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A REVIEW AND EVALUATION of POLICE COMMUNICATIONS

A TECHNICAL ASSISTANCE REPORT

prepared for

THE POLICE DEPARTMENTS OF:

MANTECA, CA

ESCALON, CA

RIPON, CA

66957

TASK NO. 7900801

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PERFORMED BY: ASSOCIATED PUBLIC SAFETY COMMUNICATIONS OFFICERS, INC.

UNDER A GRANT FROM THE LAW ENFORCEMENT ASSISTANCE ADMINISTRATION

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i. ACKNOWLEDGMENTS

The advisor wishes to acknowledge the gracious assistance provided him by the following during his on-site visit:

Manteca

Chief Leonard B. Taylor
Capt. Willie Weatherford
Lt. Ralph Jessee, Operations
Lt. Bill Mahaffey, Services
The shift watch commanders
Dispatcher Charlotte Ellis
Dispatcher Sheri Olsen
Dispatcher Lynette Currenton
Supervisor Verlene Walraven
Fire Captain Ron Waddle
Firefighter Steve Consentino

Escalon

Chief James Black
Lt. Jack Storme

Ripon

Chief Harvey Douma

I. INTRODUCTION

The Police Departments of Manteca, Ripon and Escalon, California, concerned about their communications problems, requested technical assistance from the Law Enforcement Assistance Administration (LEAA).

Their request was passed by the LEAA to the Technical Assistance Program office of the Associated Public-Safety Communications Officers, Inc. (APCO) for action. This program, funded by a grant from the LEAA, provides short term advisory assistance through its member resource. APCO, a not-for-profit institution, is the professional organization of telecommunicator employees of local, state and federal agencies nationwide.

This report, prepared by Bruce M. Karr, APCO Technical Assistance Program Manager, contains an evaluation of the police communications situation in Manteca, Ripon and Escalon, a discussion of options available to the cities, and recommendations for a course of action to improve their communications posture.

This report is advisory in nature and is not intended to be sufficiently detailed as to provide engineering design or specification.

Due to the complexity of the problems, the analyses, conclusions and recommendations of each problem element will be addressed before going on to the next element. This approach will provide better continuity and make for easier reference.

Basis of Analysis

The findings presented here were developed by several visits to the three departments, interviews with personnel, and personal observation of dispatching operations over seven shifts in the Manteca Police Department.

The findings concerning fire and ambulance operations are based on visits and interviews with fire personnel at their stations, and by observation of dispatching operations at the Manteca Police Department communications center which is responsible for fire and ambulance dispatching.

II. PROBLEM STATEMENT

The cities of Manteca, Escalon and Ripon, CA, faced with increasing problems of radio frequency congestion, nuisance and destructive radio interference, increasing individual department costs for dispatching service, an out-dated radio system design, and old equipments, have banded together to reduce these areas of concern.

A LEAA grant request to fund many of the perceived corrections did not receive approval when submitted last year. Funding of these corrections remains a critical item in the improvement of the communication posture of these departments.

The communities are concerned as to the steps they propose, the order of addressing the tasks, and the viability of the proposed solution which will combine dispatching services of the cities under one main center (Manteca).

III. PROBLEM ELEMENTS, ANALYSIS, CONCLUSIONS AND RECOMMENDATIONS

Elements of the problem are addressed in this order:

A. Consolidation of dispatching services
   - General
   - Escalon
   - Ripon
   - Manteca

B. Radio systems

C. Dispatching facilities

D. Dispatcher functions and duties

E. Fire aspects of dispatching

F. Equipment

G. Maintenance

H. Procurement of new equipments

Several of the problem elements are cited as being specific to Escalon or Ripon or both. All others apply more to Manteca as it is the focal point of the three-department effort. All three departments are concerned in all the problem elements, however, as their efforts are necessary to effect a solution, and they each will be affected by the solutions.

A. Consolidation of dispatching services

1. Analysis

The proposed combination of police dispatching services into one center, at the Manteca Police Department, is feasible. Both Ripon and Escalon are small towns of approximately 3,000 persons each. While there is usually an officer or clerk on duty at the department during normal business hours to receive complaints, assign them to

a police officer for service, and perform the dispatching tasks of supervision, obtaining information, and providing for officer safety, there are insufficient funds to provide this same "personal" coverage during the non-business hours.

The means proposed to provide citizen access, dispatching and overwatching for officer safety in these towns would provide a telephone line switch in Ripon and Escalon to transfer the caller to the Manteca dispatcher where the call would be answered as if it were in the local department. Dispatching and overwatching then would be performed by the Manteca center.

During normal business hours the switch would not be thrown and calls would be answered locally and dispatching would be by the local department.

This type of transfer operation provides a continuous overwatching of the field officer, to answer his needs and insure his safety. Most importantly, the option as to who answers calls and provides for dispatching is exercised by the local department on its need or convenience.

Several factors must be considered for this type of operation. They are:

a. the provision of adequate radio coverage by the dispatch center in Manteca. Portable radios in use at Ripon and Escalon must be capable of reliably reaching the Manteca center. The provision of radio coverage will be discussed more fully under Radio systems.

b. Protocols must be established and adhered to among departments for the transfer of responsibility for citizens call acceptance, officer supervision and safety. The dispatcher or officer should never have to question who is responsible at any given instant.

c. Dedicated off-premises extensions are provided as the transfer line medium. These extensions are charged for monthly as a normal cost of telephone service. Rates are generally based on an established figure per quarter mile of distance by the telephone company.

The benefits expected of this proposed arrangement among the cities are several:

a. continuous complaint answering and dispatching service for the citizen;
b. continuous officer watching by a dispatcher to insure a much higher degree of officer safety than is now realized;
c. continuous recording of the telephone and radio traffic at the central dispatch;
d. the ready availability of information from other departments, APBs, broadcasts, intelligence and like data which is normally available in the 24-hour center.

Escalon (approximately 12 miles east of Manteca)

Citizen access is via one dedicated telephone number for police services with an alternate through the city hall number. Walkup services are provided by the CETA clerk/dispatcher.

Command/control is exercised by the CETA dispatcher via the common Manteca/Escalon radio channel at 159.150 MHz.

CETA dispatchers are of very recent employment and have received minimal dispatching training. These employees were hired as a short-term temporary relief to meet the present dispatching problems faced by this small department.

Backup police services are available from Manteca and San Joaquin County.

Ripon (approximately 7 miles south of Manteca)

Citizen access is provided via two police emergency lines and a city hall business number.

Dispatching is currently performed on the Ripon police channel via the department during business hours (by contract with the fire chief and the chief's wife until his recent retirement) and is now planned to be moved into the Ripon rural fire district fire alarm office for 24-hour service.

Coordination with Manteca is minimal due to the different radio channel used by Ripon.

Manteca

The Manteca Police Department currently provides dispatching service for itself and for the Manteca Fire Department from a single operator position and a partial operator position in the center.

Citizen access for emergency police, fire or ambulance services are provided via five telephone lines in rotary. Additionally, walk-up

complaints are taken via a secure window in the department foyer where the dispatcher acts as complaint taker or receptionist. During normal department duty hours the window is closed and walkups are processed at an inside counter by records personnel.

2. Conclusions

The rapidly escalating growth pattern of the cities, especially Manteca, is a significant factor when applied to these conclusions. A new or improved dispatching radio system is needed. This new system must be capable of expansion to handle the 10% annual growth anticipated.

The combination of dispatching services for Escalon, Ripon and Manteca appears to be an effective method of providing for dispatching service and officer safety. The proposed part-time solution with telephone transfer of calls to Manteca offers the most practical method of demonstrating central dispatching advantages to the communities involved. As these advantages become apparent, the cities should evaluate the use of full time central dispatching as a viable cost alternative.

3. Recommendations

Manteca, Escalon and Ripon continue their individual and joint efforts toward combining their dispatching and radio operations. This includes establishing funding, agreements, protocols and operational procedures.

The CETA program at Escalon be used to evaluate CETA employees for selection and future training as an additional source of full-time

dispatching at the combined center.

Combination into one center should not occur until radio coverage improvements have been completed.

B. Radio systems

1. Analysis

Ripon

Radio contact with Ripon portables is expected to be poor. Ripon is not on the same frequency as Escalon and Manteca.

It was noted that the Ripon FCC license for its police base station on 155.370 MHz had expired.

Escalon

Coordination with neighboring Stanislaus County is an on-going need which is met by each car radio being able to access the Stanislaus Sheriff's frequency, and via the CETA dispatcher who monitors the Stanislaus County frequency. Escalon portable radios are not able to reliably contact the Manteca dispatch. Dismounted officers are not protected through a continuous radio watch when the Escalon CETA dispatcher is not on duty.

Interference from co-channel radio systems in the Bay area is more of a nuisance character to local Escalon radio operation. However, low power portable transmissions of Escalon are overridden and blocked to the Manteca dispatcher.

Manteca

Command and control of the police department units is exercised by

a watch commander and the dispatcher via the single police radio channel (159.150 MHz) and, at times, over a second "city works" local government channel.

The single police channel is shared, as all police radio channels nationwide are shared, with San Mateo County Sheriff, San Bruno, Burlingame, and numerous other cities in the Bay area. Radio propagation conditions are such that nuisance interference, if not destructive interference, is received by Manteca as a matter of course. Atmospheric conditions vary the effect or intensity of the interference to Manteca. To some degree the interference is mutual and Manteca interferes with the Bay area users.

Manteca city area growth has exceeded the talk-back range of the hand-held portable units used by the officers when dismounted, and while the officer can hear the dispatcher, he may not be able to talk back or initiate a call; thus, officer safety through radio watch may be sacrificed. Much of the interference received from the Bay area co-channel users will override a hand-held radio signal, further reducing the officer's ability to call for assistance.

Of equal importance is the effect of this interference on the dispatcher who hears all of the transmission from the Bay area users and many times must reduce the radio volume to answer telephones or other radio channels, further reducing the ability of a Manteca or Escalon officer to contact the dispatcher.

The radio frequency used by Manteca and Escalon - 159.150 MHz - is heavily congested by co-channel radio traffic from the Bay area.

There is one method of softening the effect of this interference to the dispatcher. This method does not remove the possibility of a strong interfering co-channel signal from blocking a local unit. The addition of continuous tone coded squelch (CTCSS) devices to the transmitter and receivers of the Manteca/Escalon system would reduce the nuisance interference factor. An estimated cost for these devices is approximately $75 per unit.

The Motorola proposal and the grant request involve improving the radio system by changing to the UHF 450-470 MHz band from the current 150 MHz VHF band.

Mr. Art McDole, Director of Communications for Monterey County and the APCO frequency coordinator for Northern California, was contacted by the advisor to determine if:

(a) there is a "new" 150 MHz VHF frequency available to Manteca that might offer less co-channel interference;

(b) there are two frequencies available with less co-channel interference possibilities;

(c) there are any channel pairs in the UHF band available for the "Motorola" proposed new system.

Mr. McDole, after reviewing his records, offered this general reply.

(a) The Bay area cities currently causing co-channel interference to Manteca/Escalon are supposed to be relinquishing the frequency over the next six to nine months, as they move to a different band. This should remove much of the received co-channel interference.

(b) Another 150 MHz frequency may be available on application to the FCC and the APCO Frequency Advisory Committee. However, tests would be required before assignment could be assured. This opens the possibility of a mobile relay (repeater) operation to the combined cities.

(c) There are no frequencies available in the 460-470 MHz region for assignment; however, there may be two pair available in the 450 MHz region.

(d) Application must be made to the FCC via the Frequency Advisory Committee of APCO, through Mr. McDole, for determination on each of these possibilities. Other co-channel users must be contacted, tests conducted, and related aspects of frequency management must be considered.

Minimum costs would be entailed through retaining the existing 150 MHz equipments, adding CTCSS devices, and applying for a new 150 MHz frequency to support mobile relay operation.

Continued use of 150 MHz frequencies would permit use of the Manteca LG frequency and the ability of Manteca's units to talk directly with fire/ambulance units as presently enjoyed. However, system growth possibilities will be limited as additional channels may not be available in the future. The 150 MHz channel frequencies should be adequate for 5 - 10 years of growth.

Fire radio operation can be improved by installation of a fire base radio at the dispatch center, and by providing radio receivers at the fire stations. This removes the dependence on vulnerable wire lines for dispatching.

Obtaining a new 450 MHz system would permit better system design measures to be applied treating the entire radio operation as a system.

- All new police radio equipments would be required.
- Co-channel interference would be reduced.
- Older 150 MHz mobile and base units replaced by UHF could be placed in operation at the fire stations, providing the necessary radio backup for dispatching.
- Several of the better 150 MHz radios could be retained in police vehicles for direct communication with fire and ambulance units.

The radio system of each city is generally old and for Ripon and Escalon is performing reasonably well. The Manteca system, if it is to support a combined operation, needs revision, which will affect all three cities.

Personal portable operation is desired by all the chiefs, and foreseen as the major radio tool in their future. Personal portables, because of size restrictions, are low power transmitters of 1 to 5 watts. This low power limits their area of reliable coverage severely when compared with the high power base or mobile.

It was noted that Escalon and Manteca units are not always able to talk back to the Manteca dispatcher from their patrol areas.

A properly designed satellite receiver system can overcome the low power deficiency by placing receivers closer to the portable transmitters and passing the received signal back to the dispatcher. Since the transmitter may hit several satellite receivers at once, a selector is used at the dispatch end to select the best quality signal and present that signal to the dispatcher. (The signal may also be used to key a repeater for rebroadcast.) This technique is well recognized and widely used.

The number of receiver sites needed and their placement should be determined by engineering study.

2. Conclusions

The radio system is in need of several improvements. Co-channel interference must be reduced or removed either by actions to add CTCSS devices or by moving to another frequency band. Any new equipments or systems will still require the application of CTCSS concepts. Minimum overall costs to the cities would entail adding CTCSS and obtaining a second 150 MHz frequency. A more initially expensive solution is to move to a new band (450 MHz), replace all existing equipments, and obtain several frequency pairs, thus providing for system expansion. The current single channel should be adequate for 5 - 10 years.

It is necessary to add a fire radio capability at the dispatch center to back up the current wire line dispatching operation.

Adequate radio coverage must be provided between the Manteca center, Ripon and Escalon. Better coverage can be assured by use of a properly designed satellite receiver system. This satellite receiver system will be necessary whether the cities remain on the 150 MHz band or move to a new 450 MHz band and, for Manteca, it will be necessary to support personal portable radios, whether or not Ripon and Escalon join Manteca in a central dispatching operation.

3. Recommendations

- Manteca and the cities must improve their radio systems.
- Add CTCSS devices to the equipments to reduce present and future nuisance interference.
- Determine whether remaining on the 150 MHz frequency with the possible addition of another frequency will be more cost effective over the long term (10 years),

  or
- move their operations to the 450 MHz band on obtaining one or more pairs of these frequencies with the attendant costs of 150 MHz equipment replacement.
- Install a satellite voting receiver system to better support personal portable radio operations. This is not dependent on the decision of frequency band choice.
- An independent communications consultant should be obtained to develop system recommendations for adoption.
- A fire radio base must be added at the police/fire dispatch center.

C. Dispatching facilities

1. Analysis - Manteca

The desire of the three city police departments to consolidate communications and dispatching is highly commendable and should result in a more efficient dispatching service to all, greater amounts of information to be made available to the officers, better officer safety through a continuous radio watch, and reduced overall cost to the taxpayers.

Several major deficiencies exist in the current Manteca dispatching capability. Although some may be corrected with better equipment facilities through the proposed grant, they are described here for pre-grant amelioration where possible.

The single position dispatching console is a patchwork of devices and controls that are cumbersome to use, placed so that a second dispatcher cannot fully assist the primary working position, and is in need of upgrading.

Two full working positions are necessary for busy shifts, unusual occurences and future growth.

Console arrangements should be changed to place the San Joaquin data system CRT terminal between operating positions.

The keyboard should be lowered and placed between the positions on a swivel for easy access to each dispatcher.

Radio controls should be paralleled to each position.

Muting capability is needed to reduce unwanted chatter or signals

from blocking desired signals.

Common facilities should be placed in the middle of the two operating positions.

Fire and ambulance Plectron toning devices, run cards, etc. should also be available to both positions.

A multi-channel recorder with instant replay is necessary to log and record all emergency lines, radio channels and the time. This would allow an instant replay of a telephone conversation to insure all appropriate data was obtained should the caller hang up. City and department liability would be enhanced through having an available record of all that transpired, training of officers and dispatchers would be improved, and the tape record would reduce potential misunderstandings.

Security of the dispatch facility could be improved. It is in view, through the foyer window, of all persons waiting in the lobby. It is accessible to all officers, at times creating a cacaphony of noise and impeding the operation of the dispatchers.

The general console equipment as proposed by Motorola should provide the many features necessary for better console capabilities.

2. Conclusions

The Manteca dispatching center and facilities need improvement to support the additional load of Ripon and Escalon. Even without this load, the console should be replaced with a more modern one

containing a centralized arrangement of common features and two working positions.

A multi-channel recorder would assist the dispatching function by making a record of all radio and telephone communications. The potential for litigation must be considered as well as the enhancement of training.

Security of the dispatching operations needs improvement; however, budgetary restrictions may limit immediate corrections.

3. Recommendations

Dispatcher operating equipments and consoles must be improved. A new console with appropriate features should be obtained. In addition, a multi-channel tape recorder will provide a much-needed record.

A consulting engineering study is necessary to define equipments and arrangements through procurement specifications.

The current proposal of Motorola for a console is insufficiently detailed as to arrangements and requirements. It should not be relied on for procurement.

D. Dispatcher functions and duties

1. Analysis

The dispatchers observed and interviewed (Manteca) have each completed the California Peace Officers Standards and Training course and they appear to be a capable, enthusiastic group. They are knowledgeable of the city, the officers, and their general duties.

Dispatcher duties, as observed, involved: answering telephone calls for service, dispatching the appropriate response, answering radio calls from the officers, obtaining the required information by radio, telephone or computer system, completing a complaint card with appropriate time stamps, writing an incident log of all entries for which cards had been initiated, answering window-walkup traffic, contacting owners of buildings by telephone, maintaining a local wants file, receiving fire/ambulance calls, initiating the appropriate Plectron tone alert device and subsequent radio callout dispatch for fire volunteers, obtaining second alarm calls for fire mutual aid with adjacent fire services via telephone, maintaining local map and address files, using the CLEMARS radio, using the citizens band radio as appropriate, interviewing a rape victim, searching a female prisoner, observing the silent alarms and initiating an appropriate response, contacting the Sheriff's Office via radio, monitoring the activities of field units, transporting a female prisoner to county jail, accepting bail money, establishing court dates.

2. Conclusions

The dispatcher functions require two trained persons during the evening and early night hours, at least through midnight. The amount of communications traffic and the ancillary duties are sufficiently high that one person is not adequate. Although there are times when a police officer is called in from the field to fill in for a regular female dispatcher who is performing matron duties or absent, the critical nature of the dispatcher's job requires a thoroughly trained replacement.

The fact that the center is also responsible for fire dispatching with its attendant severe procedural requirements should preclude using an inexperienced replacement for dispatching. This is discussed more fully under Fire aspects of dispatching.

(The adjective "inexperienced" refers to dispatching only and not to the police officer performing police duties.)

The ancillary duties detract from the effectiveness of the dispatcher.

The dispatcher rides by radio with each police officer on every call, watching, waiting, concerned for his safety. The dispatcher shares the apprehension, the elation and the boredom, only it is multiplied by the number of officers on duty.

The absence of standard operating procedures is apparent. A poor procedure can be changed, but until formally established, all "procedures" are poor.

3. Recommendations

Standard operating procedures must be established and adhered to once established.

These procedures should be maintained in a ready reference document book.

Trained dispatchers should be scheduled to cover the heavy load shifts.

Recommendations provided under fire dispatching are appropriate to this Section as well.

E. Fire aspect of dispatching

1. Analysis

The Manteca Police Department dispatches the Manteca Fire Department and the Manteca Volunteer Ambulance Service.

Fire, police and ambulance services are closely related and inter-dependent in any public safety operation. In Manteca many accidents or incidents are first viewed by an arriving police officer. This officer makes the initial request for fire, emergency medical and/or ambulance response. The request from the officer or public caller as received or perceived by the dispatcher is the key determinant in whether the proper response is made to meet the situation.

In the Manteca police dispatch center the dispatcher initiates the fire/ambulance callout by activation of a Plectron tone alerting device on the fire or local government frequency. This alert is responded to by the fire/ambulance station and the full dispatch is made by the police dispatcher with an acknowledgment of receipt transmitted by the responding fire/ambulance unit. An additional arrival or on-scene call is given by the responding fire/ambulance unit which, in turn, is acknowledged by the dispatcher for time logging. This series of events is described here because it is most critical to a proper provision of these fire/ambulance services and to future potential litigation should there be a failure or inordinate delay in the total response effort.

Critical nature of fire dispatching

Complete detailed procedures are established by the Board of Fire Underwriters to be followed by dispatchers and fire departments.

The fire protection classification of a city is determined by adherence to these procedures.

Fire insurance premiums (costs) paid by citizens are established by this classification rating. An improvement in rating can amount to many dollars saved in collective community insurance premiums.

Observed deficiencies

- Dispatch fire callout procedures are not formally established or, if established, are not always followed by dispatchers.
- Callouts are made over land line to the fire station. Should the land line be cut or impaired, dispatches could not be made.
- Twice daily testing of fire circuits and communications equipments are not consistently performed (at the same times in the same manner).
- Dispatcher training with established fire procedures is essential. Insufficient attention has been given to this area.
- Visitors in a dispatch center are generally prohibited in fire work.
- Ancillary jobs detract from the dispatcher's ability to perform - answering the door, logging, filing, records, etc. should be eliminated insofar as possible.

2. Conclusions

Additional dispatcher duties interfere with the provision of dispatching services. This item is of particular importance on single dispatcher shifts. The critical nature of fire dispatching precludes a substitute "inexperienced" dispatcher as a replacement for a trained,

experienced dispatcher.

Procedures should be formally established, and the critical nature of fire dispatching operation given high priority if the center is to retain the responsibility for fire operations.

3. Recommendations

Establish fire dispatching procedures.

Perform testing at set times.

Provide radio backup to the land line callout link.

Provide a trained dispatcher (fire dispatcher competent) on all shifts.

F. Equipment

1. Analysis

The radio equipment in service is old and will soon need replacement. Several of the portables are not capable of meeting specific power output, etc.

The antenna tower at the police department needs a new (metal) support for the CB radio antenna.

Several call button lights on the dispatcher telephone consoles do not light.

The radio vault, served by contract maintenance, requires additional AC power outlets. The radios should be on blocks, up off the floor. Cavities/radios/transmission lines should be clearly identified.

Console equipment and arrangements were discussed earlier.

2. Conclusion

The majority of the radio dquipment will need replacement over the next few years. Items to be replaced are keyed to the decision of going to a new band, requiring all new radio equipments, or remaining on 150 MHz, selectively replacing equipment as funds permit.

The console should be replaced now.

The equipment vault needs attention.

3. Recommendations

Replace equipment based on a schedule developed to meet decision

of 450 MHz vs. 150 MHz described earlier.

Cause the radio maintenance contractor to organize the equipment vault and to replace wooden mast on CB radio tower.

Cause telephone company to replace burned out lamps.

G. Maintenance

1. Analysis

Maintenance of communications equipment in a small city is an on-going problem. Manteca is forced to contract with a maintenance provider, usually at the lowest possible rate. As the equipment gets older, requiring more service, the contractor may become complacent and his quality of service deteriorate.

Several contractors have been used in the past. None have proved satisfactory in the long run.

In the foreseeable future, at the current rate of growth, obtaining or sharing a city radio technician may be practical.

2. Conclusion

Manteca must continually investigate cost effective methods of obtaining competent maintenance and repair services.

3. Recommendations

Develop technical standards for maintenance contract services.

Consult with other cities as to better contract maintenance service.

H. Procurement of new equipments

1. Analysis

The proposal by Motorola to provide new equipments - dispatcher consoles, base stations, portable and mobile radios, voting receiver and a logging recorder - was reviewed.

The proposal appears to provide the majority of the equipment elements necessary for operation by the departments.

There are, however, several gaps that should be filled. The dispatching needs and functions have not been carefully developed and related to the equipments proposed. Control arrangements, muting needs, paralleling of positions and control functions have not been adequately described.

Radio frequencies needed are treated ambiguously and the related base station's effective radiated power proposed appear excessive for the area to be covered, resulting in higher equipment costs than might result from a properly engineered system directed at the three cities.

Other equipment vendors may provide alternate equipment lists, arrangements and costs that could appear attractive to the cities.

These other vendors should be solicited for proposals to meet the perceived needs.

System design and procurement specifications could alternately be developed by an independent consultant engineer. A single vendor should not be relied on to provide the options, courses of action

and cost effective comparisons necessary to system solution.

Funding is a key element of all improvements. However, the cities face an imminent need. With an appropriate communications system improvement plan where goals and objectives are clearly defined, these improvements can be started with local resources while major funding sources are pursued.

2. Conclusions

The city has obtained a proposal from one vendor to improve its communications ability.

Other vendors have not been solicited for similar proposals.

Standards and specifications have not been developed for proposal solicitation.

An outside engineering firm as recommended in previous elements could provide specifications yielding a more cost effective manner of procuring equipment.

3. Recommendations

The city should prepare specific data for vendor proposal solicitation.

Several vendors should be contacted.

A consulting engineering firm should be solicited for proposals to design systems and develop specifications for procurement.

The vendor and engineering firm proposals should be evaluated in light of city needs and the most cost effective method of obtaining the new system.

The city should select the option appearing most beneficial to its needs.

IV. SUMMARY OF KEY RECOMMENDATIONS IN ORDER OF PRECEDENCE

The cities should continue to pursue outside funding sources for assistance. Efforts to correct major deficiencies should not be delayed for total outside funding. Several of the key elements can be corrected with local funding.

1. Install CTCSS devices on all 155.190 MHz radio equipments.

2. Portable radio coverage, i.e., providing for portable talk-back to the dispatcher, is essential to full consolidated dispatching. This can be accomplished through installation of a satellite voting receiver system.

3. A fire base station radio should be installed at the dispatch center to back up vulnerable wire line circuits.

4. A new well-designed two-position dispatcher console should be installed.

5. Standard procedures, protocols, and basic agreements should be implemented.

6. Install telephone transfer lines from Ripon and Escalon to Manteca.

7. Operate a consolidated dispatch system.

END