downey has also been purchasing UHF radios capable of being flash upgraded to operate in the trunked mode used by ICIS users. These radios are needed in the current conditions to communicate with the County and Montebello, and mobile radios are available in all rigs and will soon have enough portable radios for each on-shift position. These radios will make a transition to UHF trunked ICIS even more attractive, as the radios necessary to provide interoperability today can eventually be used for the internal communication needs as well as communicating with others.

Mobile data is used on an 800 MHz channel. Another channel is needed for capacity reasons, as Whittier and Montebello PD also use the channel.

Interview with Downey Police Department

Date: October 11, 2005, 6:30 am

Attending: Lt. Steve Garza
Heidi Calhoun
Scott Johnson, RCC Consultants

Location: Tele-Conference

Downey Police have a 2 channel repeated, 1 channel direct, VHF system. It is old and increasingly having failures. They have good coverage in the city, but run out of coverage when only a few miles outside city limits, such as when in a vehicle pursuit.

They participate in LARTCS testing, but feel getting a channel is too cumbersome, and causes too much delay during a fast moving incident. Also, their dispatchers are not comfortable with requesting the patch and coordinating their radio users to the new channel.

The city has UHF/800 MHz radios in dispatch, but do not cross patch, as the equipment is not set up properly and the dispatchers would need training if it was modified. The patrol cars also have UHF radios, and the command vehicle has UHF and 800 MHz radios.

They also use Verizon for mobile data, but are limited to getting criminal information. The next step in the future is getting the ability to do reports in the field, and eventually images, such as mug shots and fingerprints.

Downey is in need of a new radio system, and is interested in ensuring the new system is interoperable with surrounding communities.

Interview with El Segundo Fire Department

Date: October 24, 2005, 1:30 pm

Attending: Administrative Battalion Chief John Gilbert
Scott Johnson, RCC Consultants

Location: Tele-Conference

Chief Gilbert indicated the Fire Department uses mostly UHF, with some VHF radios for interoperability. They do not carry any 800 MHz radios to speak with LAFD, but LAFD has UHF radios to interoperate with El Segundo.

The UHF system is analogue, digital, and trunked capable.

El Segundo has not used LARTCS, but they have used the South Bay interoperability system for actual responses, and it has worked well. The main outside communications are with the South Bay system.

They have numerous radio channels programmed into their mobile and portable radios to maximize the ability to communicate with other users.

They are looking at MDC's (mobile data computers), mainly interest is to record times of dispatch, arrival, premise history, etc. They would also have access to the DOT Guidebook, RMS (records management system) in the stations, and AVL. Their CAD needs to be replaced, especially to support the new data needs.

When discussing the idea of a shared, countywide radio system, the Chief remarked, it was the "only way to do it, with limited resources and funds we have to share."

Interview with Glendale Fire & Police Departments

Date: August 23, 2005, 1:00 pm

Attending: B/C Don Wright, GFD
Capt. Ray Edey, GPD
Lt. Don Shade, GPD
Rich Kaufman, Fire Comm. Administrator, GFD
Steven Hronek, Glendale Information Services
Jim Walls, Glendale Information Services
Mark Revis, RCC Consultants
Tony Busam, RCC Consultants
Tom Gray, RCC Consultants

Location: Verdugo Fire Communications Center, Glendale

The Verdugo Dispatch Center dispatches Fire and EMS (a total of 40 fire stations) for the following communities:

Burbank	Glendale	Pasadena	So. Pasadena
San Marino	Arcadia	Monrovia	Sierra Madre
San Gabriel	Monterey Park	Alhambra (soon)	

Verdugo's dispatch consoles are mfd. by Orbacom but Motorola Gold Elite is planned for the future. They use Vista 9-1-1 and a PRC CAD system. Mapping and AVL applications are planned to be added next year. The center has six positions, of which 3 or 4 are typically manned. The center handles approximately 50,000 calls per year.

The Verdugo radio communications system is UHF conventional at this time, with 5 simulcast channels and 3 single site repeaters, but is planned to become part of ICIS. There are also 3 simplex frequencies which are used as fire ground channels. UHF was determined to be the spectrum of choice by the LA Area Fire Chiefs as part of a series of recommendations from 2003. Because UHF propagates well and many area agencies are already on UHF, the Chiefs agreed that it was a good platform to move towards. There are also 10 VHF channels used for admin. and disaster communications.

Glendale Fire has an automatic aid agreement with LAFD. It is frequently used for freeway fires. However, interoperability with LAFD leaves a lot to be desired. The UHF portable LAFD has in every apparatus isn't effective because it is difficult to use while driving. Often communications with LAFD consists of hand signals and yelling. For large incidents there is a combined command post and the agencies meet face to face in unified command, discuss available communications options, or swap portables. The GFD command vehicles have an 800 MHz radio in them.

Dispatch role in ICS is to respond to requests from the IC. There is no procedure to dedicate a dispatcher to the incident. The IC handles the incident on tactical channels.

When calling LAFD to request resources, sometimes LAFD's dispatchers don't know whether they should dispatch or not. The request often has to go up to a floor Captain or Battalion Chief which causes delay when time is critical.

LAFD now sends a representative to the meetings of the 11 Verdugo fire chiefs.

Chief Wright was the Incident Commander at the recent Glendale train derailment. Upon the initial response, the Chief contacted his dispatcher and had them contact LAFD to make sure that they were aware of the derailment. On his Glendale Police radio, he heard GPD talking about the Costco parking lot, so he went there and found LAFD to be just arriving. He and the LAFD B/C set up a common command post, so most of the interoperability was done face-to-face.

There were two medical stations set up, one on each side of the tracks. Whichever side a victim was on, they went to the medical station on that side. Each agency was in charge of one of the medical treatment areas. Crews from each agency worked in their own groups. Mixing the crews in the treatment areas would have been difficult, it was much better to have them working with familiar people. The only area where personnel were mixed was on the tracks themselves where triage and extrication were being conducted. There, all communication with those around was done face to face or with hand signals. Things were moving quickly and a hand signal was more efficient than having to pick up a radio to call someone. The command post was kept apprised of operations by officers from both agencies.

Glendale PD arrived on the scene first. GFD got intel on the incident from listening to GPD's radio channel. GPD set up their command post alongside GFD and LAPD. Ultimately there were nine or ten agencies involved: GPD, GFD, LAFD, LAPD, LASD, LACoFD, Burbank PD, FBI and Union Pacific Railroad. Briefings were given at the command post about every 45 minutes. An old Winnebago was used as a meeting room (a meeting room for ICs and command staff was much more useful than a command vehicle that is built to be both a conference room and a comm. center and doesn't do either very well).

GPD provided 2 levels of perimeter security and took over as IC after the rescue phase ended and investigation and recovery began. They owned the incident for 30 hours and then turned it over to the NTSB and Union Pacific.

During the incident, LASD was on 4 different frequencies. They don't carry all channels in all radios so sometimes deputies couldn't find each other. LASD does not have ICIS in its radios, but GPD could switch to LASD frequencies if needed. Ultimately, they relied on face-to-face communications at the CP.

The five UHF mutual aid channels that are part of LARTCS are not very useful. If you call the SCC to request a mutual aid channel for a pursuit, etc., the channel often doesn't

work because the coverage is poor. There is no law enforcement mutual aid channel that has countywide coverage (unlike Orange County, that has a countywide "Red" channel for pursuits). There is a UHF CLEMARS repeater on Mt. Tom that has good area-wide coverage that GPD and LAPD uses, but LASD does not.

The Fire Department is actively pursuing integrating CAD systems with LAFD and LACoFD because they do extensive mutual aid with them. An integrator needs to provide a message switch and software to relay messages between the CAD systems. CDF is publishing tables to cross-reference CAD system equipment so they can be more easily integrated.

Glendale PD uses the ICIS trunked system. The coverage is good and officers have little to no problem with the way the trunked system operates (i.e. waiting for the go-ahead beeps before speaking into the microphone).

Glendale PD and Burbank PD are looking to integrate their records management systems. A CAD interface is not needed because they so rarely have to call outside their jurisdiction for support. GPD handles about 75,000 calls yearly and Burbank handles about 40,000 calls.

There is a lot of joint training. Since they all have each other's channels in their radios, it is easy to talk together.

GPD and GFD have an 800 MHz mobile data channel (RD-LAP @ 19.2 kbps) that they share. There are 3 antenna sites, soon to be 4. It has very good coverage. It isn't terribly fast but is reliable for dispatch, lookups and other critical applications. Currently using Motorola MDTs but will be replacing with ruggedized laptops and Padcom software. They are looking for a commercial high-speed data service for additional applications that need a lot of bandwidth.. GPD has been experimenting with EV/DO.

CITY OF LOS ANGELES
Radio Communications Interoperability Project

Interview with Hermosa Beach Police Department

Date: September 26, 2005, 3:00 pm

Attending: Chief Mike Lavin
Scott Johnson, RCC Consultants

Location: Tele-Conference

Chief Lavin indicated they are very satisfied with the services of the South Bay Regional Communications Center, stating they are "very proactive". Although a very short interview, it is noteworthy the regional dispatch and radio system is another example of the success of this model within the Los Angeles area.

Interview with Interagency Communications Interoperability System (ICIS)

Date: August 23, 2005, 1:00 pm

Attending: Don Wright, Executive Director
Capt. Ray Edey, GPD
Lt. Don Shade, GPD
Rich Kaufman, Fire Comm. Administrator, GFD
Steven Hronek, Glendale Information Services
Jim Walls, Glendale Information Services
Mark Revis, RCC Consultants
Tony Busam, RCC Consultants
Tom Gray, RCC Consultants

Location: Verdugo Fire Communications Center, Glendale

The Interagency Communications Interoperability System (ICIS) is a Joint Powers Authority established to build an interoperable communications network. The member cities are:

- Glendale
- Burbank
- Culver City
- Montebello
- Beverly Hills
- Torrance
- Pomona

The system is currently being constructed by the member cities but is not yet completed. Burbank and Glendale have completed their portions of the systems and have linked the systems together. The other members' systems are either under construction or awaiting the start of construction. Culver City, Montebello, Pomona and Beverly Hills are expected to be done by 2006. Other cities that subscribe to the ICIS service but are not members are: San Fernando PD, City of San Marino, Glendale Community College PD and the Burbank-Glendale-Pasadena Airport Authority. ICIS is looking to expand its membership with new users in the San Gabriel Valley, the Verdugo Fire Communications Center with its 11 member cities, and the Los Angeles County Department of Health Services Paramedic program. ICIS has invested over $59 million in local funding, and is pursuing grants from the federal Department of Homeland Security. It collects fees from its subscribers and has received $2 million in state grants through the Los Angeles Area Fire Chief's Association.

The radio system itself is a Motorola SmartZone system with a 3,600 bps control channel operating in the UHF frequency band. The current users report that the coverage is very good. At this time, ICIS has good in-building coverage in the San Fernando Valley, and good outdoor coverage over much of the City of Los Angeles. When Culver City,

Beverly Hills and Pomona come on-line, coverage will be improved even further. The system is mixed analog and digital. Dispatch channels are analog, all else is digital. There are direct channels available, as well as a conventional access channel. At some point in the future, Chief Wright expects that the technology will be upgraded to a newer version of trunking. It will be important that the ICIS members upgrade their systems as a group rather than "leapfrogging" over each other with new and different versions of trunked technology.

ICIS and LAPD share many antenna sites. ICIS would welcome participation by the City of Los Angeles, and feels that cost savings to the City could be achieved if their systems could be combined. LAPD would not have to contribute all of its frequencies if they felt it would be too big an impact to the officers on the street. If they were to trunk some percentage of their frequencies, it would provide them with many more talkgroups than the frequencies they contributed, and provide talkgroups for LAFD and other City users as well.

The combined footprint of a network developed jointly with the City of Los Angeles would provide tremendous advantages in coverage with a smaller investment by each of the agencies. The original intent of the ICIS system was to be able to leverage the resources of different agencies in order to develop a wide area network that would provide additional capacity and redundancy as well as enhanced coverage.

Interview with Long Beach Fire Department

Date: October 11, 2005, 10:30 am

Attending: John Landstrom
Scott Johnson, RCC Consultants

Location: Tele-Conference

Mr. Landstrom described the Long Beach Fire radio system as very similar to the Police system, except it operates in the VHF band, compared to UHF for the Police system. However, most of the same sites are used. There are 4 repeated and 2 direct channels. Also, there are 2 main simulcast sites along with 5 receive-only voter sites.

LARTCS has access to the Long Beach VHF channels, but the most common mode of interoperability is to exchange radios, as it takes too long to set up the interoperability cross band channels. The Battalion Chief vehicles have UHF mobile radios for interoperability purposes. Because of the proximity and level of joint activities with Orange County Fire Authority, LBFD is in possession of a number of OCFA 800 MHz portable radios, which are assigned to units that commonly respond to Orange County. OCFA similarly has a number of LBFD radios.

Long Beach also uses an 800 MHz channel for mobile data. Data is text only. AVL is available in some vehicles, but this is not very useful, as it needs to be available in all vehicles to provide complete asset location information.

Interview with Los Angeles Fire Department, A/C Michael Fulmis

Date: August 9, 2005, 2:00 pm

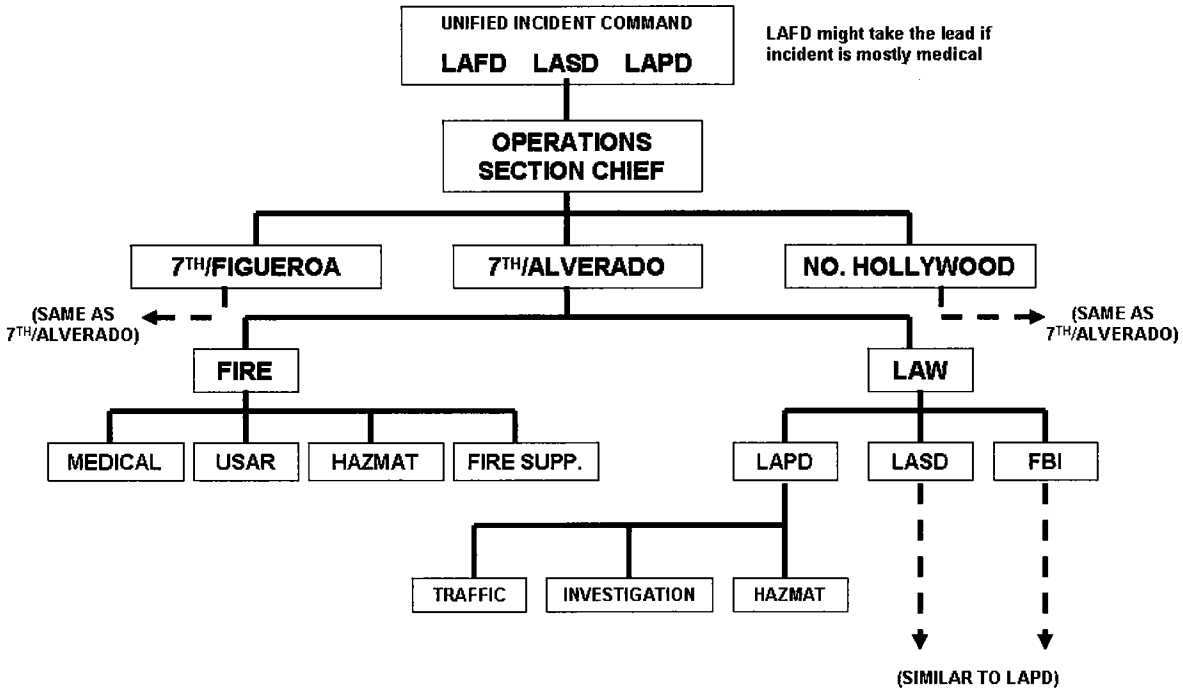
Attending: A/C Michael Fulmis, LAFD Division 1, B Platoon
Mark Revis, RCC Consultants

Location: 108 N. Fremont Ave., Los Angeles

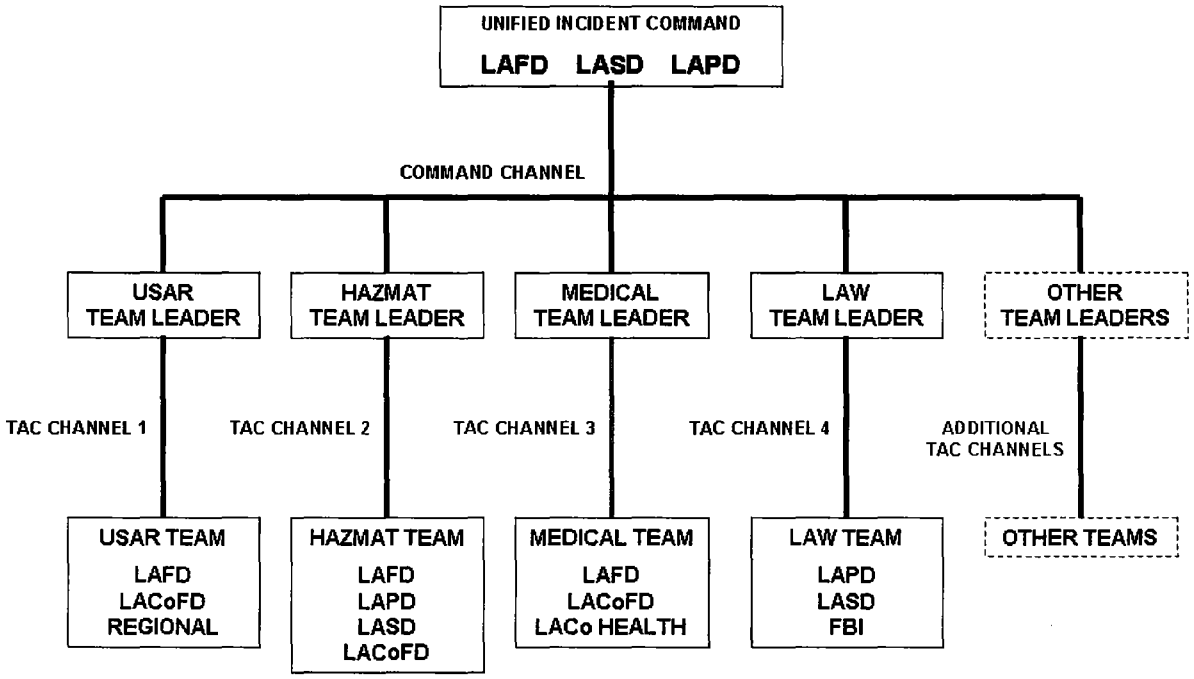
In a major incident (a subway multiple bombing with three separate incident scenes was used as an example) a number of different agencies will respond:

LA City Fire Department
LA Police Department
LA County Sheriff
FBI
MTA
LA County Div. of Health
Military (possibly)
LA City Parks & Recreation Dept. (for evacuation center setup)
LA Unified School District (if evac center set up at a school)

An ICS organization chart for the incident might look like this:



Ideally, all Hazmat would be on the same channel, all fire suppression on the same channel, etc. From a radio communications perspective, the organization would look like this:



LAFD apparatus has a LAPD portable radio that can be used to talk to police when needed, although face-to-face communication occurs often. With unified incident command, the fire and police incident commanders are co-located and can communicate freely. Incidents with shootings: Rescue monitors LAPD's channel to listen for an all-clear message before sending personnel in.

LAFD seems to be ahead of LAPD when it comes to the use of ICS, although LAPD is getting better. Joint exercises are conducted regularly, and many events (Academy Awards, Emmy Awards, marathons, etc.) require joint operations.

For a very big event (such as the World Trade Center), one channel is needed so that everyone can hear evacuation messages.

The LARTCS system was utilized at a recent exercise to simulate a train wreck in the Alameda Corridor. The Corridor is a 20 mile trench that begins south of the 405 and runs up Alameda St. to 25th Street and the train yards. Freight trains run through it, no passenger trains. It runs through five different jurisdictions. The exercise included LAPD, LAFD, LACoFD, Sheriff, Vernon and the NTSB. LARTCS worked OK, but the incident was staged and there wasn't the chaos that is present at a real incident.

At a large fire incident, the I/C may have to monitor five or six channels: OCD, the tactical channel(s), command channel, medical channel, staging channel and RIC. The I/C may assign command staff to monitor channels for them. The I/C is responsible for overall command and shouldn't necessarily be the one to monitor all those channels. Let the command staff do it. Staff assistants for chief officers are invaluable. At one point, staff assistants were taken away. Then a fatality occurred which pointed out the need for assistants and they were reinstated.

The VHF/UHF Kenwood radios are installed in chief officer's vehicles.

- Sometimes finding the correct channel is difficult.
- Usually leave them on the LA County frequency to make it easier to find.
- LASD and LAPD often will have different channels assigned which makes it difficult to figure out. Best way is to find the PD I/C and ask what channel they are on.
- A unified command channel for all agencies is needed. Getting other agencies to buy off on this concept may be a difficult challenge.
- Patching would work OK, but it is needed the most in the first few minutes of an incident and it rarely happens that quickly.

Strike teams (a battalion command team and five engine companies) are sent to fires (mostly brush fires) in other regions around 5 to 10 times per year. Two years ago strike teams were sent out 16 times. When strike teams are away, people are recalled to man relief equipment. Inspectors and special duty people are also called to man equipment.

Cell phones are used often, mostly to talk to dispatch in situations where the 2-way dialog makes communication easier, when the radio channel is congested, and when private information that shouldn't be on the radio must be communicated to OCD. An encrypted, private radio channel might be used, but the cell gives you 2-way communication that you can't get on the HTs.

Cell phone coverage is poor in the hills. You have to drive around until you find a signal and mark the location on a map. There is no cell coverage in parts of Fire Station 3. Dropped calls happen too often. Law enforcement can call the phone company and have all cell calls dropped except for public safety, but it would have to be a really big incident for that to happen.

Interview with LAFD Division 3, Asst. Chief Varela

Date: August 1, 2005, 1:00 pm

Attending: A/C Tony Varela
Mark Revis, RCC Consultants
Scott Johnson, RCC Consultants
Marc Bono, RCC Consultants
Tony Busam. RCC Consultants

Location: Fire Station 88, 5101 N. Sepulveda Blvd., Sherman Oaks

The Chief opened with the comment that LA City Fire is the single largest departmental user of 800 MHz in the area, and that surrounding agencies rely on VHF and UHF, so there are significant communications issues in mutual aid incidents: the mutual threat zone (referred to herein as MTZ), support, etc. He defined the agencies most concerned with the mutual threat zone are the tri-cities (Glendale, Burbank, Pasadena), the Angeles National Forest and LA City. When 5 MTZ agencies arrive at a scene, only LAFD is in the wrong band. Communications issues sometimes cause fires to be fought in a less than optimum manner.

The 800 MHz radio coverage is good except in some canyons and on the other side of the San Gabriel Mountains. There are also significant coverage issues north of the city. He has no problems with channel congestion.

Chief Varela is the chairman of the Brush Committee, representing all of LA City. This organization is a chiefs' committee representing LA City, Beverly Hills, Santa Monica, and Culver City.

He related the fact that the Kenwood radios are only in Chiefs' cars and they need more training. It would be very desirable to install the Kenwoods in all apparatus.

The MTZ agencies have agreed on a common channel for communications, 154.4 MHz, which also covers ground to air communications. Again, this frequency appears on the chiefs' radios, but it is not found in fire fighting apparatus and cannot be monitored by LA firefighters on their 800 MHz radios. At an incident scene, if LA units are out of repeater range, they can go to direct without a problem, but if the department receiving aid does not have a cache of properly tuned radios to distribute, which is more often the case than not, there won't be any radio communications. He stated he has a cache of about 100 800 MHz radios, set at 25 per division and could move a cache of 25 pretty much wherever needed in about a half an hour.

The issue is that while communications between Chiefs is maintained, the communications to the LA firefighters must be relayed over the 800 MHz tactical channel, causing a delay. This is a significant problem because firefighters need to listen

to the main tactical channel in order to be aware of changing conditions and other important information. For example, in a brush fire, a wind shift could bring a fire down on top of firefighters off in the woods. If they were listening to the main tactical channel they would be alerted more quickly which could prevent their injury or death. Thus safety is compromised because fire fighters cannot hear what is happening around them.

If the firefighters are issued VHF radios to listen to tactical communications, another problem can occur. When given radios they are not trained for, personnel sometimes push buttons (even though told not to do so) without understanding the consequences and may effectively disable their communications in the process.

The ideal solution would be for all agencies to have the same system and same radio with easy access to necessary channels.

The Chief cited as a concern the need to annually verify frequencies in use. During the course of a year, many agencies will change frequencies, making the current programming in the Kenwoods and BK radios out of date. This information ought to be as current as possible so that trucks responding to out of area incidents can know where to go, frequency-wise, to be able to communicate.

The Chief cited problems with communications with the PD. Of particular concern is the ability to communicate during a mass evacuation. Planning between the FD and the PD is somewhat weak in this regard. Later in the discussion, it was pointed out that inter-service communications regularly occurs in the following situations:

- Barricade
- Medical
- Bombing
- Stand-by situation at an airport
- Plane down (there are three moderately sized airports in the vicinity—not counting LAX)
- Traffic situation
- Officer involved in a shooting

Interoperability with the PD in a terrorism incident would be limited to the command level only.

The Chief said he has not relied on the LARTCS system very much. He then cited a concern related to patching in an incident involving LA City, LA County, and Ventura County, where the traffic became overloaded: too many details hindered effectiveness. They needed multiple channels, for command and tactical use. He cited a requirement for 6 channels: one each for dispatch and command, two tactical channels, one for staging and one for medical response.

We next discussed terrorist attacks, in particular one wherein an EMP downtown might fry equipment. His station is 18 miles from downtown. When asked, the Chief agreed

that encryption might be desirable, with the potential to improve firefighter safety, especially in shooting situations or terrorist incidents. It would also eliminate scanner buffs that tend to show up on-scene and get in the way.

The Chief stated that there is a communications van for each division. He feels that ACU-1000s work well, except that there is no pre-defined channel patching plan, and too many channels can be patched together. A plan needs to be developed. The Chief feels that every battalion needs an ACU-1000 and that firefighters could be trained to use them.

Another concern the Chief cited was that the Sheriff has responsibility for policing the MTA stations, and that EMS cannot communicate with them when responding to incidents on station platforms.

Interview with LAFD Battalion 12, Battalion Chief Mark Saxelby

Date: August 4, 2005, 9:00 am

Attending: B/C Mark Saxelby, LAFD
Mark Revis, RCC Consultants
Scott Johnson, RCC Consultants
Marc Bono, RCC Consultants
Tony Busam, RCC Consultants

Address: Fire Station #98, Pacoima

Chief Saxelby is responsible for Battalion 12, which covers an area somewhat north east of L. A. center, an area of approximately 77 square miles. In addition to this, Battalion 12 also responds into an area known as the Mutual Threat Zone. The MTZ is about 70 square miles and is comprised of LA County and part of Angeles National Forest. The terrain is hilly with less dense housing. It is subject to frequent brush fires, which threaten the houses and could threaten the more densely populated areas in the City. The Chief characterizes it as "urban interface" as opposed to wild land. Thus the area represents a significant fire threat to life and property. The "mutual" refers to the fact that a brush fire in the MTZ threatens several jurisdictions; thus interoperability is of extreme significance. Fire fighting agencies involved in the mutual threat zone are as follows:

- LA City
- LA County
- Glendale
- Verdugo
- Burbank
- The US Forest Service

The frequency of brush fires and their threat to property is of such a magnitude, and the coordination with so many agencies so complex, that the Chief takes what might be extraordinary steps to ensure proper radio interoperability in mutual aid situations. Five radios are regularly used by incident commanders for mutual aid purposes. In addition to these radios, the Chief requires a minimum of three channels for his own people: command, dispatch, and tactical. Communications alone becomes somewhat overwhelming. After an incident is underway and more people arrive, some of the communications duties can be handed off to subordinates (example: the EMS channel to the EMS Captain). Normally, command of the scene is a joint effort between the ranking B/Cs from each jurisdiction.

Adding another layer of complexity is that fact that every radio differs from every other one in some manner. All look different, and various channels and zones must be selected. Many radios do not have all the other channels of the particular band programmed into the radio, so the appropriate radio must be used. Moreover, depending upon where one is in the national forest, one needs to know the appropriate PL tone to

send to activate the correct USFS repeater. Not everyone is fully trained on how to do this. He noted that changing PL tones requires familiarity with the surrounding geography. This need poses a problem when a large incident brings in people from diverse areas, people lacking the familiarity with the locale. The department does not have mapping, so the problem is acute.

During the summer, it is likely that there will be several calls per day. A "full brush [fire] response" may require a dozen aircraft and 270 personnel.

The first engine in assumes IC, which is then passed up the chain of command as higher ranks arrive. It really takes a Battalion Chief's involvement to get control of the situation.

In general, where coverage is available, there are sufficient radio channels available to conduct operations. However, there are many areas where only one radio channel actually works, due to limitations in coverage. When there is a lack of channels or coverage, firefighters rely on cellular phones to communicate.

To facilitate communications at a major incident, the different agencies' commanders will congregate at one command post and line cars up next to one another. This approach facilitates command-to-command communications, although there are situations where such co-location would not be that essential and so better interoperability would allow for more flexibility in command post deployment. Communications with firefighters on the fire line is different. Often fire crews are co-mingled (firefighters from two or more jurisdictions on the same crew) so that every crew will be equipped with radios on the primary tactical frequency. This means that firefighters may not get important messages at the same time, as they are relayed over different radios. We probed whether this practice results solely from the shortcomings of the current level of interoperability. The Chief said that the inadequacies of their radios were the major factor, but that in fact the on site co-mingling offers firefighters the ability to learn from each other and enhances the co-operative, co-working relationship, and so would probably continue even if the radio situation were improved. However, the crews would be easier to manage if they were not co-mingled.

He pointed out that LA County does not carry LA City radios as a rule, only a few County Battalion Chiefs are equipped with it. and the forest service is on two VHF radios. The Forest Service Chief and Engine 10 also have 800 MHz radios.

The Chief stated that he needs to talk with the PD commanders, but it is often done face to face at a command post. However, better radio interoperability is essential in evacuation situations where the police have significant involvement in controlling access. He stated it would be "very nice" to be able to contact police, especially on the working level. The Chief also noted there are times when having more than one radio is desirable, to allow him to talk on one radio while monitoring another.

Another type of incident where interoperability with the PD is important is a violent incident wherein an ambulance will be needed, but cannot go in until the situation is secured and the armed person(s) are subdued.

Given that the IC needs to talk on multiple radios or channels, their mobility in terms of leaving the vehicle is limited, since doing so deprives them of the additional radio. A captain then needs to carry two or more portable radios to leave the truck.

With respect to channel availability, the Chief said that was adequate, and that he may use up to five channels on an incident:

- Two tactical
- One command
- One emergency
- One dispatch

Coverage is an issue of significant magnitude in certain areas. Of particular concern is the area along I-210, between La Tuna Canyon and Sunland Blvd., where they have "real problems." Here they frequently are forced to go to cellular. The Chief emphasized again that this situation/area is a "huge problem." A repeater site is available, but when it is used, interference is caused in other areas of the city, so they have to especially request that it be brought up, and another one must be turned off to reduce the interference. He added that even the cellular coverage is poor—and he has experienced that with both Nextel and Verizon, the phones of both of which he carries. He added that by Fire Station 75, the coverage is also poor and suspects Nextel is causing interference.

MDC coverage is good, except in Big Tujunga Canyon. Two way pagers are not used.

The lack of mapping software in the MDCs was again noted as a problem. This limitation causes administrative problems when determining who pays the costs for an incident. The rule is that the jurisdiction in which the incident occurred pays, but without the ability to determine an exact location, it becomes difficult to adjudicate a settlement. Chief Saxelby carries a personal GPS receiver to be able to pinpoint where a fire is, and some cellular phones include GPS. The GPS has helped in rescues in guiding helicopters into remote areas. But the GPS is not integrated into any system. This lack of capability added to the lack of mapping really complicates things. The Chief has been told that he cannot install his own mapping software into the MDC in his vehicle because of computer security policies, and his requests for the City to purchase and install the software have received no response.

The Chief also noted that they have no maps of areas outside the City, and so have to resort to purchase topographical maps.

We next discussed the dimensions of a full brush response in terms of apparatus. Such a response calls for the following:

- Los Angeles City:

  - 5 engines
  - A taskforce consisting of 2 engines and a truck
  - 3 helicopters
  - 2 Battalion Chiefs
  - A fourth heavy lift helicopter
  - A bull dozer
  - An ambulance
- Los Angeles County: a mirror, i.e.:
  - 5 engines
  - A taskforce consisting of 2 engines and a truck
  - 3 helicopters
  - 2 Battalion Chiefs
  - A heavy lift helicopter
  - A bull dozer
  - An ambulance
- U. S. Forest Service:
  - 5 engines
  - 2 water tenders
  - 2 Battalion Chiefs
  - 2 additional helicopters
  - 2 patrol vehicles
  - 1 bull dozer
  - 2 "super scooper" fixed wing water bearing aircraft
  - 2 helicopters
- Verdugo:
  - 1 engine (four men) each from Glendale, Pasadena and Burbank

Manpower for the City in the above is as follows on a per apparatus basis:

- Engine: 5 persons
- Task Force: 10 persons
- Helicopter: 2 persons
- Chief's car: 2 persons
- Dozer: 4 persons
- Ambulance: 2 persons

The U. S. Forest response is as follows:

- Engine: 4 persons
- Water truck: 1 persons
- Chief's sedan: 1 persons
- Patrol vehicle: 1 persons
- Dozer: 3 persons
- Scooper aircraft: 2 persons
- Helicopter: 2 persons

There is no RIC in place for brush fires as it is unnecessary. However the presence of aircraft requires air-to-ground channels. The Chief said that the City's helicopters are the only ones to drop on fires at night.

Additionally, the County may activate and deploy hand crews.

Most brush fires, even large ones, are out in 12 to 24 hours. When one takes longer, then it becomes a truly major incident and there is a profound change in how it is handled. This situation results from the fact that relief troops have to be called in, essentially doubling the manpower. The resultant expansion of logistical support requires a significant increase in channels.

The Chief brought up another significant point: a lack of familiarity with the many different agencies' radios limits their effective use, even if they available to be handed out. The Chief said that he often has to personally set up a radio before he gives it out to someone.

The Chief noted that there is little interface with the CDF in his area. He does have access to statewide interoperability channels. His command vehicle is equipped with a Kenwood, and the suburbans and newer apparatus also have these radios.

He stated that, in his opinion, the Tactical Channel Plan is very difficult to read when time is of the essence. He has created an edited channel list containing the channels he uses most often so that he can identify a channel and switch to it quickly. The channel plan hasn't been fully implemented because the County radios are programmed differently. Channel 502 in his radio is a different frequency from channel 502 in a County radio.

He noted that the BK radios may be old but use alkaline AA batteries which last much longer than the rechargeable batteries on the Motorola radios. The Chief said they get a couple of hours on a hand held radio and then need to recharge it. He said that men on the line in a brush fire do not transmit over the radios that frequently—they are too busy shoveling—and so the radios last usually up to 8 to 10 hours even with the rechargeable battery. He noted that Motorola makes a clam shell (battery compartment for the alkaline batteries) for his Motorola radios but the City won't buy them. He was told that there is a possibility that they might damage the radio.

In discussing coverage and audio quality, he mentioned that Battalion 15 has simulcast issues near Ventura County.

The Chief said that his number one biggest need is mapping software and GPS in his MDC. Second, the Chief wants a dual-band VHF/UHF handie-talkie so he can carry it away from the vehicle. He would like to see the radio programming changed so that the channels he uses most frequently are in the same zones. He is more interested is getting quickly to the channels he uses every day, as opposed to access to more channels.

With respect to training, the Chief characterized training on hand held radios as being good, but that provided on the Kenwood radios is poor.

At this point Captain Stone joined the interview. He stated he usually uses two radios and works on three channels. He characterized coverage as fairly good, mentioning that at times firefighters have to go to direct mode when in large buildings or basements. OCD cannot contact paramedics when they are inside Holy Cross Hospital. He received no training at all on the Police Astro Saber radios.

He also said that the old handie-talkies had a frequency knob on the speaker-mike which was a good feature. You could press a button to lock the channel and prevent an accidental change. The new radios don't have this feature making it hard to change frequency or go direct when needed because the radio is inside the turnout coat. A radio that changed channels in response to a spoken command would be very desirable.

He also said that the old mobile radios had 2 receivers so you could listen to OCD and the tactical channel simultaneously through different speakers. The new mobile radios don't have this feature.

Interview with LAFD Bureau of Support Services, D/C Keane

Date: August 2, 2005, 8:30 am

Attending: D/C Dennis Keane, Bureau of Support Services
Mark Revis, RCC Consultants
Scott Johnson, RCC Consultants
Tony Busam, RCC Consultants
Marc Bono, RCC Consultants

The Chief pointed out that all of the area fire chiefs have agreed with respect to developing interoperability and a regional approach to dispatch based on six centers (Verdugo, Long Beach, Downey, LA County, LA City, and South Bay), with CAD networked together. This approach is seen as far superior to patching together disparate networks. With separate, incompatible networks, each agency will still have limited coverage, even if they are patched together. When LAFD goes into the national forest, their 800 MHz radios do not work. Also cited the fact that the police cannot operate a pursuit across the county without losing contact, nor maintain contact with surveillance and task force activities outside of the City.

A common, shared radio system (voice and data) for all FD and PD in the region is seen as the optimum solution to the problem. Primary advantages are: 1) Common radio equipment, all channels pre-programmed and everyone knows how to use it, 2) Extended coverage, you would still be within coverage of your radio system even if you left your jurisdiction, 3) Common data system would enable region-wide alerts and sharing of data. The Chief maintains the no jurisdiction should be left behind; all agencies should be brought to the same level. The ICIS system in use by Glendale, Burbank and Pasadena is a model for what can be accomplished. The region's fire chiefs are sold on trunking. The Sheriffs Department has stated they want to build a trunked system too. The Chief feels that collectively all of the participants could pool about 300 channels, but more work needs to be done before everyone will accept the concept of pooling frequencies.

LA City is building a new building which will contain a new fire station, new fire dispatch, new Departmental Operations Center, and a new City Emergency Operations Center. The building is expected to be complete in May 2008. The building location is a few blocks from City Hall. LAFD may take over the dispatching of Santa Monica FD beginning in 2006. SMFD is purchasing 800 MHz radios but will keep their UHF radios for interoperability with SMPD.

Chief Keane estimates that around 100 calls per day call for a joint response from LAFD and LAPD. Not all of these calls require radio interoperability, however, improved communications always enhance operations.

The Chief said that the department is looking into Sprint for its broadband data offerings.

The Chief does feel that 700 MHz offers an alternative, but is concerned that the availability date for the band is in flux and may not be available for many years. There are a number of short-term issues that must be addressed in the interim. He is looking at a timeframe of 5 to 7 years to complete a LA regional consolidated system, and 15 to 20 years for a system that consolidates all of Southern California.

Chief Keane provided a number of documents, including a copy of the California Mutual Aid Plan, and a number of Automatic Aid agreements with other municipalities.

Interview with LAFD Bureau of Support Services, Capt. Nida

Date: August 2, 2005, 9:00 am

Attending: Captain Kevin Nida, Bureau of Support Services
Mark Revis, RCC Consultants
Scott Johnson, RCC Consultants
Tony Busam, RCC Consultants
Marc Bono, RCC Consultants

Location: LAFD Headquarters, City Hall East, Los Angeles

Captain Nida plays a leading role in a number of technology related initiatives. He chairs a committee on standards and technology for the L.A. Regional Tactical Communications System (LARTCS). He represents LAFD as well as L.A. Area Fire Chief's on LARTCS.

We began our interview with a discussion of the LARTC (LA Regional Tactical Communications) system. This concept was initiated after 9/11/01 and formed in early 2002. The basic principle is the patching together of VHF, UHF, 800 MHz, and low-band channels. There are six UHF channels, one of which is Countywide and the others cover only a part of the County. There is a plan to make these channels county wide on a simulcast basis, as suggested by a consultant, ICTAP. Right after September 11th, the County acquired an ACU-1000 provided by the US Secret Service. This system was placed on Mt. Disappointment. It was used to link a VHF and a 38 MHz military channel as a proof of concept. The goal had been to set this up within a year and this objective was achieved. But then the County has expanded this concept to a more complete and permanent system. It has secured a $7 million grant and allocated another $40 million from the budget, with the goal of making this concept a permanent solution to interoperability. This money has not yet been spent, and there is some controversy as the region's fire chiefs are uncertain that the money should be spent on expanding LARTCS rather than to create a consolidated county-wide radio system.

The current system has significant gaps in coverage and it is recognized that more sites need to be identified for build-out. Despite the success of the proof of concept there is limited channel capacity. The Captain cited a drill (with federal, state and local participants) wherein the limited capacity forced the Sheriff's Department to kick the drill off of the network in favor of a surveillance operation it was conducting. This occurrence is a demonstration that LARTCS has some significant limitations. Therefore in the Captains' view, the concept is proven, but cannot serve as the only solution. The project represents a template for interoperability.

Given technical considerations, the group may have to sole source a solution from Motorola. However, pending the identification of sites, the cost, coverage, and final design cannot be completed.

We next discussed ICIS, which runs on UHF using Motorola's Smart Zone. This system will serve seven cities (Glendale, Burbank, Montebello, Culver City, Beverly Hills, El Segundo, and Pomona) and is still being built. The cities of Downey, Santa Fe Springs and Compton are also showing serious interest in ICIS. The Captain feels ICIS needs more capacity if the City of Los Angeles were to participate in the system. Fire could add frequencies from its data system, as could the PD (from its voice system), but the latter needs to upgrade its system. The Executive Director of ICIS is Battalion Chief Don Wright of Glendale FD.

The Captain said his perception was that the PD is resistant to the notion of a trunked system, based on possible reliability problems, and the fact that their transition to digital was difficult and they don't want to repeat the experience. The Captain believes that there are many other channels that are available that could be used if a trunked system failed. The LAPD has already operated in their "fall back" (simplex) mode due to two lightening strikes. Having a fallback plan for lightening strikes could also be used if the trunked portion of the system failed. The Captain feels strongly that not all channels should be trunked to add another layer of redundancy.

Moreover, the PD has a shortage of capacity that will get worse over time—the PD recently converted a tactical channel to a dispatch channel, for example. And there are groups that want their own channel as well, such as SWAT and other special units. Thus there are elements within the PD who may favor trunking.

Other factors impel a move to a trunked system:

- Re-banding is looming and will add to the problem. Eight of ten frequencies will be affected, whereas Fire will only have to deal with two of its eighteen.
- The EDACs system now extant does not provide good coverage. Consideration has been given to push from six to nine repeaters.
- There is consideration also for tying in DOT and other agencies.

The Captain's goal would be to have a county wide 800 MHz system for data and a trunked UHF system for Voice. Hand-held radios would be for both LAPD, FD, 13 of 30 other fire departments, and other agencies.

The sequence of steps he envisions would be as follows:

1. Trunk the police UHF system
2. Move the fire to the trunked UHF system
3. Re-use the now vacant 18 channels for re-banding and PD and for data
4. Leave ten channels for county wide interoperability

The Captain would support a plan for a 700 MHz system but feels that 700 MHz is a long-term (15 years) initiative.

Other Mutual Aid Initiatives:

FIRESCOPE is a consortium of fire departments that meet to set policies for mutual aid operations, communications and administration within California. FIRESCOPE has a mutual aid channel plan for VHF, UHF and 800 MHz. The LA Region has taken this a step further and defined TMAC (Tactical Mutual Aid Channel Plan), which standardized programming of VHF and UHF radios so that mutual aid frequencies can be easily and reliably accessed by fire crews at an incident scene. Every radio has 160 common mutual aid frequencies pre-programmed in a standard order, so that "channel 210" is the same frequency in every radio.

LAFD and LAPD both have purchased several vehicles with ACU-1000s installed for local cross-patching of channels at incident scenes. These are extremely useful but it takes time to drive the vehicles out to the scene of an incident. They were used at the recent Glendale train derailment but were lightly used because there was so much radio traffic that patching lots of channels together would have resulted in chaos. A single-band wide-area interoperable radio system would make the need for "patching" less frequent, and would provide for more reliability.

A pre-defined plan for patching needs to be created. You can't randomly patch channels together because the traffic volume goes way up and will cause congestion.

Better radio discipline is needed, as well as better training. Firefighters are very familiar with other firefighting tools but often are mystified by their radio. This has been identified as a serious firefighter safety issue.

There have been discussions about a consolidated City/County CAD system and AVL. Both would be extremely beneficial in that the closest unit could be dispatched, instead of the closest station. Apparatus is often out of the station when a call comes in, and sometimes another station could be dispatched that would get help to the incident more quickly.

Interview with Los Angeles Fire Department Operations Control Dispatch (OCD)

Date: August 1, 2005, 10:00 am

Attendees: Battalion Chief Martinez, Dispatch Commander
Battalion Chief Thomas Brennan, Dispatch Commander
Battalion Chief Brian Schultz, FCCS II/RCN
Ms. Kathy Evansen, Dispatch Support
Captain Jim Littlefield, Dispatch Floor Captain
Mark Revis, RCC Consultants Project Manager
Tony Busam, RCC Consultants
Scott Johnson, RCC Consultants
Marc Bono, RCC Consultants

Location: OCD offices, Los Angeles City Hall East

The operation is organized into three shifts, also called platoons—A, B, C. Shifts are 24-hour stints. Each dispatchers 24 hour shift is determined by a rotating watch schedule that places them "on watch" 10 –14 hours. Dispatchers off-watch are subject to recall depending on activity levels. Dispatchers are uniformed fire fighters. The center handled around 766,000 calls last year. Fire and EMS 9-1-1 calls are first received at LAPD Dispatch and sent to one of two dispatch centers (main dispatch at City Hall East or backup at Coldwater Canyon), where an incident is created in CAD and dispatched. OCD is the only active dispatch center. The backup center is unstaffed and has a very limited operational capacity. It's primary use is when OCD is evacuated or has a critical system failure.

The CAD system is integrated with the phone and radio systems, voice and data, and with all fire stations for alerting.

The Captain pointed out the difference that fire provides fixed based dispatching (fire units are normally in-station at the time of dispatch), as opposed to the police, who are on patrol at the time of dispatch. The CAD assumes a unit on the radio in their district (or "patrol area") is in the station for dispatching purposes. In other words, the computer normally calculates the closest unit to an incident from the location of the fire station regardless of where they actually are.

Fire uses 800 MHz for voice and 450 MHz for Data, the Police are opposite. The current network design dates from the late 80s. The system is analog conventional. The department sets up what was referred to as "manual trunking" for incidents. Tactical channels are assigned to the incident by the CAD system at the time of dispatch. If more tac channels are needed, the dispatcher can add them manually. As soon as an incident is dispatched, people switch to the tactical channel. Large incidents (3 or more units dispatched) get multiple tactical channels. An incident might be large enough to demand

five tactical channels. If multiple large incidents occur simultaneously, there are not enough tac channels to go around.

It was mentioned that one major area of concern is the fact that on some incidents, tactical channels get eaten up and the department runs out of tactical channels. Those present stated they are looking for a recommendation from RCC.

The department operates in three divisions. Division III is also referred to as the "north end," and covers the San Fernando Valley above the Santa Monica mountains. Ambulance and fire are dispatched on channel 8. Channel 10 is a pre-designated, citywide channel for ambulance and EMS. Either the repeater or direct talkaround communications may be used.

In Divisions I an II, fire and ambulance dispatch are split in their respective areas, Channel 7 covers fire and 4 is given to Rescue/Ambulance. An example was cited regarding the Metro rail crash when multiple tactical channels were also provided due to the scope of the incident.

Channel 11 is a citywide, Chiefs' command intercommunications channel.

Channel 5 is devoted to general administrative traffic.

Channel 6 is the emergency trigger channel.

Each division also has an administrative channel dedicated to itself:

- Div. I: Channel 1
- Div. II: Channel 2
- Div. III: Channel 3

Thus nine channels out of eighteen are designated and dedicated to specific uses. Channels 12 through 18 are reserved for assignment as tactical channels.

Summary: (this chart was put up on the board)

Channel	Designated Use
1	Division I Administrative
2	Division II Administrative
3	Division III Administrative
4	Metro RA (Div I and II EMS Dispatch)
5	Fire Prevention Bureau
6	Emergency
7	Metro Fire Dispatch (Div. I and II)
8	Valley Fire & EMS Dispatch (Div. III)
9	Brush/Large Incident
10	RA (Citywide EMS talkaround)
11	Command
12-18	Tactical channels

Channels 1, 2, 3 and 10 may be used in direct mode. Other channels are typically used in repeater mode unless in a dead spot. Note: if repeater fails, firefighters may not be able to switch over to direct mode because the radio is underneath their gear.

The comment was made that dispatch sets up for fire flow. This refers to the number of units sent on initial dispatch. Fireflow is the amount of water required to extinguish a fire in a given size building. So, larger buildings receive a larger number of apparatus on initial dispatch.

There is a special unit, the Rapid Intervention Company (RIC) that is dispatched if the fire is more than one alarm. RIC is not a special unit, it is a special designation for a job given to a group of firefighters. For example, if Task Force 15 is responding to a fire the incident commander may assign them as RIC. RIC monitors the emergency trigger channel. Their purpose is to track firefighter's locations and rescue them if they get into trouble. If a fire fighter were in danger the RIC would come in, but only to rescue the firefighter. It is often easier to track firefighter's locations at a large incident rather than a small one because people are assigned specifically to track firefighters at large incidents. At smaller incidents, the B/C or Captain must do it and they have other things to do.

In addition to the above channels, there are four 800 MHz ITAC channels designated for mutual aid. Since they are almost never used for mutual aid (LAFD is the only fire agency in the county using 800 MHz), HAZMAT team and others sometimes use these as tac channels.

There is a radio in the rig as well as on each firefighter. Personnel contact dispatch and then go to tactical channels.

Tactical channels have lots of traffic at an incident. There are pre-planned staging areas.

Battalion Chiefs have to be on the tactical channel as well as communicate elsewhere and so carry two radios, rather than having to keep switching. If at the command post, the radio channels being monitored will vary depending on the type and size of the incident. Normally the OCD/dispatch channel and the tactical channel, and the emergency channel are the primary channels that are monitored. Larger incidents with multiple chiefs would also require the monitoring of channel 11. A Battalion Chief given a working assignment at an incident would be assigned to a "division" and be away from their apparatus. At that time they would monitor the tactical channel assigned to their division (the incident division, not fire department geographic division) and the command channel.

It was mentioned that the plan originally called for a coat-mounted radio. All turnout coats have a radio pouch in which the handi-talkie is carried.

There are BDAs for some channels in Metro Rail tunnels, but not all tactical channels are available. Channels available are: 4, 6, 7, 12, 17, and 18.

Radios are issued to positions, not individuals. Thus personnel swap out radios at shift change.

The emergency trigger elicits an OCD response to validate that the firefighter indeed initiated the signal. The request is time stamped and what is said is recorded. Attempts have been made to program the firefighter's name into CAD so their name will show up on the screen when the ET is hit. This is a lot of work and doesn't get applied consistently. An automatic means of accomplishing this, such as having the firefighter sign on to their radio at the beginning of their shift, would be welcomed.

If there are multiple hits of the ET, it will cause confusion. An ET will prompt the RIC to leave staging and go to where assigned. An incident was cited where it was hit 9 times (turned out to be a false alarm).

At this point the name Rob Wilcox was mentioned as the training chief. He was cited as a person with whom we should speak.

It was expressed that GPS capabilities would solve many issues, especially if tied to an AVL system.

Bone mikes were tested and work much better than standard speaker-mikes. Estimated $1 million to outfit the entire department.

The interviewees stated that the department still uses tone alerts.

It was mentioned that it usually takes three months to complete a hands-on training evolution.

There is concern in some areas regarding a trunked system. It faces some degree of opposition. Some people are down on the digital system as well. A large amount of hands-on training would be required to overcome firefighters objections. The conversion from MX to STX portables was difficult because not everyone was properly trained on he operation of the new radio.

There has been a trial of an IPC/Orbacom and Nextel talk group arrangement where in the inspector can patch in, but "our guys don't do console patching."

The staff said that there is frequent interaction with the PD. Each rig has a UHF digital Astro portable radio for intercommunication with the police, but "One radio for both agencies would be outstanding." Rescue/EMS would benefit the most.

Certain vehicles have dual band VHF/UHF Kenwood radios to enhance interoperability, due to their special capabilities. It costs about $5,000 for an installation in a heavy rig. The department is very happy with the Kenwood radios, but limited funding forestalled their full deployment. Currently equipped are the following:

- All chiefs' vehicles
- All rescue vehicles
- Selected heavy apparatus, especially those of units most likely to be involved in mutual aid incidents.

Voice calls to hospitals are handled over the UHF Kenwoods. The Hospital Emergency Adminitrative Radio (HEAR) is one of many channels programmed into the Kenwood and is primarily used to determine destinations for patients at multi-casualty incidents. Most routine calls to hospitals are made via cell phones. The HEAR Radio is a VHF frequency and is currently programmed into the Kenwoods (VHF) and on the new Motorola XTL5000 Mobiles.

Currently, there are no handhelds (except for test units) assigned to the field with the HEAR channel(s). The Base Hospital Hailing and Communications frequencies are UHF and are programmed into the following:

1) Kenwood 90 Series TK890 Mobiles
2) Motorola XTL5000 UHF Mobiles (New Rigs)
3) Motorola Saber and XTS 5000 UHF Handhelds

There is some poor coverage in certain areas. Lack of money has been an obstacle to building more saturated network coverage. Many south-facing canyons have poor coverage. The emergency trigger only works in L.A. city, not the county. ITA has mobile repeaters mounted in trailers that it could use. But use of the mobile repeaters must be limited because they can cause interference to other users elsewhere in the City. There are two ACU 1000 switches in suburbans to link frequencies at incidents.

It was mentioned at this time that personnel are provided body armor as well for incidents that might involve shooters.

There ensued a discussion on operational constraints.

While there is great respect for the PD, the departmental personnel present expressed the feeling that ICS was an unfamiliar concept to the PD. ICMS is new to police, although it has been around fire departments for years. It appears at times that the police have redefined the concept to fit their current operations, rather than adjusting operations. Cited was an incident wherein the PD in fact set up two IC posts with two incident commanders, and the fact that PD will assign a sergeant as I/C when there are higher ranking officers on-scene. There are also some PD units that will operate independently of the I/C. It was felt the PD could do a better job explaining and disseminating the correct understanding of ICS to its personnel.

It was mentioned that California State law holds the incident commander responsible for personnel on the scene of an incident.

With respect to mutual aid, the staff mentioned that the current LARTCS system came into existence after 9/11/01 to plan for support covering operations and radio communications. The Sheriff's office is the coordinator. Since its inception, the system has changed direction and the program is not ideal for fire fighting agencies and seems to work better for law enforcement. There is a concern over the adequacy of staffing support for interoperability related projects with respect to Fire. It appears that the Sheriff's office and the PD seem in good shape with respect to resources.

With respect to the basic philosophical view of interoperability as it relates to mission, the sense is that there is a dichotomy between police—who are concerned with pursuits—and fire, which is concerned with major responses.
Mutual aid in L.A. relies on UHF and VHF channels, but the surrounding counties are somewhat different:

- Orange County uses 800 MHz
- Ventura uses 450 MHz
- San Bernardino uses 800 MHz
- Riverside Fire uses CDF VHF channels. Riverside Sheriff uses 800 MHz

Fire data traffic is carried via 450 MHz, using six repeaters. Currently a migration is underway from 4,800 baud to RDLAP, which, by running at 19.2 will double throughput. The migration is due for completion in October. Every dispatch goes out to the MDTs as well as by voice. Fire data traffic is now text only, but other applications, such as mapping, schematics and drawings are desired.

The department is evaluating Sprint for its high-speed data requirements, although some concern was expressed because the City of Los Vegas uses a commercial service and their data throughput is thought to slow down when a convention is in town. MDTs by the fire services are not the same as police MDTs. All fire apparatus have MDTs as well as Chiefs' cars, ambulances and special vehicles—anything classified as an emergency dispatch vehicle (thus excluding personal vehicles).

The CAD system does not currently dispatch the closest responder. CAD dispatch recommendations are based on the location of the fire station relative to the location of the incident, not where a truck might be at that specific time. MDTs are now being selected based on their ability/capacity to incorporate GPS and related features internally.

A final note was made regarding the work performed by ITA in that that agency bills back to fire services, but not to the PD. Sometimes the ITA sets its priorities for the money spent by Fire differently than Fire would like.

Interview with Los Angeles City General Services Department Police

Date: August 16, 2005, 9:00 am

Attendees: Capt. Richard Musquiz, GSD Police
Sgt. Victor Dial, GSD Police
Sgt. Robert Payan, GSD Police
Sgt. Kevin Ahlemeir, GSD Police
Richard Villalobos, GSD Police
Dwayne Healy, Security Technology Administrator, GSD
Mark Bono, RCC Consultants
Scott Johnson, RCC Consultants

Location: GSD Public Safety Divison HQ, Los Angeles Mall

This agency's mission is to protect buildings and facilities belonging to the City. It is undergoing a major transition. Officers currently protect buildings but also patrol areas on foot, in vehicles and on bicycles. There are 635 buildings, but much fewer officers. Many buildings are merely alarmed or have video surveillance. The video systems in many buildings are stand-alone, i.e. there is no networking. The city-wide alarm system draws a pre-planned response.

There are currently 58 sworn officers but the number is expected to grow to 101 upon the completion of the transition. Essentially the Division will be absorbing the park ranger force, Parks and Facilities Police and those officers guarding the Convention Center. Those groups have their own radios. In the course of the transition, the CC people will keep their radios, which it is believed operate on 900MHz.

Consolidated new office of Public Safety: The new organization will have two bureaus: The Parks/Facility Bureau consists of a Police force to patrol city buildings, Parks, Convention Center, Library and Zoo and respond to law enforcement calls for service. There will be about 60 patrol officers assigned. The second organization, the Support Services Bureau, will consist of 150 full time security officers who will man various posts at the Civic Center buildings, Convention Center, Library, Zoo and perform a gate lock up procedure at the parks. The Support Services Bureau will cover specific large areas, such as the zoo, Convention Center, and the libraries. This group will consist of the remainder of the sworn officers plus about 100 part-time security officers and 150 full time security officers (total authorized strength is set at 350).

Currently the Division operates on a shared 800 MHz trunked system with many other General Services divisions. The system consists of four sites. Coverage in canyons is not good. Downtown buildings often block 800 MHz signals. Senior Lead Officer Gabriel Mayorga has coverage testing results, he is currently out of the country. At this point in the discussion, it was noted for the first time that there are dead zones of coverage with the parks personnel's' radios, which are 800 MHz. It was added that a preliminary

analysis had been performed on the coverage requirements that will exist after the merger, such analysis strongly indicating that coverage will not be adequate in the new, expanded area (i.e. the parks currently secured by the rangers), especially in those areas from which rescue calls originate.

The Captain stated his goal would be to have a dedicated channel on the LAPD system. This desire is prompted by the fact that current protocols for response entail close work with the LAPD. Moreover, the Division's staff will still be so small (covering on a 7X24 basis) that police assistance will be even more essential than it is today. Again, the group strongly expressed the desire to be on the LAPD system. This time they pointed out that coverage problems exist in downtown, a primary area of responsibility, due to the dense urban topology. It was noted also that coverage is inadequate in the San Pedro area. Most significantly, in building coverage is poor—no radio use in elevators or on high floors, or in basements. This condition is especially unfortunate due to the fact that the mission is building related. Nextel is also used for communications because of better coverage. It was added that a further negative is the demoralizing effect poor coverage has on the staff that see the LAPD do not have the same problems.

When asked about congestion, coverage again came up when it was cited that an "NC" (no coverage) often is displayed by the radio and that problems seemed to exist in the same geographic areas of operations—congestion would not be site specific. Thus is can be assumed that capacity is adequate—however, it is not clear how that will change with the absorption of other operations.

The Park Rangers and LAFD work together for rescue calls. Rangers carry a set of radios: their own 800 MHz (trunked), the Fire 800 MHz (conventional), and the Police UHF. Vehicles have mobile 800 MHz radios. The police radios are Astros. Outside of the rangers, Division personnel do not carry Fire radios, instead typically meeting Fire personnel at the site and guiding them.

The Division does not work much with LA Sheriff or LA County Fire. The LARTCS system is not being used. They only recently became aware of the system. They often trade radios or have person with radio assigned at scene to support interoperability. The Division used to work with Housing Police (disbanded), and were given PD UHF radio because of better coverage. It was suggested that perhaps there is another frequency available since the Housing Authority has no real independent police force, but the Captain was uncertain what happened to the frequency.

Only one drill has been conducted with respect to major incidents, and it was structured as an exercise of a small evacuation due to a bio weapon incident. Radios had to be handed out to provide communications. However, there is no cache on hand. The distribution was planned. It was recognized that the situation would be chaotic in real life, with communications heavily dependent on presence in a CP.

In discussing incoming calls, the Division receives as follows:

- Alarms from alarm panels.
- Calls from departments, usually on seven digit lines.
- Calls forwarded from the LAPD for their handling, which are the only ones where 9-1-1 would have been dialed.

Some rescue calls also come in on seven digit lines. An example was discussed wherein an alarm might display in the dispatch room, to which Dispatch may send a patrol officer of the Division or might call over to LAPD for coverage, depending on the site, and the nature of the alarm. Some remote alarms also go to both the LAPD and the Division. In such cases, the dispatcher will check with the PD to see what action they took and only one will be sent. The efficacy of this depends upon the experience level of the PD dispatcher—whether they know or remember that the Division might send someone. If a call came in via 9-1-1 it automatically goes to the LAPD, who may or may not think to call the Division.

Work with LAFD is fairly straightforward in terms of communications. On rescue calls in the parks, which usually come from someone on or near a trail, the rangers are familiar with the territory and so they bring in the fire responders and guide them to the scene.

Ranger dispatch is being integrated into GSD dispatch. It came up a number of times that the ranger absorption will lead to a redeployment of their dispatching and other systems capabilities, so the Captain is looking forward to some improvements in his technology profile. However in our later visit to the dispatch and monitoring room, during our conversations as to where the new system would go, it appeared that that issue had not been addressed—interesting in that the move is supposed to happen by Oct. 1. The consolidation has been delayed due to ACLU action regarding civilian oversight. One major interoperability plus of getting on the rangers' system is that they now have the capability to patch in with the Division—the Division cannot initiate that action, however. The rangers will also bring their own CAD and RMS systems.

We were then told that an emergency trigger exists, but the call comes into LA's 3-1-1 center. The emergency trigger is monitored by the 3-1-1 center as well as the GSD dispatch. The 3-1-1 center operators come up on the GSD channel and broadcast the emergency trigger activation. This is a poor arrangement because the GSD dispatcher is often forced out of the conversation between the officer and the 3-1-1 operator.

In discussing ITA's management of the radios, we were told that the change process consisted of the Division initiating a communications service request (CSR) to ITA, who then rules on viability and estimates the cost. If the cost had been budgeted, a Division person then approves the expenditure and orders the component. They would like to have regular meetings with ITA, but currently do not.

It was then, again mentioned how helpful it would be to get on the PD system and the notion was supported by the fact that such a move would increase (Division) officer safety by a factor of 100%. The Division has a need for about 8-10 channels to operate.

Duane Healy then spoke to us, citing that there are a number of projects not specific to communications, but touching upon them and suggested we contact Kim Bayer, a grant specialist who would know the big picture on projects (978-0707). He stated that MDTs were a wished for capability for the future. He also spoke of some security projects—note a company called TRC is their security consultant. He provided some contacts: Greg Brandon at 949-341-0370 and Jim Black, their PM at 978-4674.

In this context he gave a more immediate picture regarding MDTs, saying they would be there in one year. Applications running would be NCIC/CLETS, unit to unit text messaging, and report writing system. He was not sure to what extent field reporting would be used.

Duane's long-term goal would be to see video in the cars, having images on monitors patched to the officer en route to the incident.

He and the others again mentioned their hope that the study would lead to getting on the LAPD system. It would be a "tremendous" benefit to be on same radio system as LAPD. The Division has a need for about 8-10 channels to operate. LAPD is currently on a digital system but there is doubt that LAPD has this many channels available. The Captain pointed to all the initiatives he has attempted (bomb-sniffing dogs and AVL were examples). These have all been rejected. He wants video for officers in the field from fixed cameras around buildings. This capability currently exists in dispatch. Many buildings have their own cameras that are not connected to dispatch, not all cameras are recorded.

Interview with Los Angeles Information Technology Agency (ITA)

Date: July 21, 2005, 8:30 am

Attending: Ken Chan, P.E., Senior Communications Engineer
Mehrdad Larijaniha, P.E., Communications Engineer
Mark Revis, RCC Consultants
Scott Johnson, RCC Consultants

Location: 250 E. First St. Los Angeles

ITA is responsible for 5 radio systems:

1. LAPD Voice, 114 Narrowband digital UHF T-band channels, conventional simulcast, all but 1 is P25
2. LAPD Data, 10 - 800 MHz channels, RD-LAP format
3. LAFD Voice, 18 - 800 MHz channels, analog conventional simulcast
4. LAFD Data, 4 - 25 kHz T-band channels, MDC-4800 format (conversion to RD-LAP planned within next few months)
5. General Services Trunked Radio System, 41 - 800 MHz NPSPAC channels, EDACS simulcast (divided into two systems, one 21 channel and one 20 channel)

LAPD:

Dispatch at Parker Center handles South and Metro Bureaus, Valley Dispatch handles Valley and West Bureaus. Each can back up the other dispatch center, nearly identical capabilities.

Citywide channels are 6-site simulcast, P25, with voter at Mt. Lee. The Emergency Trigger and Metro-1 channels are the same as Citywide but have 2 additional receivers, used for juvenile, detectives, SWAT, narcotics, etc. Antennas are directed south to minimize TDI..

Air support has separate channels with single transmitter sites (monocast). Also used for "hotshot" calls. Simulcast overlap causes poor reception when airborne. Some sites are probably spaced too far apart for narrowband simulcast.

Portables are programmed for 2 Watts on all channels except for Emergency Trigger which is programmed for 4 Watts. Police often use simplex in tunnels and when one officer is inside and another outside a building. Officers complained when the transition to digital was made because they lost the ability to do "talkaround" on the dispatch channel. In digital mode the simplex transmissions would interfere with the repeater (and vice-versa) much more severely than in analog mode. Separate channels have been set aside for simplex operation only.

West Bureau coverage area is mountainous with numerous dead spots in canyons. Valley Bureau terrain in hilly in many areas and has some poor coverage areas. Mt. Lukens puts

in a good signal over most of the valley, except for Woodland Hills area. Oat Mtn. used primarily to cover Woodland Hills area.

Tower construction in LA area is very difficult. Homeowners protest to City Council and towers are blocked. Several structures have been cancelled or built to lower heights than were required by the system design due to community resistance. Mt. Lukens is the only leased tower site.

LAPD has one analog wideband channel (LAPD ACCESS) that is used as a "hailing frequency" for interoperability purposes. The GSD Police has a talkgroup on the trunked system patched to this channel.

In general LAPD and LAFD rarely need to communicate via radio. When they do, LAFD has UHF portable radios assigned to each piece of equipment, which seems to fill the need. Fire talks on UHF to other fire departments more than they talk with police. LAFD has VHF, UHF, and 800 MHz radios in equipment.

Red Line Metro Rail Tunnel - A limited number of PD and FD channels have been brought into the tunnel. A total of 20 VHF, UHF and 800 frequencies have been brought in. Only 8 FD frequencies are available. Originally the tunnel system was built with only one Radiax for both uplink and down link. Intermodulation problems eventually forced a second Radiax to be installed so uplink and downlink could be separated. System works OK now but the addition of a large number of new frequencies to support a trunked system could present an interference problem.

The LAPD radio system relies upon "5 levels of survivability". The first level is normal operation, all components are working properly. The second level is a failure of the dispatch centers. The system is designed so field users and control stations will function normally if the dispatch centers are cut off from the network. The third level is a failure of the voters. In this instance, the systems will fail over to in-cabinet repeat at selected sites, allowing the continuation of communications with degraded coverage (monocast). The LAPD system's MOSCAD will detect the voter failure and automatically switch to monocast operation. For the LAFD's system, technicians manually disable the simulcast system and then command the failover repeater into in-cabinet repeat mode using DTMF signaling. The fourth level is failure of individual transceivers. Backup transceivers are located where they can fill in (with somewhat degraded coverage) when the primary fails. The satellite receiver system provides redundancy if a receiver fails. Level 5 is a scenario where the entire network fails and the entire radio system is off the air. Communications will still be possible (with severely degraded coverage) through the use of standalone transceivers located at each Police station (19 stations total, but 2 more will be added, in Mid-Wilshire and in the Valley).

The voice system has non-standard (SP) voters that contain 2 DIU ports (ITA insisted on this because of migration to new consoles. They would be needed to avoid downtime during the cutover). Current consoles are Motorola Centracom Gold Elite, although the

VoIP console is the console that was contracted for. Motorola couldn't deliver the VoIP console on time so they installed Centracom Gold Elite instead. Motorola is promising shipment of the VoIP consoles in 2007.

The LAPD data system uses 10 - 800 MHz channels. 7 channels need to be moved for rebanding.

For high-speed data, Tim Riley (LAPD CIO) favors CDMA over TDMA, actively working with Sprint on high-speed data needs.

General Services Trunked System:
The trunked system has approximately 6,000 users. Several users (General Services Police, LADOT, Park Rangers, and others) operate dispatch facilities that are connected to the network. DOT moves their dispatching location from time to time. Had 4,000 users originally, about 1/3 are mobile. 41 channels on 2 systems (20 and 21 channels) simulcast. LA city is about 400 square miles, LA county about 4,000 square miles.

LAFD:
18 - 800 MHz voice channels total. 14 channels are 9-site simulcast, 4 channels are 6-site simulcast. There are intermodulation problems at some sites (FD interferes with PD). Problems can be traced to insufficient separation between antennas, often because towers are not tall enough, and it is difficult to increase tower height because of citizen objections to visual aesthetics. 3 LAFD voice channels are in upper portions of band, and may need to be moved due to rebanding.

Main dispatch is at City Hall East. A backup dispatch center is located at Fire Station 108 (Coldwater Canyon). Coldwater Canyon is equipped with RF control stations only, but improvements are planned for the near future.

Data system is 4-channel UHF T-band (25 kHz) at 6 sites, using MDC-4800. Conversion to RD-LAP is planned in the next few months. Base stations are mostly older MSF5000 and DSS II stations, but a program of replacing the old models with Quantars is underway.

The voice system uses Quantars on 6 channels and MSF5000s on 12 channels. A project to replace the MSFs is also underway. ITA is replacing 2 channels per year. The sites are being converted to -48 VDC primary power at the same time the MSFs are replaced.

LARTCS:
LA County is the caretaker of the LARTCS (Los Angeles Regional Tactical Communications System) system. It consists of five 800 MHz channels (the ITAC/ICALL channels), five UHF channels, and five VHF channels, all cross-patched so a call in one band repeats out over the other two. A roll call/test is made twice a week. Participating agencies are: LAPD, LAFD, LA Area Fire Chief's Assn., LA County Police Chief's Assn., LA County Sheriff, LA County Fire, California OES, CHP, California

Army National Guard and Federal agencies. LARTCS works but has a fairly significant problem in that the channels all have different coverage footprints. The County has received $40 million to upgrade LARTCS to improve and expand the coverage, however the participants seem to have different agendas for the money and this is causing some disagreements.

LA County:
County system has 15 sites, 60 channels. Police consoles are Gold Elite, fire uses Orbacom. Connectivity is microwave and fiber.

Site Visits:
RCC set up a visit to the Mt. Lee site for 8:30 am, Monday July 25. RCC is to meet Mehrdad at his office and he will escort us to the site.

Documents Provided By ITA:
Block diagrams of all 5 radio systems
Site location and interconnection diagrams for all 5 systems.
Frequency plans for all systems.
Microwave site location and interconnection diagram.

Interview with Los Angeles World Airports Police

Date: July 28, 2005, 8:30 am

Attending: David Chen, LAWA ITG
Phil Goodman, LAWA
Dennis Lau, LAXPD
Darren Gilbert, LAXPD
Frank Vargas, LAWA Associates
Tony Chen, LAWA ITG
Mike Post, Consultant
Scott Johnson, RCC Consultants
Mark Revis, RCC Consultants

Location: LAX (Los Angeles International Airport)

LAWA consists of four airports, Los Angeles International (LAX), Ontario International (ONT), Van Nuys (VNY) and Palmdale (PMD). ONT is actually located in San Bernardino County. VNY is strictly an general aviation airport. PMD has general aviation and some commercial flights. The Police at each airport operate autonomously (each has its own Chief), but consolidating all 4 airports under one Chief is planned. LAWA PD is the fourth largest PD in LA County.

All airports have four radio channels:

Channel	Frequency	Designated Use
1	460.525/465.525 MHz	Police Dispatch
2	453.375/458.375 MHz	Police Tactical
3	460.100/465.100 MHz	Construction/Maintenance
4	460.550/465.550 MHz	Airport Operations

VNY and ONT use the same CTCSS tones, LAX and PMD use different tones. The Police channels are extremely congested, more channels are needed.

LAX has 3 transmitter/receiver sites, plus 3 additional receive only sites for the Police frequencies only. The transmitters for channels 1 & 4 are at the Theme Building, channel 2 is at the Admin West building, and channel 3 is at the Tom Bradley International terminal. The Theme building has the best penetration into the terminals. Police at LAX have an additional backup site at the PD Communications Building. The other airports have only one site each.

Airport Police at Ontario use the County of San Bernardino 800 MHz system. However, repeaters for each of the four frequencies are located at ONT.

An upgrade from analog conventional to digital conventional operation is being planned. It is expected that an agreement for more frequencies will be reached within the next two to three months.

The service area for LAX Police is approximately bounded by Manchester Ave. to the north, La Cienega to the east, Imperial Highway to the south and the beach to the west, although the officers go outside the area often for assistance, K-9, transportation of prisoners, etc. Some coverage problems exist at Manchester Square and along the beach. Airport police also patrol neighborhoods and commercial areas around the airport. In-building coverage is very important. There are BDAs in Terminals 5, 6 and 7 and in some tunnesl, but there are still many dead spots within the terminal buildings.

Police vehicles are equipped with MDCs. There is one 800 MHz data channel (4800 bps). Currently data is only text but mug shots and streaming video is desired. Wireless PDAs are also desired. A future upgrade to 4.9 GHz or a commercial data service (possibly Verizon or Cingular) could make this possible.

Three fire stations normally support LAX, Crash 80 and Stations 95 and 51. Initial call goes to Crash 80. Station 5 is the second backup station. For an aircraft fire or emergency, the tower picks up the crash phone which rings at Fire, Airport PD, Operations, Public Relations, US Coast Guard, LAPD and Maintenance. At ONT, the PD responds to aircraft fires instead of local FD.

LAX Dispatch currently has 5 positions (Gold Elite Consoles with CRT displays), with 3-4 dispatchers normally on shift. The dispatch center is moving to the 2nd floor and will expand to 12 positions next year. There are also 2 remote dispatch positions in other buildings for backup. Several mutual aid channels are installed in the consoles and the consoles have patch capability, but it is not known if the dispatchers are trained to do it. A new Motorola CAD system is being purchased, and there have been discussions about linking the CAD system to LAPD's new CAD system.

The dispatch center at ONT is similar to the dispatch at LAX. PMD and VNY handle dispatch at the Watch Desk.

LAWA currently interoperates with: LAPD, LAFD and LASD. LAWA and LAPD have each other's frequencies in their radios. LAPD provides checkpoint support and bomb squad support. LAWA signed the LARTCS MOU but hasn't used it except for roll-call participation. ONT interoperates with San Bernardino Co. Sheriff. It is sometimes necessary to monitor or talk on tower/aircraft frequencies.

The TSA uses a leased commercial radio system. It is not known whether it is Nextel. Airport buses are operated by LAWA and use the Operations channel. Street-side buses (parking) are operated by vendors under contract and have their own radio channels.

Interview with Los Angeles Police, ECCCS Division

Date: August 4, 2005, 1:00 pm

Attending: Lt. Anita McKeown, LAPD
Sgt. Curt Miles, LAPD
Mark Revis, RCC Consultants
Tony Busam, RCC Consultants
Marc Bono, RCC Consultants
Scott Johnson, RCC Consultants

Address: 250 E. First St, Los Angeles

Sgt. Miles began with an overview of the current radio capabilities:

- 114 UHF voice frequencies
- 108-109 of these are usable, the remainder have insufficient frequency separation to be effectively used.
- All but one of the 108 frequencies are digital. The one analog channel is provided as an "access channel" for other departments to contact LAPD via radio.
- All the frequencies are used, but some are being reserved as spares.
- The Department operates out of 19 police stations, each covering a different geographic area. Each station has a pair of frequencies associated with it; one for dispatch and one for simplex—talk around. Two new stations are expected to open in the next 2 years, and so four more channels will be dedicated there.
- Additionally there are four frequencies for traffic.
- He characterized coverage for Police radio as "awesome." The RFP requirement was 99%, actual is 99.3%. He also cited the robust nature of the equipment and its service record in the face of earthquakes.
- Special channels are designated for tactical use and for special divisions, such as homicide, robbery, etc.
- Police radios are programmed to access 250 channels.
- There are not a lot of spare channels for the department.
- The radio used is the Motorola Astro Saber that operates both in analog and digital modes and has 250 channel capacity.
- The radios operate in the 450-512 MHz range.
- Sharing agreements are in place with LA County and most cities on LA City's borders. The agreements permit the agencies to program their radios to talk on the other agencies' channels. All users have to do is change the channel on their radio to talk to the other agency.
- The Department uses only hand held radios, and has no mobiles; they hook them into an apparatus in the car that serves as a converter and charger/amplifier, effectively making them equivalent to mobile radios. However they are now looking into a conversion to use mobiles in their cars.
- Another practice about to change relates to radio issuance. Currently radios are assigned to a position, not an individual. At the end of a shift, officers drop off

radios in the kit room. This causes greater damage and loss, so there is a plan in place to issue radios to each individual.

- The Department is looking to go outside of Motorola for new radios, considering M/A- COM and Johnson.
- LA is an APCO Project 25 compliant city.
- LA City Fire's radios are not compatible with the PD, but the Sergeant feels that intercommunications with the fire department is not that important a demand. At an incident, the officer-in-charge meets the fire IC at the CP and deals face to face, relying on the radio to communicate with police personnel for their assignments. Further, the PD bought 350 Astro radios for the Fire Department and that works well, except for move ups: when firefighters go to other stations, they don't know which PD channel to call on.

The Sergeant said Fire moved to 800 MHz against the PD's advice. He added that the PD had in the past extensively studied interoperability which indicated that interoperability with Fire wasn't needed that often.

Interoperability with LASD is a bigger need since there are numerous unincorporated areas in and around the city. The Sheriff's frequencies are already programmed into LAPD's radios. Police have to make only one click to reach the Sheriff's system.

The Sergeant feels LARTCS is sufficient. He discussed this system at some length. LASD is mandated to maintain the interoperability channels. The Sheriff has 3 ACU 1000s hooked to command console to enable interoperability. The ACUs patch mutual aid channels together so that users in different bands can talk to each other. The system started with 5 UHF channels. The City contributed 3 VHF channels, 2 more VHF channels found by LASD. Also, the 800 MHz ITAC channels are included. Problems occurred because the channels had differing coverage, so the decision was made to build out the system so that the channels had the same coverage. An $8 million grant was awarded and the County found an additional $40 million for the buildout. (Sgt. Miles provided a copy of the buildout plan). The LARTCS system is tested twice a week, Tuesday at 0900 and Thursday at a random time. The Sergeant clearly stated that LARTCS is "the direction we want to go" and that spending will start soon.

He stated that an unusually large incident might stress out LARTCS. But police officers stay on their primary channel and don't change it, except that they might monitor tactical channels. Police and fire commanders are at a common command post and usually talk to each other face to face.

LAPD has 3 vehicles with ACUs installed in them. 1 is for the Harbor and 2 for the rest of the City.

Regarding a common radio system platform for the entire City: He stated that Fire wants to go back to UHF, regretting its move to 800 MHz, and wants to pool frequencies with

the PD. But he feels the plan is faulty because the channels are area specific and fears interference.

He also recognizes that Fire wants interoperability on a trunked system, but opposes that because of the problems that were experienced in the move from analog to digital. He feels users will now be even more upset with dealing with a trunked system. They just finished one upgrade and don't want to make another change. In addition, LAPD doesn't have enough frequencies as it is. Giving up frequencies for a new trunked system will make matters worse.

The problems that officers had with the digital transition relate to the fact that two digital signals received at the same time cancel each other out. Nothing at all is heard, instead of the analog system where you could hear parts of both transmissions. This situation occurs when there is a major incident and many officers respond, all talking at the same time and causing cut outs and drops. He characterized this as "a real problem." When officers went to simplex (direct mode), it cut out dispatch altogether. It took months for the department to figure this problem out, and required reprogramming 10,000 radios, a major undertaking. The solution has been to go to a separate talk around channel. Other lesser problems arose out of programming issues. They thought tuning would not be a problem, but found the radios drifted and needed to be retuned.

Normally it takes 2 ½ months to completely reprogram all of the Department's 10,000 radios. They have the capability to perform over the air programming.

The Sergeant had further concerns about building a common trunked system: The system they now have is too new and cost too much to replace it this soon. He saw great expense ($200 Million) and effort and is concerned on now more funds being needed, pointing out his feeling that $40 million will just cover the cost of hand held radios. He feels that a future move to 700 MHz would make more sense, even though it would represent another great investment. He estimated it requiring 40 transmitter sites costing at least $1 million per site. He feels that, as a concept, yes, a countywide system sounds good, but practically speaking the money required is a huge issue.

The Sergeant does not like the idea of a trunked system as he sees it inappropriate for supporting the job police do. He mentioned that the Police and Fire Department have very different jobs and so different radio communications needs. Police go everywhere and are constantly mobile; Fire responders go from a specific place, a fire house, to a specific place, a fire. Trunking "may not be the wisest choice." LARTCS is a fine solution. Trunking will add a level of confusion.

Another area we covered was high-speed data communications. The PD is now building out a mobile data system to support 1,500 laptops (about 350 per shift). One anticipated application will be a field reporting system enabling the remote entry of up to 20 different reports.

The Sergeant said that the Department is moving to a Printrak CAD system. An expectation of the new CAD system will be the ability to share data with the Sheriff. Also desired will be field updating of the CAD.

He spoke about Orange County using Cingular data service from which several advantages have been derived. The former LAPD CIO anticipating moving MDC's to a commercial system, but issues with data security prevented that from happening. Security of the commercial systems is now much better. They have high confidence in commercial providers to supply this service on a dedicated basis. Commercial systems are cheaper (estimated $1.2 million per year for LAPD), have better coverage and provide extra capacity for growth.

Interview with Los Angeles Police, Tim Riley, CIO

Date: August 15, 2005, 10:30 am

Attending: Tim Riley, CIO, LAPD
Mark Revis, RCC Consultants

Location: 250 E. First St, Los Angeles

The Police Department is dependent upon its data system. The voice system would be completely overloaded if all the dispatch details were sent via voice.

The data system is currently Motorola RD-LAP at 19.2 kbps. High-speed data is needed and is planned for the near future. Higher speed/throughput is needed for photos, fingerprints, video. e-mail and internet access.

Northrop Grumman is in the process of providing a new Print Trak CAD system. Also using Vision Tech software as a message switch, and Data Max, an application that selects the best channel for the data being transmitted. It will be used to supplement RD-LAP by routing high-bandwidth data to the high speed network. Northrop is currently experiencing problems with system integration.

The current RD-LAP system is very robust, with good citywide coverage. Coverage from individual sites overlap which provides good redundancy. LAPD might entertain an upgrade to Motorola's new High Performance Data (HPD) system (up to 96 kbps), but even that increase in speed will not eliminate the need for a commercial high speed data solution. The ROI may not be there to upgrade to HPD. Sprint's EV/DO solution is being considered, but it is likely that more than one network will be necessary, and a switch (like Datamax, PadCom or Data Motion) to switch between networks based on coverage or congestion. In any case, RD-LAP will be retained and used to transmit the most crucial dispatch data, with the commercial networks used for supplementary data, photos, etc. Other possible solutions being investigated: Wi-Fi at stations to download large files or update MDC software, and 4.9 GHz. Neither of those solutions will be able to replace RD-LAP or commercial high speed networks, and would be used for supplemental purposes. For instance, it might be useful to build a mesh network at the Staples Center/Convention Center for handheld computers during events.

Officers in their vehicles need to have access to all applications they can access in the station.

By law, Police data (DOJ and CLETS data) cannot traverse the internet, and must be on a private connection. LAPD will need a frame relay to connect their system to the Sprint network in order to bypass the internet. Sprint coverage is mostly within the City only. Costs are $60/month/terminal for unlimited access. Sprint provides the wireless card for free. Contract this with new RD-LAP Vehicular Radio Modem (VRM) which costs

$2,500 to $3,000 each. To replace modems for 1500 vehicles would cost up to $4.5 million.

Chief Riley was with Newport Beach PD for 31 years. Newport Beach became a part of the Orange County countywide system several years ago. The Orange County system had numerous start-up problems:

- It was under-engineered and had poor coverage. Supplemental coverage was required in Newport Beach (and was paid for by the county), especially in canyons. The problems were fixed by installing Intelli-repeaters, which are not a perfect solution.
- Dana Point also had poor coverage.
- The old UHF system had good coverage and everyone was displeased when the new system had considerably less coverage.
- Firemen in Newport Beach purchased Family Radio Service (FRS) radios in order to have reliable fire ground communications.
- Budget problems forced the cancellation of the data portion of the system.
- There was an MOU between the Police Chiefs, each department contributed money for maintenance and upgrades.

In regard to the LAPD radio system(s), the coverage is very good. It is fine-tuned to the Department's needs and works well. The system can be heard clearly as far south as Laguna Niguel. From just the PD's standpoint there is not much incentive to make any changes. Ken Chan and the ITA staff are very dedicated and are the best support team he has ever worked with.

Interview with LAPD Metropolitan Dispatch Center staff

Date: August 18, 2005, 10:00 am

Attending: Mark Ehring
Larry Cardinas
Jill Woo
Michael Elling
Jed Fer
Mark Revis, RCC Consultants, Inc.
Scott Johnson, RCC Consultants

Address: MDC (Metropolitan Dispatch Center), 150 N. Los Angeles Street, Media Room

The LAPD Communications Division stated they do not talk with the Sheriff or LA County Fire very often.

During freeway pursuits, messages from the California Highway Patrol to the pursuing officer are relayed by telephone. This can delay messages by several minutes.

There is limited radio coverage outside the officer's normal area, especially with tactical channels since they cover the bureau area only. The citywide channels have the best coverage. If an air unit is involved, they can often hit the repeaters at a great distance. Often, news helicopters are the best source of information about a pursuit after they lose radio contact. Officers therefore lose their "lifeline" of communications when out of coverage.

In the city, there are a few dead spots. The Hollywood Hills and West LA were mentioned as having dead spots. Nextel causes some interference to the MDCs. When the new police station opened, officers couldn't sign on to their MDC because of the nearby Nextel tower. ITA is working on the system to improve coverage.

The digital system is much less forgiving than the old analog system. If channel is in use (someone else is talking), officers cannot transmit. Instead, officers receive a tone when they press the transmit button. This is designed to prevent "walking on" the existing channel user. The officers do not care for this arrangement, as there are often times when their message is critical. However, there is a method of "double clicking" the PTT to override the transmit lockout and make the radio transmit. With the old system, you could hear parts of both transmissions if two officers tried to transmit at once. With the new digital system, you either hear just one or neither of them.

There are three levels of dispatch priority. Priority 1 is defined as urgent, life threatening, Priority 2 is urgent, not life threatening, and Priority 3 is routine. All calls are dispatched via the data network to the MDC's. Priority 1 & 2 are also dispatched by voice radio.

For a big incident, MDC only handles the initial dispatch. There are no formal procedures set up for MDC for a major disaster. After a command post is established, the Incident Commander takes over the incident. The DOC (Department Operations Center) will be activated for major responses, and they will handle the communications for the incident. Initially, the interface with LAFD is via telephone. LAPD is having discussions with LAFD on how to control the chaos in the early stages of a big incident.

The DOC uses CAD and mostly telephones for their needs. The EOC (Emergency Operations Center) is a multi-agency work resource center.

LARTCS is not used much (use telephone instead). The reasons for this are there is a lack of protocol, and the system is new.

There are 7 citywide tactical channels, 4 bureau channels, for a total of 11. These channels are used for special events, and sometimes the officers get low on extra channels. There were supposed to be 1 dispatch channel and two tactical channels for each bureau, but Valley bureau has only one due to the shortage of channels. There are now 19 police stations, one more will be added in the next year or so.

The Centracom Gold Elite consoles allow only 32 channels/console. The new consoles do not have the ability to select multiple channels, so the dispatchers have to broadcast one message multiple times to cover the entire city's geographic area.

AVL is not currently available, but LAPD is interested in this technology, especially Chief Riley. The officers themselves don't particularly like the idea, and don't see it as something that will help them.

A new CAD system is scheduled for production in mid-October, but there is a problem with the interface to the MDCs. Northrop Grumman is the prime for this contract, Visiontech is the subcontractor. There could be an issue with too many vehicles using the system.

SEMS (Standardized Incident Management System) training was conducted with Assistant Watch Commanders and above to familiarize them with the procedures. It is geared to field operations, not dispatch center operations. However, calls do come back to dispatch for assistance, such as requests for telephone numbers, additional resources needed, etc.).

Most mutual aid is LAPD going out to other areas rather than others coming into Los Angeles. Amber Alerts come into dispatch from CHP via teletype. Tactical teletypes, such as R & I (Research and Investigation), handle most other kinds of teletype information. Dispatch helps out with tactical alert teletypes when area resources are overloaded or do not have proper resources.

There is a Mobile Field Force (used for riot, shootings, and barricading) composed of 40 officers, 9 sgts., and 1 Lt. They often use cell phones or land line for communications for a number of reasons: the radio system is too busy, trying to stay off of tac channels to save them for others to use, sometimes its easier to communicate full duplex over the phone than over the radio, sometimes the information is private and you don't want the media and others listening in.

Blackberrys are used by the command staff for communications, most at this level and above do not carry radios. Chief Bratton is viewed as very positive in his views towards new technology.

When the new consoles were installed, the emergency trigger procedure had to change because the consoles operated differently. Before, the dispatcher's console would automatically go to the emergency trigger channel. Now, the system registers an alarm but it doesn't automatically select the emergency trigger channel. The Bureau Communications Coordinator (BCC) now has the emergency trigger channel selected at all times, so they get the emergency first, then hand it off to the RTO. Occasionally, there is some difficulty in handing off the emergency from the BCC to the RTO.

Interview with Port of Los Angeles Police Department

Date: 07/26/05, 1:30 pm

Attending: Captain Martin Renteria, Port of Los Angeles Police
Mel Samples, CADSTAR, Inc., Consultant
Ken Martin, CADSTAR, Inc., Consultant
Mark Revis, RCC Consultants
Scott Johnson, RCC Consultants

Location: Port of Los Angeles Headquarters, 425 South Palos Verdes St., San Pedro

The existing Centracom II consoles will be replaced in the next few months with new Motorola Gold Elite consoles. Increasing from 2 positions to 6 positions when the new building is available in about 18-24 months. The new building design is currently at the 25% level.

Main repeater site is on San Pedro Hill, in the Sigma building, about 100 ft. down the north side of the hill. Police operate on a single channel, call sign WPRF253. The channel is digital and encrypted. Coverage is generally good, officers can communicate with the repeater north to the Sepulveda Pass and south to Orange County but will get spotty in some areas. Coverage in downtown LA is good. Port Police sometimes transport prisoners to Parker Center or to Van Nuys. There are some problems along the coast, especially Cabrillo Beach (south of San Pedro Hill) and when ships shade the signal. Coverage can change dramatically depending on where ships are berthed. Backup site is at San Pedro City Hall. There are 3 receive only sites. There are about 100 to 125 radios (portable and mobile) currently in use. Radio system hardware is about 3 years old.

Task forces and detectives primarily use Nextels because multiple talk groups are available. Nextel sometimes has problems with availability due to high demand or poor coverage. A common trunked radio system for LA City departments could be good because additional channels (talkgroups) could be obtained and interoperability could be improved. A possible drawback could be loss of interoperability with the CHP.

More frequencies are needed. 100 officers are authorized, but only 60 have been hired. Expect to hire remaining officers over the next 4-5 years. Night and morning shift has 7 officers on duty, day shift has 14. Shifts are currently 5 days/8 hrs., but are considering 3/12 or 4/10 shift. 12 hour shifts would result in about 15-20 officers on duty. The Police are on board ships often and there is extensive use of dive and ship inspection teams.

The Port Police currently interoperate with CHP, LAPD, LAFD, US Coast Guard, US Customs, LA City Lifeguards, LA County Lifeguards, Port of Long Beach, Long Beach Police, and terminal operators on business frequencies. The Port of Long Beach is

adjacent so there is a lot of interaction. Southern California has an interoperability committee (technical and operational) chaired by the LA County Sheriff's Department.

Vehicles are equipped with MDT's. The Police are currently subscribers on the City of Inglewood's mobile data system. The Port of LA is licensed for one mobile data channel, call sign WNSS857, operating on 809.9625/854.9625 MHz, using the RD-LAP protocol. There are 2 transmitters, one on San Pedro Hill and one at San Pedro City Hall.

The Port is considering linking up to Inglewood's CAD system also. It is now being upgraded to Tiburon.

Interview with Los Angeles County Fire, Assistant Chief Mike Morgan

Date: August 15, 2005 2:30 pm

Attendees: A/C Mike Morgan
Mark Revis, RCC Consultants
Marc Bono, RCC Consultants
Scott Johnson, RCC Consultants
David Feeney, RCC Consultants

Location: Fire Dispatch, 1320 No. Eastern Ave., Los Angeles

The Chief stated that he felt the LAFD's approach to interoperability is a "grand vision to be applauded." He further stated that the County needed to replace both voice and data networks on an immediate basis. The Chief believes in creatively, and thoroughly exploring approaches with an eye for the future. He acknowledged some of the resistance and the arguments used, pointing out that he felt there were obvious operational requirement differences between fire and police and the study should consider that regional fire service agencies respond routinely in automatic and mutual aid situations on a daily basis requiring seamless interoperability. He also acknowledged that fire to law enforcement interoperability is needed but usually for much shorter durations. The region's fire departments regularly work together as a matter of course--the ICS is used every single day. One major goal of the Los Angeles Area Fire Chief's Association is: how to accomplish Auto/Mutual Aid better via interfacing voice and data including CAD to CAD interface for regional fire service agencies?

From the voice standpoint, the County relies on VHF for tactical channels and UHF for dispatch and command channels. The Chief cited that the demarcation was set at the level of Captains and above for use of UHF frequencies, and below that, one would find VHF radios used. He said that Command and Dispatch UHF channels are denoted "blue" channels and the VHF tactical channels are labeled "white channels." Resource ordering and filling staffing needs are the primary subject of communications at the Division/Group Supervisor level and above (on the Blue channels). VHF (White channels) are used for tactical communications, as well as mutual aid. All firefighters have VHF radios, Captain and above have VHF and UHF radios. All vehicles also have VHF/UHF radios. An IC or others managing a fire need a minimum of 2 radios, VHF and UHF. Paramedic units in La Habra must also carry an 800mHz radio to achieve base-station contact with hospitals The US Forest Service recently moved to VHF narrowband, but the County does not have narrow-band radios. The County is in the process of procuring new UHF and VHF radios that will be resolve this concern and be "transitional to P25." Currently mutual aid communications at major incidents involving Federal Fire Agencies is accomplished by either having a cache of radios to hand out to the Forest Service (to ensure common communications) or by deploying resources with common communications and co-locating incident commanders (with disparate communications) at a common Incident Command Post. Most FDs in the region use VHF and UHF radios

however, LA City Fire is using 800 MHz. He added that when his personnel need to communicate on 800 MHz at an incident, they swap radios at the Captain level. Both City and County routinely request aid from each other and this is an interoperability concern that must be improved. VHF is commonly used when interoperating with other agencies and counties because it is a common denominator supported by most fire agencies and works well on large incidents such as wild land fires.

The Chief pointed out that there are times when a 1st Alarm response requires apparatus from more than one agency. The assignment of the IC is dependent upon jurisdiction in which the incident is occurring. Currently, crews remain on their own radio channels, reporting to their supervisors on up to the CP where the communications occurs across lines on a face to face basis.

He stated that County Fire is currently in the procurement phase of a strategic plan that will replace current radios with new equipment to support fire service operational requirements including programmable radios capable of narrowband analog interoperability. The new radios will support up to 800-channel capacity (not to be confused with an 800 MHz capacity). With regard to the pooling of UHF frequencies to create a regional, standards-based shared system, he feels will be a difficult sale despite compelling merits. He noted that the following agencies, and many other smaller agencies, currently utilize UHF: LAPD, Sheriff LA County Fire, and ICIS so it makes sense to explore the possibility of moving to a regional, standards-based common platform UHF system. The key will be to get the right people into one room and get their agreement and commitment to do it. He feels that this is the best long-term voice communications solution for the region.

Mobile data is currently operating on UHF frequencies. For critical data, a private system is preferred over a public network for reasons of reliability and security. However, the Chief is looking at using a commercial high speed data network for less critical data communications. Desired new applications are AVL/AVRR, and reporting and intelligence databases such as EMS and fire prevention reports, mapping and building blueprint applications, etc. He is also looking at hot spot/mesh networks at 4.9 GHz when mobile data computers replace the current mobile data terminals.

New areas on east end (Diamond Bar area) and La Habra (Orange County), Hollywood hills area, Santa Clarita and Topanga Canyon represent coverage problem areas because of new housing developments. There are also capacity issues across the current radio system. 5 UHF direct channels and 1 repeated channel were recently obtained. Motorola may have identified some UHF spectrum available for purchase. The Department has 2 county-wide channels: the rest are regionalized in 5-6 regions throughout county. Command (UHF) radios in particular have capacity issues, as they can only hold 12 channels. Congestion does occur on the command and dispatch channels as incidents grow in dimension.

His desire for a new radio system would be:

- Adequate number of tactical channels
- A separate command channel
- A clear channel the IC can use

The current radios are Motorola MX 330's, Motorola Sabers, Motorola Astros, and Kenwoods. The Motorola MX radios discontinued production in the 1980's. The Kenwoods are not waterproof or intrinsically safe. None of the current radios have emergency trigger button, but the new radios are expected to have this capability. Also now available is an evacuation notification system to be used by the IC. The IC presses one button and an evacuation notice is sent to all radios. The signal is 3 loud beeps emanated by the radio. The firefighter presses his PTT to acknowledge. The IC's radio automatically keeps track of who has acknowledged thru the Unit ID function.

The Chief views LARTCS as an interim solution with some long term application for agencies that cannot move towards a regional standards-based solution. He feels that the City and County ultimately need a regional standards based system, not just a means of patching when needed. Gateways present several problems because they require third party intervention for connectivity and are difficult to manage at large incidents and may indeed create safety concerns of their own. He stated the opinion that to go to a regional standards-based system will require regional executive buy-in, funding, and multi-agency cooperation.

In response to the question of how a common radio system would be managed, he said he felt that a separate entity with a strong, fairly represented board of directors was a possibility. This point generated some further discussion on how it might operate.

The Chief said the Los Angeles Area Fire Chief's Association envisions regional dispatch centers, with both common communications and interfaced CAD systems to support automatic and mutual aid resource deployment. If one center went down for any reason, the others could immediately step in as backup.

We discussed the nature of the imperative for interoperability: interoperability should address day-to-day as well as major incidents in as seamless a fashion as possible The Chief sees the need to bring elected and appointed officials together to discuss the importance of public safety communications and interoperability. Those individuals in our region would include:

- LA City Fire Chief
- LA City Police Chief
- LA County Fire Chief
- LA County Sheriff
- Their respective CIOs
- LA County CAO
- President of the Los Angeles Area Fire Chiefs' Association
- President of the Los Angeles Area Police Chiefs' Association

This group appears, in fact, to be the current Regional Interoperability Steering Committee. We discussed how achieving a public commitment to consensus there would alter the study and its outcome, better enabling the move to interoperability. The Chief said he hoped our report would be "courageous," and would explore the possibility of change including the rearrangement of spectrum to accommodate regional voice and data systems and the utilization of 700 MHz when it becomes available.

After the meeting we toured the dispatch center. Note that calls are handled in a multiple step process. Incoming calls would have been answered elsewhere prior to arrival. The initial response would have been the LA PSAP or the State Police PSAP. A call taker receives the call from them, then passes it to a dispatcher who then passes it to another person who stays on the phone as long as is required.

Interview with Los Angeles County Department of Health Services EMS staff

Date: September 19, 2005, 3:00 pm

Attending: Carol Meyer, Director Los Angeles County EMS Agency
Cathy Chidester, Assistant Director Los Angeles County EMS Agency
Joe Betance, Chief, Communications & Support
Scott Johnson, RCC Consultants

Location: Tele-Conference

The LA County EMS Agency coordinates hospitals and provides 911 coordination, among other duties. There are currently contracts with 21 hospitals operating the UHF Medical channels. 9 of the 10 FCC designated channels are in use, and provide 90/90 coverage. Most facilities have a primary (base station, for local coverage) and backup channel (mountaintop, for wider area coverage). The conventional analog Channels are reused through the use of PL tones.

There is a concern 50-75% of EMS calls are via cell phones, which have a high probability of not being available in a major emergency. However, many EMS personnel would have to carry an additional radio in the field to make use of the UHF radio system.

Over the recent past, 15 hospitals have discontinued use of the UHF system. It is typical for hospitals to come and go from the system, and updates to the plan are required every 6-12 months. The design assumed mid-power radios, most personnel now use low-power radios, so the coverage is not adequate. Also, about 75% of calls are made from inside buildings, and coverage suffers further.

Telemedics are not currently used, but may be in the future. The only mobile data in use is for after patient care.

About 85% of all Fire Department calls are EMS related.

The UHF Medical radio system is composed of older equipment, much of it does not have spare parts available.

LA County EMS also uses a 956 MHz REDDINET data radio system that provides 82 hospitals data regarding current capabilities, level of Emergency Services available, etc. It is linked to Central Dispatch in a 3 available path "mesh" configuration (every hospital has a link to at least 3 other hospitals and/or the Central Dispatch central point of communications/polling). In the near future, the network will also be capable of internet-linked communications (currently, the system can be used for viewing only via the internet).

There is a 155 MHz system used as voice backup to the REDDINET system. This VHF system works from 3 sites, 3 more are planned in the near future and 2 more (for a total of 8) are planned in the longer term.

The LA County Department of Health Services EMS Agency is very much in favor of a regional system, providing they have influence over such issues as coverage, capacity, and access to the system.

The documents below were forwarded after the conference call:

PARAMEDIC COMMUNICATION SYSTEM (PCS) BACKGROUND

Currently pre hospital on-line medical control is provided by 20 acute care hospitals. Two (2) of these hospitals are operated by the Department of Health Services (DHS). Staff providing on-line medical control are employed by the hospitals under the direction of the Pre-hospital Care Coordinator (nurse) and a Medical Director (physician). In calendar year 2003 the then, nineteen hospitals handled 205,355 contacts. In addition to field medical control, the hospital staff is also responsible for continuing medical education and quality assurance.

The communication equipment used for medical control is purchased, installed and maintained by the participating hospitals. Except for a few exceptions all hospitals are assigned a primary communication channel and a back up. In addition hospitals provide a minimum of two telephone lines to be used for paramedic access. Due to the Los Angeles topography some hospitals must maintain remote radio sites to provide communication to some outlying field units. These remote sites are connected to the base hospital using leased lines, leased by the base hospitals.

Los Angeles County maintains a network of high remote radio sites that are available to extend local hospital communications when necessary. The county's back haul circuits (i.e. fiber, microwave) interfaces with the hospital lease lines at local county buildings. The county remote radio sites along with the circuits are maintained by the Los Angels County Internal Services Department (ISD).

The Los Angeles County Emergency Medical Services Agency (EMS) is the local authority for all issues regarding pre-hospital care to include communications. In reviewing the status of the Los Angeles County Paramedic Communication System, EMS has concluded:

- PCS is the first line of communication from the field to hospitals. Although paramedics are trained to begin triage and stabilization prior to base hospital contact, notification to the base hospital is often the first indicator of a mass casualty or disaster event.

- During disaster incidents, PCS is a contingent communication tool in the event of other communication failures.

- The current paramedic communication system was engineered in 1982-83 to operate using a computerized assignment model. The design was to utilize the Computerized Paramedic Communication System (CPCS) to match paramedic calls with the least busy base hospital and assign the call. As a back-up procedure in the event of failure of any of the CPCS components a "fall back mode " (FBM) was established. This FBM permanently assigned paramedic units to a specific base hospital with an assigned channel protocol and hailing procedure. In the event of CPCS failure, paramedics were instructed to follow the FBM procedures until the problem was corrected. In 1984 in anticipation of the Summer Olympics held in Los Angeles and in response to computer problems with CPCS, paramedics were instructed to implement FBM until after the Olympics and /or the computer problems were corrected. As a result of the review of the communication needs of Los Angeles County, the state of technology at the time (1984) and lack of funding to repair or replace CPCS it was decided to remain on FBM until a replacement system was designed and purchased.

- The current communication design uses twenty- year- old technology

- The equipment is outdated and in most cases can not be supported or repaired

- The channel assignment protocols are currently being revised by the Federal Communications Commission

- The entire system will have to be re designed using narrow band protocols and all hardware will have to be replaced

- Increasingly, paramedic base hospitals are not renewing their contracts or canceling their participation in the paramedic base hospital program

- With the current system, reassigning paramedic field units to other base hospitals is difficult due to the technical limitations of the twenty-year-old design

- The entire PCS must be re designed to utilize current technology and address current obstacles

- Due to the need for uninterrupted communications, implementation of any communication upgrade or replacement must be done in parallel with the current system.

The Los Angeles County Emergency Medical Services Agency operates three independent radio systems. The Hospital Emergency Administrative Radio (155.340 MHz.), the Paramedic Communication System (483/485 MHz.) and the Rapid

Emergency Digital Data Interface Network (956 MHz.). In addition LACOEMS participates with other Los Angeles County Departments in an 800MHz Trunked Radio System (CWIRS) and monitors a two meter (147.7) amateur radio frequency.

HOSPITAL EMERGENCY ADMINISTRATIVE RADIO (HEAR)

Using remote transceivers in selected high elevation radio sites and a manual voter (please see Exhibit I), EMS has expanded coverage of HEAR for almost complete coverage of the Los Angeles County area. There still exist some canyons and shadow areas that due to sparse population would be cost prohibitive to attempt to cover.

The key to effective communications using HEAR is the Medical Alert Center.
On a daily basis, the Medical Alert Center (MAC), a 24/7 communications center operated by LACOEMS, provides communication monitoring. They provide relay information to hospitals, and would be the primary notification center for any events requiring medical resources outside the normal operating channels. Along with the Central Dispatch Office (CDO) MAC is part of the Coordinated Communications Center for the Department of Health Services.

In addition to building out the VHF channel by installing remote transceivers at strategic "high" sites", LACoEMS participates in the Los Angeles Regional Tactical Communication System (LARTCS). LARTCS provides frequency patching for VHF, UHF and 800 MHz and is in the process of expanding it's coverage to provided complete Los Angeles County coverage. Once completed the level two interoperability solution would provide gateways coordinated by the Los Angeles County Sheriffs Communication Center (SCC). This would allow agencies on different frequencies to communicate using their own equipment with other agencies once a patch has been established.

PARAMEDIC COMMUNICATION SYSTEM

The Paramedic Communication System (PCS) in Los Angeles County consists of three main participants, the base hospitals, ALS providers and EMS.

Base hospitals are responsible for purchasing and maintaining all communication equipment required to provide communication to their assigned ALS units. Communication is provided either by a local radio system installed at the base hospital (please see Exhibit III) or when necessary at remote sites. Remote sites are either owned and operated by the base hospital or are the property of Los Angeles County (see Exhibit II, for locations). Whether owned by the hospital or at a "County" owned site, the connectivity from the radio and the controller at the hospital remains the responsibility of the base hospital. The base hospitals (see Exhibit III, for locations) are assigned a primary and in most cases a secondary channel for their local system. If remote sites are necessary a separate channel is necessary. A channel consists of a frequency pair (half duplex) and a PL tone (see Exhibit IV, for channel assignments).

RAPID EMERGENCY DIGITAL DATA INTERFACE NETWORK

Los Angeles County has been involved with the design and development of the Rapid Emergency Digital Data Interface Network (ReddiNet®) since it's inception in the early eighties. The Medical Alert Center is the System Central Point for Los Angeles County and monitors the ReddiNet around the clock. On a daily basis, ReddiNet documents and displays hospital diversion status and allows MAC to query Department of Health Service hospitals on service availability. MAC uses the multi-casualty incident (MCI) module to coordinate the dispersion of field patients and in the event of a disaster, the disaster assessment module assists with assessing impact and assigning available medical resources. The system operates at 956 Mhz. It works similar to a token ring, constantly polling the hospitals for data packets to forward to the destination identified by its ReddiNet Address.

COUNTY WIDE INTEGRATED RADIO SYSTEM

The County of Los Angeles operates an 800 MHz, trunked radio system. With the exception of the County Fire Department and the Sheriff, all county departments participate. To communicate with Fire and Sheriff, there exists a bridging interface. In the event of a declared emergency Los Angeles County departments can communicate with each other and free up the other communication channels.

AMATEUR RADIO

The Coordinated Communications Center monitors 147.27 MHz. in the two meter amateur radio band to facilitate communications with health care facilities that have established amateur radio as a back-up communication system. In the event of a major event with county-wide impact, volunteers are recruited through the RACES and ARES to actively communicate with these facilities if their primary communication methods have become disabled.

POSSIBLE RADIO SOLUTIONS FOR EMS OPERATIONS

1- Small Cell Analog, migration-able to Digital and Narrow-Band

Keeping the current operation with Base Stations covering the service area of each Base Hospital. New equipment is required to migrate to narrow-band and digital to satisfy FCC requirements. Each base is an insulated island. Equipment cannot be used to cover other areas. Portable and/or Mobiles need to be replaced before the migration occurs. Use of high sites will be required. Voted receivers can complement coverage for the uplink.

Pros: Cost may be less. Simpler system

Cons: Reliability of the system as a whole is diminished. A failure at a Hospital causes loss of coverage to the whole service area.

2- Simulcast Conventional Digital Narrow-band System.

This system uses a combination of high transmit-receive sites and low receivers to cover the whole County with all the Channels available to EMS. Intelligent distribution and reuse of the frequencies will allow assignment of some channels to each service area. Control can be operated from a centralized location (EMS Central) or via the Hospitals or both. Centralized traffic can be logged at EMS Central, with access to the traffic via IP. . Portable and/or Mobiles need to be replaced before the migration occurs.

Pros: System is more reliable, and flexible. Use of high sites with back up radios, power, failure alarms, increase reliability, and reconfiguring of equipment (newer radios can be reconfigured remotely) adds the flexibility. New, emerging technologies can be applied reducing cost of the backbone and it's maintenance.

Cons: Simulcast coverage is more difficult to achieve. Cost will be higher than the Small Cell System but not much since there will be less equipment ant the Hospitals. Careful consideration of areas of coverage needs to be studied to avoid addition of sites and escalating cost.

3- Trunked Digital Narrow-band System

A trunked system can divide the service areas and assign talk groups to the areas and the local hospitals. The system can be designed with the whole area of the County with exception of forest areas as a service area. Several high sites, with careful frequency planning will allow that any responding unit can be handled by EMS Central, a County Hospital, A Trauma Center Hospital or Major Hospital, as long as the site is provided with Control Consoles, able to operate in all talk groups. Since Control Consoles have converged to Desktop Computers operating specialized software the cost of Command and Control equipment can be reduced in comparison to old-fashioned Control Consoles. Smaller hospitals can be fitted with two (or more if needed) Trunked Base Stations, each monitoring and operating on a specific talk group, if the system is still using smaller hospitals as Base Hospitals. The whole system can be controlled from EMS Central. An all call group can be used as the Hailing Channel if operations still require such handling. Instructing the responding unit to move to a talk group assigned to any hospital can dispatch calls, or the call can be handled entirely at EMS central. The whole system will require new equipment, all county owned and maintained, eliminating variations between hospitals.

Pros: Extremely reliable and flexible system. With the amount of frequencies and the traffic, current and future, a system can be designed with overlapping coverage

from high sites, plus satellite receivers to improve uplink, allowing any unit to be able to contact any hospital, even if one high site is removed.

Cons: It will be the most expensive option. Cost will be amortized because the system will be much more long lived. The system can be upgraded to include other areas, increases in channels if traffic demands change, or any other unanticipated event.

Also see attached Exhibits (I, II, and III), as well as channel and hailing channel frequency assignments.

Interview with Los Angeles County Sheriff's Department, Cmdr. Bob Sedita

Date: August 10, 2005, 9:00 am

Attending: Mark Revis, RCC Consultants
Cmdr. Bob Sedita, LASD

Location: Technical Services Div., 12440 E. Imperial Hwy. Norwalk

LASD currently has 2 major communications-related projects, the first being a consolidated voice radio system for LACoFD and LASD, and the second being new CAD and mobile data systems for LASD, LACoFD and LA Co. Office of Public Safety. (The Office of Public Safety is Los Angeles County's internal security division... safety police, park police, etc.)

The current radio systems were built in 1987 and are now failing. Immediate replacement is needed. Also, coverage needs have changed. There is a much larger population in the north areas of the county than there was in 1987. The current LASD radio systems were manufactured by General Electric (voice) and Electrocom (data). LASD and LACoFD have their voice and data radio systems in the UHF band. The Office of Public Safety uses the 800 MHz band.

A new, digital trunked radio system for voice, plus a new mobile data system with greater speed and capacity is desired.

LASD has 55 UHF channels (frequency pairs). Currently they are wide-band but most will be made narrow-band when the digital conversion occurs. Data channels will remain wide-band.

More channels are desired. Tactical channels are shared with others and they are not always available.

There are 50 law enforcement agencies within Los Angeles County. 31 use UHF, 15 use VHF, 2 use 800 MHz and 2 use HF.

Up to this point, the County hasn't considered 700 MHz for a consolidated countywide radio system. 700 MHz frequencies were requested based on what they thought they would need to meet current requirements, and not enough frequencies were requested. 700 MHz could be used for a shared data system.

700 MHz probably won't be available soon because of incumbent TV stations on channels 63, 64, 68 and 69. The stations are owned by Buenavision and serve the Hispanic market, which is very sensitive. Buenavision has been approached by Congresswoman Harmon about voluntarily moving and the idea was turned down. Activists have already gotten involved and litigation is expected if the stations are

transitioned to digital before the cost of digital converters and digital TVs comes down and their penetration reaches the 85% mandated by the FCC ruling.

Data is a bigger issue for Law Enforcement than for Fire. Fire sets up their command posts in the middle of an incident scene, and dispatching and tactical communications are mostly done with voice. LASD uses lots of data, typically 60,000 inquiries and text messages per day. Dispatching is done primarily by data. Routine dispatches are rarely done via voice. For priority dispatches, data and voice are used. NCIC and other lookups are done via data. Contract service minutes for contract cities, as well as other statistical data, are collected via the data system.

A project is underway to share real-time data between law enforcement agencies. The Regional Terrorism Information and Integration System (RTIIS) is a joint undertaking between the LA area Police Chiefs and the FBI to build a large data warehouse that will be routinely accessed by officers. Agencies will contribute their data for others to share. The intent is to catch terrorists and other criminals by providing quick access to information. For example, an officer may stop a vehicle for suspicious behavior near a potential terrorist target, and, through the RTIIS database, could discover that the same person and vehicle had recently been reported at other potential terrorist targets in other cities.

LASD interoperates with other law enforcement agencies all the time, but only rarely with fire departments. However, Cmdr. Sedita is pushing to have fire command posts co-located with law command posts for interoperability at the command level. Cmdr. Sedita is also pushing to have a communications officer, known as a "Comm. Unit Leader", on-scene at large incidents (per NIMS requirements), not just a technician. When the ICU vehicle goes out it is assigned a communications officer, a security deputy and a technician.

Cmdr. Sedita is the California Sheriff's Association representative to the SIEC executive committee, and is chair of the So. California planning committee, consisting of 12 southern counties. The commitee is tasked with finding out who has what type of equipment, and establishing MOUs and protocols for their use.

Operations protocols are extremely important. For instance, commonality of terminology is an important issue. LASD and CHP have totally opposite meanings for the terms "officer needs backup" and "officer needs assistance". To one, "assistance" means lights and siren, and "backup" means "whenever you get there". To the other, the meanings are reversed. This could lead to problems in a critical situation where a quick response is needed.

During a large incident, the incident communications need to be isolated so the incident doesn't consume an excessive amount of resources. The rest of the county still needs to

maintain its routine communications. The intent is to create an incident network "communications bubble" that is self-contained to the greatest extent possible.

The concept for the LARTCS system was conceived in April of 2000. It was determined that better communications was needed with CHP and others, including Fire. In November of 2000, a press conference and demonstration was held where Sheriff Baca, LACoFD Chief P. Michael Freeman, and Mike Brown of CHP each used their radios to talk to each other thru a hard-wired patch. At that time, there was no funding or support to continue development. After 9/11, the need for interoperable communications was obvious and support was available. A LARTCS executive committee was formed with representatives from LA area police and fire chiefs, CHP, Department of Health and federal government agencies. There are 9 voting members plus additional adjunct members. The Sheriff's Department is the Chair and the representative from the Los Angeles Area Fire Chiefs' Association is the Vice-Chair. There are 2 subcommittees, Technical Standards and Operational Protocols. John Garamaldi of Manhattan Beach FD is the chair of the Technical Committee.

For the first phase of the LARTCS build-out, LASD contributed 5 UHF mutual aid channels, LAPD contributed 3 VHF channels and Long Beach FD contributed 1 VHF channel. Two ACU-1000s were donated and federal grant money purchased additional radios. 22 radios were wired in, with the Sheriff's Communications Center being the hub. Two more ACU's have since been added to the SCC and are working great.

LARTCS is effective. Cmdr. Sedita related an incident where a particularly violent armed robbery occurred in Ventura County. Ventura Co. put out a crime broadcast, and a LASD unit in Westlake Village spotted the vehicle. The deputy asks for assistance. SCC contacts Ventura County dispatch and finds that a Ventura County unit is just 1.5 minutes away, while another LASD unit is 10 minutes away. The Ventura Co. unit is dispatched, and SCC sets up a LARTCS patch so the two units can communicate directly. The two units coordinate and apprehend the suspect.

Phase Two of the LARTCS implementation will be to build a county-wide infrastructure, so that LARTCS can be accessed from anywhere in the county. LASD began by pursuing federal funding under a LA regional joint application with LAPD. That grant provides $4 million, state funds provide another $3 million. More money was needed, so the Sheriff embarked on a program of education for County officials, the CIO and others. A plan was laid out and reinforced by the accomplishments to-date. Within three months a call was received from a CAO budget analyst saying that the County had found $20 million within their budget that could be applied to LARTCS. Later, another $20 million was found. There is some controversy over the money... initially the Fire Dept. wanted to use the money for immediate needs instead of LARTCS.

The build-out plan for Phase 2 will use existing tower sites. The money will be used to buy equipment, antennas, etc. to put the mutual aid channels at each site. Phase 2 will also have dedicated staff: a Lieutenant, a Sergeant, two Deputies and two technicians.

The staff will oversee the build-out. Throughout construction and after completion of that phase, the Lieutenant will act as the liaison to other public safety agencies within and outside of Los Angeles County. The Sergeant will assist the Lieutenant and supervise the rest of the staff. The Deputies will become trainers, making sure everyone has realistic expectations for the system.

The Orange County 800 MHz system had problems partly because the vendor didn't properly set expectations for the system, and the officers weren't properly trained. The differences between analog conventional and digital trunked were not clearly explained beforehand. The users were disappointed with the system's performance, so they abandoned it in favor of cell phones. Only Anaheim appeared to do an adequate job in training its officers.

A system is only as good as the people that know how to use it. Most users don't have the time to fully learn how to use a complex system. That is why a communications unit leader is needed. Incident commanders need to be trained to use the comm. unit leader.

Phase 3 of LARTCS is envisioned to be the linking of LARTCS with similar systems in other counties. In support of this concept, the new mission statement reads "*To enhance the safety of the citizens of Southern California by providing the highest degree of operational communications interoperability among the public safety agencies of Los Angeles County and the five adjacent counties and to do so in the most efficient and cost effective manner possible*". In reality, the group includes LA County and 11 other Southern California counties, per SIEC mandate. LASD holds joint operations with Orange, San Bernardino and Ventura counties regularly.

Cmdr. Sedita recently assisted Orange Co. to get a grant to put up cross-band repeaters on the same frequencies as LARTCS.

It was suggested that Phase 4 of LARTCS might be to construct a large, countywide, consolidated 700/800 MHz system and to link it with systems in San Bernardino, Orange and possibly Riverside counties. Cmdr. Sedita remarked that that might be a viable plan because it is new spectrum and no one would be required to give up spectrum they already have committed to other uses. However, ISD was responsible for applying for the frequencies, and he did not know what their intentions were.

Immediate needs: LASD needs to upgrade their data system. Parts for the old equipment are no longer manufactured by IP Mobilenet (formerly Electrocom), and they are purchasing used equipment to cannibalize for parts. New technology from IP Mobilenet will immediately boost their speed to 32 kbps, with another upgrade within 6 months that will take it to 64 kbps. Cmdr. Sedita remarked that IP Mobilenet had been very supportive of LASD and went out of their way to help them keep the old system running.

Cmdr. Sedita envisions that applications such as photos and fingerprints will be transmitted over a commercial data service that supplements LASD's data infrastructure.

Critical dispatch data will continue to be transmitted over the private data network, to ensure that critical data still is available even if the commercial service is overloaded or fails.

The LASD voice radio system has a unique feature. When a field user transmits, their voice is heard by dispatch, but not by the other field units. Instead, a busy tone is transmitted to let users know that the channel is busy. This is done because there is enough voice traffic that it would distract field users, sometimes causing them to turn the volume down and thereby miss important messages from the dispatcher. The tone is effective because it lets users know someone is talking but it doesn't distract as much.

Cmdr. Sedita suggested others that RCC should contact about interoperability:

Chief Bob Sanderson, Arcadia PD – LA Police Chief's Association rep to LARTCS
Lt. Merrit Mielke, CHP
Don Root, CA OES Asst. Director of Communications
Salvatore Santangelo, CA Military Dept.
Mark Flath, US Secret Service

Interview with Los Angeles County Sheriff's Department, East Los Angeles Station

Date: November 1, 2005, 3:20 pm

Attending: Sgt. Ignacio Somoan
Scott Johnson, RCC Consultants

Location: Tele-Conference

Sgt. Somoan indicated the Los Angeles County Sheriff's Office provides law enforcement services to the City of Commerce and the East Los Angeles unincorporated area. Los Angeles County Fire provides fire services. The City of Commerce has a Public Safety Department, with non-sworn officers who use different radios than the Sheriff's UHF conventional analog system. The Public Safety officers also carry a Sheriff radio to provide interoperability between the two groups.

The coverage of the Sheriff's radio system is good; the City of Commerce has flat topography. The number of channels is also adequate. There are 5 patrol cars in the City of Commerce during peak hours, 3 during off-peak times.

Regarding the need for interoperability, Sgt. Somoan stated it is "always helpful to be able to communicate." He mentioned separate incidents involving Monterey Park and Bell Gardens where lack of interoperability was an issue in responding to the incidents.

Interview with Manhattan Beach Police Dept.

Date: October 5, 2005, 3:00 pm

Attending: Sgt. Cochran
Scott Johnson, RCC Consultants

Location: Tele-Conference

Sgt. Cochran indicated they are a part of the South Bay regional system. He indicated Manhattan Beach is satisfied with the South Bay system and supports the direction South Bay is going with future upgrades.

Interview with San Fernando Police Department

Date: September 14, 2005, 9:00 am

Attending: Detective Tony Vairo
Scott Johnson, RCC Consultants

Address: San Fernando Police Station, 901 1st Street

Detective Tony Vairo indicated they joined ICIS this year. They also have 2 legacy repeated analog channels they still use for most communications. There are some instances of interference on these analog channels with Long Beach, which uses the same frequencies, but coordinating with Long Beach personnel has significantly reduced this issue. All Motorola Astro radios were flash upgraded to trunking, 19 mobiles are on order. The Comm. Center has also been recently upgraded.

San Fernando is part of Area C mutual aid, and trunking helps in this regard. LARTCS is used, but it is cumbersome to coordinate with the County dispatch.

San Fernando is in favor of a countywide radio system. They currently share mobile data with Inglewood and Torrance (19.2 kbps). Voice is considered more important than data communications.

Voice radio capacity is adequate. The conventional system was installed in 1991, and San Fernando did not have to add a new site to join ICIS. There are 800 MHz radios available in the command vehicle.

San Fernando has no Fire Department, and contracts with LA City FD, as they are surrounded by LA city territory.

The in-building coverage of the conventional system is better, as the tower is more centrally located than the trunked ICIS system.

Interview with San Marino Fire Department

Date: September 1, 2005, 2:30 pm

Attending: Chief John Penido
Tony Busam, RCC Consultants

Location: San Marino FD, HQ

Chief Penido is the LA Fire Chiefs representative to LARTCS. He speaks from both a technical as well as an operational point of view.

San Marino FD is a member of the 11-city Verdugo Fire Communications system. It is the Chief's opinion that integrated regional communication systems are essential for efficient incident control and mitigation. This requires regional dispatch centers to be interconnected, and public safety first responders to share a common radio and data communications system. He believes the LARTC system has value for larger incidents where agencies not normally involved with day-to-day operations are participants; ie, secondary responders such as state and federal investigators.

The Chief recognizes the difficulties of coverage in the remote areas of Los Angeles County. While overcoming this obstacle could be challenging, the fact that responding fire agencies cope with this limitation during daily operations proves that a "work-around" currently exists. The costs associated with gaining 100% coverage should not preclude the goal to gain interoperability in the majority of the County. Because it is needed almost daily, interoperability between all fire agencies is essential. Interoperability between disciplines is also required, though less frequently.

With regard to an expanded "Verdugo Type" countywide communications system the Chief made several observations.

- Interoperability must be instantly available and uncomplicated for line personnel to access
- The system must have dedicated frequencies especially as they pertain to incident command
- The system must have a credible and responsive governance
- Access to interoperability solutions for an emergency incident must require no human intervention
- There is a need to increase the understanding of line personnel about readily available interoperability solutions

Interview with Santa Monica Fire Department

Date: November 1, 2005, 8:00 am

Attending: Chief Bruce Davis
Scott Johnson, RCC Consultants

Location: Tele-Conference

Chief Davis stated Santa Monica FD is planning on joining the City of Los Angeles 800 MHz system by May/June 2006, plus Los Angeles will provide dispatch services to Santa Monica. There are several reasons to have Los Angeles Fire Department dispatch for Santa Monica Fire Department including: 24 dispatchers on duty each day, command and control from the dispatchers whom are experienced firefighters, priority medical dispatch to screen and send appropriate resources to EMS calls, 24 radio frequencies, a dedicated firefighter and officer to monitor the emergency channel when firefighters enter an IDLH atmosphere and our current mutual aid and automatic aid agreements with Los Angeles Fire Department. Additionally Santa Monica is surrounded on 3 sides by Los Angeles (the Pacific Ocean is on the fourth side), and most of their interoperability needs are therefore with LAFD. Coverage and channel capacity with this arrangement is expected to be good. Santa Monica will continue to use the existing 3 channel repeated, 1 channel direct, UHF system for some internal uses and for when traveling to other locations that also use UHF radios.

Santa Monica does not use LARTCS or the South Bay interoperability capabilities. As stated above, most interoperability is with LAFD, so the need of additional capabilities is not significant.

Interview with City of South Gate Police Dept., Sheri Koomen, Emergency Services Manager.

Date: September 15, 2005, 2:30 pm

Attending: Sheri Koomen, Emergency Services Manager, South Gate PD
Tony Busam, RCC Consultants
Mark Revis, RCC Consultants
Scott Johnson, RCC Consultants

Address: Tele-Conference

Ms. Koomen indicated South Gate uses a VHF (155 MHz) analog system. The system has 4 sites, one is for transmit/receive (the main station), the other 3 are for receive only. The receive signals are voted. There is one channel, plus a CLEMARS (California Law Enforcement Mutual Aid Radio System) channel available. There is also a low-power, mobile-only frequency (156.000 MHz) that is for Narcotics. A tactical channel is needed.

South Gate contracts with Los Angeles County Fire (station 54 is located in city limits), as they do not have their own fire department. LA County Fire uses UHF radios.

The city has recently become more involved in LARTCS, they are currently attending training on how to use the system. It will be used to communicate with County Sheriff, Fire and surrounding agencies.

The department would like to be on the same frequencies as other surrounding agencies. They also need more channels, especially on weekends. MDC's are also being used over a GPRS network (AT&T). The vendor is Hitech Systems. Use of the MDCs is encouraged instead of voice calls, particularly for data requests.

The city covers 7.5 square miles and includes a population of 110,000. There are 97 sworn personnel, with about 45,000 dispatched calls per year.

There is a need to have better interoperability with the surrounding cities (particularly Downey, Bell and Bell Gardens), and most significantly, the LA County Sheriff. The Century Sheriff's station is usually the first in for mutual aid. There is also a need for interoperability with CHP, more than LA City police.

Of the 30 police vehicles, 15 have new VHF radios, the rest are 8-10 years old. There are no other radios installed in the vehicles for interoperability purposes. All officers are assigned a portable radio.

Dispatch has 3 positions, normally staffed with 2 persons. CAD is available, but no AVL. The dispatch center is a primary PSAP. The Sheriff's Department installed one

desktop base station in the dispatch center on mutual aid channel, which is scheduled to be integrated into the radio console.

Interview with South Pasadena Police Department

Date: September 12, 2005, 1:00 pm

Attending: Sgt. Mark Miller
Scott Johnson, RCC Consultants
Tony Busam, RCC Consultants

Location: South Pasadena Police Station, 1422 Mission St.

Sgt Miller had coincidentally written an e-mail memo the Chief of Police the day before the interview. The memo contains many ideas and concepts consistent with the vision of a countywide, shared radio system. See the memo at the end of these notes.

South Pasadena Police currently operate on a 2 (one repeated, one direct) channel, analog UHF conventional system. They have 6 digital radios to communicate with neighboring agencies. The Fire Department is part of the Verdugo regional system.

Dispatch uses Orbacom consoles. The repeater is located on a water tank, with 45 portable and 28 mobile radios in use for the Police. Police desire to communicate with Public Works, buses, etc. Also there is a need to have a mutual aid channel with neighboring cities. The Raymond Hill Water Tank is potentially a good new radio site.

There are times when there is channel contention. The issue of grant tone delay is not a major issue. Use mostly HT-2000 radios, now purchasing dual mode analog/digital radios as budget permits. 4-5 units are normally on shift at a time. Mutual aid are includes Alhambra, Glendale, and Pasadena. Sharing a system is not an issue for most officers, including the Chief. Use mobile command vehicle for backup dispatch. Can redirect 911 calls to other cities' 911 if necessary.

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>  -----Original Message-----
> From:     Mark Miller
> Sent:     Sunday, September 11, 2005 4:55 PM
> To: Daniel Watson
> Cc: Mike Ward
> Subject:  Proposal for a Strategic Communications Plan
>
> Sir,
>
> First, let me state that I make no claim to be an expert on radios or
>  communications.    With  that  in  mind,  I  understand  that  voice
communications
>  are  an  essential  component  of  law  enforcement  operations,  and
absolutely
> critical to our core mission.  Since beginning the radio inventory
> project,  I  have  been  studying  our  radio  system.   As  part  of  this
study,  I
```

> have talked with various vendors such as Motorola, COMSERCO, K. R. Nida,
> and Communications Center. I have examined all of our radio gear from the
> transmitter in the basement to the repeater on the tank.. I have
> discussed our system with engineers, technicians, and sales reps; attended
> presentations on Glendale's ICIS project, LASD's LARTCS system, Orange
> County Sheriff's system, San Diego County's mammoth Regional
> Communications System (3 counties, 2 states, 217 agencies, 18,000 users),
> and most recently attended a day of seminars sponsored by Motorola. With
> this information, I have discovered the following.
>
> * Like most small agencies, we currently operate a 40-year-old legacy
> system. While we have replaced the majority of individual components; the
> system's design, concept, architecture, and basic technology date back to
> the 1970's or before. We have roughly 70 units (console, hand-helds and
> mobiles). Our system is solely designed to carry voice communications.
>
> * Because of FCC requirements, our analog system is becoming obsolete,
> and we will have to cease analog operations and be digitally compliant
> within the next 5 years. We have already made the commitment to purchase
> only digitally compliant components from this point forward, but less than
> 20% of our components are presently digitally compatible.
>
> * Trends in public safety since 9-11 are towards increasing
> regionalization and shared resources. We have numerous examples: Verdugo
> Fire dispatch; Pasadena's regional helicopter and CSI programs; Foothill
> Regional SWAT; cooperative use of Urban Area Security Initiative (UASI)
> grant funds to purchase regional command posts and bomb equipment; and the
> de facto regionalization of local K9 units.
>
> * With that in mind, Motorola has designed a new communications
> dispatch center, incorporating CAD and RMS. This system is designed to
> serve as the hub of a large scale regional dispatch center (such as a
> sheriff's department) and service remote locations (such as independent

> police departments). Motorola claims that Pasadena PD just purchased this
> system, with completion estimated at a year from now. I do not know their
> intentions in purchasing this system, or whether we might be considered a
> potential partner.
>
> * Federal grant money is increasingly biased toward collaboration and
> interoperability of communications and other equipment. The recent
> debacle in New Orleans will likely give further impetus to these types of
> projects.
>
> * The interoperability issue goes far beyond law enforcement agencies
> talking to each other. In disaster scenarios, interoperable
> communications should be available between police, fire, state and local
> agencies, private ambulance services, public works crews, city buses, Red
> Cross, Ham operators, SPUSD, and federal agencies. Such programs as ICIS
> and LARTCS presently offer that ability. I believe our participation in
> ICIS or a similar program is inevitable, but delayable.
>
> * It appears to me that ICIS is at the forefront of this technology,
> and will become the regional provider, at least for the San Gabriel
> Valley. Managers of some of these systems believe that within a few years
> their trunking systems will be able to provide us with seamless contact
> with any agency via hand-helds and mobiles anywhere in Southern
> California. As an example, San Marino PD is presently digital and in
> ICIS. A San Marino officer can pick up his handheld in Lancaster or
> Culver City, and talk to his station or any other ICIS agency.
>
> * It appears to me that regional policing authorities (such as
> Whittier/Santa Fe Springs and Bell/Cudahy) are an established trend and a
> real potential in our area. It is not inconceivable that the distant
> future might hold a San Gabriel Valley Regional Police Authority.
>
> * Technology continues to advance with blinding speed. Police
> communications are expanding to carry voice, data, and video feeds.
> Prototype law enforcement radios are multi-function computers capable of
> interfacing with cellular communications, data transmission, magnetic
> strip readers, and offer photo and fingerprint capture. The rapid
> advances have moved equipment purchases from a one-time capital investment

> to a continuing annual expense. I believe we need to start budgeting for
> these purposes.
>
> Considering all of the above, I believe we need to design and build a
> completely new, ground-up communications system for the city of South
> Pasadena, replacing our entire communications infrastructure. Costs I
> have discussed with the professionals range from $350,000 to a million
> dollars over a 5-year period. I would like permission to pursue this
> further. To do this I need to:
> * Get estimates from Motorola and other vendors for a complete survey
> of our existing system.
> * Get estimates from Motorola and other vendors for the design and
> completion of a new contemporary communications system.
> * Establish contact with Pasadena PD's project manager. These
> discussions could include contracting with Pasadena for all dispatch
> services.
> * Meet with appropriate representatives from Public Works, Fire
> Department, SPUSD, and other stakeholders.
> * Explore grant possibilities.
> * Define the most viable alternatives.
> * Explore resale markets (perhaps foreign) and the value of our
> existing system.
>
> I would like to prepare a comprehensive report on this subject,
> establishing recommendations, a time line, budget, and strategic plan for
> implementation. This will be a long term project requiring substantial
> time and effort.
>
> Please let me know if you would like me to proceed, how you wish me to
> proceed, and what other persons if any you would like me to involve.
>
> Respectfully,
>
> Sgt. Miller

Interview with Vernon Police Department

Date: September 14, 2005, 2:45 pm

Attending: Captain Steve Towles
Scott Johnson, RCC Consultants

Location: Tele-Conference

Vernon police operate on a VHF repeated channel, with another channel used in the direct/simplex mode. Interoperability is an issue; Vernon is in the process of implementing a patch solution to UHF users in the area. Dispatch and command vehicles have extra radios for interoperability. A regional radio system would be of great interest to Vernon.

The Police Department has participated along with the Fire Department in drills where LARTCS was used. A recent drill went through all of the steps to have LARTCS ready to be used in anticipation of needing a multi-agency response to potential civil unrest. The LARTCS patch was tested and things went well, although the system was never actually used in a live incident situation.

The Vernon Police mobile data system initially used a CDPD network, then moved to a GPRS network and then moved to the EDGE network which has been in use for the past several months. They are implementing a very forward-thinking application that will allow downloading of commercial and business building floor plans, blueprints, the number of employees for various days of the week and shifts, photographs of the building, the alarm company name, contact information, etc. It is expected this information will be of significant value to police officers as they approach a facility. There is effort required to develop and maintain the information, but most building occupants have responded very favorably to this initiative.

Vernon Police are currently looking at implementing a MESH network which will give them the functionality of a local area network but with a broader footprint than would be obtained if they used only their existing fiber-optic loop for the LAN.

CITY OF LOS ANGELES
Radio Communications Interoperability Project

Interview with the City of West Covina

Date: September 26, 2005, 2:00 pm

Attending: Mike Urban
Scott Johnson, RCC Consultants

Location: Tele-Conference

Mr. Urban stated the Fire Department operates from 2 VHF channels, and the Police Department uses 3 UHF-T channels, although one is used by Public Works during the day, so the channel is used mainly after hours (but could be used by the Police Department during a large scale incident at any time of day). Under cover Police also have a VHF non-encrypted channel used in the direct mode. Most of the system is 20 years old and needs to be replaced soon. Also, the dispatch consoles are the old style "buttons and LED's" models that are limited in functionality and difficult to support. West Covina is looking at replacing the dispatch consoles in the next 2 years or so. There have been more frequent failures in the recent past, especially with the Police Department radio equipment, as it is older than the Fire Department radio equipment.

Interoperability was described as "woefully lacking". This is particularly true for incidents involving helicopter evacuations of injured people, as communications with on scene personnel is difficult, and often dispatch must get involved. Although not currently involved with LARTCS, West Covina has been attending some meetings recently and may become a user of the system. West Covina has also retained a consultant to determine whether joining ICIS would be the best future alternative for the city.

The Fire Department has mutual aid agreements with LACO fire and is a member of the State mutual aid group I. They use BK portable radios that are programmed at the fire scene for interoperability with other strike team units.

A GPRS cellular system is used for mobile data. West Covina developers support the mobile data software and records management software that is used by 20 other cities in the Central/Southern California areas.

Appendix D - Master List Of Antenna Sites

Site Name	Site Owner or Licensee	Lat.	Long	Gnd El.	Struct./ Ant. Ht.	Call Sign/ ASR #
100 Wilshire	LA City	34-01-00.0	118-30-03.3	27.0m	104.0m	WNXI691
1277 Eastern	LA County	34-03-17.0	118-10-29.3	183.0m	37.0m	WIJ739
1401 W. 6th Street	LA City	34-03-26.0	118-16-00.3	114.0m	18.0m	KFG564
9100 Wilshire	City of Beverly Hills	37-03-57.0	118-23-23.3	57.0m	38.0m	WPML947
Adams Hill	LA City	34-07-43.0	118-14-10.3	250.0m	30.0m	KJC625
Agoura Hills	City of Agoura Hills	34-08-42.0	118-46-43.3	266.0m	10.0m	WPSL285
Agoura Hills 2	Nextel of CA	34-08-35.0	118-46-24.0	297.8m	10.7m	WPSW973
Bald Mountain	LA County	34-44-39.9	118-43-41.3	1380.1m	36.6m	WBM464
Baldwin Hills LA Co	LA County	34-00-17.0	118-21-44.3	156.0m	37.0m	WII795
Baldwin Hills LA City	LA City	34-00-24.0	118-21-45.3	148.0m	30.0m	WNXI690
Beverly Glen	LA City	34-07-43.0	118-26-34.3	421.0m	24.0m	WNXI689
Beverly Hills Rexford Dr.	City of Beverly Hills	34-04-26.0	118-23-58.3	76.0m	37.0m	WPML947
Big Pines	LA County	34-23-55.0	117-43-51.2	1859.0m	24.0m	KMB862
Black Jack Peak	LA County	33-23-12.1	118-24-03.3	613.0m	34.0m	WII796
Blue Ridge Mtn.	San Bernardino Co.	34-21-07.0	117-40-32.2	2500.0m	21.0m	WPKR326
Blue Rock	LA County	34-42-06.3	117-49-27.7	1024.1m	24.4m	WPUW770
Bouquet Cyn	City of Santa Clarita	34-25-47.0	118-30-45.3	543.0m	6.0m	WIL591
Briarcrest	LA City	34-07-07.0	118-23-33.2	449.6m	6.7m	KDF47
Burbank Reservoir	City of Burbank	34-11-47.0	118-17-52.3	304.0m	18.0m	WIK334
Burnt Peak	LA County	34-40-55.9	118-34-39.3	1755.6m	15.2m	WNES506
Burnt Peak 2	LADWP	34-40-55.9	118-34-26.3	1716.0m	35.7m	KYL21
Canyon Crest	City of Santa Clarita	34-26-05.0	118-28-09.0	498.0m	6.0m	WPWM369
Carillo	State of CA	34-02-38.0	118-56-05.3	8.0m	15.0m	WPKY535
Castaic	Nextel of CA	34-33-00.0	118-40-05.0	748.0m	30.5m	WPYE835
Castaic Lake	LADWP					
Castro Peak	LA County	34-05-09.0	118-47-09.3	860.0m	40.0m	WII794
Century Plaza	LA City	34-03-31.0	118-24-47.3	67.0m	157.0m	WPRJ338
Chilao	State of CA	34-19-00.0	118-00-31.2	1597.2m	29.0m	WHJ602
Crystal Lake	Verizon California	34-18-41.0	117-50-10.2	1536.2m	6.1m	WHS996
Dakin Peak	LA County	33-21-00.1	118-21-08.3	482.0m	64.0m	WII793
Decker Canyon	LA County	34-04-37.0	118-52-51.3	495.0m	7.0m	KVP644
Elysian Park	LA City	34-04-18.0	118-13-57.3	170.0m	54.0m	WXZ989
Encinal 1	LA County	34-05-08.0	118-51-49.3	419.0m	7.0m	KVP645
Encinal 2	LA County	34-05-38.0	118-50-16.3	533.0m	19.0m	WNCX741
Fed Ex	LA City	33-56-29.0	118-23-50.0	31.0m	42.0m	WPVM496
Fire Station 101	LA City	33-43-15.8	118-18-34.0	109.0m	12.2m	proposed
Fire Station 24	LA City	34-15-50.2	118-20-13.3	530.7m	15.2m	proposed
Fire Station 69	LA City	34-02-40.0	118-31-31.0	97.0m	46.0m	WPVL893

Fire Station 74	LA City	34-15-11.0	118-18-03.0	465.0m	30.0m	WPVT500
Foothill PD	LA City	34-15-11.0	118-24-36.0	287.0m	30.0m	WPVM496
Frazier Peak	Ventura County	34-46-30.0	118-58-09.9	2439.9m	37.8m	KME545
Frost Peak	LA County	34-21-07.0	117-40-28.2	2584.7m	24.4m	WNES502
Getty Center	J. Paul Getty Trust	34-06-30.0	118-28-33.3	335.6m	8.0m	WNYZ242
Green Mtn.	LA City	34-05-08.0	118-32-56.0	547.0m	15.0m	WPVL893
Hacienda Heights	Comm Enterprises, LLC	33-59-07.0	118-00-10.2	351.0m	18.0m	WII253
Hauser Peak	LA County	34-32-47.9	118-13-03.2	1575.8m	42.7m	KHF99
Johnstone Peak	LA County	34-09-38.0	117-47-55.2	975.0m	37.0m	KMB861
KHTS	Jerilyn Broadcasting	34-27-55.0	118-24-10.3	562.9m	30.0m	KHTS
KIIS	LA City	34-05-05.0	118-12-12.0	237.0m	13.0m	WPVM494
KSKQ	LA City	34-04-43.0	118-11-08.3	232.0m	11.0m	WNXI693
KYSR	AM/FM Ohio, Inc.	34-07-08.0	118-23-33.0	472.0m	94.0m	ASR 1013828
LA City Hall	LA City	34-03-13.0	118-14-33.3	87.0m	142.0m	KFG564
LAX	LA City	33-56-39.0	118-23-38.3	32.0m	20.0m	WZG297
Long Beach DWP	LADWP	33-45-35.1	118-05-38.2	3.0m	50.0m	KCW538
Long Beach W. Broadway	City of Long Beach	33-46-08.1	118-11-49.0	8.0m	38.1m	KMA651
Lower Blue Ridge	LA County	34-22-28.0	117-42-22.2	2300.3m	30.5m	WNTB366
Magic Mountain	LA County	34-23-09.9	118-19-46.2	1475.2m	36.6m	WNES504
Malibu	City of Malibu	34-02-34.0	118-41-34.0	20.0m	15.0m	WPTD929
Marina Del Rey	LA County	33-58-12.0	118-26-46.3	5.0m	23.0m	WII811
Mirador	Glendale	34-09-35.6	118-11-02.2	471.0m	12.2m	WPZU953
Montebello	City of Montebello	34-01-55.0	118-05-49.2	172.0m	61.0m	WPXP547
Mt. Baldy	San Bernardino Co.	34-14-20.0	117-39-28.2	1286.0m	12.0m	WPKR326
Mt. Disappointment	LA County	34-14-48.0	118-06-17.3	1812.0m	34.0m	WIJ737
Mt. Emma	So. Cal. Regional Rail Auth.	34-28-56.0	118-04-50.3	1349.0m	18.0m	WPLF338
Mt. Lee	LA City	34-08-04.0	118-19-14.2	515.1m	106.1m	KDF46
Mt. Lukens LA Co	LA County	34-16-07.0	118-14-11.3	1542.0m	56.0m	WIJ509
Mt. Lukens LA City	LA City	34-16-08.0	118-14-20.3	1547.0m	30.0m	KNFV977
Mt. Lukens LACoMTA	LA County MTA	34-16-22.0	118-14-20.0	1532.0m	23.0m	KRW246
Mt. Lukens Long Beach	City of Long Beach	34-16-09.0	118-14-01.3	1545.0m	26.0m	WIJ537
Mt. McDill	LA County	34-33-57.9	118-16-31.2	1581.0m	37.2m	WAS384
Mt. Thom	Glendale	34-11-13.8	118-15-22.6	666.0m	46.0m	WPZU953
Mt. Washington	LA City	34-06-16.0	118-12-52.3	283.0m	24.0m	WNXI695
Mt. Wilson	TouchTel Corp	34-13-36.0	118-04-00.2	1709.9m	137.2m	WNEY739
MTA	LA County MTA	33-55-44.1	118-14-13.3	25.9m	32.9m	ASR 1215519
Oat Mountain LA City	LA City	34-19-42.0	118-35-53.3	1117.0m	24.0m	WNXI694
Oat Mountain Nike LA Co	LA County	34-19-35.0	118-35-12.3	1074.0m	30.0m	WIK223
Oat Mtn. Nike Glendale	City of Glendale	34-19-31.5	118-35-11.1	1016.0m	30.5m	WPVN326
Palos Verdes Estates	City of Palos Verdes Est.	33-46-55.0	118-23-20.3	338.9m	25.0m	WPXB573

Palos Verdes Est. LA Co	LA County	33-48-00.1	118-23-30.3	63.0m	12.0m	WIK409
Playa Del Rey	LA City	33-55-49.0	118-25-47.3	19.0m	18.0m	WPPB231
Pomona 1620 Hillcrest	City of Pomona	34-01-00.0	117-45-58.2	379.0m	24.0m	KMA384
Pomona Trail View	City of Pomona	34-01-00.0	117-45-58.2	379.0m	24.0m	KMA384
Portal Ridge	LA County	34-40-31.9	118-24-48.3	1164.0m	20.0m	KEY816
Pt. Fermin	LA City	33-42-19.0	118-17-37.0	25.0m	9.0m	WPVT500
Puente Hills	LA County	33-57-20.0	117-53-42.2	432.8m	42.7m	WQAF451
Rancho Palos Verdes	LA County	33-46-07.1	118-22-35.3	365.0m	49.0m	WII797
Saddle Peak	LA County	34-04-31.0	118-39-36.3	864.4m	51.6m	WNES499
San Augustine	Glendale	34-10-40.3	118-11-20.6	495.0m	23.8m	WPZU953
San Dimas	LA County	34-04-18.0	117-48-49.2	393.0m	34.0m	KMG941
San Francisquito Cyn.	LADWP	34-33-04.0	118-31-30.3	464.0m	18.0m	KIY486
San Pedro City Hall	LA City	33-44-17.0	118-16-49.0	6.8m	71.0m	WPWJ627
San Pedro Hill LA City	LA City	33-44-46.1	118-20-10.3	442.0m	6.0m	KJC625
San Pedro Hill LA Co	LA County	33-44-50.1	118-20-10.3	445.0m	15.0m	KFR578
San Vicente Peak	LA City	34-07-43.0	118-30-47.3	598.0m	22.0m	KGE571
Sandstone Peak	Not Known	34-07-13.3	118-55-53.0	907.8m	15.2m	proposed
Santa Monica Water Tank	Santa Monica	34-02-38.0	118-28-33.3	108.0m	12.0m	WIL344
Sepulveda 2	Los Angeles SMSA L.P.	34-07-26.0	118-28-57.2	432.8m	13.7m	WMJ418
Sequoia Park Water Tank	City of Monterey Park	34-03-19.0	118-08-33.3	215.0m	9.0m	KNAK313
Sherwood	Los Angeles SMSA L.P.	34-07-40.0	118-52-43.3	415.4m	Not known	WLN610
Signal Hill LA Co	LA County	33-47-58.1	118-09-47.2	107.0m	40.0m	WIK913
Signal Hill Muni.	City of Signal Hill	33-47-58.1	118-09-47.2	108.0m	50.0m	WPSD861
Southwest PD	LA City	34-00-38.0	118-18-18.0	45.0m	51.0m	WPVT500
Sulphur Springs USD	Sulphur Springs USD	34-25-08.0	118-25-22.3	470.8m	475.0m	KEF986
Sunland	LADWP	34-15-30.0	11820-09.3	436.0m	15.0m	KDL454
Sylmar	LADWP	34-19-38.0	118-29-46.3	546.0m	14.0m	KRZ720
Table Mountain	Nextel of CA	34-23-00.0	117-39-52.2	2275.0m	15.0m	WIL681
Tenhi Mtn.	City of Palmdale	34-32-08.0	118-08-14.3	1173.0m	15.0m	WIG515
Topanga	LA County	34-05-22.0	118-35-39.3	404.0m	11.0m	WIL603
Topanga 2	State of CA	34-05-36.0	118-35-18.3	366.0m	8.0m	WPKY527
Tower Bldg.	Burbank	34-09-02.0	118-20-33.3	169.0m	30.0m	WQBJ318
Tower Peak	LA County	33-25-33.1	118-28-34.3	335.0m	34.0m	WII790
Verdugo Peak LA City	LA City	34-13-11.0	118-17-26.3	907.0m	23.0m	WNXI692
Verdugo Peak LACoMTA	LA County MTA	34-13-09.0	118-17-10.3	919.0m	30.0m	KRW246
Verdugo Peak LA Co	LA County	34-13-03.0	118-16-59.3	935.0m	45.7m	ASR1220578
Vincent	Los Angeles SMSA L.P.	34-30-11.9	118-06-09.2	1272.2m	13.7m	WPOU357
Walker Drive	City of Beverly Hills	34-06-35.0	118-23-27.3	450.0m	46.0m	WNFT622
Walnut	LA County	34-01-43.0	117-50-03.2	185.9m	44.2m	WNEP964
West Hollywood	LA County	34-05-28.0	118-21-25.3	88.0m	18.0m	WGH876
West LA	LA City	34-02-39.0	118-27-01.0	67.0m	54.0m	WPVL893
West Lancaster	City of Lancaster	34-38-39.0	118-19-27.3	1215.0m	18.0m	WNBE432
West Valley PD	LA City	34-11-38.0	118-32-54.3	225.0m	32.0m	KJC625

Westlake		LA County	34-08-19.0	118-49-15.3	267.0m	6.0m	KRO240
Whittaker Ridge		LA County	34-35-01.9	118-43-17.3	1216.2m	36.6m	WNES505
Whittier		LA County	34-01-02.0	118-00-52.2	356.0m	37.0m	KNER448
Zuma Beach		LA County (County Park)	34-01-35.5	118-49-34.6	40.5m	15.2m	proposed
	125	TOTAL SITES					

Appendix E - Details of Budgetary Cost Estimates

Conceptual Design #1 - Regional UHF Voice System/800 MHz Regional Data System

		Low		High	
Description	Qty	Each	Ext.	Each	Ext.
10 rptr standalone site	9	1,650,000	14,850,000	2,175,000	19,575,000
10 rptr simulcast site	9	1,830,000	16,470,000	2,355,000	21,195,000
10 rptr simul prime equip	4	715,000	2,860,000	715,000	2,860,000
15 rptr standalone site	4	2,047,500	8,190,000	2,572,500	10,290,000
15 rptr simulcast site	10	2,247,500	22,475,000	2,772,500	27,725,000
15 rptr simul. prime equip	4	840,000	3,360,000	840,000	3,360,000
20 rptr standalone site	2	2,377,500	4,755,000	2,902,500	5,805,000
28 rptr simulcast site	28	2,910,000	81,480,000	3,435,000	96,180,000
28 rptr simul prime equip	7	1,124,000	7,868,000	1,124,000	7,868,000
Master Trunking Control	2	2,500,000	5,000,000	3,000,000	6,000,000
1 freq. data site	15	176,000	2,640,000	176,000	2,640,000
3 freq. data site	6	316,000	1,896,000	316,000	1,896,000
Data system controller	2	1,000,000	2,000,000	1,000,000	2,000,000
CAD/Database interfaces	lot	5,000,000	5,000,000	7,500,000	7,500,000
In-Building Amplifiers	10	500,000	5,000,000	750,000	7,500,000
LA MTA Tunnel System	1	7,500,000	7,500,000	10,000,000	10,000,000
SCADA Central	1	2,000,000	2,000,000	2,500,000	1,500,000
LAPD Mobile Radios	1,500	3,500	5,250,000	4,000	6,000,000
LASD Mobile Radios	2,000	3,500	7,000,000	4,000	8,000,000
Other PD Mobile Radios	1,500	3,500	5,250,000	4,000	6,000,000
LAFD Mobile Radios	1,000	3,500	3,500,000	4,000	4,000,000
LACoFD Mobile Radios	1,750	3,500	6,125,000	4,000	7,000,000
Other FD Mobile Radios	550	3,500	1,925,000	4,000	2,200,000
Mobile Installations	8,300	200	1,660,000	300	2,490,000
LAPD Portable Radios	10,500	4,000	42,000,000	4,500	47,250,000
LASD Portable Radios	10,500	4,000	42,000,000	4,500	47,250,000
Other PD Portable Radios	5,500	4,000	22,000,000	4,500	24,750,000
LAFD Portable Radios	1,600	4,000	6,400,000	4,500	7,200,000
LACoFD Portable Radios	4,000	4,000	16,000,000	4,500	18,000,000
Other FD Portable Radios	2,000	4,000	8,000,000	4,500	9,000,000
LAPD Data Modems	1,500	4,000	6,000,000	4,500	6,750,000
LASD Data Modems	2,000	4,000	8,000,000	4,500	9,000,000
Other PD Data Modems	1,500	4,000	6,000,000	4,500	6,750,000
LAFD Data Modems	1,000	4,000	4,000,000	4,500	4,500,000
LACoFD Data Modems	1,750	4,000	7,000,000	4,500	7,875,000
Other FD Data Modems	550	4,000	2,200,000	4,500	2,475,000

Data Modem Installation	8,300	200	1,660,000	300	2,490,000
LAPD Console Mods	1	1,000,000	1,000,000	2,000,000	2,000,000
LASD Consoles	30	250,000	7,500,000	500,000	15,000,000
Other PD Consoles	15	250,000	3,750,000	500,000	7,500,000
LAFD Consoles	30	250,000	7,500,000	500,000	15,000,000
LACoFD Consoles	15	250,000	3,750,000	500,000	7,500,000
Other FD Consoles	15	250,000	3,750,000	500,000	7,500,000
Hospital Control Stations	40	13,600	544,000	28,600	1,144,000
LAPD Control Stations	45	13,600	612,000	28,600	1,287,000
LASD Control Stations	45	13,600	612,000	28,600	1,287,000
Other PD Control Stations	100	13,600	1,360,000	28,600	2,860,000
LAFD Control Stations	103	13,600	1,400,800	28,600	2,945,800
LACoFD Control Stations	169	13,600	2,298,400	28,600	4,833,400
Other FD Control Stations	100	13,600	1,360,000	28,600	2,860,000
Engineering/Proj. Mgmt.	1	10,000,000	10,000,000	15,000,000	15,000,000
SUBTOTAL			440,751,200		549,591,200
10% Contingency			44,075,120		54,959,120
TOTAL			484,826,320		604,550,320

Conceptual Design #2 - Regional 700/800 MHz Voice System/Regional 700/800 MHz Data System/Regional UHF Non-Public Safety Voice System

Public Safety Voice + Data		Low		[redacted]	
Description	**Qty**	**Each**	**Ext.**	**Each**	**Ext.**
5 rptr standalone site	6	1,205,000	7,230,000	1,705,000	10,230,000
5 rptr simulcast site	23	1,465,000	33,695,000	1,990,000	45,770,000
5 rptr simul prime equip	5	590,000	2,950,000	590,000	2,950,000
10 rptr standalone site	2	1,650,000	3,300,000	2,175,000	4,350,000
10 rptr simulcast site	9	1,830,000	16,470,000	2,355,000	21,195,000
10 rptr simul prime equip	2	715,000	1,430,000	715,000	1,430,000
15 rptr standalone site	3	2,047,500	6,142,500	2,572,500	7,717,500
15 rptr simulcast site	22	2,247,500	49,445,000	2,772,500	60,995,000
15 rptr simul. prime equip	5	840,000	4,200,000	840,000	4,200,000
20 rptr simulcast site	15	2,647,500	39,712,500	3,172,500	47,587,500
20 rptr simul prime equip	3	955,000	2,865,000	955,000	2,865,000
Master Trunking Control	2	2,500,000	5,000,000	2,500,000	5,000,000
1 frequency data site	16	176,000	2,816,000	176,000	2,816,000
3 frequency data site	6	316,000	1,896,000	316,000	1,896,000
Data system controller	2	1,000,000	2,000,000	1,000,000	2,000,000
CAD/Database interfaces	lot	5,000,000	5,000,000	7,500,000	7,500,000
In-Building Amplifiers	10	500,000	5,000,000	750,000	7,500,000
LA MTA Tunnel System	1	7,500,000	7,500,000	10,000,000	10,000,000
SCADA Central	1	2,000,000	2,000,000	2,500,000	2,500,000
LAPD Mobile Radios	1,500	3,500	5,250,000	4,000	6,000,000
LASD Mobile Radios	2,000	3,500	7,000,000	4,000	8,000,000
Other PD Mobile Radios	1,500	3,500	5,250,000	4,000	6,000,000
LAFD Mobile Radios	1,000	3,500	3,500,000	4,000	4,000,000
LACoFD Mobile Radios	1,750	3,500	6,125,000	4,000	7,000,000
Other FD Mobile Radios	550	3,500	1,925,000	4,000	2,200,000
Mobile Installations	8,300	200	1,660,000	300	2,490,000
LAPD Portable Radios	10,500	4,000	42,000,000	4,500	47,250,000
LASD Portable Radios	10,500	4,000	42,000,000	4,500	47,250,000
Other PD Portable Radios	5,500	4,000	22,000,000	4,500	24,750,000
LAFD Portable Radios	1,600	4,000	6,400,000	4,500	7,200,000
LACoFD Portable Radios	4,000	4,000	16,000,000	4,500	18,000,000
Other FD Portable Radios	2,000	4,000	8,000,000	4,500	9,000,000
LAPD Data Modems	1,500	4,000	6,000,000	4,500	6,750,000
LASD Data Modems	2,000	4,000	8,000,000	4,500	9,000,000
Other PD Data Modems	1,500	4,000	6,000,000	4,500	6,750,000
LAFD Data Modems	1,000	4,000	4,000,000	4,500	4,500,000

LACoFD Data Modems	1,750	4,000	7,000,000	4,500	7,875,000
Other FD Data Modems	550	4,000	2,200,000	4,500	2,475,000
Data Modem Installation	8,300	200	1,660,000	300	2,490,000
LAPD Console Mods	1	1,000,000	1,000,000	2,000,000	2,000,000
LASD Consoles	30	250,000	7,500,000	500,000	15,000,000
Other PD Consoles	15	250,000	3,750,000	500,000	7,500,000
LAFD Consoles	30	250,000	7,500,000	500,000	15,000,000
LACoFD Consoles	15	250,000	3,750,000	500,000	7,500,000
Other FD Consoles	15	250,000	3,750,000	500,000	7,500,000
Hospital Control Stations	40	13,600	544,000	28,600	1,144,000
LAPD Control Stations	45	13,600	612,000	28,600	1,287,000
LASD Control Stations	45	13,600	612,000	28,600	1,287,000
Other PD Control Stations	100	13,600	1,360,000	28,600	2,860,000
LAFD Control Stations	103	13,600	1,400,800	28,600	2,945,800
LACoFD Control Stations	169	13,600	2,298,400	28,600	4,833,400
Other FD Control Stations	100	13,600	1,360,000	28,600	2,860,000
Engineering/Proj. Mgmt.	1	10,000,000	10,000,000	15,000,000	15,000,000
SUBTOTAL			446,059,200		564,199,200
10% Contingency			44,605,920		56,419,920
TOTAL			490,665,120		620,619,120

Non-Public Safety Voice		Low		High	
Description	**Qty**	**Each**	**Ext.**	**Each**	**Ext.**
28 rptr standalone	13	2,775,000	36,075,000	2,902,500	37,732,500
Master Trunking Control	1	2,500,000	2,500,000	2,500,000	2,500,000
City Mobiles	2,500	2,500	6,250,000	3,000	7,500,000
County Mobiles	5,000	2,500	12,500,000	3,000	15,000,000
Mobile Installations	7,500	200	1,500,000	300	2,250,000
City Portables	1,000	2,500	2,500,000	3,000	3,000,000
County Portables	1,500	2,500	3,750,000	3,000	4,500,000
County Control Stations	40	13,600	544,000	28,600	1,144,000
City Control Stations	40	13,600	544,000	28,600	1,144,000
Engineering/Proj. Mgmt.	1	1,000,000	1,000,000	1,500,000	1,500,000
SUBTOTAL			67,163,000		76,270,500
10% Contingency			6,716,300		7,627,050

TOTAL	73,879,300	83,897,550

Conceptual Design #3 - LA City Only UHF Voice System/800 MHz Data System

		Low		High	
Description	**Qty**	**Each**	**Ext.**	**Each**	**Ext.**
5 rptr standalone site	1	1,205,000	1,205,000	1,705,000	1,705,000
5 rptr simulcast site	3	1,465,000	4,395,000	1,990,000	5,970,000
5 rptr simul prime equip	1	590,000	590,000	590,000	590,000
10 rptr standalone site	1	1,650,000	1,650,000	2,175,000	2,175,000
10 rptr simulcast site	7	1,830,000	12,810,000	2,355,000	16,485,000
10 rptr simul prime equip	2	715,000	1,430,000	715,000	1,430,000
15 rptr standalone site	3	2,047,500	6,142,500	2,572,500	7,717,500
15 rptr simulcast site	11	2,247,500	24,722,500	2,772,500	30,497,500
15 rptr simul. prime equip	3	840,000	2,520,000	840,000	2,520,000
Master Trunking Control	2	2,500,000	5,000,000	2,500,000	5,000,000
1 frequency data site	1	176,000	176,000	176,000	176,000
4 frequency data site	7	535,000	3,745,000	316,000	2,212,000
Data system controller	2	1,000,000	2,000,000	1,000,000	2,000,000
CAD/Database interfaces	lot	2,000,000	2,000,000	5,000,000	5,000,000
In-Building Amplifiers	10	500,000	5,000,000	750,000	7,500,000
LA MTA Tunnel System	1	7,500,000	7,500,000	10,000,000	10,000,000
SCADA Central	1	1,000,000	1,000,000	1,500,000	1,500,000
LAPD Mobile Radios	1,500	3,500	5,250,000	4,000	6,000,000
LAFD Mobile Radios	1,000	3,500	3,500,000	4,000	4,000,000
Mobile Installations	2,500	200	500,000	300	750,000
LAPD Portable Radios	10,500	4,000	42,000,000	4,500	47,250,000
LAFD Portable Radios	1,600	4,000	6,400,000	4,500	7,200,000
LACoFD Portable Radios	0	4,000	0	4,500	0
Other FD Portable Radios	0	4,000	0	4,500	0
LAPD Data Modems	1,500	4,000	6,000,000	4,500	6,750,000
LAFD Data Modems	1,000	4,000	4,000,000	4,500	4,500,000
Data Modem Installation	2,500	200	500,000	300	750,000
LAPD Console Mods	1	1,000,000	1,000,000	2,000,000	2,000,000
LAFD Consoles	30	250,000	7,500,000	500,000	15,000,000
LAPD Control Stations	45	13,600	612,000	28,600	1,287,000
LAFD Control Stations	103	13,600	1,400,800	28,600	2,945,800
Engineering/Proj. Mgmt.	1	5,000,000	5,000,000	7,500,000	7,500,000

SUBTOTAL	165,548,800	208,410,800
10% Contingency	16,554,880	20,841,080
TOTAL	182,103,680	229,251,880

Line Item Breakdowns Applicable To All Budgetary Estimates

		Low		High	
Item	Qty	Ea	Ext	Ea	Ext
5 RPTR STANDALONE SITE					
Repeaters	5	20,000	100,000	20,000	100,000
TX Antenna System	1	20,000	20,000	20,000	20,000
RX Antenna System	1	30,000	30,000	30,000	30,000
SCADA	1	30,000	30,000	30,000	30,000
DC Backup Pwr	1	50,000	50,000	50,000	50,000
Tower & Site Improvements	1	50,000	50,000	250,000	250,000
Shelter & Generator	1	180,000	180,000	180,000	180,000
Construction Overhead	1	345,000	345,000	645,000	645,000
Installation	1	400,000	400,000	400,000	400,000
			1,205,000		1,705,000
5 RPTR SIMULCAST SITE					
Repeaters	5	20,000	100,000	20,000	100,000
TX Antenna System	1	20,000	20,000	20,000	20,000
RX Antenna System	1	30,000	30,000	30,000	30,000
SCADA	1	30,000	30,000	30,000	30,000
DC Backup Pwr	1	50,000	50,000	50,000	50,000
Tower & Site Improvements	1	50,000	50,000	250,000	250,000
Shelter & Generator	1	180,000	180,000	180,000	180,000
Construction Overhead	1	345,000	345,000	645,000	645,000
Simulcast Equipment	1	60,000	60,000	60,000	60,000
Microwave	1	100,000	100,000	125,000	125,000
Installation	1	500,000	500,000	500,000	500,000
			1,465,000		1,990,000
5 RPTR PRIME SITE EQUIP.					
Prime Controller	1	275,000	275,000	275,000	275,000
RX Comparators	5	18,000	90,000	18,000	90,000
Simul Prime Site Equip	1	225,000	225,000	225,000	225,000
			590,000		590,000
10 RPTR STANDALONE SITE					
Repeaters	10	20,000	200,000	20,000	200,000
TX Antenna System	1	30,000	30,000	30,000	30,000
RX Antenna System	1	45,000	45,000	45,000	45,000
SCADA	1	35,000	35,000	35,000	35,000
DC Backup Pwr	1	65,000	65,000	65,000	65,000
Tower & Site Improvements	1	50,000	50,000	250,000	250,000
Shelter & Generator	1	240,000	240,000	240,000	240,000
Construction Overhead	1	435,000	435,000	735,000	735,000
Microwave	1	100,000	100,000	125,000	125,000
Installation	1	450,000	450,000	450,000	450,000

			1,650,000		2,175,000
10 RPTR SIMULCAST SITE					
Repeaters	10	20,000	200,000	20,000	200,000
TX Antenna System	1	30,000	30,000	30,000	30,000
RX Antenna System	1	45,000	45,000	45,000	45,000
SCADA	1	35,000	35,000	35,000	35,000
DC Backup Pwr	1	65,000	65,000	65,000	65,000
Tower & Site Improvements	1	50,000	50,000	250,000	250,000
Shelter & Generator	1	240,000	240,000	240,000	240,000
Construction Overhead	1	435,000	435,000	735,000	735,000
Simulcast Equipment	1	80,000	80,000	80,000	80,000
Microwave	1	100,000	100,000	125,000	125,000
Installation	1	550,000	550,000	550,000	550,000
			1,830,000		2,355,000
10 RPTR PRIME SITE EQUIP.					
Prime Controller	1	285,000	285,000	285,000	285,000
RX Comparators	10	18,000	180,000	18,000	180,000
Simul Prime Site Equip	1	250,000	250,000	250,000	250,000
			715,000		715,000
15 RPTR STANDALONE SITE					
Repeaters	15	20,000	300,000	20,000	300,000
TX Antenna System	1	40,000	40,000	40,000	40,000
RX Antenna System	1	55,000	55,000	55,000	55,000
SCADA	1	40,000	40,000	40,000	40,000
DC Backup Pwr	1	75,000	75,000	75,000	75,000
Tower & Site Improvements	1	75,000	75,000	275,000	275,000
Shelter & Generator	1	300,000	300,000	300,000	300,000
Construction Overhead	1	562,500	562,500	862,500	862,500
Microwave	1	100,000	100,000	125,000	125,000
Installation	1	500,000	500,000	500,000	500,000
			2,047,500		2,572,500
15 RPTR SIMULCAST SITE					
Repeaters	15	20,000	300,000	20,000	300,000
TX Antenna System	1	40,000	40,000	40,000	40,000
RX Antenna System	1	55,000	55,000	55,000	55,000
SCADA	1	40,000	40,000	40,000	40,000
DC Backup Pwr	1	75,000	75,000	75,000	75,000
Tower & Site Improvements	1	75,000	75,000	275,000	275,000
Shelter & Generator	1	300,000	300,000	300,000	300,000
Construction Overhead	1	562,500	562,500	862,500	862,500
Simulcast Equipment	1	100,000	100,000	100,000	100,000
Microwave	1	100,000	100,000	125,000	125,000
Installation	1	600,000	600,000	600,000	600,000
			2,247,500		2,772,500

15 RPTR PRIME SITE EQUIP.					
Prime Controller	1	295,000	295,000	295,000	295,000
RX Comparators	15	18,000	270,000	18,000	270,000
Simul Prime Site Equip	1	275,000	275,000	275,000	275,000
			840,000		840,000
20 RPTR SIMULCAST SITE					
Repeaters	20	20,000	400,000	20,000	400,000
TX Antenna System	1	45,000	45,000	45,000	45,000
RX Antenna System	1	65,000	65,000	65,000	65,000
SCADA	1	45,000	45,000	45,000	45,000
DC Backup Pwr	1	85,000	85,000	85,000	85,000
Tower & Site Improvements	1	75,000	75,000	275,000	275,000
Shelter & Generator	1	360,000	360,000	360,000	360,000
Construction Overhead	1	652,500	652,500	952,500	952,500
Simulcast Equipment	1	120,000	120,000	120,000	120,000
Microwave	1	100,000	100,000	125,000	125,000
Installation	1	700,000	700,000	700,000	700,000
			2,647,500		3,172,500
20 RPTR PRIME SITE EQUIP.					
Prime Controller	1	295,000	295,000	295,000	295,000
RX Comparators	20	18,000	360,000	18,000	360,000
Simul Prime Site Equip	1	300,000	300,000	300,000	300,000
			955,000		955,000
20 RPTR STANDALONE SITE					
Repeaters	20	20,000	400,000	20,000	400,000
TX Antenna System	1	45,000	45,000	45,000	45,000
RX Antenna System	1	65,000	65,000	65,000	65,000
SCADA	1	45,000	45,000	45,000	45,000
DC Backup Pwr	1	85,000	85,000	85,000	85,000
Tower & Site Improvements	1	75,000	75,000	275,000	275,000
Shelter & Generator	1	360,000	360,000	360,000	360,000
Construction Overhead	1	652,500	652,500	952,500	952,500
Simulcast Equipment	0	120,000	0	120,000	0
Microwave	1	100,000	100,000	125,000	125,000
Installation	1	550,000	550,000	550,000	550,000
			2,377,500		2,902,500
28 RPTR STANDALONE SITE					
Repeaters	28	20,000	560,000	20,000	560,000
TX Antenna System	1	50,000	50,000	50,000	50,000
RX Antenna System	1	70,000	70,000	70,000	70,000
SCADA	1	50,000	50,000	50,000	50,000
DC Backup Pwr	1	95,000	95,000	95,000	95,000
Tower & Site Improvements	1	85,000	85,000	285,000	285,000

Shelter & Generator	1	375,000	375,000	375,000	375,000
Construction Overhead	1	690,000	690,000	990,000	990,000
Simulcast Equipment	0	135,000	0	135,000	0
Microwave	1	100,000	100,000	125,000	125,000
Installation	1	700,000	700,000	700,000	700,000
			2,775,000		3,300,000
28 RPTR SIMULCAST SITE					
Repeaters	28	20,000	560,000	20,000	560,000
TX Antenna System	1	50,000	50,000	50,000	50,000
RX Antenna System	1	70,000	70,000	70,000	70,000
SCADA	1	50,000	50,000	50,000	50,000
DC Backup Pwr	1	95,000	95,000	95,000	95,000
Tower & Site Improvements	1	85,000	85,000	285,000	285,000
Shelter & Generator	1	375,000	375,000	375,000	375,000
Construction Overhead	1	690,000	690,000	990,000	990,000
Simulcast Equipment	1	135,000	135,000	135,000	135,000
Microwave	1	100,000	100,000	125,000	125,000
Installation	1	700,000	700,000	700,000	700,000
			2,910,000		3,435,000
28 RPTR PRIME SITE EQUIP.					
Prime Controller	1	295,000	295,000	295,000	295,000
RX Comparators	28	18,000	504,000	18,000	504,000
Simul Prime Site Equip	1	325,000	325,000	325,000	325,000
			1,124,000		1,124,000
1 DATA BASE STN					
Data Base Station	1	60,000	60,000	100,000	100,000
TX Antenna System	1	8,000	8,000	8,000	8,000
RX Antenna System	1	8,000	8,000	8,000	8,000
Installation	1	100,000	100,000	100,000	100,000
			176,000		216,000
2 DATA BASE STN					
Data Base Station	2	60,000	120,000	100,000	200,000
TX Antenna System	1	12,000	12,000	12,000	12,000
RX Antenna System	1	15,000	15,000	15,000	15,000
Installation	1	100,000	100,000	100,000	100,000
			247,000		327,000
3 DATA BASE STN					
Data Base Station	3	60,000	180,000	100,000	300,000
TX Antenna System	1	16,000	16,000	16,000	16,000
RX Antenna System	1	20,000	20,000	20,000	20,000
Installation	1	100,000	100,000	100,000	100,000
			316,000		436,000

4 DATA BASE STN					
Data Base Station	4	60,000	240,000	100,000	400,000
TX Antenna System	1	18,000	18,000	18,000	18,000
RX Antenna System	1	22,000	22,000	22,000	22,000
Installation	1	100,000	100,000	100,000	100,000
			380,000		540,000
CONTROL STATION					
Control Station	1	6,000	6,000	6,000	6,000
Antenna System	1	1,100	1,100	1,100	1,100
Remote Control	1	1,500	1,500	1,500	1,500
Installation	1	5,000	5,000	20,000	20,000
			13,600		28,600

Appendix F - Frequency Pool Licensed to ICIS Member Cities

470 MHz to 512 MHz (duplicates removed)

Glendale:			
WIJ366:	470.0875	473.0875	Wideband (WB)
	470.3625	473.3625	WB
	482.0500	485.0500	Narrowband (NB)
	482.0875	485.0875	WB
	482.1375	485.1375	WB
	482.1875	485.1875	WB
	482.2375	485.2375	WB
	482.2875	485.2375	WB
	482.3875	485.3875	WB
	482.4875	485.4875	WB
	482.5875	485.5875	WB
	484.1875	487.1875	WB
	484.2625	487.2625	WB
WPPG590:	470.6250	473.6250	NB
WPPV641:	484.2750	487.2750	NB
WPYN326:	482.0625	485.0625	WB
	482.1625	485.1625	WB
	482.2625	485.2625	WB
	482.3625	485.3625	WB
	482.4625	485.4625	WB
	482.5625	485.5625	WB
Burbank:			
WIK334:	470.0625	473.0625	WB
	470.1125	473.1125	WB
	470.1375	473.1375	WB
	470.1625	473.1625	WB
	470.1875	473.1875	WB
	470.2125	473.2125	WB
	470.2375	473.2375	WB
	470.2625	473.2625	WB
	470.2875	473.2875	WB
	470.3250	473.3250	NB
	471.0750	474.0750	NB
	482.0250	485.0250	NB
WPCS810:	471.0500	474.0500	NB

Burbank (cont'd):			
WPYW272:	470.1500	473.1500	NB
	470.1750	473.1750	NB
	470.2000	473.2000	NB
	470.2250	473.2250	NB
	470.2500	473.2500	NB
	470.2750	473.2750	NB
	470.3000	473.3000	NB
Culver City:			
WPRS450:	484.2500	487.2500	NB
Montebello:			
WIJ365:	482.0375	485.0375	WB
	482.1125	485.1125	WB
	482.2125	485.2125	WB
	482.3125	485.3125	WB
	482.4125	485.4125	WB
	482.5125	485.5125	WB
	482.6125	485.6125	WB
WIM618:	482.1500	485.1500	NB
WPLW595:	482.2750	485.2750	NB
	482.3750	485.3750	NB
	482.4750	485.4750	NB
Torrance:			
WIK591:	482.4250	485.4250	NB
	482.5000	485.5000	NB
	482.6000	485.6000	NB
	506.1375	509.1375	WB
	506.1625	509.1625	WB
	506.1875	509.1875	WB
	506.2125	509.2125	WB
	506.2375	509.2375	WB
	506.2625	509.2625	WB
	506.2875	509.2875	WB
	506.5000	509.5000	NB
WQAY282:	506.1500	509.1500	NB
	506.2500	509.2500	NB

Pomona:			
WPPW580	470.0250	473.0250	NB
	470.0750	473.0750	NB
	470.1000	473.1000	NB
Beverly Hills:			
WPML947:	470.3750	473.3750	NB
	482.2250	485.2250	NB
	482.4000	485.4000	NB
	482.6250	485.6250	NB
El Segundo:			
KDA209:	470.3875	473.3875	WB
	470.6375	473.6375	WB
	471.1125	474.1125	WB
WQAD318:	471.3375	474.3375	WB
	472.5375	475.5375	WB

UHF TOTALS: 46 Wideband (92 Narrowband equiv.)
32 Narrowband

124 Narrowband Frequency Pairs

Note: Licensees may be currently operating in wideband mode on an interstitial frequency (last digit is a "0"). Interstitial frequencies are classified as narrowband as they are not eligible to be split.

806 MHz to 869 MHz

Glendale:		
KNFU724:	814.2375	859.2375
Burbank:		
KNNM483:	810.7375	855.7375
Montebello:		
KNGD850:	814.2625	859.2625
WQP500:	809.9875	854.9875

Torrance:			
WNRE795:	812.2625	857.2625	
WXD691:	808.5125	853.5125	
Beverly Hills:			
WNVF964:	823.8375	868.8375	NPSPAC
800 MHz TOTAL:		7 frequency pairs	

Appendix G - Frequency Pool Licensed to Other Cities

470 MHz to 512 MHz (duplicates removed)

Alhambra:			
KWT671:	471.0125	474.0125	WB
	471.1000	474.1000	NB
	471.1375	474.1375	WB
Arcadia:			
KXC723:	506.5625	509.5625	WB
KXN419:	507.0625	510.0625	WB
WPMW764	506.4000	509.4000	NB
Baldwin Park:			
WQEI900:	506.1750	509.1750	NB
	506.2750	509.2750	NB
City of Industry:			
WPTM688:	506.4125	509.4125	WB
Claremont:			
KXC905:	506.1500	509.1500	NB
	506.2500	509.2500	NB
	506.3875	509.3875	WB
Compton:			
WPRJ330:	506.5250	509.5150	NB
	506.5500	509.5500	NB
	506.6750	509.6750	NB
Compton Unified School District Police:			
WIL353:	470.1625	473.1625	WB
Downey:			
WIM839:	471.0250	474.0250	NB
	482.4500	485.4500	NB
El Monte:			
KBY750:	470.7125	473.7125	WB
	470.9625	473.9625	WB
Hermosa Beach:			
KDA240:	470.1875	473.1875	WB

La Mirada:			
KUU520 & WDD499:			
	471.0375	474.0375	WB
La Verne:			
WIL293:	482.2500	485.2500	NB
	482.5750	485.5750	NB
WIL702:	482.0750	485.0750	NB
	506.2125	509.2125	WB
Manhattan Beach:			
KUY444:	470.3875	473.3875	WB
Palmdale:			
WIG515:	470.3375	473.3375	WB
	471.0375	474.0375	WB
Palos Verdes Estates:			
WPXB573:	506.3750	509.3750	NB
Pasadena:			
WIJ442:	482.3375	485.3375	WB
	482.4375	485.4375	WB
	482.5375	485.5375	WB
	482.6375	485.6375	WB
WIL549:	506.2000	509.2000	NB
	506.2250	509.2250	NB
Santa Clarita:			
WIL591:	471.0000	474.0000	NB
	471.0250	474.0250	NB
	471.1250	474.1250	NB
Simi Valley:			
WQDH479:	471.1125	474.1125	NB
	471.1375	474.1375	NB
	482.2125	485.2125	NB
	482.4125	485.4125	NB
	482.6125	485.6125	NB

South Bay Regional Public Communications Authority:			
KDL483:	470.3125	473.3125	WB
	470.3875	473.3875	WB
	470.6375	473.6375	WB
	470.8125	473.8125	WB
WPMN535:	470.0125	473.0125	WB
	470.0375	473.0375	WB
	506.0125	509.0125	WB
	506.0375	509.0375	WB
South Pasadena:			
KVF692:	470.9875	473.9875	WB
West Covina:			
KYO871:	506.3375	509.3375	WB
	506.5125	509.5125	WB
KYO872:	506.4875:	509.4875	WB
Whittier:			
KBQ770:	470.1125	473.1125	WB

UHF TOTALS 32 Wideband
25 Narrowband

806 MHz to 869 MHz

Arcadia:		
WNZB824:	823.6375	868.6375
Downey:		
WNZX991:	823.9125	868.9125
Inglewood:		
WNMA484:	810.9875	855.9875
Pasadena:		
WNVF960:	821.5625	866.5125
Redondo Beach:		
KNCD499:	810.7375	855.7375
	810.9625	855.9625
WPNW552:	813.3375	858.3375

Signal Hill:		
WNVG202:	823.6125	868.6125
	823.9375	868.9375
WPSD861:	811.2875	856.2875
	812.2875	857.2875
	813.2875	858.2875
South Bay Regional Public Communications Authority:		
KNCD500:	810.2375	855.2375
West Covina:		
WNNF953:	810.4875	855.2375
800 MHz TOTAL:		14 frequency pairs

Appendix H - Other Regional/Large Municipal Radio Systems

Jurisdiction	St.	No. of Users	Freq. Pairs	Sites	Freq. Band	Area (mi^2)
City of Austin/Travis County	TX	10,000	120		800	989
City of San Antonio/Bexar County	TX	6,500	108	13	800	1,265
Harris County	TX	20,000	164	18	800	1,729
City of Richmond/Henrico Co./Chesterfield Co.	VA		74	14	800	
Commonwealth of Pennsylvania	PA	25,000		300+	800	45,000
City of Philadelphia	PA	6,000	35	10	800	
County of Orange	CA	15,000	86	23	800	
County of San Diego	CA	16,000	153	50	800	4,500
County of San Bernardino	CA	15,000		22	800	
City of Seattle/King County	WA	13,500	96	28	800	2,200
Minneapolis/Hennepin, Carver, Anoka Cos.	MN			36	800	

Appendix I - Minnesota Statutes Authorizing the Metropolitan Radio Board

403.20 System name.
The statewide, shared, trunked radio and communication system established under section 403.36 may be referred to as "Allied Radio Matrix for Emergency Response" or "ARMER."

HIST: 2004 c 201 s 1

403.21 Definitions.

Subdivision 1. Applications. The definitions in this section apply to sections 403.21 to 403.40.

Subd. 2. Board. "Board" or "radio board" or "Metropolitan Radio Board" means the Metropolitan Radio Board or its successor regional radio board.

Subd. 3. First phase. "First phase" or "first phase of the regionwide public safety radio communication system" means the initial backbone which serves the following nine-county metropolitan area: Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, and Washington Counties.

Subd. 4. Local elected officials. "Local elected officials" means any elected official of a local government.

Subd. 5. Local government. "Local government" means any county, home rule charter or statutory city, or town.

Subd. 6. NPSPAC channels. "NPSPAC channels" or "National Public Safety Planning Advisory Committee channels" means the following 800 megahertz channels: 821 to 824 and 866 to 869 megahertz.

Subd. 7. Plan. "Plan" or "regionwide public safety radio system communication plan" means the plan adopted by the Metropolitan Radio Board for a regionwide public safety radio communications system.

Subd. 8. Subsystems. "Subsystems" or "public safety radio subsystems" means systems identified in the plan or a plan developed under section 403.36 as subsystems interconnected by the system backbone and operated by the Metropolitan Radio Board, a regional radio board, or local government units for their own internal operations.

Subd. 9. System backbone. "System backbone" or "backbone" means a public safety radio communication system that consists of a shared, trunked, communication, and interoperability infrastructure network, including, but not limited to, radio towers and associated structures and equipment, the elements of which are identified in the regionwide public safety radio communication system plan under section 403.23, Subdivision 6, and the statewide radio communication plan under section 403.36.

Subd. 10. Second phase. "Second phase" means the enhancement of the phase one backbone by local government units building subsystems in the metropolitan area that did not build their own subsystems in the first phase.

Subd. 11. Third phase. "Third phase" means an extension of the backbone system to serve the southeast and central districts of the State Patrol.

Subd. 12. Greater Minnesota. "Greater Minnesota" means the area of the state outside the nine-county metropolitan area served by the first phase.

Subd. 13. Regional radio board. "Regional radio board" or "regional board" means a regional radio board established under section 403.39.

HIST: 1995 c 195 art 1 s 2; 2002 c 401 art 1 s 4,5; 1Sp2003 c 1 art 2 s 113,114,135; 2004 c 201 s 2-10; 2005 c 136 a 10 s 16

403.22 Board; membership, administration.

Subdivision 1. General. The Metropolitan Radio Board is established as a political subdivision with jurisdiction in the counties of Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, and Washington. The board shall be organized, structured, and administered as provided in this section. Until funds to administer the board become available under section 403.23, subdivision 19, the Metropolitan Council shall provide office space and administrative support to the board at no cost.

Subd. 2. Membership. (a) The board consists of 21 members. Seventeen members shall be local officials and shall include:

(1) one county commissioner appointed by each respective county board from each of the counties in the board's jurisdiction;

(2) an elected official from each of the cities of Minneapolis, St. Paul, and Bloomington appointed by each respective city governing body;

(3) two elected officials from other metropolitan cities appointed by the governor, who shall consider recommendations made by the Association of Metropolitan Municipalities when making these appointments;

(4) an elected official from a county or a city within a county in Minnesota that is contiguous to the metropolitan area appointed by the governor, who shall consider recommendations made by the League of Minnesota Cities when making this appointment;

(5) a sheriff appointed by the governor, who shall consider recommendations made by the Metropolitan Sheriffs Association when making this appointment; and

(6) a police chief appointed by the governor, who shall consider recommendations made by the Minnesota Police Chiefs Association when making this appointment.

The 18th member shall be a member of the Metropolitan Council appointed by the council. The 19th member shall be the director of electronic communications of the Minnesota Department of Transportation. The 20th member shall be the commissioner of public safety, or a designee of the commissioner. As provided in section 403.23, subdivision 20, the chair of the Technical Operations Committee serves as the 21st member of the board.

(b) The members shall be appointed within 30 days of the effective date of Laws 1995, chapter 195. Upon the effective date of Laws 1995, chapter 195, the Metropolitan Council shall inform the entities listed in this subdivision of the appointments required by

this subdivision and shall provide whatever assistance is necessary to facilitate the appointment process and establish the radio board.

(c) Board members have no set term and remain on the board until a successor is appointed as provided by this subdivision. However, with respect to those board members who, under this subdivision, must be elected officials, a successor must be appointed as provided by this subdivision no later than the date that a member is no longer an elected official, unless the member dies while in office, in which case a successor must be named as soon as practicable.

Subd. 3. Officers. The officers of the board are: chair; vice-chair; secretary; and treasurer. The chair shall preside at all meetings of the board, and in the chair's absence, the vice-chair shall preside. The secretary shall keep a complete record of the minutes of each meeting. The treasurer shall keep the financial records of the board. The chair and vice-chair of the board shall be selected by a majority vote from the members of the board. The secretary and treasurer need not be members of the board.

Subd. 4. Contracts. Contracts and other written instruments of the board shall be signed by the chair or vice-chair and if the board has an executive director, by the executive director of the board pursuant to authority from the board.

Subd. 5. Bylaws. The board shall conduct its business in accordance with bylaws duly adopted by a majority of the board.

Subd. 6. Voting. Each member has one vote. The majority of the voting power of the board constitutes a quorum although a smaller number may adjourn from time to time. Any motion, other than adjournment, shall be favored by a majority of the voting power of the board in order to carry.

HIST: 1995 c 195 art 1 s 3; 1Sp2003 c 1 art 2 s 135; 2004 c 201 s 11,12

403.23 Powers of the board.

Subdivision 1. General. The board has the powers necessary and convenient to discharge the duties imposed on it by law, including those listed in this section.

Subd. 2. Planning. (a) The board shall review and, within 90 days of the effective date of Laws 1995, chapter 195, adopt the regionwide public safety radio system communication plan prepared by the Metropolitan Radio Systems Planning Committee pursuant to Laws 1993, chapter 313, section 3, subdivision 2, for using the 800 megahertz and other frequencies available for public safety use. The plan must include, at a minimum:

(1) a system design recommended by the Minnesota commissioner of transportation for the first phase consisting of a shared regionwide infrastructure network;

(2) a system design for subsequent phases; and

(3) a plan for assignment of frequencies to the regional network and to each subsystem.

(b) No later than 30 days prior to adoption of the plan by the board, the board shall submit the plan to the Metropolitan Council for review in accordance with section 473.165, clause (1). The council may make comments to the board about the plan in accordance with section 473.165, clause (2), except that the deadline for comments shall be made within 30 days after submission of the plan to the council.

(c) If, within the 30-day review period, the council has made no comment on the plan or has made no findings as provided in section 473.165, clause (2), the plan shall go into effect as of the date of adoption by the board.

(d) If, within the 30-day review period, the council has made findings as provided in section 473.165, clause (2), the board and the council shall follow the procedure provided in section 473.165, clause (2). The board may adopt revisions to the plan in the same manner as is provided in this subdivision for adoption of the plan.

Subd. 3. Application to FCC. Within 180 days from adoption of the regionwide public safety radio system communication plan, the commissioner of transportation, on behalf of the state of Minnesota, shall use the plan adopted by the board under subdivision 2 to submit an extended implementation application to the Federal Communications Commission (FCC) for the NPSPAC channels and other public safety frequencies available for use in the metropolitan area and necessary to implement the plan. Local governments and all other public or private entities eligible under part 90 of the FCC rules shall not apply for public safety channels in the 821 to 824 and 866 to 869 megahertz bands for use within the metropolitan counties until the FCC takes final action on the regional application submitted under this section. Exceptions to the restrictions on the application for the NPSPAC channels may be granted by the board. The Minnesota Department of Transportation shall hold the master system licenses for all public safety frequencies assigned to the first phase under the board's plan and these channels must be used for the implementation of the plan. The board shall hold the master system licenses for the public safety frequencies assigned to local government subsystems under the board's plan and these channels must be used for implementation of the plan. Upon approval by the board of a local government's subsystem plan and evidence of a signed contract with a vendor for construction of a subsystem consistent with the board's system plan, the board shall apply to the FCC to transfer to the local government the licenses for the public safety frequencies assigned by the plan for use in the network infrastructure owned by the local government. The board, the commissioner of the Minnesota Department of Transportation, and local subsystem owners shall jointly colicense all subscriber equipment for the system backbone.

Subd. 4. Plan implementation. The board shall supervise the implementation of the regionwide public safety radio system communication plan adopted under subdivision 2 and must ensure that the system is built, owned, operated, and maintained in accordance with the plan. The board will work with the region 22 NPSPAC committee to incorporate the board's adopted plan into federal communication system regulations.

Subd. 5. Required minimum level of service for local governments. Subject to system capacity and channel availability, the board shall ensure that all local governments, quasipublic service operations, and private entities in the metropolitan counties that are eligible to use radio frequencies reserved for public safety use have adequate communications capacity and intercommunications capability.

Subd. 6. Backbone and subsystems. In the regionwide public safety radio system communication plan, the board shall define the backbone consistent with the recommendations made by the commissioner of transportation and the subsystems of the system, the timing and phasing of system development, the geographic scope of the

system, the timing and extent of participation in the system including participation by additional entities, and standards for system performance. System performance standards shall be developed in consultation with the commissioner of transportation. The initial backbone shall serve state and regional agencies and shall include capabilities for regionwide mutual aid and emergency medical services communications and potentially provide alternative routing for 911 services.

Subd. 7. Existing channel allocation. The board shall coordinate allocation of existing radio channels made available to the board by conversion to 800 megahertz or other public safety frequencies.

Subd. 8. Cost apportionment. The board shall determine how capital, operating, and administrative costs of the first phase system will be spread across users of the regionwide public safety radio communication system, including costs for additional participants.

Subd. 9. Excess capacity allocation. The board shall determine how excess capacity provided in the initial system design in the regionwide public safety radio communication system will be allocated.

Subd. 10. System enhancement regulation. The board shall determine the extent to which local governments, quasi-public service corporations, and private entities eligible to use the system may provide system enhancements at their own direct expense.

Subd. 11. Standards. The board is authorized to set or adopt performance and technical standards for operation of the backbone and subsystems and may modify standards as necessary to meet changing needs.

Subd. 12. Use priorities. The board shall establish priorities or protocols for use of the system.

Subd. 13. First phase construction. In order to implement the first phase backbone, the board shall contract with the state of Minnesota, through the commissioner of transportation for construction, ownership, operation, maintenance, and enhancement of these elements of the first phase backbone as defined in the plan. The commissioner, under appropriate state law, shall contract for, or procure by purchase or lease (including joint purchase and lease agreements), construction, installation of materials, supplies and equipment, and other services as may be needed to build, operate, and maintain the first phase system network. In accordance with the terms of the contract entered into with the radio board under this subdivision, the Department of Transportation will own, operate, and maintain those elements identified by the radio board in the plan as the first phase. The state will finance and pay for its share of the first phase.

Subd. 14. Executive director. The board may employ and fix the duties and compensation of an executive director who shall supervise the implementation of the plan including the design, ownership, construction, and operation of the first phase system and shall administer the business affairs of the board. The executive director is eligible for membership in the Minnesota State Retirement System. Until funds to administer the board become available under subdivision 19, the Metropolitan Council shall provide to the board an executive director who will be a staff member of the council. The executive director shall serve at the pleasure of the board.

Subd. 15. System use by nongovernmental entities. The board may contract with entities in the metropolitan counties eligible to use the public safety channels other than local governments, to provide them with public safety radio communication service. The board may contract with eligible jurisdictions and entities outside the metropolitan counties for inclusion in the regionwide public safety radio communication system.

Subd. 16. Minutes of board meetings. The board shall keep proper minutes of all its proceedings which shall be open to public inspection at all reasonable times.

Subd. 17. Accounting. The board shall keep proper and adequate books of accounts showing all its receipts and disbursements by date, source, and amount. The board must be audited at least once each year. The board may elect to be audited by a certified public accountant or by the state auditor.

Subd. 18. Insurance. The board may obtain suitable, proper, and adequate public liability and workers' compensation insurance and other insurance as it deems necessary, including but not limited to, insurance against the liability of the board or its officers and employees for personal injury or death and property damage or destruction, with the force and effect stated in chapter 466, and against risks of damage to or destruction of any of its facilities, equipment, or other property.

Subd. 19. User fees. In accordance with the plan authorized in subdivision 2, the board may establish and impose user fees on entities using the first phase system to cover the board's costs of implementing the plan and the costs of operating the first phase system in the metropolitan area. The Metropolitan Council will collect the user fees.

Subd. 20. Technical Operations Committee. The board shall establish a Technical Operations Committee composed of representatives of the following functional categories to advise it in carrying out its purposes:

(1) Minnesota Department of Public Safety;

(2) Minnesota Department of Transportation;

(3) sheriffs;

(4) police;

(5) fire protection;

(6) emergency medical service;

(7) public works;

(8) civil defense;

(9) Metro 911 Telephone Board;

(10) entities using 800 megahertz prior to initiation of the regional system;

(11) managers or purchasing agents possessing expertise from a general perspective;

(12) representatives of local units of government; and

(13) regionwide public safety radio communication system users.

The members of the Technical Operations Committee serve without compensation. The chair of the Technical Operations Committee is an ex officio member of the radio board.

Subd. 21. Contracts. The board may enter into contracts necessary to carry out its responsibilities.

Subd. 22. Property. The board may acquire by purchase, lease, gift, or grant, property, both real and personal, and interests in property necessary for the accomplishment of its purposes and may sell or otherwise dispose of property which it no longer requires.

Subd. 23. Gifts; grants. The board may apply for, accept, and disburse gifts, grants, or loans from the United States, the state, or from any person for any of its purposes. It may enter into an agreement required for the gifts, grants, or loans and may hold, use, and dispose of money or property received according to the terms of the gift, grant, or loan.

Subd. 24. Authority to litigate. The board may sue and be sued.

HIST: 1995 c 195 art 1 s 4; 1996 c 463 s 46; 1997 c 143 s 17; 1997 c 202 art 3 s 28; 1Sp2003 c 1 art 2 s 135; 2004 c 201 s 13

403.24 Adverse interests of board members.

As provided in section 471.87, no member of the board shall have any personal or financial interest in any sale, lease, or other contract made by the board. Any violation of section 471.87 may make the sale, lease, or other contract voidable by the board. Upon conviction for a violation of section 471.87, a board member is automatically disqualified from further service on the board.

HIST: 1995 c 195 art 1 s 5; 1Sp2003 c 1 art 2 s 135

403.25 Compensation of board members.

Subdivision 1. Per diem and expenses. Except as provided in subdivision 2, and unless otherwise prohibited by law, each board member of the radio board shall be reimbursed for actual and necessary expenses incurred in the performance of duties. The chair shall be paid a per diem in the same amount as is provided in section 15.0575, subdivision 3, for attending meetings, monthly, executive, and special, and board members shall be paid a per diem in the same amount as is provided in section 15.0575, subdivision 3, for attending meetings, monthly, executive, and special. A board member who receives a per diem from the board member's county or city shall not be paid a per diem for the same day by the board for attending meetings of the board. The annual budget of the board shall provide, as a separate account, anticipated expenditures for per diem, travel, and associated expenses for the chair and members, and compensation or reimbursement shall be made to the chair or members only when budgeted.

Subd. 2. Limitation. A board member whose annual public salary is $25,000 or more shall only be reimbursed for expenses related to travel.

HIST: 1995 c 195 art 1 s 6; 1Sp2003 c 1 art 2 s 135

403.26 Finance.

Subdivision 1. Budget preparation; review and approval. (a) The board shall prepare a proposed budget by August 1 of each year. The budget shall include operating revenues

and expenditures for operation, administration, and maintenance. In addition, the budget must show for each fiscal year of the state biennium:

(1) the estimated operating revenues from all sources including funds on hand at the beginning of the year, and estimated expenditures for costs of operation, administration, maintenance, and debt service;

(2) capital improvement funds estimated to be on hand at the beginning of the year and estimated to be received during the year from all sources and estimated cost of capital improvements to be paid out or expended during the year, all in such detail and form as the council may prescribe; and

(3) the estimated source and use of pass-through funds.

(b) As early as practicable before August 15 of each year, the board shall hold a public hearing on a draft of the proposed budget. Along with the draft, the board shall publish a report on user charges. The report must include an estimated analysis of the changes in user charges, rates, and fees that will be required by the board's budget. Not less than 14 days before the hearing, the board shall publish notice of the hearing in a newspaper having general circulation in the metropolitan area, stating the date, time, and place of hearing, and the place where the proposed budget and report on user charges may be examined by any interested person.

(c) Following the hearing, the board shall publish a report of the hearing that summarizes the comments received and board's response. The council shall approve or disapprove the entire budget by October 1 of each year. The council may disapprove only if the budget does not have adequate reserves to meet debt service. If the council disapproves the budget in accordance with this subdivision, the board shall, by November 1, resubmit to the council for approval, a budget which meets the requirements for council approval as provided in this subdivision. The council shall approve or disapprove the entire resubmitted budget by December 1.

(d) Before December 15 of each year, the board shall, by resolution, adopt a final budget. The board shall file its final budget with the council on or before December 20 of each year. The council shall file the budgets with the secretary of the senate and the clerk of the house of representatives not later than January 1 of each year. Before adoption, the board must submit any budget amendment which would affect debt service reserves to the council for review. The council has 15 days to approve or disapprove the amendment. The council shall disapprove the budget amendment only if the budget does not have adequate reserves to meet debt service.

(e) Except in an emergency, for which procedures must be established by the board, the board and its officers, agents, and employees may not spend money for any purpose, other than debt service, without an appropriation by the board, and no obligation to make such an expenditure shall be enforceable except as the obligation of the person or persons incurring it. The creation of any debt obligation or the receipt of any federal or state grant is a sufficient appropriation of the proceeds for the purpose for which it is authorized, and of the tax or other revenues pledged to pay the obligation and interest on it whether or not specifically included in any annual budget. After obtaining the approval of the council, the board may amend the budget at any time by transferring any appropriation from one

purpose to another, except appropriations of the proceeds of bonds issued for a specific purpose. The council shall disapprove only if the amended budget does not have adequate reserves to meet debt service.

Subd. 2. Program evaluation. The budget procedure of the board must include a substantive assessment and evaluation of the effectiveness of each significant part of the regionwide public safety radio communication system implementation plan adopted by the board with, to the extent possible, quantitative information on the status, progress, costs, benefits, and effects of each program. The board shall transmit the evaluation to the Metropolitan Council annually.

Subd. 3. Council report to legislature. Biennially the council shall submit a report to the legislature detailing the board's activities and finances for the previous year, the extent to which the system has been expanded beyond the metropolitan area, and the appropriateness of transferring responsibility for the Metropolitan Radio Board to a state agency.

Subd. 4. Resale of services or capacity prohibited. Neither the council, the board, or any local government unit may resell any service or capacity of this system to a nonpublic entity, except for those private entities eligible to hold Federal Communications Commission licenses in the public safety and special emergency radio services, as defined in Code of Federal Regulations, title 47, part 90 (1994).

HIST: 1995 c 195 art 1 s 7; 1Sp2003 c 1 art 2 s 135

403.27 Revenue bonds; obligations.

Subdivision 1. Authorization. After consulting with the commissioner of finance, the council, if requested by a vote of at least two-thirds of all of the members of the Metropolitan Radio Board, may, by resolution, authorize the issuance of its revenue bonds for any of the following purposes to:

(1) provide funds for regionwide mutual aid and emergency medical services communications;

(2) provide funds for the elements of the first phase of the regionwide public safety radio communication system that the board determines are of regionwide benefit and support mutual aid and emergency medical services communication including, but not limited to, costs of master controllers of the backbone;

(3) provide money for the second phase of the public safety radio communication system;

(4) to the extent money is available after meeting the needs described in clauses (1) to (3), provide money to reimburse local units of government for amounts expended for capital improvements to the first phase system previously paid for by the local government units; or

(5) refund bonds issued under this section.

Subd. 2. Procedure. The bonds shall be sold, issued, and secured in the manner provided in chapter 475 for bonds payable solely from revenues, except as otherwise provided in sections 403.21 to 403.34 and the council shall have the same powers and duties as a municipality and its governing body in issuing bonds under chapter 475. The bonds may

be sold at any price and at public or private sale as determined by the council. The bonds shall be payable from and secured by a pledge of the emergency telephone service fee provided in chapter 403 and shall not represent or constitute a general obligation or debt of the council and shall not be included in the net debt of any city, county, or other subdivision of the state for the purpose of any debt limitation.

Subd. 3. Limitations. (a) The principal amount of the bonds issued pursuant to subdivision 1, exclusive of any original issue discount, shall not exceed the amount of $10,000,000 plus the amount the council determines necessary to pay the costs of issuance, fund reserves, debt service, and pay for any bond insurance or other credit enhancement.

(b) In addition to the amount authorized under paragraph (a), the council may issue bonds under subdivision 1 in a principal amount of $3,306,300, plus the amount the council determines necessary to pay the cost of issuance, fund reserves, debt service, and any bond insurance or other credit enhancement. The proceeds of bonds issued under this paragraph may not be used to finance portable or subscriber radio sets.

Subd. 4. Security. The bonds may be secured by a bond resolution or a trust indenture entered into by the council with a corporate trustee within or outside the state which shall define the fee pledged for the payment and security of the bonds and for payment of all necessary and reasonable debt service expenses until all the bonds referred to in subdivision 1 are fully paid or discharged in accordance with law. The pledge shall be a valid charge on the emergency telephone service fee provided in chapter 403. No mortgage of or security interest in any tangible real or personal property shall be granted to the bondholders or the trustee, but they shall have a valid security interest in the revenues and bond proceeds received by the council and pledged to the payment of the bonds as against the claims of all persons in tort, contract, or otherwise, irrespective of whether the parties have notice and without possession or filing as provided in the Uniform Commercial Code, or any other law, subject however to the rights of the holders of any general obligation bonds issued under section 403.32. In the bond resolution or trust indenture, the council may make covenants as it determines to be reasonable for the protection of the bondholders. Neither the council, nor any council member, officer, employee, or agent of the council, nor any person executing the bonds shall be liable personally on the bonds by reason of their issuance. The bonds are not payable from, and are not a charge upon, any funds other than the revenues and bond proceeds pledged to their payment. The council is not subject to any liability on the bonds and has no power to obligate itself to pay or to pay the bonds from funds other than the revenues and bond proceeds pledged. No holder of bonds has the right to compel any exercise of the taxing power of the council, except any deficiency tax levy the council covenants to certify under section 403.31, or any other public body, to the payment of principal of or interest on the bonds. No holder of bonds has the right to enforce payment of principal or interest against any property of the council or other public body other than that expressly pledged for the payment of the bonds.

HIST: 1995 c 195 art 1 s 8; 1999 c 248 s 12; 2002 c 401 art 1 s 6,7; 2003 c 127 art 12 s 21; 1Sp2003 c 1 art 2 s 115,116,135; 1Sp2003 c 21 art 10 s 11; 2004 c 201 s 14; 2005 c 136 a 10 s 17- 18

403.275 State 911 revenue bonds.

Subdivision 1. Bonding authority. (a) The commissioner of finance, if requested by a vote of at least two-thirds of all the members of the Statewide Radio Board, shall sell and issue state revenue bonds for the following purposes:

(1) to pay the costs of the statewide public safety radio communication system backbone identified in the plan under section 403.36 and those elements that the Statewide Radio Board determines are of regional or statewide benefit and support mutual aid and emergency medical services communication, including, but not limited to, costs of master controllers of the backbone;

(2) to pay the costs of issuance, debt service, and bond insurance or other credit enhancements, and to fund reserves; and

(3) to refund bonds issued under this section.

(b) The amount of bonds that may be issued for the purposes of clause (1) will be set from time to time by law; the amount of bonds that may be issued for the purposes of clauses (2) and (3) is not limited.

(c) The bond proceeds may be used to to pay up to 50 percent of the cost to a local government unit of building a subsystem. The bond proceeds may be used to make improvements to an existing 800 MHz radio system that will interoperate with the regionwide public safety radio communication system, provided that the improvements conform to the Statewide Radio Board's plan and technical standards. The bond proceeds may not be used to pay for portable or subscriber radio sets.

Subd. 2. Procedure. (a) The commissioner may sell and issue the bonds on the terms and conditions the commissioner determines to be in the best interests of the state. The bonds may be sold at public or private sale. The commissioner may enter any agreements or pledges the commissioner determines necessary or useful to sell the bonds that are not inconsistent with sections 403.21 to 403.40. Sections 16A.672 to 16A.675 apply to the bonds. The proceeds of the bonds issued under this section must be credited to a special 911 revenue bond proceeds account in the state treasury.

(b) Before the proceeds are received in the 911 revenue bond proceeds account, the commissioner of finance may transfer to the account from the 911 emergency telecommunications service account amounts not exceeding the expected proceeds from the next bond sale. The commissioner of finance shall return these amounts to the 911 emergency telecommunications service account by transferring proceeds when received. The amounts of these transfers are appropriated from the 911 emergency telecommunications service account and from the 911 revenue bond proceeds account.

Subd. 3. Revenue sources. The debt service on the bonds is payable only from the following sources:

(1) revenue credited to the 911 emergency telecommunications service account from the fee imposed and collected under section 237.491 or 403.11, subdivision 1, or from any other source; and

(2) other revenues pledged to the payment of the bonds.

Subd. 4. Refunding bonds. The commissioner may issue bonds to refund outstanding bonds issued under subdivision 1, including the payment of any redemption premiums on

the bonds and any interest accrued or to accrue to the first redemption date after delivery of the refunding bonds. The proceeds of the refunding bonds may, in the discretion of the commissioner, be applied to the purchases or payment at maturity of the bonds to be refunded, or the redemption of the outstanding bonds on the first redemption date after delivery of the refunding bonds and may, until so used, be placed in escrow to be applied to the purchase, retirement, or redemption. Refunding bonds issued under this subdivision must be issued and secured in the manner provided by the commissioner.

Subd. 5. Not a general or moral obligation. Bonds issued under this section are not public debt, and the full faith, credit, and taxing powers of the state are not pledged for their payment. The bonds may not be paid, directly in whole or in part from a tax of statewide application on any class of property, income, transaction, or privilege. Payment of the bonds is limited to the revenues explicitly authorized to be pledged under this section. The state neither makes nor has a moral obligation to pay the bonds if the pledged revenues and other legal security for them is insufficient.

Subd. 6. Trustee. The commissioner may contract with and appoint a trustee for bond holders. The trustee has the powers and authority vested in it by the commissioner under the bond and trust indentures.

Subd. 7. Pledges. Any pledge made by the commissioner is valid and binding from the time the pledge is made. The money or property pledged and later received by the commissioner is immediately subject to the lien of the pledge without any physical delivery of the property or money or further act, and the lien of any pledge is valid and binding as against all parties having claims of any kind in tort, contract, or otherwise against the commissioner, whether or not those parties have notice of the lien or pledge. Neither the order nor any other instrument by which a pledge is created need be recorded.

Subd. 8. Bonds; purchase and cancellation. The commissioner, subject to agreements with bondholders that may then exist, may, out of any money available for the purpose, purchase bonds of the commissioner at a price not exceeding (1) if the bonds are then redeemable, the redemption price then applicable plus accrued interest to the next interest payment date thereon, or (2) if the bonds are not redeemable, the redemption price applicable on the first date after the purchase upon which the bonds become subject to redemption plus accrued interest to that date.

Subd. 9. State pledge against impairment of contracts. The state pledges and agrees with the holders of any bonds that the state will not limit or alter the rights vested in the commissioner to fulfill the terms of any agreements made with the bondholders, or in any way impair the rights and remedies of the holders until the bonds, together with interest on them, with interest on any unpaid installments of interest, and all costs and expenses in connection with any action or proceeding by or on behalf of the bondholders, are fully met and discharged. The commissioner may include this pledge and agreement of the state in any agreement with the holders of bonds issued under this section.

HIST: 2005 c 136 a 10 s 19

403.28 Depositories.

The Metropolitan Council shall, from time to time, designate one or more national or state banks, or trust companies authorized to do banking business, as official depositories

for money of the board and shall require the board's treasurer to deposit all or a part of such money in those institutions. The designation shall be in writing and shall set forth all the terms and conditions upon which the deposits are made and shall be signed by the chair and treasurer and made a part of the minutes of the board. Any bank or trust company designated shall qualify as a depository by furnishing a corporate surety bond or collateral in the amounts required by section 118A.03. No bond or collateral shall be required to secure any deposit insofar as it is insured under federal law.

HIST: 1995 c 195 art 1 s 9; 1996 c 399 art 2 s 12; 1Sp2003 c 1 art 2 s 135

403.29 Money; accounts; investments.

Subdivision 1. Treasurer's duties. All money received by the Metropolitan Council under section 403.23, subdivision 19, shall be deposited or invested by the board's treasurer and disposed of as the board may direct in accordance with its budget, provided that any money that has been pledged or dedicated by the Metropolitan Council to the payment of obligations or interest on them or expenses incident to them, or for any other specific purpose authorized by law, shall be paid by the board's treasurer into the fund to which they have been pledged.

Subd. 2. Funds and accounts established. The Metropolitan Council shall establish funds and accounts as may be necessary or convenient to handle the receipts and disbursements of the board in an orderly fashion.

Subd. 3. Depositories; investments. The money on hand in the funds and accounts may be deposited in the official depositories of the Metropolitan Council or invested as provided in this subdivision. The amount not currently needed or required by law to be kept in cash on deposit, may be invested in obligations authorized for the investment of public funds by section 118A.04. The money may also be held under certificates of deposit issued by any official depository of the Metropolitan Council.

Subd. 4. Use of bond proceeds. The use of proceeds of all bonds issued by the Metropolitan Council for the purposes enumerated in section 403.27, subdivision 1, other than investment of all money on hand in any sinking fund or funds of the council, shall be governed by the provisions of chapter 475, the provisions of resolutions authorizing the issuance of the bonds, and by the trust indenture.

HIST: 1995 c 195 art 1 s 10; 1996 c 399 art 2 s 10; 1Sp2003 c 1 art 2 s 135

403.30 Appropriation; transfers; budget.

Subdivision 1. Standing appropriation; costs covered. The amount necessary to pay debt service costs and reserves for bonds issued by the Metropolitan Council under section 403.27 or by the commissioner of finance under section 403.275 is appropriated from the 911 emergency telecommunications service account established under section 403.11 to the commissioner of finance. The commissioner of finance shall transmit the necessary amounts to the Metropolitan Council as requested by the council. This appropriation shall be used to pay annual debt service costs and reserves for bonds issued pursuant to section 403.27 or 403.275 prior to use of fee money to pay other costs or to support other appropriations.

Subd. 2. Radio board budget. The Metropolitan Council shall transmit the annual budget of the radio board to the commissioner of public safety no later than December 15 of each year. The commissioner shall include all eligible costs approved by the radio board for the regionwide public safety communication system in the commissioner's request for legislative appropriations from the 911 emergency telecommunications service fee account.

Subd. 3. Repealed, *2005 c 136 a 10 s 21*

Subd. 4. Implementation of phases three to six. To implement phases three to six of the statewide public safety radio communication system, the commissioner of public safety shall contract with the commissioner of transportation to construct, own, operate, maintain, and enhance the elements of phases three to six identified in the plan developed under section 403.36. The commissioner of transportation, under appropriate state law, shall contract for, or procure by purchase or lease (including joint purchase and lease agreements), construction, installation of materials, supplies and equipment, and other services as may be needed to build, operate, and maintain phases three to six of the system.

HIST: 1Sp2003 c 1 art 2 s 117,135; 2005 c 136 a 10 s 20

403.31 Operating costs.

Subdivision 1. Allocation of operating costs. The current costs of the board in implementing the regionwide public safety radio communication plan system and the first and second phase systems shall be allocated among and paid by the following users, all in accordance with the regionwide public safety radio system communication plan adopted by the board:

(1) the state of Minnesota for its operations using the system in the metropolitan counties;

(2) all local government units using the system; and

(3) other eligible users of the system.

Subd. 2. Payments to radio board; amounts due board when payable. Charges payable to the board by users of the system may be made payable at those times during each year as the board determines, but those dates shall be fixed with reference to the dates on which tax, assessment, and revenue collections become available to the government units required to pay such charges.

Subd. 3. Component municipalities obligations to board. Each local government and other eligible users of the first or second phase system shall pay to the board all sums charged to it under this section, at the times and in the manner determined by the board. The governing body of each local government shall take all action that may be necessary to provide the funds required for these payments and to make them when due.

Subd. 4. Powers of government units. To accomplish any duty imposed on it by the council or radio board, the governing body of every local government in the metropolitan area may exercise the powers granted any municipality by chapters 117, 412, 429, 475, and by sections 115.46, 444.075, and 471.59.

Subd. 5. Deficiency tax levies. If the governing body of any local government using the first or second phase system fails to meet any payment to the board under subdivision 1 when due, the Metropolitan Council may certify to the auditor of the county in which the government unit is located the amount required for payment of the amount due with interest at six percent per year. The auditor shall levy and extend the amount due, with interest, as a tax upon all taxable property in the government unit for the next calendar year, free from any existing limitations imposed by law or charter. This tax shall be collected in the same manner as the general taxes of the government unit, and the proceeds of the tax, when collected, shall be paid by the county treasurer to the board and credited to the government unit for which the tax was levied.

Subd. 6. Operating costs of phases three to six. (a) The ongoing costs of the commissioner in operating phases three to six of the statewide public safety radio communication system shall be allocated among and paid by the following users, all in accordance with the statewide public safety radio communication system plan developed by the planning committee under section 403.36:

(1) the state of Minnesota for its operations using the system;

(2) all local government units using the system; and

(3) other eligible users of the system.

(b) Each local government and other eligible users of phases three to six of the system shall pay to the commissioner all sums charged under this section, at the times and in the manner determined by the commissioner. The governing body of each local government shall take all action that may be necessary to provide the funds required for these payments and to make the payments when due.

HIST: 1995 c 195 art 1 s 12; 2002 c 401 art 1 s 9-11; 1Sp2003 c 1 art 2 s 118,135; 1Sp2003 c 21 art 4 s 11

403.32 Sale of general obligation bonds.

Subdivision 1. Amount; purposes. The Metropolitan Council may by resolution authorize the issuance of general obligation bonds of the council, in an amount outstanding and undischarged at any time not more than $3,000,000, for which its full faith and credit and taxing powers shall be pledged for the council's share of the first phase. The Metropolitan Council may also issue general obligation bonds to refund outstanding obligations issued under this section. The amount of refunding bonds that may be issued from time to time shall not be subject to the dollar limitation contained in this subdivision nor the refunding bonds be included in computing the amount of bonds that may be issued within that dollar limitation.

Subd. 2. Sale, terms, security. The Metropolitan Council shall sell and issue the bonds in the manner provided in chapter 475 and shall have the same powers and duties as a municipality issuing bonds under that law, except that the approval of a majority of the electors shall not be required and the net debt limitations shall not apply. The bonds shall be secured in accordance with section 475.61, subdivision 1, and any taxes required for their payment shall be levied by the council, shall not affect the amount or rate of taxes which may be levied by the council for other purposes, and shall be levied without limitation of rate or amount upon all taxable property in the transit taxing district and transit area as provided in section 473.446, subdivision 1.

Subd. 3. Temporary loans. The Metropolitan Council may, after the authorization of bonds under this section, provide funds immediately required for the purposes of subdivision 1 by effecting temporary loans upon terms as it shall by resolution determine, evidenced by notes due in not exceeding 24 months from their date, payable to the order of the lender or to the bearer, to be repaid with interest from the proceeds of the bonds when issued and delivered to the purchaser. The temporary loans may be made without public advertisement.

HIST: 1995 c 195 art 1 s 13; 1Sp2003 c 1 art 2 s 135

403.33 Local planning.

Subdivision 1. County planning process. (a) No later than two years from May 22, 1995, each metropolitan county shall undertake and complete a planning process for its public safety radio subsystem to ensure participation by representatives of local government units, quasipublic service organizations, and private entities eligible to use the regional public safety radio system and to ensure coordination and planning of the local subsystems. Local governments and other eligible users shall cooperate with the county in its preparation of the subsystem plan to ensure that local needs are met.

(b) The radio board shall encourage the establishment by each metropolitan county of local public safety radio subsystem committees composed of representatives of local governments and other eligible users for the purposes of:

(1) establishing a plan for coordinated and timely use of the regionwide public safety radio system by the local governments and other eligible users within each metropolitan county; and

(2) assisting and advising the board in its implementation of the regional public safety radio plan by identification of local service needs and objectives.

(c) The board shall also encourage the establishment of joint or multicounty planning for the regionwide public safety radio system and subsystems.

(d) The board may provide local boards with whatever assistance it deems necessary and appropriate.

(e) No metropolitan county or city of the first class shall be required to undertake a technical subsystem design to meet the planning process requirements of this subdivision or subdivision 2.

Subd. 2. Cities of first class; planning process. Each city of the first class in the metropolitan counties shall have the option to participate in the county public safety radio subsystem planning process or develop its own plan.

Subd. 3. Submission of plans to board. Each metropolitan county and each city of the first class in the metropolitan area which has chosen to develop its own plan shall submit the plan to the board for the board's review and approval.

Subd. 4. Local government joinder. Local government units, except for cities of the first class, quasi-public service organizations, and private entities eligible to use the regional public safety radio system cannot join the system until its county plan has been approved by the board.

HIST: 1995 c 195 art 1 s 14; 1Sp2003 c 1 art 2 s 135

403.34 Optional local use of regional system.

Subdivision 1. Options. Use of the regional public safety radio system by local governments, quasi-public service organizations, and private entities eligible to use the system shall be optional and no local government or other eligible user of the system shall be required to abandon or modify current public safety radio communication systems or purchase new equipment until the local government or other eligible user elects to join the system. Public safety radio communication service to local governments and other eligible users who do not initially join the system shall not be interrupted. No local government or other eligible users who do not join the system shall be charged a user fee for the use of the system.

Subd. 2. Requirements to join. Local governments and other entities eligible to join the regional public safety radio system which elect to join the system must do so in accordance with and meet the requirements of the provisions of the plan adopted by the radio board as provided in section 403.23, subdivision 2.

HIST: 1995 c 195 art 1 s 15; 1Sp2003 c 1 art 2 s 135

403.35 Continuation of enhancements to regional system.

Upon the transition of the Metropolitan Radio Board to a regional radio board under section 403.39, the Metropolitan Radio Board may continue the planning, implementation, operation, and maintenance of the second phase and of local and regional enhancements to the system backbone. The Metropolitan Radio Board may retain property, interests, obligations, and rules that relate exclusively to the planning, implementation, operation, and maintenance of the second phase and to local and regional enhancements to the system backbone. Where the property, interests, and obligations of the Metropolitan Radio Board are combined with elements of the system backbone, the commissioner of public safety, the Statewide Radio Board, and the Metropolitan Radio Board shall formulate and submit to the legislature by February 1, 2005, a plan, consistent with the public safety radio system communication plan, specifying the terms and conditions under which the combined property, interests, or obligations will be jointly maintained.

HIST: 1999 c 238 art 2 s 76; 1Sp2003 c 1 art 2 s 135; 2004 c 201 s 15

403.36 Statewide Radio Board.

Subdivision 1. Membership.

(a) The commissioner of public safety shall convene and chair the Statewide Radio Board to develop a project plan for a statewide, shared, trunked public safety radio communication system. The system may be referred to as "Allied Radio Matrix for Emergency Response," or "ARMER."

(b) The board consists of the following members or their designees:

(1) the commissioner of public safety;

(2) the commissioner of transportation;

(3) the state chief information officer;

(4) the commissioner of natural resources;

(5) the chief of the Minnesota State Patrol;

(6) the commissioner of health;

(7) the commissioner of finance;

(8) two elected city officials, one from the nine-county metropolitan area and one from Greater Minnesota, appointed by the governing body of the League of Minnesota Cities;

(9) two elected county officials, one from the nine-county metropolitan area and one from Greater Minnesota, appointed by the governing body of the Association of Minnesota Counties;

(10) two sheriffs, one from the nine-county metropolitan area and one from Greater Minnesota, appointed by the governing body of the Minnesota Sheriffs' Association;

(11) two chiefs of police, one from the nine-county metropolitan area and one from Greater Minnesota, appointed by the governor after considering recommendations made by the Minnesota Chiefs' of Police Association;

(12) two fire chiefs, one from the nine-county metropolitan area and one from Greater Minnesota, appointed by the governor after considering recommendations made by the Minnesota Fire Chiefs' Association;

(13) two representatives of emergency medical service providers, one from the nine county metropolitan area and one from Greater Minnesota, appointed by the governor after considering recommendations made by the Minnesota Ambulance Association;

(14) the chair of the Metropolitan Radio Board; and

(15) a representative of Greater Minnesota elected by those units of government in phase three and any subsequent phase of development as defined in the statewide, shared radio and communication plan, who have submitted a plan to the Statewide Radio Board and where development has been initiated.

(c) The Statewide Radio Board shall coordinate the appointment of board members representing Greater Minnesota with the appointing authorities and may designate the

geographic region or regions from which an appointed board member is selected where necessary to provide representation from throughout the state.

Subd. 1a. Terms. Board members have no set term and remain on the board until a successor is appointed as provided in subdivision 1. However, with respect to those board members who, under subdivision 1, must be elected officials, a successor must be appointed as provided in subdivision 1 no later than the date that the member is no longer an elected official, unless the member dies while in office, in which case a successor must be named as soon as practicable.

Subd. 1b. Compensation; removal; vacancies. Compensation, removal, and filling of vacancies of board members are governed by section 15.0575, except that appointments to the board are not subject to the open appointments process of sections 15.0597 to 15.0599.

Subd. 1c. Voting. Each member has one vote. The majority of the voting power of the board constitutes a quorum, although a smaller number may adjourn from time to time. Any motion, other than adjournment, must be favored by a majority of the voting power of the board in order to carry.

Subd. 1d. Calling meeting. The board shall convene upon the call of the chair or any six members of the board.

Subd. 1e. Implement plan and establish statewide system. The Statewide Radio Board has overall responsibility for the statewide, shared radio and communication system project plan. The commissioner of public safety shall implement the plan adopted by the Statewide Radio Board. The commissioner of public safety shall contract with the commissioner of transportation to construct, own, operate, maintain, and enhance the elements of the backbone system defined in the plan. The commissioner of transportation, under appropriate state law, shall contract for, or procure by purchase or lease (including joint purchase and lease agreements), construction, installation of materials, supplies and equipment, and other services as may be needed to build, operate, and maintain the system backbone. The Department of Transportation shall own, operate, and maintain those elements identified in the project plan as the system backbone, including, but not limited to, radio towers and associated structures and equipment related to the system backbone.

Subd. 1f. Advisory groups. (a) The Statewide Radio Board shall establish one or more advisory groups for the purpose of advising on the plan, design, implementation, and administration of the statewide, shared trunked radio and communication system.

(b) At least one such group must consist of the following members:

(1) the chair of the Metropolitan Radio Board and the chair of each regional radio board or, if no regional radio board has been formed, a representative of each region of development as defined in the statewide, shared, trunked radio and communication plan, once planning and development have been initiated for the region, or a designee;

(2) the chief of the Minnesota State Patrol or a designee;

(3) a representative of the Minnesota State Sheriffs' Association;

(4) a representative of the Minnesota Chiefs of Police Association;

(5) a representative of the Minnesota Fire Chiefs' Association; and

(6) a representative of the Emergency Medical Services Board.

Subd. 2. Plan contents. (a) The statewide, shared radio and communication system project plan must include:

(1) standards, guidelines, and comprehensive design for the system, including use and integration of existing public and private communications infrastructure;

(2) proposed project implementation schedule, phases, and estimated costs for each phase of the plan;

(3) recommended statutory changes required for effective implementation and administration of the statewide, shared trunked radio and communication system; and

(4) a policy for the lease of excess space or capacity on systems constructed under the project plan, consistent with section 174.70, subdivision 2, with priority given first to local units of government for public safety communication transmission needs and second to any other communications transmission needs of either the public or private sector.

(b) The Statewide Radio Board must ensure that generally accepted project management techniques are utilized for each project or phase of the backbone of the statewide, shared radio and communication system consistent with guidelines of the Project Management Office of the Office of Technology:

(1) clear sponsorship;

(2) scope management;

(3) project planning, control, and execution;

(4) continuous risk assessment and mitigation;

(5) cost management;

(6) quality management reviews;

(7) communications management; and

(8) proven methodology.

Subd. 3. Local financing. A local unit of government that receives state funds for integration with the statewide, shared, trunked radio and communication system must have a plan approved by the Statewide Radio Board and must comply with the standards and guidelines contained in the project plan. The Statewide Radio Board must review and approve all local and regional planning initiatives for connectivity to the system to assure compatibility, interoperability and integration support with the system and plan standards. As part of the review the Statewide Radio Board must require, and a county or local unit of government must provide, a detailed plan including a budget and detailed cost estimates.

Subd. 4. Reporting. In conjunction with each biennial budget process, the Statewide Radio Board must submit a status report to the governor and to the chairs and ranking minority members of the house and senate committees with jurisdiction over capital investment and criminal justice funding and policy. The report must include a substantive assessment and evaluation of each significant part of the implementation of the statewide public safety radio plan with (1) to the extent possible, an update on risks and mitigation strategies; and (2) quantitative information on the status, progress, costs, benefits, and effects of those efforts.

HIST: 2002 c 401 art 1 s 12; 1Sp2003 c 1 art 2 s 119,135; 2004 c 201 s 16; 2005 c 156 a 5 s 21

403.37 Powers of Statewide Radio Board.

Subdivision 1. General. In addition to any other powers specifically provided by law, the Statewide Radio Board has the powers given in this section.

Subd. 2. Planning. The board shall coordinate the statewide, shared radio and communication system project plan with local and regional plans and modify the plan as

necessary to facilitate the implementation of the backbone of the statewide, shared radio and communication system.

Subd. 3. System architecture. The board shall define the backbone of the system, the timing and regions of system backbone development, the geographic scope of each region, and the standards for system backbone performance necessary to assure systemwide development that maximizes interoperability throughout the system.

Subd. 4. Implementation. The board shall oversee the implementation of the plan and ensure that the system is built, owned, operated, and maintained in accordance with the plan.

Subd. 5. Assignment of frequencies. The board shall oversee the assignment of frequencies to local users and to subsystems.

Subd. 6. Cost apportionment. The board shall determine how capital and operating costs of the system backbone are apportioned to users, including the cost of additional participants.

Subd. 7. Excess capacity allocation. The board shall determine how excess capacity provided in the system backbone design will be allocated.

Subd. 8. System enhancements. The board shall coordinate the extent to which local governments, quasi-public service corporations, and private entities eligible to use the system may provide system enhancements at their own expense.

Subd. 9. Technical standards. The board shall establish and enforce performance and technical standards for the operation of the system backbone.

Subd. 10. Protocols. The board shall establish and enforce priorities or protocols for the system that facilitate statewide uniformity.

Subd. 11. Integration. The board shall coordinate the integration of the statewide, shared radio and communication system among regions, adjoining states, federal entities, and to the extent permitted by law, with Canadian public safety entities.

Subd. 12. Allocation of money. The board shall allocate money available to the Statewide Radio Board among regional radio boards or to local entities within a region to encourage local and regional participation in the system. This does not limit the authority of regional radio boards and local entities to individually or collectively seek funding of local and regional enhancements and subsystems to the system backbone.

HIST: 2004 c 201 s 17

403.38 Statewide integration.

Notwithstanding any provision to the contrary in sections 403.21 to 403.40, the Statewide Radio Board has the final authority over technical and operational standards necessary to provide for the development and implementation of a statewide backbone that maximizes the integration of the public safety radio communication system throughout the state, including the backbone previously established by the Metropolitan Radio Board. Technical and operational standards that do not interfere with the integration of the system may be established locally or regionally.

HIST: 2004 c 201 s 18

403.39 Regional radio boards.

Subdivision 1. Establishment. Notwithstanding the provisions of section 471.59, subdivision 1, requiring commonality of powers, two or more counties or a city and one or more counties within a region defined in the statewide radio board's project plan under section 403.36, through action of their governing bodies, by adoption of a joint powers agreement that complies with section 471.59, subdivisions 1 to 5, may establish a regional radio board to implement, maintain, and operate regional and local improvements to the statewide, shared, trunked radio and communication system provided for in section 403.36. Membership in a regional radio board shall include one county commissioner appointed by each respective county board party to the joint powers agreement and an elected official from any city party to the joint powers agreement, and may include additional members whose qualifications are specified in the joint powers agreement.

Subd. 2. Powers. In addition to the powers enumerated in section 471.59, a regional radio board, as necessary and convenient to implement regional and local improvements to the statewide, shared, trunked radio and communication system provided for in section 403.36, has the following powers:

(1) to establish bylaws and other organizational procedures consistent with the terms of the joint powers agreement;

(2) to apply for and hold licenses for public safety frequencies to be used in regional and local improvements, including a regional data system;

(3) to set or adopt regional performance and technical standards, subject to review by the Statewide Radio Board, that do not interfere with the backbone or interoperability infrastructure administered by the Statewide Radio Board;

(4) to enter into contracts necessary to carry out its responsibilities;

(5) to acquire by purchase, lease, gift, or grant, property, both real and personal, and interests in property necessary for the accomplishment of its purposes and to sell or otherwise dispose of property it no longer requires; and

(6) to contract with the state of Minnesota, through the commissioner of transportation, for construction, ownership, operation, and maintenance of regional or local improvements to the statewide, shared, trunked radio and communication system.

Subd. 3. Relationship to local governments. Where a regional radio board has been established in accordance with this section, local governments and other public entities eligible under part 90 of the FCC rules to operate upon a statewide, shared public safety radio and communication system within the region covered by the regional radio board must coordinate its implementation through one of the parties to the joint powers agreement. For purposes of grants made available by the Department of Public Safety, a regional radio board is entitled to apply for and receive a grant on behalf of one or more counties who are a party to the joint powers agreement.

HIST: 2004 c 201 s 19

403.40 Advisory committees.

Subdivision 1. Regional advisory committees. The Statewide Radio Board shall facilitate the formation of a regional advisory committee in each region of development. A regional advisory committee may create a regional radio board under section 403.39 and conduct its affairs in accordance with the joint powers agreement. During the initial phase of development within a region, the Statewide Radio Board shall act cooperatively with the regional advisory committee or the regional radio board to complete development of the basic communication infrastructure and interoperability infrastructure.Upon the completion of the initial phase of development within a region, the Statewide Radio Board shall cooperate with and assist the regional advisory committee or the regional radio board in implementing its regional plan and with subsequent development within the region.

Subd. 2. Topical advisory committees. The Statewide Radio Board may establish the following additional advisory committees with representatives from each region of implementation to advise on the following topical areas:

(1) a committee of users representing all regions where the system backbone has been implemented to make recommendations on how capital and operating costs of the system should be apportioned among users, including the cost of additional participants;

(2) a systems manager committee to make recommendations on performance and operational standards for the system to the extent that performance and operational standards impact the operation of the system backbone and interoperability infrastructure; and

(3) an operations and technical committee to make recommendations on the plan and operational issues related to the technical aspects of the system backbone and interoperability infrastructure.

HIST: 2004 c 201 s 20

OTHER CHANGES IN HF0001

237.491

237.491 Combined per number fee. Subdivision 1. Definitions. (a) The definitions in this subdivision apply to this section.

(b) "911 emergency and public safety communications program" means the program governed by chapter 403.

(c) "Minnesota telephone number" means a ten-digit telephone number being used to connect to the public switched telephone network and starting with area code 218, 320, 507, 612, 651, 763, or 952, or any subsequent area code assigned to this state.

(d) "Service provider" means a provider doing business in this state who provides real time, two-way voice service with a Minnesota telephone number.

(e) "Telecommunications access Minnesota program" means the program governed by sections 237.50 to 237.55.

(f) "Telephone assistance program" means the program governed by sections 237.69 to 237.711.

Subd. 2. Per number fee. (a) By January 15, 2006, the commissioner of commerce shall report to the legislature and to the senate Committee on Jobs, Energy, and Community Development and the house Committee on Regulated Industries, recommendations for the amount of and method for assessing a fee that would apply to each service provider based upon the number of Minnesota telephone numbers in use by current customers of the service provider. The fee would be set at a level calculated to generate only the amount of revenue necessary to fund:

(1) the telephone assistance program and the telecommunications access Minnesota program at the levels established by the commission under sections 237.52, subdivision 2, and 237.70; and

(2) the 911 emergency and public safety communications program at the levels appropriated by law to the commissioner of public safety and the commissioner of finance for purposes of sections 403.11, 403.113, 403.27, 403.30, and 403.31 for each fiscal year.

(b) The recommendations must include any changes to Minnesota Statutes necessary to establish the procedures whereby each service provider, to the extent allowed under federal law, would collect and remit the fee proceeds to the commissioner of revenue. The commissioner of revenue would allocate the fee proceeds to the three funding areas in paragraph (a) and credit the allocations to the appropriate accounts.

(c) The recommendations must be designed to allow the combined per telephone number fee to be collected beginning July 1, 2006. The per access line fee used to collect revenues to support the TAP, TAM, and 911 programs remains in effect until the statutory changes necessary to implement the per telephone number fee have been enacted into law and taken effect.

(d) As part of the process of developing the recommendations and preparing the report to the legislature required under paragraph (a), the commissioner of commerce must, at a minimum, consult regularly with the Departments of Public Safety, Finance, and Administration, the Public Utilities Commission, service providers, the chairs and ranking minority members of the senate and house committees, subcommittees, and divisions having jurisdiction over telecommunications and public safety, and other affected parties.

HIST: 2005 c 136 a 10 s 1

403.misc2005

2005 c 136 a 10 s 22. Effective date. Sections 1 to 21 are effective the day following final enactment and apply to contracts entered into on or after that date. Notwithstanding Minnesota Statutes, section 403.11, subdivision 1, as amended by this act, a fee change under that subdivision in calendar year 2005 may become effective after a minimum of 30 days' notice.

Appendix J - Orange County Joint Agreement

JOINT AGREEMENT

FOR THE

OPERATION, MAINTENANCE, AND FINANCIAL MANAGEMENT

OF THE

ORANGE COUNTY 800 MEGAHERTZ COUNTYWIDE COORDINATED COMMUNICATIONS SYSTEM

NOVEMBER 2004

JOINT AGREEMENT FOR THE OPERATION, MAINTENANCE AND FINANCIAL MANAGEMENT OF THE ORANGE COUNTY 800 MEGAHERTZ COUNTYWIDE COORDINATED COMMUNICATIONS SYSTEM

This Agreement is entered into on _____, 2005 by and between the Parties listed on Exhibit "A" which is attached hereto and incorporated herein. This Agreement replaces the 1995 Agreement as amended, and to the extent there is a conflict, this Agreement controls. Exhibit "A" identifies the Parties to the Agreement. Exhibit "B" identifies the Partner Agencies currently operating on the system. Exhibit "C" identifies the current Mutual Aid operations on the system as approved by the appropriate body (Orange County Chiefs of Police and Sheriff's Association [OCCOPSA], Orange County Fire Chiefs' Association [OCFCA], Orange County Public Works Committee [OCPWC], or Orange County Lifeguard Committee [OCLC]). Exhibit "D" identifies those Participating Agencies that have joined the system as everyday users but were not original Partners on the system. Partners and Participating Agencies on the 800 MHz CCCS are limited to public entities.

RECITALS:

Whereas, the initial installation and implementation of the 800 MHz Countywide Coordinated Communications System (800 MHz CCCS) has been completed; and, Whereas, the Parties to the Agreement want to define operational, technical and financial requirements and guidelines going forward; and,

Now, Therefore, in consideration of the mutual covenants, conditions, agreements and stipulations hereinafter expressed, the Parties hereby agree as follows:

1. SYSTEM

The 800 MHz CCCS, hereinafter referred to as System, has been implemented in the County of Orange. Said System is described in Contract No. S0000015.95 for an 800 MHz CCCS, dated September 19, 1995, and related Amendments No. 1, 2, 3, 4, 5 and appropriate change orders.

The Parties hereby designate Orange County Sheriff-Coroner Department (OCSD)/Communications Division as the "Lead Agency" in maintaining and enhancing the System.

2. DEFINITION OF TERMS

"Contract City" is defined as a city receiving law enforcement, lifeguard, public works or fire services from the County or any Partner Agency under the terms of a contract.

"Fire Agency" is defined as, and shall include, all governmental Fire Agencies operating primarily within the limits of Orange County.

"Governing Authority" is a City Council, County Board of Supervisors or Orange County Fire Authority Board of the Partner Agencies, responsible for approving cost modifications. Exhibit "A" provides a list of City, County, and Orange County Fire Authority administrators representing these bodies.

"Law Enforcement Agency" is defined as all governmental Law Enforcement Agencies operating primarily within the limits of Orange County, as follows: Orange County Sheriff's Department, Orange County City Police Departments, Orange County District Attorney's Office, and Orange County Probation Department.

"Lifeguard Agency" is defined as, and shall include, all governmental lifeguard agencies operating primarily within the limits of Orange County.

"Mutual Aid Provider" is defined as any governmental or private organization, not otherwise defined in this Agreement, that has a legitimate Mutual Aid operational requirement with another Partner or Participating Agency. Guidelines for the approval of a mutual aid provider have been developed and are available to OCCOPSA, OCFCA, OCPWC and OCLC as needed.

"Net" is defined as a group of Partner Agencies who operate a joint dispatch center, or a combination of radio dispatch talkgroups used by a fixed group of Partner Agencies.

"New City" is defined as a city incorporated after the effective date of this Agreement.

"Non-City/Non-County User" is defined as a special district, water district, sanitation district, or similar governmental or quasi-governmental agency. These are Participating Agencies.

"Participating Agency" is any agency identified in Exhibit D that would not have a role in defining the operation of the 800 MHz CCCS, but would pay to join the system based on a predefined allocation.

"Partner Agencies" are those agencies identified in Exhibit "B" that have joined the 800 MHz CCCS for everyday use since its original inception and are operating on the 800 MHz System.

"Parties" are those public entities which are listed in Exhibit "A."

"Public Works Agency" is defined as, and shall include, all County or City departments that perform public works functions, other than those defined as a Law Enforcement, Lifeguard or Fire Agency. Public Works Agencies include, but are not limited to, Public Works Departments, Municipal Utility Departments, and County agencies including Resources and Development Management Department, John Wayne Airport, Health Care

Agency, and Integrated Waste Management Department, and public works functions within County operations such as the Transportation and Facilities Operations functions with the Sheriff's Department and Probation.

"Subsystem" is defined as one of four operational subsystems that use common equipment, each in a similar way, but use different operational procedures. These are referred to as the Law Subsystem, the Fire Subsystem, the Lifeguard Subsystem and the Public Works Subsystem.

"System Backbone" is defined as those portions of the System Backbone that provide the means by which dispatch centers and mobile radios communicate with each other, and is composed of radio infrastructure equipment, microwave equipment, and associated control equipment.

"System Field Equipment" is defined as that portion of the System that uses the System Backbone for communications and consists of dispatch center equipment, mobile radios, and portable radios.

3. OPERATIONAL POLICIES – LAW ENFORCEMENT SUBSYSTEM

The Orange County Chiefs of Police and Sheriff's Association (OCCOPSA) is an established organization composed of representatives from the Sheriff's Department, City Police Departments, District Attorney's Office and Probation Department. The OCCOPSA Communications Committee has been delegated by OCCOPSA the responsibility for operational policy development for the Law Enforcement Subsystem. Partner and Participating agencies agree that operational policy for the Law Enforcement Subsystem shall be developed by the OCCOPSA Communications Committee and ratified where appropriate by the OCCOPSA, in accordance with the terms and conditions of this Agreement.

4. OPERATIONAL POLICIES – FIRE SUBSYSTEM

The Orange County Fire Chiefs' Association (OCFCA) is an established organization composed of representatives from the Orange County Fire Authority and City Fire Departments. The OCFCA Communications Committee has been delegated by OCFCA the responsibility for operational policy development for the Fire Subsystem. Partner and Participating agencies agree that operational policy for the Fire Subsystem shall be developed by the OCFCA Communications Committee and ratified where appropriate by the OCFCA, in accordance with the terms and conditions of this Agreement.

5. OPERATIONAL POLICIES – LIFEGUARD SUBSYSTEM

The Orange County Lifeguard Committee (OCLC) is an established organization composed of representatives from the City and County Lifeguard Departments. The OCLC Communications Committee has been delegated by OCLC the responsibility for operational policy development for the Lifeguard System. Partner and Participating agencies agree that operational policy for the Lifeguard System shall be developed by the OCLC Communications Committee and ratified where appropriate by the OCLC, in accordance with the terms and conditions of this Agreement.

6. OPERATIONAL POLICIES – PUBLIC WORKS SUBSYSTEM

The Orange County Public Works Committee (OCPWC) is an established organization composed of representatives from the City and County Public Works Departments. The OCPWC has been delegated the responsibility for operational policy development for the Public Works Subsystem. Partner and Participating agencies agree that operational policy for the Public Works Subsystem shall be developed by OCPWC and ratified where appropriate, in accordance with the terms and conditions of this Agreement.

7.0 OPERATIONAL POLICY

7.1 Law Enforcement Subsystem

The administration and ongoing development of the Law Enforcement Subsystem operational policy has been delegated to the OCCOPSA Communications Committee. That Committee reports to the OCCOPSA. Policies developed by OCCOPSA for the operations of the Law Enforcement Subsystem shall ensure that each participant is treated

equitably and has sufficient communications capability to meet its legitimate needs. Any dispute between Partner and Participating Agencies over operational policies shall be reviewed by the OCCOPSA Communications Committee, and if not resolved, then reviewed by the OCCOPSA. Any unresolved dispute may be appealed to the Governance Committee for final decision.

7.2 Fire Subsystem

The administration and ongoing development of the Fire Subsystem operational policy has been delegated to the OCFCA Communications Committee. That Committee reports to the OCFCA. Policies developed by OCFCA for the operations of the Fire Subsystem shall ensure that each participant is treated equitably and has sufficient communications capability to meet its legitimate needs. Any dispute between Partner and Participating Agencies over operational policies shall be reviewed by the OCFCA Communications Committee, and if not resolved, then reviewed by the OCFCA. Any unresolved dispute may be appealed to the Governance Committee for final decision.

7.3 Lifeguard Subsystem

The administration and ongoing development of the Lifeguard Subsystem operational policy has been delegated to the OCLC Communications Committee. That Committee reports to the OCLC. Policies developed by OCLC for the operations of the Lifeguard Subsystem shall ensure that each participant is treated equitably and has sufficient communications capability to meet its legitimate needs. Any dispute between Partner and Participating Agencies over operational policies shall be reviewed by the OCLC Communications Committee, and if not resolved, then reviewed by the OCLC. Any unresolved dispute may be appealed to the Governance Committee for final decision.

7.4 Public Works Subsystem

The administration and ongoing development of the Public Works Subsystem operational policy has been delegated to the OCPWC. Policies developed by OCPWC for the operations of the Public Works Subsystem shall ensure that each participant is treated equitably and has sufficient communications capability to meet its legitimate needs. Any dispute between Partner and Participating Agencies over operational policies shall be reviewed by the OCPWC. Any unresolved dispute may be appealed to the Governance Committee for final decision.

7.5 Standard Operating Procedures

Except as provided in Section 11.3 ("Security"), individual subsystem operational policy, as well as policy affecting all users, shall be published in the 800 MHz CC and will be updated any time an approved change is made to this document.

7.6 System Priorities

Public Safety, consisting of City and County Law Enforcement and Fire Agencies dispatch functions and individual radio emergency buttons, shall have System operational priority over all law/fire/public works non-life threatening operations when and if it is necessary to establish System priorities.

8. OPERATIONAL POLICY REVIEW

To ensure that operational policy developed by the various individual Subsystems is compatible with all of the other Subsystems, such policy shall be subject to review by all other Subsystems and OCSD/Communications when appropriate. Review would be required when policy is developed that crosses over into another Subsystem. Review is not required when policy is developed that is specific to one Subsystem only. A thirty (30)-day review period prior to policy implementation shall be observed in order to ensure appropriate time for review. Exceptions can be made when the policy is of an emergency nature and immediate implementation is necessary for safety purposes. All emergency exceptions shall be reviewed by the appropriate Subsystems as described above within the thirty (30)-day period. The intent of this review is to assure that decisions made by any one subsystem do not adversely affect the operation of any other group and to promote and ensure interoperability and compatibility.

9. MUTUAL AID

9.1 Mutual Aid Policies and Procedures

Mutual Aid communications is an important capability of the System. Utilizing this capability in an efficient manner is essential. Mutual Aid operational policies and procedures must be coordinated between Partner and Participating Agencies within Orange County and Partner and Participating Agencies outside of Orange County. All Partner and Participating Agencies shall comply with the operational policies of the Mutual Aid Plans described in Section 9.2.

9.2 Mutual Aid Plans

The following Mutual Aid Plans shall establish Mutual Aid operational procedures for all Participating Agencies.

Orange County Mutual Aid Implementation Plan for the Use of the 800 MHz National and State Mutual Aid Channels

This plan is required by the Southern California 800 MHz Regional Communications Plan and, together with any plan modifications, must be approved by the State of California Office of Emergency Services, Telecommunications Advisory Committee. The plan in effect on the date of this Agreement is on file with the OCSD/Communications Division. Any proposed modifications to the plan must be reviewed and approved by the Governance Committee, if needed, prior to submission to the State.

Orange County Mutual Aid Plan for the Use of the 800 MHz Local Mutual Aid Channels

The plan was prepared by OCSD/Communications Division and approved by the Partner and Participating Agencies, based upon approval by OCCOPSA, OCFCA, OCPWC and OCLC, as appropriate.

9.3 Mutual Aid Priorities

Partner and Participating Agencies who from time to time have need to communicate with Law Enforcement or Fire Agencies during emergencies or in their daily support of Law Enforcement or Fire Agencies will be allowed to access the Law Enforcement or

Fire Subsystems as approved by those respective agencies. Such use may include the day-to-day operations of said non-Law Enforcement and non-Fire Partner and Participating Agencies on a non-interfering, prioritized basis. This use shall be subject to approval of OCCOPSA and the OCFCA as it affects their respective communications.

10.0 RELINQUISHING EXISTING OPERATING CHANNELS

Existing Partner and Appropriate Participating Agencies operate existing systems on a variety of radio channels licensed by the FCC. Both the FCC and the Southern California Regional Plan, approved by the FCC on November 21, 1989 for the implementation of new systems using the 800 MHz spectrum, require that Partner and Participating Agencies that transfer operation to the new 800 MHz channels must give back licenses on existing system frequencies. These "give-up" channels will then be redistributed to meet the needs of other agencies in Southern California which have not been met with the limited 800 MHz channels available.

Partner and Participating Agencies entering into this Agreement agree to "give up" channels licensed on existing systems that are replaced by the new System. FCC licenses on these "give-up" channels shall be returned to the FCC for cancellation not more than thirty (30) days after transfer and acceptance of law enforcement and/or public works operations to the System.

An exception to the paragraph above is when Partner and Participating Agencies who, as a result of transferring law enforcement operations to the System, subsequently move other public works operations to their current 460 MHz channels. In this case, Partner and Participating Agencies agree to relinquish the previously used 460 MHz channels to public works operations within thirty (30) days of completion of the transfer to the 800 MHz System and such a transfer to public works must occur within one hundred eighty (180) days of transfer of law enforcement operations to the System (FCC requirement), at which time the previously used public works FCC licenses on these "give-up" channels must be returned to the FCC for cancellation not more than thirty (30) days after transfer of public works operations to the 460 MHz channels.

Any city that does not have a 460 MHz law enforcement "give-up" GREEN channel to use for public works may be able to use another city's "give-up" 460 MHz GREEN channel in a cellular re-use pattern.

11.0 SYSTEM TECHNICAL MANAGEMENT

Proper operation of a modern, trunked, multi-channel communications System requires centralized technical coordination. OCSD/Communications Division has established a 24-hour System Watch at Loma Ridge to assure seamless operation of this complex system. The infrastructure for this System is currently housed in 24 separate radio sites, with Loma Ridge serving as the master site.

11.1 Technical Liaison Committee

The 800 MHz Technical Liaison Committee is utilized to develop the technical operation policies and procedures of the System. This committee is composed of sworn, technical and operational personnel of County and City Law Enforcement, Fire, Lifeguard and Public Works operations involved in the 800 MHz CCCS.

11.2 Technical Standards

Technical standards are an essential part of the operation of a multi-user system. To ensure the long-range effective operation of System, technical standards shall continue to be reviewed and evaluated. Said standards shall be approved by the Technical Liaison Committee and all Partner and Participating Agencies will be required to adhere to them. Failure to adhere to the technical standards may result in mobile or portable field equipment being restricted from access to the associated Backbone System.

11.3 Security

Any authorized user of the 800 MHz CCCS shall be required to protect the security of the system, which includes but is not limited to: adhering to the Lost/Stolen/Missing Radio Procedure, providing physical security for equipment and documentation, not using Radio Service Software (RSS) to modify the configuration of any radio programming, and not providing technical information or radio equipment to unauthorized persons. As Participating Agencies or Mutual Aid organizations join the system, a copy of the Security Plan will be provided to the director of said organizations and will be advised to share it with appropriate personnel.

11.4 Approved Equipment

The initial System implementation consisted of equipment supplied by the original system equipment vendor and met the technical requirements of the System. OCSD/Communications shall compile a list of this approved equipment and make it available to all Partner and Participating Agencies.

In the future, as newer equipment from the original vendor or other vendors become available, OCSD/Communications shall evaluate it for compatibility with the System and make recommendations to the Technical Liaison Committee. Any equipment that meets the technical criteria for operation on the System shall be added to the approved list.

OCSD/Communications will be responsible for negotiating pricing on new equipment with recommendations forwarded to the Governance Committee for final approval.

11.5 Technical Standards and Equipment Evaluation

The OCSD/Communications Division maintains engineering and technical staff whose task is to maintain, manage and operate the 800 MHz CCCS. Technical management of the System shall continue to be the responsibility of OCSD/Communications Division. County technical staff shall evaluate new radio subscriber equipment for adherence to technical standards prior to the Technical Liaison Committee for approval and to the vendor requesting equipment evaluation. Any disputes regarding the technical evaluation of equipment will be referred to the OCCOPSA Communications Committee, OCFCA Communications Committee, OCLC Communications Committee, and OCPWC, with final approval by the Governance Committee.

12.0 SYSTEM MODIFICATION COST APPROVALS

Any Law Enforcement Subsystem modification or other action proposed by OCCOPSA which requires Partner or Participating Agencies to obligate funds for cost sharing shall require prior approval by the Governing Body of each Partner or Participating Agency, following approval by the Governance Committee.

Any Fire Subsystem modification or other action proposed by the OCFCA which requires Partner or Participating Agencies to obligate funds for cost sharing shall require prior approval by the Governing Body of each Partner or Participating Agency, following approval by the Governance Committee.

Any Lifeguard Subsystem modification or other action proposed by the OCLC which requires Partner or Participating Agencies to obligate funds for cost sharing shall require prior approval by the Governing Body of each Partner or Participating Agency, following approval by the Governance Committee.

Any Public Works Subsystem modification or other action proposed by the PWPC which requires Partner or Participating Agencies to obligate funds for cost sharing shall require prior approval by the Governing Body of each Partner or Participating Agency, following approval by the Governance Committee.

13.0 CONTRACTS

The County may from time to time enter into such agreements or contracts with various vendors to purchase or lease equipment, and for installation, service and maintenance of equipment as may be necessary and required in order to effectuate this Agreement. All such agreements or contracts shall comply with applicable State Law for counties. Appropriate shared costs will be included in backbone cost-sharing allocations.

13.1 County Responsibilities

OCSD/Communications shall negotiate and enter into agreements or contracts with the various vendors as contemplated in this Agreement. OCSD/Communications shall make payments due and payable under such agreements on behalf of Partner and Participating Agencies. OCSD/Communications shall negotiate and enter into agreements with new Participating Agencies which may hereafter receive approval to access the System for day-to-day operations pursuant to this Agreement, provided that:

- The Participating Agency agrees to the terms, conditions and costs for entry as defined by the Governance Committee on behalf of the Partners. Current policy by the Governance Committee directs a system entry fee of $3,295 per radio for Federal or State agency participation and $2,480 per radio for agencies operating strictly within the confines of the County. Participating Agencies are required to have their radios templated and programmed by OCSD/Communications Division staff, participate in the flat fee radio equipment maintenance program, and meet their annual backbone cost sharing obligation.
- Requests by Participating Agencies will be evaluated in terms of potential channel loading on the 800 MHz CCCS. This evaluation will include an identification of the number of radios to be added, the type of communication being conducted, and the specific radio cell that will be impacted by the addition of this Participating Agency. If the addition of the Participating Agency may cause an extensive impact on channel loading, an outside channel loading analysis may be pursued at the expense of the requesting Agency.
- Additional terms, conditions, and costs for entry shall be included in a separate agreement as established by the Governance Committee. The Governance

Committee is given said authority under this Agreement with the understanding that adequate fees will be charged as appropriate. Said separate agreement shall include any direct or indirect compensation to Partner Agencies for System Backbone usage by new Participating Agency(s).

- OCSD/Communications shall obtain the approval of the Governance Committee to determine the appropriate additional terms, conditions, and costs to be included in said separate agreement.
- Any such new Participating Agency hereafter who shall desire to become a party to this Agreement may do so by executing a copy of this Agreement, as well as the separate agreement if applicable.
- Compensation may take the form of improvement or modification of System or other contribution for the benefit of all Partner or Participating Agencies.

14. EQUIPMENT FACILITIES AND STRUCTURES

Additional facilities, structures, and modifications may be needed to implement the System, including System Backbone facilities and System Field Equipment facilities (e.g., dispatch centers).

14.1 System Backbone Facilities

In the event of a decision by the Governing Authorities to financially support expanding or modifying existing facilities, or adding new County radio structures or facilities as necessary, to support the implementation of the System Backbone, the County shall be responsible as lead agency to implement these expansions, modifications, or additions.

14.2 Field Equipment Facilities

Individual Partner or Participating Agency shall, at its sole Partner or Participating Agency expense, expand or modify its existing y structures, facilities, or dispatch centers as required to support the installation or enhancement of Partner or Participating Agency System Field Equipment.

15. SYSTEM MODIFICATIONS AND COST SHARING

15.1 System Modifications

System modifications may be needed from time to time to meet the changing needs of Partner and Participating Agencies. System modifications, expansions or enhancements will not be allowed without technical review by the County and approval by the Governance Committee. System modifications recommended by County and agreed to by the Governance Committee will then be forwarded to Governing Authorities for approval, as appropriate, and implemented by County.

Cost sharing of future System Backbone modifications shall be determined based on the benefit to be derived by individual Partner or Participating Agencies.

The cost for any modification intended for the sole use and support of a single Partner or Participating Agency shall be borne by that Partner or Participating Agency.

The cost for any modification intended to improve service for an identifiable group of Partner or Participating Agencies in a local area or Net shall be shared by those Agencies in a manner agreeable to those Agencies.

15.2 Cost Sharing Beginning July 1, 2002

A. Effective Date/Percentage Share

The Cities and Orange County Fire Authority (OCFA) will commence System Backbone cost sharing payments as of July 1, 2002. The following represents the respective aggregate obligations for the ongoing maintenance costs of the System Backbone expressed as a percentage of the total cost:

1. FY 02-03
    a. County's share of cost 51%
    b. Cities'/OCFA's share of cost 49%
2. FY 03-04
    a. County's share of cost 45.6%
    b. Cities'/OCFA's share of cost 54.4%
3. FY 04-05 and thereafter
    a. County's share of cost 40.18%
    b. Cities'/OCFA's share of cost 59.82%

The individual obligations for the ongoing maintenance cost of the System Backbone, as approved by the Governance Committee, for each of the Cities and OCFA shall be determined by dividing the number of radios that each of the Cities and the OCFA, respectively, are operating on the System by the total number of radios that the Cities and OCFA are collectively operating on the System. The resulting ratios shall each be multiplied by the aggregate percentage obligations of the Cities and the OCFA for each fiscal year as set forth above. The resulting products shall be the Cities' and OCFA's individual percentage obligations for the ongoing maintenance cost of the System Backbone in each applicable fiscal year.

The contribution made by Participating Agencies will be calculated based on a per radio cost, which will be calculated on an annual basis by dividing the total operating and infrastructure backbone cost, by the total number of radios. The calculated contributions for the Participating Agencies will then be deducted from the total backbone cost-sharing expense. The remaining amount will be used to calculate the City, OCFA and County obligations consistent with 15.2.A.3. above.

Emergency radios held in a separate pool will not be included in the radio counts for backbone cost-sharing purposes. Radios, as identified by the Partner or Participating Agencies, that are set aside strictly for the purpose of an emergency activation or some other emergency situation, and are not used for any other purpose, will be excluded from backbone cost-sharing counts. Serial numbers for these radios are to be provided by the Partner or Participating Agency. The OCSD/Communications Division will run random

radio traffic checks on those radios identified as emergency radios and will advise department heads if any ongoing traffic is occurring.

15.3 Cities/OCFA Payment of FY 02-03 Backbone Costs

A. County is authorized to transfer from the County's Site Development and Infrastructure Fund to the County General Fund, an amount equal to the Cities' and OCFA's FY 02-03 share of cost for System Backbone operations. The purpose of this transfer is to finance Cities' and OCFA's FY 02-03 share of the System Backbone costs and to allow cities and OCFA to pay said costs over a period of time. Furthermore, it allows the County to receive said amount in its General Fund as was budgeted for FY 02-03.

B. Each city and OCFA will amortize its share of the FY 02-03 System Backbone costs, interest free, over a period of 5 years, commencing July 1, 2003, by paying back to County 20% of its share of the FY 02-03 System Backbone cost each year thereafter for five years. Each city and OCFA shall make this payment to County along with its regular System Backbone cost-sharing expense payment for that particular fiscal year.

15.4 Annual Payment

Commencing July 1, 2003, and continuing each year thereafter, each city and OCFA will contribute 100% of its allocated share of the System Backbone costs based on the formula set forth in 15.2.A above. Said payments shall be made on a quarterly basis in advance within thirty days of billing.

15.5 New Site Development and Infrastructure Fund

The County will place the approximately $4.1 million currently in the County's Site Development and Infrastructure Fund, less the amount County is allowed to deduct from that fund pursuant to 15.3.A above, into a separate Site Development and Infrastructure Fund. This fund will be controlled by the 800 MHz Governance Committee. Each project financed from this fund will require prior Governance Committee approval. Each expenditure from the Site Development and Infrastructure Fund must be utilized for County's share of site development and/or infrastructure costs. On June 30, 2008, any remaining balance in the Site Development and Infrastructure Fund shall be administratively transferred to the County General Fund without further approval by the 800 MHz Governance Committee, cities or the OCFA.

The Partner and Participating Agencies will share in the cost of 800 MHz CCCS system and infrastructure upgrades. The funding sequence for payment of these costs will be as follows:

- Use of grant funds if available.
- Use of system entry fees contributed to the system from new Participating Agencies if any as they join the system.
- Use of combined City/County contract reserve fund consistent with percentage contributions made by cities versus County.
- Use of infrastructure contributions collected annually as part of the backbone cost-sharing allocations. Contributions to infrastructure payments will be made on

a 70% Cities/OCFA and 30% County of Orange basis, consistent with the Motorola contract allocation split during 800 MHz CCCS implementation. OCSD/Communications will prepare a document and timeline that identifies the remaining infrastructure requirements and estimated costs by fiscal year, thereby bringing closure on the balance of the infrastructure necessary to complete the original 800 MHz CCCS. Infrastructure payments beginning in FY 2005/2006 will reflect contributions needed to meet these outstanding obligations.

- County will pay for design and construction costs for radio sites required to address outstanding coverage issues that remain from initial 800 MHz CCCS implementation, which are Newport Beach, Dana Point and Brea/Carbon Canyon sites.
- County will evaluate the inclusion of radio site construction and infrastructure for new housing developments as part of Mello-Roos costs.

15.6 Exclusive Backbone System Costs

Unless otherwise authorized by separate agreement or an amendment to the 800 MHz CCCS Joint Agreement, none of the cost elements covered under the 800 MHz Communications System Agreement for Cost Sharing shall be included in other service agreements between the County of Orange and the Cities or OCFA.

15.7 New Participating Agencies

New users of the System shall be charged pursuant to the policy established by the Governance Committee under Sections 13.1 and 16 of the 800 MHz CCCS Joint Agreement.

15.8 Budget/Year-End Settlement

A. The 800 MHz budget and allocation of expenses will be submitted for approval to the Governance Committee ninety (90) to one hundred and twenty (120) days in advance of each fiscal year and communicated to the Partner and Participating Agencies for purposes of including same in their budgets for the next fiscal year.

B. As soon as practicable following the end of each fiscal year, a final independent audit or a financial review as stipulated by the Governance Committee, shall be performed to determine the actual cost of backbone system operations, infrastructure and maintenance costs for that fiscal year. The findings of this audit or financial review shall be made known to the Partners and Participating Agencies on the 800 MHz CCCS. Thereafter, to the extent there have been contributions made by the Partners and Participating Agencies which exceed the actual cost of operations and maintenance, the amount of said excess contributions shall be credited to each party in the same proportion as was used to create the excess. Any excess for operational expenses shall be deducted from each entity's fiscal year obligation for the following fiscal year. In the event of a shortfall, each party shall be billed its prorata share of the shortfall, which shall be paid in the first quarter payment for the next fiscal year following the fiscal year of the shortfall.

C. Contributions made to infrastructure by each Partner Agency and Participating Agency will be held in either the specific County Account (15L) designated for 800 MHz CCCS infrastructure or system upgrades or in the third-party escrow account as determined by

the Governance Committee. In either case, interest earnings will be allocated to these specific funds. Whether the Governance Committee determines that these funds will be held in a third-party escrow account or a County fund, the fees for this account will be included as a backbone cost sharing expense. As designated under the 800 MHz Escrow Agreement, unless otherwise modified, escrow account funds can only be spent for Motorola expenditures in support of system enhancements or infrastructure costs.

D. Should any Partner Agency or Participating Agency fail to make its appropriate payments when due, the County shall take action as is appropriate to obtain such payment. Nothing in this Agreement shall be construed as the County's exclusive remedy for the remediation of defaults by Governing Authorities, and the County reserves the right to pursue any and all available rights and remedies at law or in equity.

15.9 800 MHz Site Revenues

In the event County decides to generate revenues from the commercial, non-governmental sector by leasing space at the County's radio sites, the following shall apply:

A. The use of said radio sites shall not interfere with or degrade the efficiency of the System.

B. The net revenues generated from such use shall be shared among the Parties to this 800 MHz CCCS Joint Agreement in the same proportion as each party contributed to the maintenance and repair of the radio site(s) for the fiscal year the revenue is generated, up to the amount of each party's contribution for maintenance and repair of the base radio site(s) from which the revenue is generated. All additional net revenues shall go to the County.

15.10 Future System Enhancements/Upgrades/Replacements

It is anticipated that a significant upgrade of the 800 MHz CCCS will be required as early as 2010. The Governance Committee, with staffing provided by the County, will be responsible for defining the required upgrades and anticipated funding requirements. The Governance Committee will develop a long-range plan and establish a multi-year Equipment Replacement Fund for the purpose of accumulating funds from the Partner and Participating Agencies. The Equipment Replacement Fund will be designed to allow for the tracking of interest by individual contributor.

16. ADDITIONAL PARTICIPATING AGENCIES OR CONSOLIDATION OF PARTICIPATING AGENCIES

Law Enforcement/Public Works/Fire/Lifeguard Agencies may be added to the system with approval by that Agency's Governing Authority, support by appropriate operational committees, and approval of Governance Committee.

The System is designed to support multiple Participating Agencies. New Participating Agencies may only be added to the System within channel loading limits without degrading the level of service. (Refer to Section 13.1.)

The System must adhere to FCC minimum loading standards. In order to meet the minimum loading standards established by the FCC and to ensure efficient utilization of

the System spectrum resource, County will continually monitor the level of use of the System.

The County shall be responsible for coordinating access to the System, training new users in operational and security procedures, and assuring compliance with technical standards. The new Agency may be responsible for the cost of these services.

16.1 Adding Participating Agencies: Newly Incorporated or Contract Cities

Cities presently contracting for law enforcement, fire or public works services from the County or other Participating Agencies may in the future desire to form their own departments. In such cases, the County shall work with these agencies to develop an appropriate system design and implementation plan to transition to an independent city system similar to other cities.

Any System Field Equipment or other costs associated with the transition of a New City or Contract City to the System shall be the responsibility of the city unless addressed in a separate agreement with County.

16.2 Consolidation of Law Enforcement Agencies, Public Works Agencies or Fire Agencies

Cities presently contracting for law enforcement, fire or public works services from the County or other Partner or Participating Agencies may in the future desire to consolidate with other departments to form regionalized systems. In such cases, the County shall work with these agencies to develop an appropriate system design and implementation plan to transition to a consolidated system. Any System Field Equipment or other costs associated with the transition of a Contract City or Independent City to form with others in a consolidated unit shall be the responsibility of the consolidated entity, unless addressed in a separate agreement with the County.

16.3 Adding Non-City/Non-County Participating Agencies

Newly formed Non-City/Non-County Participating Agencies that do not participate in the System in its initial implementation may desire to use the System. County shall work with any such Participating Agency to develop an appropriate system design and implementation plan to transition to the System after approval is recommended by OCCOPSA, OCFCA, OCLC, and OCPWC, as appropriate, and approved by the Governance Committee.

An agency that does not participate in the original purchase and cost sharing of the System Backbone shall contribute a share of the System cost consistent with Section 13.1. Funds from this account may be used for Backbone System enhancements for the benefit of all Partners and Participating Agencies. Enhancements shall be recommended by the Technical Liaison Committee and OCCOPSA, OCFCA, OCLC, and OCPWC as appropriate, with final approval by the Governance Committee. Approved enhancements involving cost sharing shall be submitted to the Governing Authorities for approval as appropriate.

Any Backbone System modification costs required to transition a New Non-City/ Non-County Participating Agency to System shall be the responsibility of the new Non-City/Non-County Participating Agency.

Any System Field Equipment costs associated with the transition of a New Non-City/Non-County Participating Agency to System shall be the responsibility of the new Non-City/ Non-County Participating Agency.

16.4 Adding Mutual Aid Providers

Certain governmental and non-governmental Mutual Aid Providers may be granted access to the subsystems, for the expressed purpose of providing Mutual Aid to a Participating Agency. Access may only be granted by the bodies described in Sections 3, 4, 5, 6 of this Agreement.

Any Backbone System modification costs associated with adding a Mutual Aid Provider to the System shall be the responsibility of the Mutual Aid Providers and/or the sponsoring Partner or Participating Agency(s).

Any System Field Equipment costs associated with adding a Mutual Aid Provider to the System shall be the responsibility of the Mutual Aid Provider and/or the sponsoring Partner or Participating Agency(s).

17. LIABILITY

Each Party listed in Exhibit "A" (the "Indemnitor") shall indemnify, defend, and hold all other parties, and their agents and employees (the "Indemnitees") harmless from all claims, liabilities, damages, and losses to the Indemnitees arising out of any acts or omissions of itself and its agents and employees in connection with the performance of this Agreement which acts or omissions constitute gross negligence.

18. GOVERNANCE COMMITTEE

The 800 MHz Governance Committee will oversee implementation and operations of the 800 MHz System including Partner and Participating Agency compliance with payment schedules, addressing operational issues affecting System operation and backbone site development, reviewing and approving conversion, modification and enhancement plans, approving contract pricing changes, resolving disputes between Partners or Participating Agencies, approving the policy recommendations of the Committees, approving policy, operational and fiscal matters necessary for the operation and maintenance of the System, and performing any other responsibilities required to implement this Agreement.

The Governance Committee shall be responsible for recommending 800 MHz Project operating and capital improvement budgets that are jointly funded by the Parties to the Agreement. The appropriate Governing Authorities will be responsible for approving these budgets through the backbone cost-sharing approval process.

Committee members, as identified below, will also be responsible for coordinating with their appropriate associations/agencies on issues involving Governing Body approvals:

- Four City Managers appointed by the Orange County City Managers' Association
- County Executive Officer, County of Orange, or Designee
- Sheriff-Coroner, or Designee
- Resources and Development Management Department Director, or Designee

Each must designate and name an alternate as a voting member if member cannot attend.

19. AGREEMENT AMENDMENT PROCESS

This Agreement may be amended or modified by consent of all of the Governing Authorities representing the Parties.

20. WITHDRAWAL FROM SYSTEM

This Agreement shall take effect as above dated. This Agreement may be terminated by any Parties or Participating Agencies to the Agreement as listed on Exhibit "A" or Exhibit "C" as to that Party or Participating Agency by serving written notice of termination on the County and after meeting its financial obligations under this Agreement. After the expiration of sixty (60) days from the giving of such notice, the Party or Participating Agency so electing to withdraw shall cease to be a Party or Participating Agency to this Agreement. Such termination shall not relieve said Party or Participating Agency or other Party of any financial obligation assumed as part of this Agreement. (Said Party and Participating Agency shall still be obligated to pay its backbone cost sharing expense for that fiscal year and its annual flat fee expense for that fiscal year if the Party or Participating Agency is participating in the flat fee program.) The Party or Participating Agency terminating shall not be responsible for any financial obligations assumed by the other Parties or Participating Agencies hereto subsequent to said termination. Similarly, it is understood that County has ownership of the System Backbone and certain backbone sites, as well as FCC licenses presently owned by the County, and upon any termination by any Parties to the Agreement, any and all right, title and interest in the System Backbone, those backbone sites and FCC licenses shall remain with the County. Should the County wish to withdraw, an orderly transition to remaining Parties and Participating Agencies must be affected.

IN WITNESS WHEREOF, the Parties and Participating Agencies hereto have set their hands and seals on the date set forth opposite their respective signatures on identical counterparts of this instrument, each which shall for all purposes be deemed an original thereof.

COUNTY OF ORANGE
By: ATTEST:
Board of Supervisors
Dated:
Approved As to Form:
County Counsel

CITY OF:
By: ATTEST:
City Clerk
Dated:
Approved As to Form:
City Attorney

ORANGE COUNTY FIRE AUTHORITY
By: ATTEST:
Chairman
Dated:
APPROVED AS TO FORM:
By:
Authority Counsel

ORANGE COUNTY TRANSPORTATION AUTHORITY
By: ATTEST:
Chairman
Dated:
APPROVED AS TO FORM:
By:
Authority Counsel

Appendix K - ICIS Exercise of Powers

JOINT EXERCISE OF POWERS AGREEMENT TO ESTABLISH A JOINT POWERS AGENCY TO CREATE THE INTERAGENCY COMMUNICATIONS INTEROPERABILITY SYSTEM

THIS JOINT EXERCISE OF POWERS AGREEMENT (the "Agreement") is made this 15th day of September, 2003, by, between and among the following public agencies:

City of Beverly Hills, a municipal corporation in the State of California;

City of Burbank, a municipal corporation in the State of California;

City of Culver City, a municipal corporation in the State of California;

City of Glendale, a municipal corporation in the State of California;

City of Montebello, a municipal corporation in the State of California;

City of Pasadena, a municipal corporation in the State of California;

City of Pomona, a municipal corporation in the State of California;

City of Torrance, a municipal corporation in the State of California; and

West End Communications Authority, a joint powers agency.

Each of the public agencies executing this Agreement shall individually be referred to as "Member" or collectively referred to as "Members."

RECITALS

A. Whereas the Members require wide area and interoperable communications, and no Member acting independently has the resources to construct a communications network providing these capabilities;

B. Whereas the County of Los Angeles and City of Los Angeles each independently operate and maintain radio communications systems which provide wide area radio communications capability; and are constructed for optimal coverage within the areas for which these entities have responsibility;

C. Whereas the Los Angeles County Sheriff operates an interoperable communications system for the benefit of all public safety agencies within Los Angeles County; this system known as the Los Angeles Regional Tactical Communications System, is intended for incident-based communications;

D. Whereas the Members have determined that working in concert and sharing their radio communications resources is in the public interest as it provides the most effective and economical radio communications network for all participating public entities;

E. Whereas the goals of the Members are to provide wide area radio communications for the Members, and to provide the Members with interoperability with the County of Los Angeles, the City of Los Angeles, the County of San Bernardino, the Members, and the other independent cities of Los Angeles and San Bernardino Counties;

F. Whereas the Members agree that it is their goal to evaluate and if feasible, cost effective and appropriate for each Member, cause to be established and to participate in a public safety radio network hereinafter referred to as the "Interagency Communications Interoperability System" or "ICIS" to meet or enhance their current public safety radio communications needs and to provide an architecture capable of expanding to meet future needs;

G. Whereas the Members are each empowered, pursuant to Section 6500 et. seq. of the California Government Code to execute agreements with other public agencies to jointly exercise powers commonly held by each of the contracting public agencies ("joint powers agreement") and other powers applicable to joint powers agencies by law. The West End Communications Authority ("WECA") is an existing joint powers agency which is comprised of the following public agencies: Chino, Montclair, Ontario, Upland, and Rancho Cucamonga; and

H. Whereas the Members agree that the Interim Joint Powers Agency creating the Interagency Communications Interoperability System, created on or about September 17, 2002, to provide a coordinated approach for the evaluation, planning, design, and securing of funding for the development and maintenance of ICIS has been terminated, and is replaced by this Agreement;

NOW, THEREFORE, in consideration of the recitals and mutual obligations of the Members as herein contained, Members agree as follows:

ARTICLE I

GENERAL PROVISIONS

1.01 Purpose. This Agreement is made pursuant to the provisions of Article 1, Chapter 5, Division 7, Title 1 of the California Government Code (commencing with Section 6500, hereinafter the "Act"), relating to the joint exercise of powers common to public agencies. The purpose of this agreement is to create an agency that will engage in regional and cooperative planning and coordination of governmental services to establish a wide-area interoperable public safety communications network. As part of this purpose, members will seek to meet or enhance the current public safety radio communications needs, and provide an architecture capable of expanding to meet future needs; develop funding mechanisms; and resolve technical and operational issues in the development and management of a wide-area interoperable public safety communications network. Such purposes are to be accomplished and said common power exercised in the manner hereinafter set forth.

1.02 Creation of Authority. Pursuant to Section 6507 of the Act, there is hereby created a public entity to be known as the "Interagency Communications Interoperability System Joint Powers Authority" or "ICIS JPA" (hereinafter referred to as the "Authority"). The Authority shall be a public entity separate and apart from the Members and shall administer this Agreement.

1.03 Governance Board. The Authority shall be administered by a governance board ("Board") consisting of as many directors as there are Members who are parties to this Agreement, unless and until such number is changed by amendment of this Agreement. The governance board shall consist of the City Manager of each Member or his/her designee and the Chairperson of the WECA Board of Directors or his/her designee ("Director"). Each Director shall have an alternate appointed by the City Manager of each Member and the Chairperson of the WECA Board of Directors, who may act in the Director's absence ("Alternate Director"). The names of the Directors and Alternate Directors shall be provided to the Chairman of the Governance Board at the first meeting of the Board. Any change of the Directors or Alternate Directors shall be provided to the Chairman of the Board in writing in advance of the meetings. Any vacancy shall be filled in the same manner as described herein for appointment. The Board shall be called the "Interagency Communications Interoperability System Joint Powers Authority Governance Board" or "the Board." All voting power of the Authority shall reside in the Board.

1.04 Fiscal Year. For purposes of this Agreement, the term "Fiscal Year" shall mean the period from July 1 of each year to and including the following June 30.

1.05 Meetings of the Board.

1.05.1 Regular Meetings. The Board shall provide for its regular meetings; provided, however, that at least one regular meeting shall be held each month. The date, hour and place of the holding of regular meetings shall be fixed by

resolution of the Board and a copy of such resolution shall be filed with the City Clerk of each of the Members.

1.05.2 Special Meetings. Special meetings of the Board may be called in accordance with the provisions of the Ralph M. Brown Act (commencing with California Government Code section 54950).

1.05.3 Call, Notice and Conduct of Meetings. All meetings of the Board, including without limitation, regular, adjourned regular and special meetings, shall be called noticed, held and conducted in accordance with the provisions of the Ralph M. Brown Act of the California Government Code.

1.06 Minutes. The Secretary shall cause to be kept minutes of the meetings of the Board and shall, as soon as possible after each meeting, cause a copy of the minutes to be forwarded to each Director and to the Members.

1.07 Voting. Each Director shall have one vote. An Alternate Director may participate and vote in the proceedings of the Board only in the absence of that Member's Director. No absentee ballot or proxy shall be permitted.

1.08 Quorum; Required Votes; Approvals. A majority of the Board shall constitute a quorum for the transaction of business, except that less than a quorum may adjourn meetings of the Board from time to time. The affirmative votes of a majority of the Directors shall be required to take any action by the Board, except, a two-thirds (2/3) vote shall be required to take any action on the following: (a) issuance of revenue bonds; and (b) payment of surplus revenue to Members.

1.09 Annual Budget and Administrative Expenses. The Board shall adopt a budget for administrative expenses, which shall include all expenses not included in any financing issue of the Authority, prior to the commencement of each fiscal year.

1.10 Bylaws. The Board may adopt, from time to time, such bylaws, rules and regulations for the conduct of its meetings as are necessary for the purposes hereof.

ARTICLE II

OFFICERS AND EMPLOYEES

2.01 Chairperson, Vice-Chairperson and Secretary. The Board shall elect a Chairperson and Vice-Chairperson from among the Directors, and shall appoint a Secretary who need not be a Director, in July of each calendar year. In the event that the Chairperson, the Vice-Chairperson or Secretary so elected resigns from such office or its represented Member ceases to be a Member of the Authority, the resulting vacancy shall be filled at the next regular meeting of the Governance Board held after such vacancy occurs. The officers shall perform the duties normal to said offices. The Chairperson shall sign all contracts on behalf of the Authority, and shall perform such other duties as may be imposed by the Board. In the absence of the Chairperson, the Vice- Chairperson shall sign contracts and perform all of the Chairperson's duties.

2.02 Treasurer. Pursuant to Sections 6505.4 and 6505.6 of the Act, the treasurer of the Authority shall be the treasurer of the City of Glendale, unless and until the Board by resolution designates another treasurer, who shall be (1) the treasurer of one of the Members; (2) a certified public accountant; or (3) such other officer or employee as the board shall deem qualified to act as treasurer of the Authority ("Treasurer"). The Treasurer shall be the depository, shall have custody of all of the accounts, funds and money of the Authority from whatever source, shall have the duties and obligations set forth in Section 6505, 6505.5 and 6547.9 of the Act.

2.03 Auditor. The Board shall appoint an auditor who shall be (1) the auditor of one of the Members; or (2) such other officer or employee as the Authority shall deem qualified to act as auditor of the Authority, ("Auditor"). The Auditor shall perform the functions of auditor for the Authority and shall make or cause an independent annual audit of the accounts and records of the Authority by a certified public accountant, in compliance with the requirements of Section 6505, 6505.5 and 6505.6 of the Government Code and generally accepted auditing standards.

2.04 Other Employees. The Board shall have the power by resolution to appoint and employ such other officers, employees, consultants and independent contractors as may be necessary for the purpose of this Agreement.

2.05 Privileges and Immunities from Liability. All of the privileges and immunities from liability, exemption from laws, ordinances and rules, all pension, relief, disability, workers' compensation and other benefits which apply to the activities of officers, agents or employees of a public agency when performing their respective functions shall apply to the officers, agents or employees of the Authority to the same degree and extent while engaged in the performance of any of the functions and other duties of such officers, agents or employees under this Agreement. None of the officers, agents or employees directly employed by the Board shall be deemed, by reason of their employment by the Board to be

employed by the Members or by reason of their employment by the Board, to be subject to any of the requirements of the Members.

2.06 Bonding of Persons Having Access to Property. Pursuant to Section 6505.1 of the Act, the Members shall designate the public office or officers or person or persons who have charge of, handle, or have access to any property of the Authority and shall require such public officer or officers or person or persons to file an official bond in an amount to be fixed by the Members.

ARTICLE III

STANDING COMMITTEES

3.01 Standing Committees. The Board shall establish two standing committees to be known as the "ICIS Operations Committee" and the "ICIS Technical Committee" for purposes of making recommendations to the Board. Each Director shall appoint one representative to each standing committee. Each Committee shall have a Chairperson appointed by the Board and a Vice Chairperson elected by the members of the respective Committee subject to the concurrence of the Board. The ICIS Operations Committee members shall be comprised of First Responding Personnel from each Member. The ICIS Technical Committee shall be comprised of Radio Communications Personnel from each Member. A quorum of a Committee shall be a majority of its membership. All meetings of each Committee shall be held in accordance with the Ralph M. Brown Act of the Government Code.

3.02 First Responding Personnel. For purposes of this Agreement, First Responding Personnel shall mean personnel of the departments of fire, police or emergency medical services. With regard to WECA, it shall include such personnel from its member cities.

3.03 Radio Communications Personnel. For purposes of this Agreement, Radio Communications Personnel shall mean personnel responsible for radio system management, planning, maintenance and operation. With regard to WECA, it shall include such personnel from its member cities.

ARTICLE IV

POWERS

4.01 General Powers. The Authority shall have the powers common to the City of Glendale and shall do all acts necessary or convenient to the accomplishment of the purposes of this Agreement, subject to the restrictions set forth in Section 4.04. As provided in the Act, the Authority shall be a public entity separate from the Members.

4.02 Power to Issue Revenue Bonds. The Authority shall have all of the powers provided in Articles 2 and 4 of Chapter 5, Division 7, Title 1 of the California Government Code (hereinafter the "Bond Act"), including the power to issue bonds thereunder, ("Bonds").

4.03 Specific Powers. The Authority is hereby authorized, in its own name, to do all acts necessary for the exercise of the foregoing powers, including but not limited to, any or all of the following:

4.03.1 To make and enter into contracts, provided that under no circumstance shall the Board enter into any contract or commit any act of omission which may result in a debt, liability or obligation, either present or future, for any individual Member, unless such Member expressly agrees in writing to be bound by such contract or conduct;

4.03.2 To acquire, construct, maintain, or operate telecommunications systems or service and to provide the equipment necessary to deliver public services therefrom;

4.03.3 To employ or engage contractors, agents, or employees;

4.03.4 To sue and be sued in its own name;

4.03.5 To apply for, receive and utilize grants and loans from federal, state or local governments or from any other available source in order to pursue the purpose of the Authority;

4.03.6 To issue bonds and otherwise to incur debts, liabilities and obligations, provided that no such bond, debt, liability or obligation shall constitute a debt, liability or obligation to the Members;

4.03.7 To invest any money in the treasury pursuant to Section 6505.5 of the Act which is not required for the immediate necessities of the Authority, as the Authority determines is advisable, in the same manner and upon the same conditions as local agencies, pursuant to Section 53601 of the California Government Code; and

4.03.8 To promulgate, adopt, and enforce any rules and regulations, as may be necessary and proper to implement and effectuate the terms, provisions, and purposes of this Agreement.

4.04 Limitation on Exercise of Powers. All common powers exercised by the Board shall be exercised in a manner consistent with, and subject to, the

restrictions and limitations upon the exercise of such powers as are applicable to the City of Glendale and as set forth in this Agreement.

4.05 Obligations of Authority. The debts, liabilities and obligations of the Authority shall not be the debts, liabilities and obligations of the Members. In addition, pursuant to Section 6547.8 of the Act, no Director shall be personally liable on the Bonds or subject to any personal liability or accountability by reason of the issuance of Bonds.

ARTICLE V

CONTRIBUTION; ACCOUNTS AND REPORTS; FUNDS

5.01 Contributions. The Members may, in the appropriate circumstance, when required hereunder: (a) make contributions from their treasuries for the purposes set forth herein; (b) make payments of public funds to defray the cost of such purposes; (c) make advances of public funds for such purposes, such advances to be repaid as provided herein; or (d) use its personnel, equipment or property in lieu of other contributions or advances. The provisions of Section 6513 of the Act, as it may be amended from time to time, are hereby incorporated into this Agreement by reference.

5.02 Accounts and Reports. To the extent not covered by the duties assigned to a trustee chosen by the Authority, the Treasurer shall establish and maintain such funds and accounts as may be required by good accounting practice or by any provision of any trust agreement entered into with respect to the proceeds of any bonds issued by the Authority. The books and records of the Authority in the hands of a trustee or the Treasurer shall be open to inspection at all reasonable times by duly appointed representatives of the Members. The Treasurer, within 180 days after the close of each Fiscal Year, shall give a complete written report of all financial activities for such Fiscal Year to the Members to the extent that such activities are not covered by the report of such trustee. The trustee appointed under any indenture or trust agreement shall establish suitable funds, furnish financial reports and provide suitable accounting procedures to carry out the provisions of said trust agreement. Said trustee may be given such duties in said indenture or trust agreement as may be desirable to carry out this Agreement.

5.03 Funds. Subject to the applicable provisions of any instrument or agreement which the Authority may enter into which may provide for a trustee to receive, have custody of and disburse Authority funds, the Treasurer of the Authority shall receive, have custody and disburse Authority funds in accordance with laws applicable to public agencies and generally accepted accounting practices, and shall make the disbursements required by this Agreement or to carry out any of the purposes of this Agreement.

5.04 Use of Master Site and Infrastructures. The City of Glendale shall permit the use of its Master Site and use of its trunking infrastructure to the Authority. Members that currently maintain Infrastructure or Members that intend to develop Infrastructure in the future may permit the use of such Infrastructure to the Authority. Members not developing an Infrastructure may permit the use of radio stations and/or trunking-capable frequencies.

5.05 Sharing of Frequencies. Members holding licenses to frequencies ("Licenses") may authorize the Authority to share the use of such frequencies and/or radio stations in accordance with the Code of Federal Regulations, (47 CFR 90.179). Such authorization may be revoked by the Member holding the License at any time. Licenses to frequencies shall remain primary to the Member

holding the License. Any authorization for the use of such License shall be made pursuant to a written agreement between the Member and Authority.

5.06 Infrastructure. For purposes of this Agreement, Infrastructure shall mean an interconnected trunked radio system or cell, not including the Master Site or improvements thereto, or the microwave.

5.07 Master Site. For purposes of this Agreement, Master Site shall mean the systems and equipment through which the infrastructure components are interconnected and which controls subscribers roaming through cells.

ARTICLE VI

TERM, WITHDRAWAL AND TERMINATION

6.01 Term. This Agreement shall become effective, and the Authority shall come into existence, on the date when at least two Members have approved and executed this Agreement, and this Agreement and the Authority shall thereafter continue in full force and effect so long as there are at least two Members who are participating as part of the Authority. However, if any Bonds have been issued and remain outstanding, this Agreement cannot be terminated, and Members benefiting from such Bonds shall not withdraw from the Authority, until all revenue bonds or other forms of indebtedness issued pursuant hereto, and the interest thereon, shall have been paid or adequate provision for such payment shall have been made in accordance with the resolution (or indenture) adopted by the Board. No termination or amendment shall be made which is contrary to the language, spirit or intent of any contract and/or grant agreement entered into by the Authority.

6.02 Withdrawal by Members. Subject to the restriction on withdrawal contained in Section 6.01 above, members of the Authority may withdraw from membership based upon the following provisions. Members who do not provide Infrastructure to ICIS shall provide ninety (90) days advanced written notice of intent to withdraw from the Authority to the Chairperson. Members which provide Infrastructure to ICIS, shall provide twelve (12) months advanced written notice of intent to withdraw from the Authority to the Chairperson. The City of Glendale shall provide twenty-four (24) months advanced written notice of intent to withdraw from the Authority to the Chairperson. In the event the City of Glendale withdraws from the Authority, the Authority and/or the remaining Members independently shall have the right and option, for consideration received, to remain interconnected with City of Glendale's Master Site, provided City of Glendale radio users retain the right to roam onto those Members' Infrastructure, and the Members provide funds sufficient for the maintenance of that portion of the Master Site used by the Members. This option must be exercised by entering into a separate agreement between the City of Glendale and by the adoption of a resolution by the Board or by the governing body of the Member on or before sixty (60) days prior to the last day for withdrawal of the City of Glendale.

6.03 Retention of Assets by Withdrawing Members. Upon the effective date of withdrawal from the Authority, a Member shall hold their Licenses and retain their licensing rights to the shared frequencies authorized to the Authority pursuant to Section 5.05. In addition, the use of the withdrawing Member's Infrastructure by the Authority shall be terminated on the effective date of withdrawal, and such Infrastructure, and any improvements thereto, shall remain the sole asset of the withdrawing Member. Such withdrawing Member shall have no interest or claim in any remaining assets of the Authority, the Board, or any of the remaining Members.

6.04 Termination of Authority and Disposition of Assets. Upon termination of this Agreement and dissolution of the Authority by all Members then party to this Agreement and after payment of all obligations of the Authority, all property of the Authority, both real and personal, shall be divided among such Members in shares proportionate to the total contributions for the acquisition of said property made by such Members. Upon a vote of a two-thirds majority of the Board, the Board may sell such property and distribute the proceeds of such sale among such Members in shares proportionate to the total contributions for the acquisition of said property made by such Members. If the assets consist of money, any money in the possession of the Authority shall be divided equally among the Members then party to this Agreement. Members shall hold their licenses and retain their licensing rights to the shared frequencies authorized to the Authority. In addition, each Member shall hold their Licenses and retain their Licensing rights to the shared frequencies authorized to the Authority pursuant to Section 5.05 and any Infrastructure provided by the Member to the Authority shall remain the sole asset of that Member.

ARTICLE VII

MISCELLANEOUS PROVISIONS

7.01 Notices. Any notice required or permitted to be made hereunder shall be in writing and shall be delivered in person or by certified or registered mail, postage prepaid, addressed to the attention of the Secretary of the Authority and to the City Clerk of each of the Members at their principal place of business or in the case of WECA to the Chairperson of the WECA Board of Directors. Any written notice sent by first class United States mail shall be deemed given on the third (3rd) business day after deposit. Any written notice sent via certified return receipt requested shall be deemed given on the date such return receipt is signed by the addressee.

7.02 Amendment; Addition of Members.

7.02.1 In addition to the original signatories to this Agreement, any local agency may become a Member of the Authority. The addition of any local agency shall become effective upon:

(i) the execution on behalf of such local agency of a counterpart of this Agreement and the delivery of such executed counterpart to the Board; and

(ii) the adoption of a resolution of the Board admitting that local agency to the Authority. As used in this section, local agency shall mean a county, a city, whether general law or chartered, or a joint powers agency.

7.02.2 This Agreement may be amended at any time by the two/thirds (2/3) agreement of the then existing Members, evidenced by the execution of a written amendment to this Agreement.

7.03 Membership. Notwithstanding any other provisions of this Agreement, if all the Members named on the first page of this Agreement have not approved and executed this Agreement on or before September 15, 2003, but two or more of the Members have approved and executed this Agreement on or before said date, then the "Interagency Communications Interoperability System Authority" shall be deemed created by only those Members who have approved and executed this Agreement on or before said date, and only those agencies shall be parties to this Agreement. After September 15, 2003, any agencies who are not then parties to this Agreement may become parties in the manner set forth in Section 7.02.1.

7.04 Consents and Approvals. Any consents or approvals required under this Agreement shall not be unreasonably withheld.

7.05 Enforcement of Authority. The Authority is hereby authorized to take any or all legal or equitable actions, including but not limited to injunction and specific performance, necessary or permitted by law to enforce this Agreement.

7.06 Severability. If any one or more of the terms, provisions, promises, covenants, or conditions of this Agreement shall to any extent be adjudged

invalid, unenforceable, void, or voidable for any reason whatsoever by a court of competent jurisdiction, each and all of the remaining terms, provisions, promises, covenants, and conditions of this Agreement shall not be affected thereby and shall be valid and enforceable to the fullest extent permitted by law.

7.07 Successors. This Agreement shall be binding upon and shall inure to the benefit of the successors of each Member.

7.08 Assignment. No Member shall assign any rights or obligations under this Agreement without the prior written consent of all other Members.

7.09 Governing Law. This Agreement is made in the State of California under the Constitution and laws of such state and is to be so construed.

7.10 Headings. The section headings herein are for convenience only and are not to be construed as modifying or governing the language of this Agreement.

7.11 Counterparts. This Agreement may be executed in counterparts.

7.12 No Third Party Beneficiaries. This Agreement and the obligations hereunder are not intended to benefit any party other than the ICIS JPA and its Members, except as expressly provided otherwise herein. No entity not a signatory to this Agreement shall have any rights or causes of action against any party to this Agreement as a result of that party's performance or nonperformance under this Agreement, except as expressly provided otherwise herein.

7.13 Filing of Notice of Agreement. Within 30 days after this Agreement becomes effective, the City of Glendale shall file with the Secretary of State the notice of Agreement required by section 6503.5 of the Act.

7.14 Conflict of Interest Code. The Board shall adopt a conflict of interest code as required by law.

7.15 Indemnification. The Authority shall defend, indemnify and hold harmless each of the Members from any and all claims, losses, suits, injuries, damages, costs and expenses, including attorney's fees, arising from or as a result of any acts, errors or omissions of the Authority or its officers, agents or employees, to the extent of the Authority's negligence or willful misconduct. The indemnity granted under this section shall extend to the officers, agents, employees and contractors of each indemnified party.

7.16 Dispute Resolution/Legal Proceedings. Disputes regarding the interpretation or application of any provision of this Agreement shall, to the extent reasonably feasible, be resolved through good faith negotiations between the Members and/or the Authority. If any action at law or in equity is brought to enforce or interpret this Agreement, the prevailing party in such action shall be entitled to reasonable attorney's fees, costs and necessary disbursements, in addition to such other relief as may be sought and awarded.

IN WITNESS WHEREOF, the Members have caused this Agreement to be executed and attested by their proper officers thereunto duly authorized, their official seals to be hereto affixed, as follows:

CITY OF BEVERLY HILLS
CITY OF BURBANK
CITY OF CULVER CITY
CITY OF GLENDALE
CITY OF MONTEBELLO
CITY OF PASADENA
CITY OF POMONA
CITY OF TORRANCE
WEST END COMMUNICATIONS AUTHORITY