



AGENDA

LOS ANGELES REGIONAL INTEROPERABLE COMMUNICATIONS SYSTEM AUTHORITY

BOARD OF DIRECTORS SPECIAL MEETING

Thursday, September 15, 2011 • 9:00 a.m.
Los Angeles County Fire Department Headquarters
Training Center – Room 26
1320 North Eastern Avenue
Los Angeles, CA 90063

Los Angeles Regional Interoperable Communications Systems Authority (the "Authority")

AGENDA POSTED: September 14, 2011

Complete agendas are made available for review at the designated meeting location during normal business hours and may also be accessible on the Authority's website at <http://www.la-rics.org>.

Members:

1. **William T Fujioka**, Chair, CEO, County of Los Angeles
2. **Mark R. Alexander**, City Manager, representing California Contract Cities Association
3. **Leroy D. Baca**, Sheriff, County of Los Angeles
4. **Charles L. Beck**, Vice Chair, Police Chief, City of Los Angeles
5. **Brian Cummings**, Fire Chief, City of Los Angeles
6. **Reginald Harrison**, Deputy City Manager, City of Long Beach
7. **LeRoy J. Jackson**, City Manager, City of Torrance, representing At Large Seat
8. **Dr. Mitchell H. Katz**, Director, DHS, County of Los Angeles
9. **Gerry Miller**, Chief Legislative Analyst, City of Los Angeles
10. **Daryl L. Osby**, Fire Chief, County of Los Angeles
11. **Donald Pedersen**, Police Chief, City of Culver City, representing At Large Seat
12. **Scott Pickwith**, Police Chief, representing the Los Angeles County Police Chiefs Association
13. **Kim Raney**, Police Chief, City of Covina, representing At Large Seat
14. **Harold Scoggins**, Fire Chief, representing the Los Angeles Area Fire Chiefs Association
15. **Miguel Santana**, CAO, City of Los Angeles
16. **Gregory L. Simay**, Assistant General Manager, City of Burbank Water & Power, representing At Large Seat
17. **Steven K. Zipperman**, Police Chief, Los Angeles School Police Department

Officers:

1. **Patrick Mallon**, Executive Director
2. **Wendy L. Watanabe**, County of Los Angeles Auditor-Controller
3. **Mark J. Saladino**, County of Los Angeles Treasurer and Tax Collector
4. **Patricia Saucedo**, Board Secretary



NOTE: ACTION MAY BE TAKEN ON ANY ITEM IDENTIFIED ON THE AGENDA

I. CALL TO ORDER

II. ANNOUNCE QUORUM – Roll Call

III. PUBLIC COMMENTS

IV. ADMINISTRATIVE MATTERS

1. Telecommunications System Procurement Options – Pat Mallon

ACTION ITEM: Proposed RFP for Telecommunications System (one RFP or two RFPs):

- A. Recommendation: Direct staff to proceed with a single RFP for the Telecommunications System, requesting that proposers include alternate pricing in their proposals as follows: (a) a price for the entire Telecommunications System, consisting of both the LMR and LTE systems; (b) a price for the LMR system alone; and (c) a price for the LTE broadband system alone.

Attachment: Item 1

V. MEETING ADJOURNMENT

VI. NEXT REGULAR BOARD OF DIRECTORS MEETING:

Thursday, October 6, 2011 at 9:00 a.m., at the Grace E. Simons Lodge.



BOARD MEETING INFORMATION

Members of the public are invited to address the LA-RICS Authority Board on any item on the agenda prior to action by the Board on that specific item. Members of the public may also address the Board on any matter within the subject matter jurisdiction of the Board. The Board will entertain such comments during the Public Comment period. Public Comment will be limited to three (3) minutes per individual for each item addressed, unless there are more than ten (10) comment cards for each item, in which case the Public Comment will be limited to one (1) minute per individual. The aforementioned limitation may be waived by the Board's Chair.

(NOTE: Pursuant to Government Code Section 54954.3(b) the legislative body of a local agency may adopt reasonable regulations, including, but not limited to, regulations limiting the total amount of time allocated for public testimony on particular issues and for each individual speaker.)

Members of the public who wish to address the Board are urged to complete a Speaker Card and submit it to the Board Secretary prior to commencement of the public meeting. The cards are available in the meeting room. However, should a member of the public feel the need to address a matter while the meeting is in progress, a card may be submitted to the Board Secretary prior to final consideration of the matter.

It is requested that individuals who require the services of a translator contact the Board Secretary no later than the day preceding the meeting. Whenever possible, a translator will be provided. Sign language interpreters, assistive listening devices, or other auxiliary aids and/or services may be provided upon request. To ensure availability, you are advised to make your request at least 72 hours prior to the meeting you wish to attend. (323) 881-8291 or (323) 881-8295

SI REQUIERE SERVICIOS DE TRADUCCION, FAVOR DE NOTIFICAR LA OFICINA CON 72 HORAS POR ANTICIPADO.

A transcript of the meeting will be made available.

CLOSED MEETINGS MAY BE CONDUCTED

Under the Brown Act, closed meetings are the exception and permitted only if they meet defined purposes and follow special requirements (§§ 54953(a), 54954.5, 554962).

PERSONNEL EXEMPTION:

In accordance with the Brown Act, the purpose of this closed session is to permit a legislative body (e.g. LA-RICS Board of Directors) in limited circumstances to exclude the public in order to interview and/or select/appoint a potential candidate for the position of Executive Director for LA-RICS (§ 54957).

At the March 3, 2011 LA-RICS Board of Directors Regular Meeting, JPA Counsel shared with the Board the relevant section in the Brown Act Code regarding hiring and interviewing individuals [Independent Contractor] in closed session.

- Pursuant to section 54957(b)(1), which provides, in pertinent part, "...nothing contained in this chapter shall be construed to prevent the legislative body of a local agency from holding close session during a regular or special meeting to consider the appointment [or] employment of a public employee...". Under applicable Attorney General Opinions, a "public employee" includes independent contractors if the independent contractor would be acting in a position that would typically be filled by a public employee, e.g., the Executive Director of LA-RICS.

ACTION TAKEN IN CLOSED SESSION UNDER SPECIFIED CIRCUMSTANCES:

At the conclusion of the closed session meeting, if any final decision is made, the legislative body may be required to report on such action. (§ 54957.1.)

- Action and Votes in closed session must be publicly reported orally or in writing (§ 54957.1(b)), and copies of any contracts or settlements approved must be made available promptly (§ 54957.1(b), (c)).



LOS ANGELES REGIONAL INTEROPERABLE COMMUNICATIONS SYSTEM AUTHORITY

2525 Corporate Place, Suite 200
Monterey Park, California 91754
(323) 881-8291

PATRICK J. MALLON
EXECUTIVE DIRECTOR

September 15, 2011

Board of Directors
Los Angeles Regional Interoperable Communications System Authority (the "Authority")

Dear Directors:

TELECOMMUNICATIONS SYSTEM PROCUREMENT OPTIONS

SUBJECT

In order to proceed with the procurement of the Los Angeles Regional Interoperable Communications System (LA-RICS), it is necessary that your Board provide direction regarding which of the following two Request for Proposals (RFP) alternatives (A or B) staff is to use for the delivery of the Project 25 Land Mobile Radio (LMR) and the Long Term Evolution (LTE) broadband systems; collectively referred to as the Telecommunications System.

- A. One RFP for the Telecommunications System – requesting that proposers include alternate pricing in their proposals as follows:
 - a. A price for the entire Telecommunication System, consisting of both the LMR and the LTE broadband systems;
 - b. A price for the LMR system alone; and,
 - c. A price for the LTE broadband system alone.
- B. Two separate RFPs for the Telecommunications System – one RFP for the LMR system and one RFP for the LTE broadband system.

RECOMMENDED ACTION

Direct staff to proceed with Alternative A – a single RFP for the Telecommunications System, requesting that proposers include alternate pricing in their proposals as follows: (a) a price for the entire Telecommunications System, consisting of both the LMR and LTE systems; (b) a price for the LMR system alone; and (c) a price for the LTE broadband system alone.

BACKGROUND

At your Board meeting of September 1, 2011, staff recommended the issuance of an RFP for the Telecommunications System in a single procurement process provided that the responses from interested vendors include alternate pricing for the system as a whole and separately, one for the LMR system and one for the LTE system. At that time, the staff additionally advised that the RFP would specify that the Authority will evaluate and score the proposals based upon the complete Telecommunications System, consisting of both the LMR system and the LTE broadband system,

AGENDA ITEM 1

but that the RFP would further specify that the Authority expressly reserves the right to award a resultant contract for all or any portion of the Telecommunications System. The staff also advised that the RFP was based on a phased approach wherein third party contractors would be utilized for architectural/engineering services and construction activities.

The staff further advised that additional modification to the RFP would be required should Los Angeles County sponsored State legislation pertaining to the LA-RICS project be adopted to allow the procurement as a "Turn-Key System," which would allow, in summary, the Authority to engage a single contractor as a prime contractor to perform all work necessary to implement the Telecommunications System, including the architectural/engineering services and construction activities. We are happy to report that the legislation, Assembly Bill 946, sponsored by Assembly Member Bonnie Lowenthal, received unanimous support both in the California State Senate and Assembly. The bill is currently awaiting signature by the Governor. Staff has undertaken the task of removing all references to a phased approach with third party contractors for architectural/engineering services and construction activities and is incorporating those aspects into the scope of work for the new Turn-Key RFP.

During consideration of this item at the September 1st Board meeting, your Board raised a number of questions regarding the feasibility of issuing one RFP or two separate RFPs, and ultimately determined, among other things, to continue the decision until such time it had been determined whether Assembly Bill 946 would pass both the California State Senate and Assembly.

In response to the questions raised during the September 1st Board meeting, and in order to assist your Board in determining whether to adopt the recommended action, staff has developed a series of charts depicting the various components and the interrelationships of the LA-RICS subsystems (Attachment A). Also attached hereto (Attachment B) is a narrative describing the LMR and LTE broadband components and issues raised by engaging separate vendors to implement those components. Attachment B also examines the opportunities for sharing infrastructure and integration between these two systems.

Staff will return to the Board requesting authorization to release the revised Request for Proposal at your Board meeting of October 6, 2011.

JUSTIFICATION

In the experience of project staff and its consultants the splitting of large complex projects, such as the LA-RICS project, is unwise and contrary to achieving maximum project success. Pursuing separate procurement processes for the LMR and LTE systems creates a substantial possibility that two different, competing vendors will be awarded contracts. Simultaneous execution of the two contracts will create an unnecessary exposure of project management and financial risk as the Authority must assume coordination responsibilities for construction activities at all shared LMR and LTE sites, installation of a common backhaul network and integration of the systems at the two proposed Network Operations Centers (NOC).

Staff has worked diligently in the preparing the current version of the Request for Proposal to identify transmitter sites which are Authority member owned, suitable for the LA-RICS project and that will present a minimal potential for delay in the CEQA approval process. Many of the locations that have been deemed as primary sites, meeting all criteria for suitability, will support both the LMR and LTE systems.

These sites will require installation of equipment by competing vendors using common towers and equipment rooms with each system presenting unique requirements for space, uninterrupted power and air conditioned environments. If two separate RFPs are issued, the Authority will be placed in the position of mediating between the two vendors as each attempts to prioritize their design, development, furnishing and installation of their system at each of the common sites. The Authority must dictate site access and work coordination, leading to claims of delay and disruption of workflow by both vendors.

In optimizing the design and cost efficiency of the overall telecommunications system, the two subsystems will benefit in substantially sharing infrastructure including antenna sites, backhaul components and other systems components. If two separate RFPs are issued, the Authority will be compelling contractors to jointly design, furnish and install the shared infrastructure, or incurring the cost of duplicative, parallel infrastructure. The Authority would be compelled to mediate and resolve technical and programmatic disputes due to differing technologies, implementation strategies and resources as neither contractor would be subservient to the other. Additionally, the Authority will be exposed to increased risk in the integration of the subsystems through a common microwave and fiber-optic backhaul network and Network Operating Centers (NOC). The Authority would be exposed to significant risk of accusation of sharing one vendor's proprietary data to the other through the required coordinating activities.

If two separate RFPs are issued the sole measure available to the Authority to mitigate its exposure to risk is through the issuance of sequential Notices to Proceed. Simply put, one of the two systems will have to take precedence over the other. This will require that each system be developed as a separate self-contained system, functioning entirely apart from each other, installed in sequential order. Duplicative construction costs for supporting infrastructure including buildings, towers and the backhaul network will result. Alternatively, the Authority must interpret the needs of one vendor and direct the other vendor to include those activities within their scope of work. The sequencing of the two systems will also dramatically impact the LA-RICS project completion schedule.

FISCAL IMPACT/FINANCING

Sequential execution of separate contract periods will substantially increase the potential that federal grant funds will be lost through the expiration of grant periods.

FACTS AND PROVISIONS/ LEGAL REQUIREMENT

The Authority's counsel has reviewed the recommended action.

AGREEMENTS/ CONTRACTING

No agreements necessary at this time.

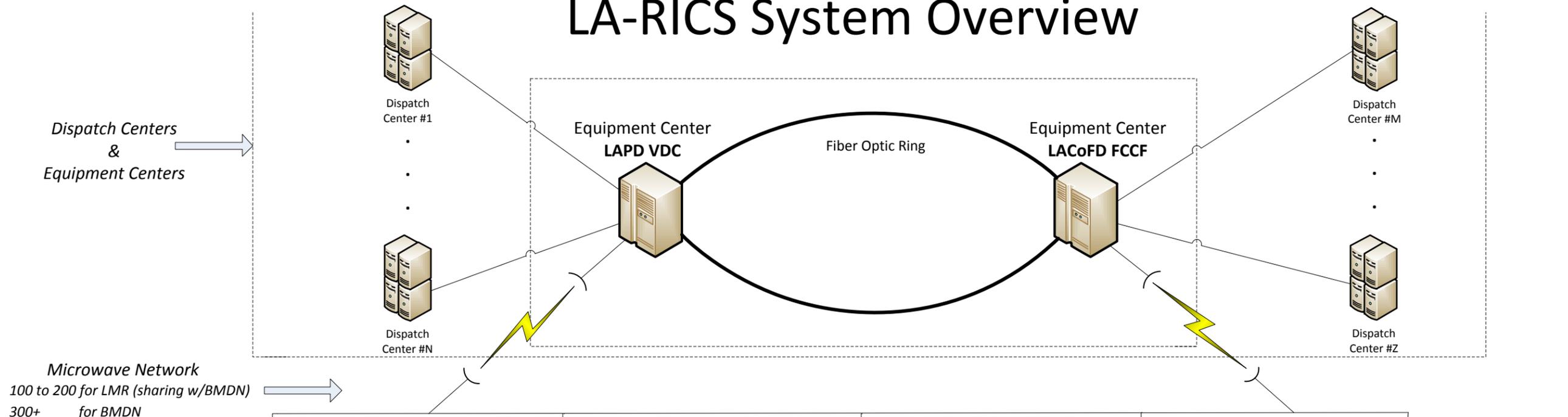
Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Patrick J. Mallon". The signature is written in black ink and is positioned above the printed name and title.

Patrick J. Mallon
Executive Director

cc: Counsel to the Authority

LA-RICS System Overview



System Name	Remote Sites	Communications Type
Analog Conventional Voice Radio System (ACVRS)	60-90 Countywide	UHF Tactical Voice Radio Communications
Los Angeles Regional Tactical Communications System (LARTCS)	60-90 Countywide	All-Band Wide-Area Voice Radio Communications
Digital Trunked Voice Radio System (DTVRS)	60-90 Countywide	UHF Wide-Area Voice Radio Communications
Narrowband Mobile Data Network (NMDN)	60-90 Countywide	700/800 MHz Narrowband mobile Data Communications
Broadband Mobile Data Network (BMDN)	250-300 Countywide	Broadband Mobile Data Communications

Interoperable Capability is shown between the equipment centers.

- On-scene incident communications with wide-area capabilities
- Serves unit-to-unit and area communications improving operating procedures
- Allows regional and flexible national interoperability
- Additional features including emergency alert, radio ID

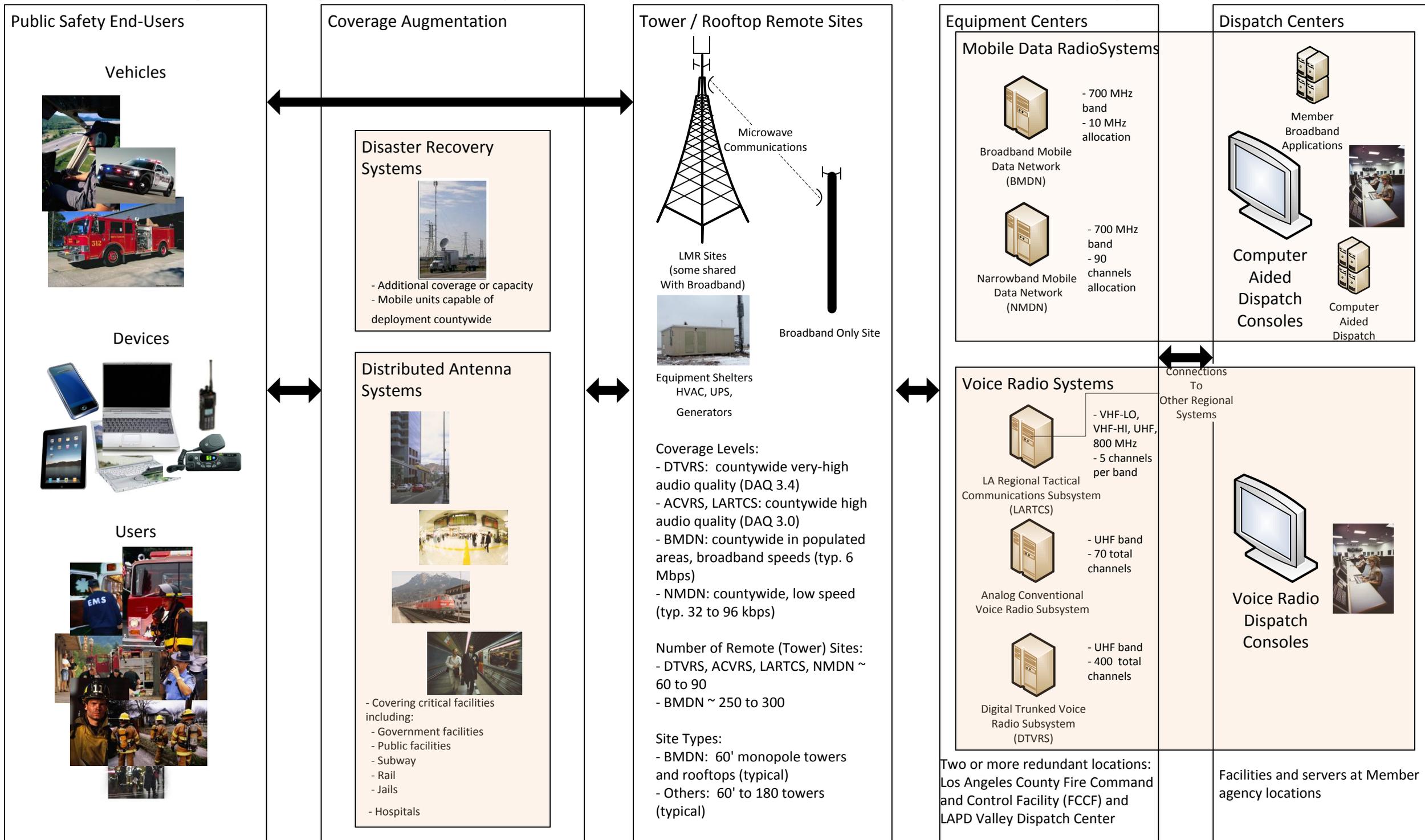
- Allows regional and flexible national interoperability
- Countywide coverage
- Capable of connecting to at least 80 conventional systems

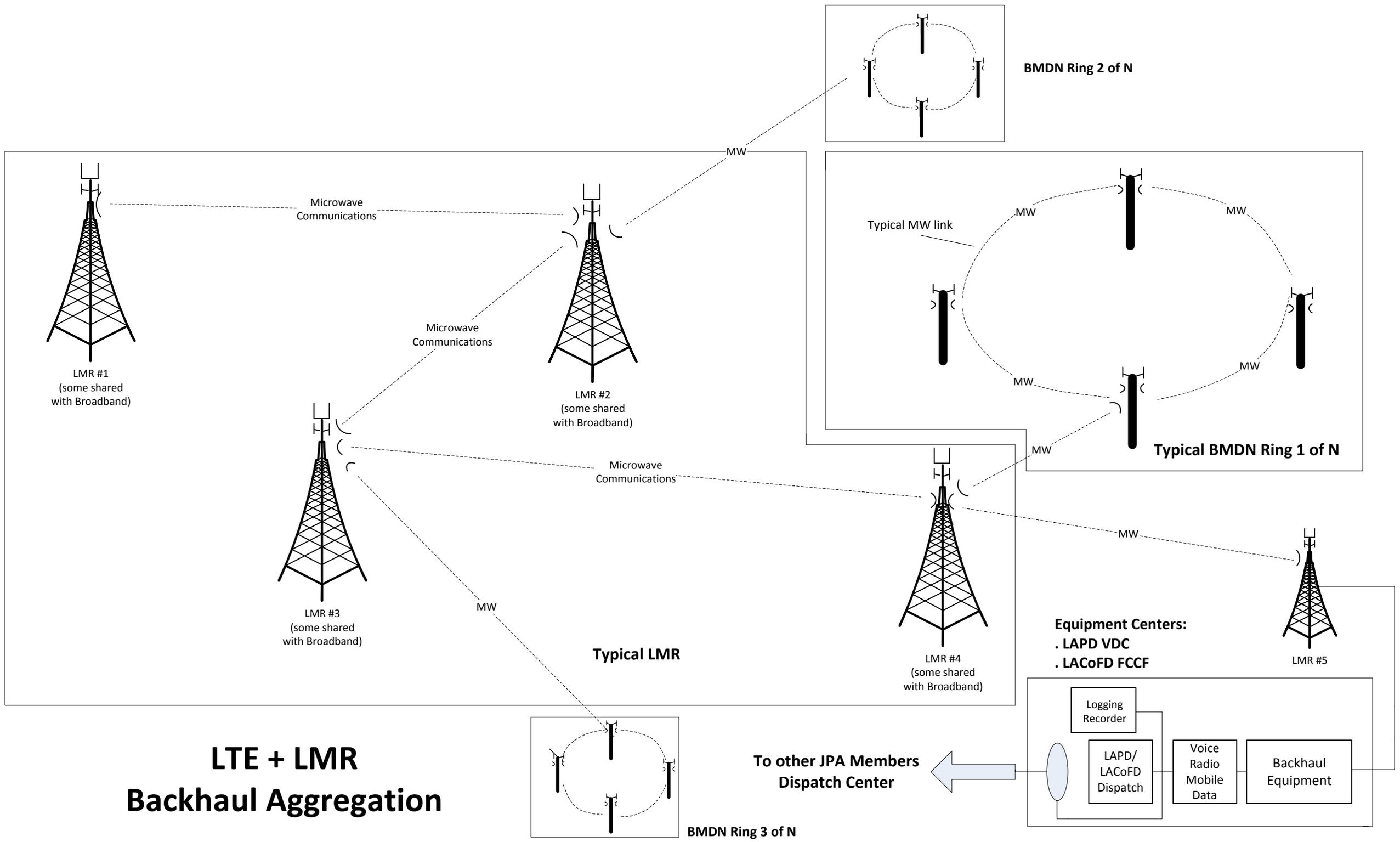
- Wide-Area high capacity communications for LA and immediate region interoperability
- Additional features including emergency alert, radio ID

- Narrowband mobile data provides slower speeds (< dial-up) mission critical data communications
- Countywide coverage, including areas of rough terrain

- Broadband Data allows desktop extension, real-time streaming video, web browsing
- Lower power requires more sites, less coverage than narrowband
- Long-term migration to support land mobile radio features

Los Angeles Regional Interoperable Communications System – Conceptual Overview

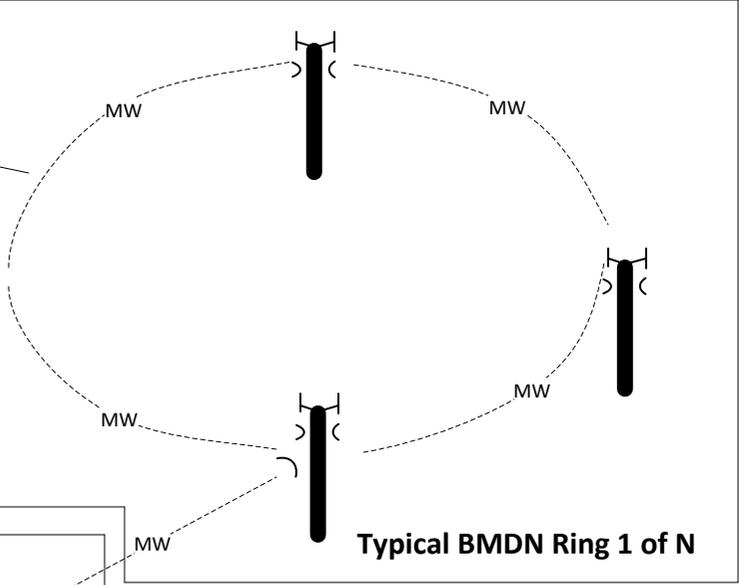
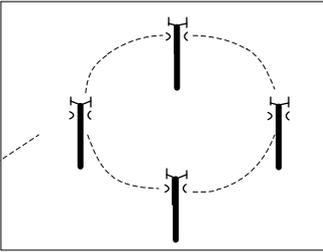
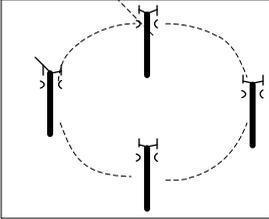
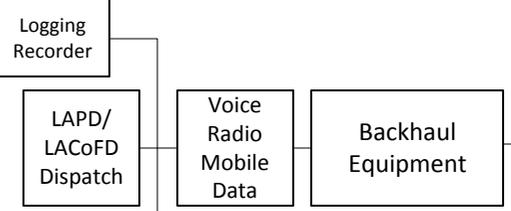




LTE + LMR Backhaul Aggregation

To other JPA Members Dispatch Center

- Equipment Centers:**
- LAPD VDC
 - LACoFD FCCF



Infrastructure Integration

Site and Network Component Sharing Between the LA-RICS Voice and Data Networks

September 2011

This paper describes the Land Mobile Radio (LMR) and the LTE Broadband (LTE) components of the proposed LA-RICS network. It then examines the opportunities for and process of integrating and sharing infrastructure between these major systems.

AGENDA ITEM 1 – ATTACHMENT B

I. Land Mobile Radio (LMR) System Overview

The LA-RICS Land Mobile Radio network will be comprised of 4 major subsystems:

- **Digital Trunked Voice Radio System:** Will provide wide-area, high-capacity UHF voice communications using the P25 standard. Benefits include efficient spectrum use and encryption capability.
- **Analog Conventional Voice Radio System:** Will provide tactical and wide-area UHF voice communications using established technology. Benefits include the capability for direct, unit-to-unit communications when out of range of the network infrastructure.
- **Los Angeles Regional Tactical Communications System:** Will support regional and national interoperability in multiple frequency bands. Capable of connecting to at least 80 conventional systems.
- **Narrowband Mobile Data Network:** Will provide low-speed, countywide data communications using the 700/800 MHz bands. Network will enable mission-critical text data transmission as a back-up to the Broadband network, particularly in remote areas or rough terrain.

A. LMR Physical Infrastructure

As proposed, these subsystems of the LMR network will each employ unique transmitters/receivers and antennas to enable transmissions between field users and the network, but all subsystems will share a common physical infrastructure comprised of:

- **Towers:** An estimated 60 to 90 towers, many of them located at higher elevations, will support the antennas that will provide communications coverage countywide. Most new towers will be between 100' and 150' tall.
- **Equipment Shelters:** Transmitters/receivers for all subsystems will be housed together in specially designed shelters that provide steady power, maintain specified temperature ranges, ensure proper electrical grounding, afford appropriate security and provide protection from the elements.
- **Back-up Power:** To ensure continuous network operations during power emergencies, sites will have uninterruptable power supply (UPS) battery systems and emergency generators, both appropriately sized to provide for all co-located subsystems.

Not every communications site will house each of the four subsystems described above. However, the similar power output of each system and the common County terrain

challenges addressed makes it highly likely that every site will house multiple subsystems and many will house all four.

B. Shared Network Infrastructure

In addition to shared physical infrastructure, these subsystems will use a shared network infrastructure to link the 60 to 90 communications sites into an integrated, countywide platform. These shared components include:

- **Network Operation Center (NOC):** The NOC will contain remote monitoring and management equipment for the entire network. Intended to be staffed 24 hours, the NOC will be the first line of defense to maintain reliable network operations and to immediately identify network problems.
- **Equipment Centers:** The system will have two redundant equipment centers to help ensure network resiliency. All communications traffic, except direct-mode field communications, from the four subsystems will be routed through the equipment centers in order to provide seamless wide area communications. Equipment centers will also provide the linkage back to member agencies' dispatch centers.
- **Fiber Optic Ring:** The two equipment centers will be linked via two high-capacity fiber optic paths, forming a ring, in order to provide redundant connectivity.
- **Microwave Backhaul Network:** In conjunction with the fiber ring, point-to-point microwave will be used to link each of the 60-90 antenna sites in the field to the NOC and equipment centers. At each site, data from all co-located subsystems will be aggregated into a single data stream, using common microwave equipment, rather than individual equipment for each subsystem.
- **Fiber Optic Backhaul Network:** Where available, existing member fiber networks or leased fiber networks may be used to supplement and/ or provide redundancy to the microwave backhaul network.

Every subsystem and every site in the LMR network will share these common network infrastructure components.

II. LTE Broadband Network (LTE) Overview

In accordance with the National Broadband Plan, the LA-RICS Broadband Mobile Data Network will be built to integrate with the nationwide, high-speed public safety data communications network. Characteristics of the network include:

- **10 MHz of Dedicated Spectrum:** LA-RICS will use 10 MHz of spectrum in the 700 MHz band class. The Authority was granted access to this spectrum under an FCC waiver order and uses it as a lessee of the Public Safety Spectrum Trust (PSST).
- **D-Block:** Depending on legislation currently pending before Congress, LA-RICS may have access to an additional 10 MHz of spectrum in the D-Block spectrum band. The D-Block would increase network capacity and performance, and call for a more robust backhaul network, but would not affect the characteristics described below.
- **Long Term Evolution (LTE) Technology:** To ensure nation-wide interoperability, the FCC has designated LTE as the public safety network standard. LTE is a fourth generation (4G) mobile broadband data standard currently being implemented across the commercial cellular industry.
- **High Speed Data Transmission:** The LTE standard is designed to provide high speed data supporting bandwidth-intensive applications such as high resolution imagery, GIS applications and streaming video.
- **Low Power Transmitters:** The LTE standard dictates that transmitters and field devices operate at lower power than traditional LMR devices. This requires the use of more sites – approximately three to four times as many – to achieve similar coverage as LMR systems.
- **Lower Elevation Sites:** To minimize interference and maximize coverage, the majority of LTE sites will be located at lower elevations.

A. LTE Broadband Site Infrastructure

An estimated 250 to 300 LTE sites will be needed to provide users countywide coverage at broadband speed and with sufficient capacity for day-to-day operations. Together, these sites make up the radio access network (RAN). The standard site will employ a common physical infrastructure, typically including:

- **Monopole Towers:** LTE antennas and microwave backhaul dishes will be mounted on monopole towers typically between 60 and 80 feet tall.
- **Equipment Cabinets:** LTE transmitters/receivers, known as eNodeBs, and microwave transmitters/receivers will be housed in specially designed cabinets that provide steady power, maintain specified temperature ranges, ensure proper electrical grounding, afford appropriate security and provide protection from the elements.

- **Back-up Power:** To ensure continuous network operations during power emergencies, sites will have uninterrupted power supply (UPS) battery systems and emergency generators.

Where available and appropriate, the infrastructure described above can be co-located at existing facilities or shared with other new system implementations.

B. LTE Broadband Network Infrastructure

The LTE will use a shared network infrastructure to link the 250 to 300 sites in the RAN into an integrated, countywide platform. These shared components include:

- **Network Operation Center (NOC):** The NOC will contain remote monitoring and management equipment for the entire network. Staffed 24 hours, the NOC will be the first line of defense to maintain reliable network operations and to immediately identify network problems.
- **Evolved Packet Cores (EPCs):** The system will have two redundant EPCs, analogous to equipment centers in the LMR network, providing reliable system control. All system access, traffic, and prioritization will be routed through the EPCs in order to provide seamless network operations. EPCs will also provide the linkage back to member agencies' dispatch centers and internal data networks.
- **Fiber Optic Ring:** The two EPCs will be linked via two high-capacity fiber optic paths, forming a ring, in order to provide redundancy.
- **Microwave Backhaul Network:** In conjunction with the fiber ring, point-to-point microwave will be used to link each of the 250 to 300 antenna sites in the field to the NOC and EPCs.
- **Fiber Optic Backhaul Network:** Where available, existing member fiber networks or leased fiber networks may be used to supplement and/ or provide redundancy to the microwave backhaul network.

Where available and appropriate, the infrastructure described above can be co-located at existing facilities or shared with other new system implementations.

III. Priorities for LMR and LTE Integration

The LMR systems and the LTE system use different technologies and, overall, require different network topologies. However, given that both systems must address the same constraints with respect to site availability, terrain challenges, and cost control, the Authority will share sites and network components across the two systems.

A. *Factors Leading to Site Sharing*

Systems co-located at shared sites can jointly use towers, shelters, and back-up power systems. Several specific factors dictate that both the LMR and LTE designs will employ some subset of shared sites. These factors include:

- **Finite Site List:** Neither network design has unlimited discretion in the use of tower sites. Both systems will use sites from the same selected set of existing tower sites and existing member facilities, in order to accelerate permitting and approvals and to minimize overall cost.
- **Limited Site Availability in Remote Zones:** In large areas of the county, such as the Angeles National Forest (ANF), Catalina Island, and the Santa Monica mountains, there are a limited number of locations currently approved as telecommunications sites. Moreover, land use policy in these areas strongly emphasizes co-location of communications equipment and infrastructure. Consequently, LMR and LTE network designs will ultimately use some of the same sites.
- **Existing, Available Tower and Shelter Infrastructure at Lower Elevations:** Throughout the region, members have made recent investments in physical infrastructure that may have available capacity for additional LMR and LTE Broadband network equipment. From a cost and schedule perspective, these sites will prove ideal for the LTE network and serve as valuable supplemental sites for the LMR system.
- **Identical Terrain Challenges:** Despite the greater site density of LTE versus LMR sites, each system faces the same terrain challenges in designing a backhaul network. Each system will likely use sites in the ANF, for example, to connect the North County to the Equipment Centers/EPCs in the basin. Each system will face the same line of sight challenges in linking Catalina Island to the mainland. Each system will face the same limited options for linking San Fernando Valley sites to the basin. County geography will lead each network design to use some of the same sites to address these challenges.

B. *Shared Network Infrastructure*

Both systems will use a similar set of core network components. The Authority will ensure that these components are effectively shared in order to shorten the implementation

schedule, minimize capital cost and streamline ongoing operations. These shared components could include:

- **Network Operation Center (NOC):** A single, integrated NOC will maintain a global perspective over all aspects of LA-RICS and minimize 24-hour staffing costs.
- **Equipment Centers/ Evolved Packet Cores (EPCs):** Co-location of the equipment centers and EPCs will simplify site preparation, connectivity to member dispatch and data systems, and equipment maintenance and monitoring. More importantly, co-location of the two systems will enable a tight integration of the narrowband and broadband data systems, enabling LA-RICS to automatically select the best network over which to send high priority, mission critical data.
- **Shared Fiber Optic Ring:** The two Equipment Centers/ EPCs can be linked via the same two high-capacity fiber optic paths.
- **Microwave Backhaul Network:** At shared sites – which could number from 30 to 60 – backhaul data traffic from LMR and LTE systems can be aggregated on shared microwave links.
- **Fiber Optic Backhaul Network:** At shared sites with access to existing fiber networks, backhaul data traffic from LMR and LTE systems can be aggregated on shared fiber paths.

IV. LMR and LTE Integration: Opportunities, Challenges, and Risks

Given the Authority's interest in sharing infrastructure across the LMR and LTE, the need to coordinate system implementation occurs throughout the project in order to exploit network efficiencies. If this joint implementation process is managed under separate vendor contracts the Authority will take on substantial project risk and expend resources mediating between competing vendor interests.

This section describes the opportunities presented by a unified systems implementation, as well as the risks and challenges if implemented under two separate contracts.

A. Initial Network Design

A coordinated design process allows each system to account for the impact of the other, rather than develop isolated designs. Any potential radio frequency interference can be accounted for and mitigated in the initial design. Where each system design initially selects a different site in close proximity to its complementary system, both designs can be modified to maximize efficient site reuse and minimize redundant infrastructure. Coordinated network designs allow for the design of a single, integrated backhaul network whose links are designed with sufficient capacity to carry all anticipated traffic to and from shared sites.

If the Authority takes the role of integrator over two separate vendors for the LMR and LTE components, the Authority will be required to manage the integration while incurring the risk of sharing potentially proprietary information across potential competitors.

B. Site Development Specifications

To maximize the potential benefits of using shared sites, physical site infrastructure should be shared, rather than duplicated. Coordinated development specifications will allow for appropriately engineered tower specifications, properly sized and equipped shelter specifications, and sufficient back-up power specifications.

If implemented under separate contracts, the Authority will be required to ensure that the final specifications meet the Authority's obligations under both contracts and maintain clear vendor responsibilities.

C. Design Review

The initial design, once analyzed with respect to permitting, environmental, budget, and other constraints, will need to be modified during the design review process. A coordinated design review process will allow for a streamlined revision of each network's design and a consistent solution to meeting any design constraints.

Design review changes will potentially have different levels of impact on each of the network designs. If implemented under separate contracts, the Authority will be required to ensure that the final design meets the Authority's obligations under both contracts and protects all performance guarantees, and the Authority will bear the risk of ensuring that changes required by one vendor are integrated as required into the system design of the other.

D. Site Construction

At the sites shared by the LMR system and the LTE, coordinated site development specifications and design review should allow for a single entity to construct all necessary, agreed-upon physical infrastructure. This should eliminate scheduling, access, and responsibility conflicts that arise when there are competing parties working at one location.

If implemented under separate contracts, the Authority will be required to mediate between vendors with competing schedules and obligations at shared sites. The Authority will bear the risk of ensuring that construction schedules meet the obligations of both contracts, that the scheduling protects all performance guarantees and that the Authority fully realizes the cost savings of elimination duplicative infrastructure.

E. Equipment Installation

If implemented under separate contracts, the Authority will be required to ensure close coordination to minimize the scheduling, access, and responsibility conflicts that arise when there are competing parties working at one location. The Authority must also ensure that all coordinated installation work meets the Authority's obligations under both contracts and protects all performance guarantees.

F. Acceptance Testing

For shared network components, such as the backhaul network, an integrated design and implementation approach should be carried forward into the acceptance testing process in order to establish clear performance standards and responsibilities to correct any deficiencies.

If implemented under separate contracts, the Authority bears substantial risk of unclear testing protocols, vendor finger pointing, and muddled responsibilities with respect to resolving underperformance.

G. Warranty and Maintenance

Separate contracts create substantial, enduring risks for the Authority with respect to warranty and maintenance guarantees. As with acceptance testing, separate contracts will complicate lines of communication and blur vendor responsibilities for identifying and

addressing system issues. The potential result will be less consistent maintenance, slower warranty response, and greater system down-time.