

AGENDA ITEM 4.e

To: Mayor and City Council Members
From: Frank Coe, Chief of Police
By: Kari Mendoza, Support Services Director
Approval: Alan Kapanicas, City Manager
Agenda Date: May 20, 2008
Subject: Radio Communication System

Summary:

The exponential growth in the City has made radio communications challenging. The current VHF radio system has been expanded to capacity to allow for better communications in the newer developments in the Community. Even with this expansion certain areas in the Community do not have good portable radio coverage, which impacts police officers tremendously.

As a result of this challenge the Beaumont Police Department entered into a consulting agreement with the Richter Group to analyze and make recommendations regarding our current radio communications system. Staff has also been involved in evaluating interoperability and regional radio efforts around the county.

Staff requests that Council approve an additional consultant agreement with the Richter Group in order to perform two tasks. The first task is to obtain and license five 800 MHz radio frequencies to serve as a basis of a new radio system. The second task is to produce a technical Request for Proposal to obtain a system design and formal cost proposal of a new radio system.

Background:

The current Police Radio System operates in the VHF high-band region of the radio spectrum. Many agencies around the county have transitioned to higher frequencies, UHF for Riverside, 800 MHz for Riverside County Sheriff, Palm Springs, Cathedral City, San Bernardino County, and San Bernardino City. The only other agencies operating VHF are Banning and Indio.

Staff has been informally involved in the establishment consideration and planning of a new regional radio system called the East Riverside County Interoperable Communications Authority (ERICA). However there is a concern based on the geography between ERICA member Cities and the San Geronio Pass. Staff also has a desire to move forward more quickly than a regional radio system would allow. A consulting study was commissioned to provide advice to which type of radio system upgrade would be compatible and feasible for the City of Beaumont.

An upgraded radio system similar to what ERICA has planned will utilize new interoperability radio protocol called P-25. All Public Safety has been converting to this standard of digital modulation for better communication and interoperability. The consultant has provided the City with four (4) possibilities. Below is a quick review of those options.

- Do nothing
- Upgrade the present VHF System
- Migrate to a four-channel conventional 800 MHz radio system
- Migrate to a five-channel trunked 800 MHz radio system

The final alternative above is a true Public Safety grade radio system. It will provide the greatest capability in efficiency and technology. It would be a fully trunked 800MHz system and would give the City significant growth capability as we continue to grow and add services. Migrating to a five-channel will allow for an interface to ERICA when they become operational as well as interoperability to Regional Communications Systems in Imperial, San Diego, Orange and San Bernardino Counties.

Migrating to five-channels would allow 4 channels for Police and one for Public Works. This will increase our own internal interoperability between departments for local emergencies.

Fiscal Impact:

Each of the above options has varying fiscal impact.

- | | |
|---|---------------------|
| ➤ Do nothing | \$0.00 |
| ➤ Upgrade the present VHF System | \$445,000 |
| ➤ Migrate to a four-channel conventional 800 MHz radio system | \$1.0 - 1.2 million |
| ➤ Migrate to a five-channel trunked 800 MHz radio system | \$3.0 - 3.4 million |

Current consulting fees required to continue the process and perform the two tasks necessary to move on will be \$19,500.

Funding source to be determined by the Finance Director.

Recommendation:

Authorize the City Manager to execute all agreements regarding the implementation of Option 4, migrate to a five-channel trunked 800 MHz radio system, in an amount not to exceed \$3.5 million, along with legal advice from the City Attorney.

Attachment(s):

Report to the City of Beaumont, Analysis and Recommendation Radio Communications System.

Proposal 08-813 Richter group Consultant Price Proposal.

April 2008

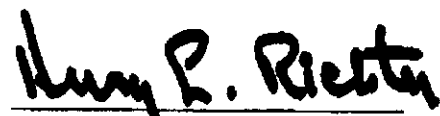
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REPORT TO THE CITY OF BEAUMONT

ANALYSIS AND RECOMMENDATION RADIO COMMUNICATIONS SYSTEM

Submitted to:
Chief Frank Coe
Beaumont Police Department
660 Orange Avenue
Beaumont, CA 92223

Submitted by:



Henry L. Richter, PhD, PE
Richter Group
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1, INTRODUCTION

This report to the City of Beaumont was commissioned to provide an evaluation of the present Police Radio system, to provide some alternatives for upgrade, and to make a recommendation to the City as which alternative is in the best interest of the City.

In March, the consultant interviewed key staff in the Beaumont Police Department to characterize the present radio system and to determine perceived needs for a suitable and modern radio system. The FCC licences were reviewed. Present and former maintenance contractors were queried as to their evaluation of the present system. An examination was made of the Dispatch Center and local radio equipment. The fixed equipment at Mt. David was also examined. A time was spent monitoring the activities on the radio system. Topological maps were studied to better understand the terrain of Beaumont.

The Police Radio System operates in the VHF high-band region of the radio spectrum, the so-called 150-170 MHz band. The Beaumont Police Department (BPD) system has operated in this band for some period of time, while most agencies around have transitioned to higher frequencies, to UHF for Riverside and to 800 MHz for Riverside County Sheriff, Palm Springs, Cathedral City, San Bernardino County, and San Bernardino City. Only Beaumont, Banning, and Indio (plus County Fire/CDF) operate on 150 MHz in the area. This severely hinders interoperability between agencies.

As background of the cause of this study, Beaumont has been informally involved in the establishment consideration and planning of a new regional radio system called the East Riverside County Interoperable Communications Authority (ERICA). The proponent has been the City of Indio who has an antiquated 150 MHz system and is anxious for regional interoperability. Indio also knows they need to upgrade their system and, in the process, intend to utilize the new interoperability radio protocol called P-25. Also, they plan to move their system to 800 MHz to match the rest of the systems in the region. After initial conversations, Cathedral City, Desert Hot Springs, and Palm Springs expressed interest in being part of a Regional System. Banning and Beaumont also joined the discussion. Since Beaumont is giving strong consideration to joining the effort, this consulting study was commissioned to provide advice to whatever kind of radio system upgrade would be feasible.

The next chapter presents the family of alternatives for consideration by the City. The following chapter discusses the alternatives and makes a recommendation for action.

2. ALTERNATIVES

The first comment which is not listed as an alternative is to convert to digital modulation. All of Public Safety has been converting to digital modulation. This trend has accelerated over the past five years since the P-25 standard has been developed and adopted. All grant money has mandated interoperability, involving the digital P-25 standard. This applies to Alternatives Two, Three, and Four below.

Four alternatives have been developed and will be described below:

- Do nothing
- Upgrade the present VHF system
- Migrate to a four-channel conventional 800 MHz radio system
- Migrate to a five-channel trunked 800 MHz radio system

2.1 Alternative 1: Do nothing

This alternative is presented for completeness' sake. This alternative could have been adopted without a consultant's recommendation, but the City is well aware that systems have moved past the present technology, and it is prudent to enter into an upgrade program, particularly as the rest of the Public Safety community is doing a major upgrade.

2.2 Alternative 2: Upgrade the present VHF system

The present VHF radio system could be upgraded to modern equipment and standards. This would mean new equipment capable of digital operation, in the P-25 format. The Federal Communications Commission has tried to mandate the conversion to digital operation, but several waves of opposition have pushed the mandatory date off to half a dozen years from now. The P-25 format is intended to enhance the efficiency of communications, and to increase interoperability among Public Safety agencies.

Upgrading to digital operation would mean new digital repeaters and voter equipment, plus new digital subscriber equipment (mobile and portable radios). It would also exacerbate the isolation of Beaumont from the Public Safety radio community (150 MHz) until the other cities converted to digital modulation. The present dispatch consoles would continue to operate, but would have to be upgraded to digital interface modules.

Beaumont now has three Police channels. One is repeated and voted, one is simplex with a local base station, and the other is a mobile-only channel. Adding a channel would be desirable, but Riverside County Fire (CDF) has been on a continuing search for more 150 MHz channels that the resource of channels is close to exhausted. Should this alternative be adopted, every effort should be made to convert the simplex channel to repeater operation.

2.3 Alternative 3: Convert to 800 MHz conventional system

Converting to an 800 MHz conventional radio system would give the first interoperability to the County and other nearby Public Safety agencies (except Banning). A new four-channel system could be developed which would provide digital and P-25 interoperability. The cost would be considerably less than a digital trunked system, and could be implemented in relatively short time. The crucial step would be to obtain radio frequencies which is a significant challenge in that Beaumont is exposed to the radio environment of both the upper Los Angeles basin and the Coachella Valley. Working out sharing arrangements with existing licensees requires extensive research, negotiation, and testing. But despite all odds, finding frequencies is possible. A first list of candidate frequencies has been developed for such a system and is presented as Appendix A.

Experience and tests show that effective coverage throughout the Beaumont area of operation requires a radio site in a strategic location. Several sites have been considered as the master site for Beaumont. Mt. David has been the operational site for the present 150 MHz system, but due to topographic shielding, it has been necessary to install several remote voting receivers to pick up the weak signals from portable radios. Voting at 800 MHz is comparable to VHF voting in a conventional designed system. However, voting in a trunked system environment is quite expensive. Therefore, a non-voted single site is desirable, even for a conventional site in that when the time comes to convert to trunked technology, the transition can be made without the voting requirement. In order to establish the suitability of Mt. David as a non-voted 800 MHz site, tests were run through the VHF-deficient areas of Beaumont. An 800 MHz portable was borrowed from the County and tests run with an 800 MHz conventional repeater at Mt. David. Satisfactory communications were achieved in all deficient areas (particularly western PGA West), thus demonstrating the effectiveness of Mt. David with a standard repeater at 800 MHz.

2.4 Alternative 4: Install an 800 MHz trunked system

The ultimate in technology to maximize the use of frequencies is a trunking system. This uses a group of frequencies (usually a minimum of five) in a dynamic computer-controlled fashion to spread a number of users over a few frequencies to average out the traffic on each channel. A simple explanation of trunking is contained in Appendix B.

The equipment to form a trunked system is expensive. Repeater radio transmitters are needed, a connecting microwave is required, specialized dispatch consoles are involved, plus a computerized controller which comes in two levels. The simple controller is about half a million dollars and will only support one site and a limited number of consoles. Such would be adequate for a Beaumont trunked system. The high level controller which will support multiple sites and thus simulcast, which can link to other controllers in a regional arrangement, is about two million dollars. Only the simple controller would be required should Beaumont (and Banning) choose to operate jointly as a cell on the ERICA System.

This cell could become a zone on the ERICA system and their primary controller could manage the simulcast Banning Pass area cell giving both full interoperability and a significant cost savings.

Beaumont could implement as a single site cell and be connected to ERICA by microwave. When Banning joins the Regional effort, a Banning site (to provide the additional needed coverage) could be established and simulcast with the Beaumont site.

3. DISCUSSION AND RECOMMENDATION

3.1 Discussion

Four alternatives have been defined above.

Alternative 1 - Do nothing. This alternative is not acceptable and the progressive nature of the City and Department management makes this clear. The City is at the point of committing to moving to a modern Police radio system, and such is certainly appropriate. This alternative was listed for completeness' sake, but is not recommended.

Alternative 2 - Upgrade the present VHF system. This is certainly a possibility; however, the desire heard from City staff is to move to a system that provides some advantages of interoperability with the majority of the surrounding Public Safety systems.

The present system consists of three channels: one repeated, one mobile and base, and one mobile only. Replacement would involve one repeater and four remote voter sites, one local base station and about 100 mobile and portable radios. The cost of such an upgrade is estimated at just under \$400,000. If another repeated channel were added, that would be another \$45,000.

Alternative 3 - Implement a four-channel conventional 800 MHz system. This alternative would put the City into an interoperable digital P-25 system, with subscriber radios capable of operating on the ERICA system, the San Bernardino County System, the new Riverside County 800 MHz trunked system, and the ITAC national mutual aid channels. Four channels would give the Police three independent channels plus one for Public Works, interoperable with Police. The three Police channels could be: Dispatch, Tac 1, and Tac 2 could double as an interoperability channel which could be tied to ERICA with a hard patch giving Beaumont radios capability through the Coachella Valley and Coachella Valley radios contact with their own dispatch through the Beaumont coverage area.

The subscriber radios should ordered soon as Motorola is running a special price (50% discount) on the XTS portable radios which have full digital P-25 and trunking capability. Buying these radios this year would enable the City to have full interoperability as the new systems come on line, and would be ready for a local trunking cell should that be in the future.

An estimate for a four-channel system with digital repeaters (no voting needed), 2 control stations, 200 subscriber units, and console enhancement would be \$1,000,000 to \$1,200,000; more than double the cost for Alternative 2. Everything would be new except the consoles. If Beaumont and Banning decide to become a cell on the ERICA system, these repeaters would be usable in the new trunked system, and the subscriber equipment would be compatible so nothing lost or being thrown away. The consoles would need to be replaced, but they are halfway through their useful life now. However, this would only be a stop-gap system to full

trunking.

Alternative 4 - an 800 MHz trunked radio system. This level of system is the true Public Safety grade and would have the greatest capability in efficiency and technology. This consultant advises that a full trunked system, implemented at the same time as ERICA would be the most cost-effective in the long run and if the City can find the funds to do this now, it would be in the best interest of Beaumont. This would give the City significant growth capability as the City builds out and adds services. If funds are a problem, Alternative Three could give the City a start and prepare the way for an upgrade to full trunking at an early time. Such an upgrade would be more expensive in the long run than putting in a full system at the start.

Cost estimates have been made by the consultant and by Motorola. To get refined pricing, a functional specification must be developed and responded to by Motorola. The pricing assumes that the portables will be ordered in 2008 to take advantage of the deep discount.

A simple trunked system would use the following components:

Trunked cell site including repeaters, antennas, cabling, equipped for simulcast Consoles (4)	
Microwave - two hops with transceivers, antennas, cabling, backup batteries	
Engineering/services plus engineering consulting and project assistance	
150 portables (encrypted)	
100 mobiles (encrypted)	
TOTAL	\$3,000,000 to 3,400,000

3.2 Recommendation

The consultant's recommendation is Alternative 4 - a five-channel trunked radio system. For the reasons just stated, developing a trunked cell radio system tied to ERICA would give the City large capacity for communications, great interoperability, the latest technology and therefore position for grants, and when the County system comes on line, wide area interoperability. Actually, when ERICA becomes operational, it is possible that an intertie with the Regional Communications System in Imperial County will open up capacity in Imperial, San Diego, Orange, and San Bernardino counties.

3.4 Action Steps

- A. Formulate a program plan to design, procure, and implement a five-channel trunked City radio system.
- B. Obtain City approval for funding the project.

- C. Immediately begin the process to secure five 800 MHz channels.
- D. Prepare a basic functional description for the system to solicit costs from Motorola.

Fixed equipment:	5-digital repeaters (wireline control) Site controller Antennas, transmission line, combiners, etc. 2 Control stations for Dispatch 2 Control stations for Public Works Trunking-digital capable consoles
Subscriber equipment:	50 Police mobile radios 100 Police portable radios 15 Public Works mobile radios 25 Public Works portable radios

APPENDIX A - POSSIBLE FREQUENCIES

Eleven possible channels are (showing co- and adjacent-channel licensees):

810/855.2250	San Bernardino County (Flash II)
810/855.2375	Indio MDT, Brea, RCC
810/855.2500	Commercial
810/855.4375	Commercial
810/855.4625	Springs Ambulance (Palm Springs AVL)
810/855.475	San Bernardino County (Quartzite)
810/855.4750	San Bernardino County (Quartzite)
810/855.4875	Palm Springs
810/855.5000	San Diego County (Valley)
810/855.7000	Commercial
810/855.7125	Palm Springs
810/855/.725	San Bernardino County (Back Country)
811/856.200	San Diego County
811/856.2125	Orange Co, LA Co
811/856.225	San Bernardino Co (Rodman), San Diego Co
811/856.2500	San Diego County MDT
811/856.2625	CCPD MDT; Huntington Beach
811/856.2750	San Bernardino County
811/856.425	San Bernardino County (West End)
811/856.4375	L.A. City
811/856.450	San Bernardino County (Rodman)
811/856.4625	Orange Co
811.856.475	San Bernardino County (Paxton)
812/857.4750	San Bernardino County (Paxton Hill)
812/857.4875	Palm Springs
812/857.	Commercial
815/860.2250	San Bernardino County (Paxton Hill), San Diego Co (NW system)
815/860.2375*	Murietta, Long Beach
815/860.250	San Bernardino County (Back Country), San Diego County (MDT)
815/860.2625*	L.A. County, Calif State (Delano)
815/860.2875	San Bernardino County (Valley system)

*- Expansion band, requires Waiver

APPENDIX B - WHAT IS TRUNKING?

To understand the value of trunking, let's forget all about radio for a moment, and consider some real-life circumstances with which we all are familiar: the supermarket and the bank.

Getting served in these circumstances typically involves two very different kinds of lines. In the supermarket, you pick a line and get in it. Hopefully, you choose one where there isn't a price check needed that delays your line, while the folks in the lane next to you move smoothly through.

Compare this to the experience at a typical bank, in which there is a single line in which you queue, and you are served by the first available teller. Granted, the person who needs the teller to balance their checkbook for them delays everyone a little, but there are four, five, or more other tellers to serve everyone else, and the line moves smoothly and more efficiently.

You have now seen the principal difference between a trunked and a conventional radio system. In a conventional system, channels serve a specific, fixed purpose. In the case of a city, one channel may be for Police dispatch, one channel is for Police tactical, one channel is for Public Works, and one channel is for Fire. There are obviously periods of inactivity at different times on each of the different channels, but there is no way to take advantage of this "dead time" on another channel to transmit our message when our channel is busy.

This is what trunking provides. It allows us to use all of the frequencies available to us to transmit our messages, instead of just one at a time.

In trunking, a central computer is in constant communications with every radio in the system at all times via a control channel. When a unit needs to transmit, the user presses their Push-To-Talk button, as with a conventional radio. The radio transmits on the control channel that Unit 123 needs to transmit on the Public Works Dispatch talkgroup. This is received by the central computer, which first validates that Unit 123 is a registered user of the system, and is not talking on a foreign or stolen radio. Once 123 has been validated, the central computer then instructs (on the control channel) all of the units listening to the Public Works Dispatch talkgroup to switch to Channel 3, which is currently idle. The central computer then instructs Unit 123 to switch to Channel 3, and also tells it that it has the channel, and may now transmit. The user receives a "talk permit" tone confirming that he has the channel, and his message is broadcast (on Channel 3, as instructed by the system) to his fellow Public Works Dispatch talkgroup users. This all happens in *a quarter of a second*.

Because of this flexibility in channel assignments, we can assign special-interest user groups to their own virtual channel, so that they do not have to listen to traffic on the system that does not concern them. These virtual channels are called "talkgroups". In the previous case of our Police Department, there are just the two channels, and everyone must listen to all of the traffic. In a trunked system, Dispatch becomes a talkgroup, and multiple tactical talkgroups would be created so that several incidents could be handled at the same time without distraction, Detectives would have a talkgroup (or more), Narcotics would have a talkgroup, Driver Training would have a talkgroup, and so on.

Trunking technology also permits far more users to be supported on a given set of frequencies than conventional operation. For example, in conventional operation, the maximum number of users that can be supported across four channels with a 5% probability that their call will encounter a busy channel (blockage) is 36. In trunked operation, that rises to 164.

This capacity rises dramatically as the number of channels increases. For example, nine channels operated conventionally can accommodate 81 users with 5% probability of blockage; trunked, the number rises to 706.

And, there is the advantage of scale. Since 1992, the City of San Diego has operated a 19-channel trunked system that serves its Police and Fire departments, the San Diego City Schools, many City agencies, and several non-City user groups, totaling more than 8,300 regular daily users, and nearly 400 talkgroups. This system, under normal conditions, delays calls less than 0.1% of the time. Under the extraordinary conditions of the Cedar Fire, where a significant fraction of the City was on fire, it delayed less than 5% of the calls.

RICHTER GROUP

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April 5, 2008

Mr. Frank Coe
Chief of Police
City of Beaumont Police Department
660 Orange Avenue
Beaumont, CA 92223

Proposal 08-813

Dear Chief Coe:

This is an informal proposal to the City of Beaumont to perform a communications consulting project with two tasks. The first task would be to obtain and license five 800 MHz radio frequencies to serve as the basis of your new radio system. The second task would be to produce the technical portion of a Request for Proposal to be issued to the Motorola Corporation to obtain a system design and formal costing for your new radio system.

Now that the Coachella Valley ERICA system is moving forward, this will allow the design of a trunked system cell for Beaumont to be formulated.

The first task would be to identify and obtain five frequencies for your new system. This begins with the development of a data base identifying the most likely frequencies. The Richter Group has a data base of all of the licensees in the Southern California area, and this is searched for candidate channels which have some likelihood of success. These frequencies are then examined for co- and adjacent-channel licensees and are ranked in order of the likelihood of a successful coordination. Since Beaumont is in a topographic saddle with the Inland Empire and San Gabriel Valley to the west, and the Coachella Valley to the east, licensees in all these areas must be considered.

Once a ranking has been established, then the negotiation process begins. Existing licensees are reluctant to allow another agency on to or adjacent to their frequency unless convinced that there is no possibility of harmful interference. This negotiation process often involves the production of computer-derived propagation maps, plus actual on-the-air testing. The RG is used to engaging in this process, and this will be an expected part of this task.

Once agreement has been reached with existing licensees, then the FCC application and APCO coordination paperwork is prepared and submitted. The RG staff is experienced in this process, and respected by the APCO/CPRA Frequency Coordination Committee which helps expedite the application.

A representation is made to the Committee and after approval is received, the applications are tracked through APCO and the FCC.

The second task is to develop the technical portion of a Request for Proposal. In order for a city to obtain the equipment that best meets its needs, at the best price, a procurement specification is needed. The RG staff have prepared many such documents and is available to produce such for Beaumont. A functional specification is the best approach to allow the Proposer to tailor the offering to the present generation of technology and equipment. Instead of calling out specific model numbers, a functional specification opens the field to the manufacturer who can produce and install equipment of the type and quality required. The RFP document is a combination of the RG technical specification and the unique City terms and conditions.

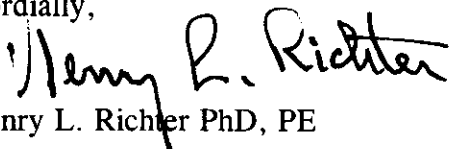
A pre-bid conference is usually held to review the RFP and answer any questions. It needs to be understood that this subject procurement will be a sole source to Motorola since the Beaumont system must be fully interoperable with the Coachella Valley ERICA and the new Riverside County 800 MHz trunked system. The RG staff assists in evaluating the bids, negotiating the best price, and making a recommendation to the City.

Price proposal)

Task 1 - frequency acquisition	\$15,000
Task 2 - RFP production	4,500

Should you have any questions, please do not hesitate to call.

Cordially,


Henry L. Richter PhD, PE

