WHAT WILL BE THE STATE OF CALIFORNIA SHERIFF'S DEPARTMENT COMMUNICATIONS SYSTEMS IN THE LATE 1990'S AND BEYOND?

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This Command College Independent Study Project is a FUTURES study of a particular emerging issue in law enforcement. Its purpose is NOT to predict the future, but rather to project a number of possible scenarios for strategic planning consideration.

Defining the future differs from analyzing the past because the future has not yet happened. In this project, useful alternatives have been formulated systematically so that the planner can respond to a range of possible future environments.

Managing the future means influencing the future--creating it, constraining it, adapting to it. A futures study points the way.

The views and conclusions expressed in the Command College project are those of the author and are not necessarily those of the Commission on Peace Officer Standards and Training (POST).

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A project of this magnitude cannot be the creation of one person alone, simply because no one person knows everything that of necessity will be in the final product. I was most fortunate in the help, assistance and support given to me because the project developed very smoothly with no insurmountable barriers or unresolvable issues. I attribute this to the generosity and expertise of those who took of their valuable time to contribute towards the final product. I take full responsibility for any errors or omissions present.

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Ladies and gentlemen,
Nicely done. I thank you.

Captain Roger Chatterton
Monterey County Sheriff's Department
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EXECUTIVE SUMMARY

Having identified the research topic I found that I had to learn some basic communications fundamentals in order to develop my research project. Through a combination of interviews with expert sources, site visits and literature searches I was able to gain a basic understanding of communications principles and terminology. The result of this learning process is the narrative appendix section A. This is an abbreviated and simplified course on communications principles. I strongly urge the lay reader to read this section first, before any of the text, in order to become familiar with the theories, principles and terms used. The intent of the paper itself is that it will be understandable to a nonspecialist law enforcement manager. The appendix section A, with its attendant diagrams provides the basis for that understanding.

The format and sequence of the text follows the four intersession exercises done as assignments during the core I of the Command College. For me these past intersession assignments became a road map.

In order to familiarize myself with the present state, and thus identify specific problem areas, I conducted a questionaire survey among the fifty seven other Sheriff's Departments in California. I received fifty responses which gave me a relatively clear understanding of the current state of Sheriff communications in California.

Concurrent with this I wrote a series of letters to selected individuals to become a technical resource group. This group was to have two basic functions:

1. Through individual brainstorming and reflection the members would furnish data on past and future significant events and trends.

2. Using the Delphi technique the group would prioritize the most significant past and future events and trends.

I solicited members of the group through a variety of sources. Local contacts supplied names of potential group members. I then used both the local contact as well as the referral if both were willing. In one instance I wrote the author of an article I had read during my literature search, and he consented to be a member of the group. I also selected group members from large as well as small departments and agencies other than Sheriff Departments to get as wide a spectrum of input as possible. I designed the processes to be used to be as time and labor-efficient as possible. The fact that the

group members would not be asked to do my research or labor served as an inducement.

Besides a literature search of local sources, primarily the Monterey County communications department library, I also utilized the resources of the POST library in Sacramento. Due to the expertise and efficiency of the personnel at that facility I was able to review and accumulate an extensive amount of useful information.

The expert resource group submitted the candidate events and trends, as well as responding to certain specific questions sent to them in questionaire form. When all candidate events and trends had been collected and organized, each member was sent the entire list for prioritization. This Delphi technique resulted in prioritization of the most significant past and future events and trends.

I developed the three requisite scenarios based on a synthesis of the significant events and trends, cross impact analysis of these events and trends, and my own perspective of possible futures based on this same data.

I consider the scenarios to be the key creative aspect of the entire project. The three scenarios I developed all lead to solutions to problems identified during the events and trends analyses. Although a negative scenario was possible, I intentionally avoided writing one as I prefer to maintain the perspective that future states will have implicit solutions.

The ultimate goal of the scenario I selected for further development is the stage of implementation. The first step was to develop a strategy that would carry the scenario through to adaptation and implementation. At this point the stakeholders had to be identified and their assumptions assessed. The identity of the stakeholders, their assumptions, importance and influence are areas that the administrator must be cognizant of in order to insure the successful implementation of any new program. Thus, a thorough analysis of the relevant stakeholders was performed. Much of this had to be by estimate due to the nature of the projected scenario.

In order to obtain some candidate strategic plans for the selected scenario, I used a diagonal and hierarchical slice of supervisors and managers from my own department and other communications departments to participate in a policy Delphi exercise. One thing not supplied to this group was the stakeholder information and analyses. For the ultimate strategy I used a synthesis of the highest priority candidate strategy identified in the Delphi process, elements of the remaining strategies and my own thoughts based on this material combined with the results of my stakeholder analyses.

The strategy was expanded and formalized to evolve into a detailed strategic plan. In the development of the scenarios as well as the

strategic plan I combined the results from the Delphi technique with my own input. This allowed me the opportunity to have an influence over the direction of the project as it developed as well as a sense of control and participation which otherwise would have been lacking.

The final phase was the development of a transition management plan. This consisted of two elements:

1. An exemplar transition management plan scheduled over ten years which would culminate in the implementation of the prediction set forth in the scenario developed throughout the paper. (In this instance, a series of inter-county Public Safety Regional Dispatch Center encompassing 29 rural and mountain counties in California).

2. A specific management structure, with responsibility charting, for each phase of development of such a dispatch center concluding with the final transition to a permanent management structure for the administrator of each center pursuant to a Joint Powers Agreement.

The conclusion ties together that which has been accomplished by the project and allows me the opportunity to personally comment on several issues of basic importance without the constraints of objectivity ethically imposed by the role of authorship.

METHODOLOGIES

For the futures portion, the following methods were used: I wrote letters to a number of experts in the law enforcement communications field to enlist them to be part of the Delphi process as well as to serve as an Expert Resource Group. Once I had these commitments I sent out a questionnaire to solicit from each significant events and trends, past and future. The individual members identified these events and trends through brainstorming as well as reflection. I collected the event and trend data from each through telephone interview. When I had the entirety of data I combined all of it and mailed it to each member. Each was asked to prioritize the ten most significant events and trends, past and future. Each was faced with having to reconsider his own input in light of the input of the rest of the group members and to prioritize on that basis. Again I collected this data by telephone, and then collated it. this completed a single Delphi round. A second round was not necessary as there were no ties at the top or bottom of either list such as to necessitate a tie-breaking Delphi round to resolve a question as to which events and trends with the same point value would have to be eliminated from the prioritized list. Each member did not know who the other members were.

Based on this input, as well as my own reflection based on my own research (to be listed below), I created three scenarios. The collection of significant events and trends had identified many serious future problem areas. The scenarios were intended to address those problem areas and develop effective long-range solutions.

The overall project started with a literature search of local sources as well as at the POST library. Concurrently a questionnaire survey was sent out to the 57 other Sheriff Departments in the state. Since people often discard surveys, the only inducement I could offer was to agree to send each department that requested it on the questionnaire a copy of the completed project. Of 57 sent out, I received 50 responses, 49 of which requested a copy of the completed project.

The Expert Resource Group listed above was also used for expert interviews on an individual basis, both by telephone and in person.

Site visits were conducted at the Los Angeles County Sheriff's Radio communications, Los Angeles Police Emergency Command Control Communications System, and the El Dorado County Sheriff's Department.

An extensive amount of diagraming and charting was done in the process of developing portions of the project as well as to

illustrate narrative areas. The diagrams and charts are accompanied by an explanatory narrative, or the relate directly to a specific area of the text and are meant to be referred to after that portion of the text has been read. There are diagrams and maps to illustrate the following topics:

1. Basic communications principles.
2. Satellite repeater coverage and orbital areas.
3. Projected differentiation between Sheriff Departments using VHF -high band and UHF.
4. Public Safety Regional Dispatch areas and microwave signal paths.
5. Tables of organization for phases of the transition management plan.

Charts were used to develop and illustrate the following topics:

1. Relevance tree.
2. Prioritized events and trends.
3. Central tendency of events and trends.
4. consensus values of events and trends.
5. Median values of events and trends.
6. Cross-impact analysis of events and trends.
7. Stakeholder assumptions.
8. Changes of stakeholder assumptions.
9. Dimensions of environment.
10. Assessment of organization's key leaders readiness for major change.
11. Readiness/Capability analysis.
12. Commitment planning chart.
13. Responsibility chart.
14. Milestone completion chart.

A policy Delphi was used in the creation of a policy to implement the scenario. The group selected for this phase differed from the Expert Resource Group. For the policy Delphi I used individuals in the Monterey County Sheriff's Department and in the Monterey County and San Benito County Communications Departments. In this instance, I solicited a candidate strategy from each individual. I removed the names from each and then sent the total out to each member along with instructions on how to score each on a desirability/feasibility basis. Thus, each member had to reconsider his submission in the light of the others and score on the basis. The fourth and third candidate strategies finished in that order, and well ahead of any of the others. This indicated that the Delphi process had worked. This input served as a partial basis for the strategy I created. The most compelling reason for me to intervene and actually create the strategy is that the Delphi group members were not privy to the subject material concerning stakeholders that had been covered in the POST Command College. Since these stakeholder issues had to be addressed, the implementation strategy had to coincide. Elements of this strategy came from the Delphi submissions.

For the reader, I would suggest the following sequence as most effective for reading and understanding this paper:

1. Read Appendix section A to gain an understanding of principles that will be referred to throughout the text.
2. Read the text and refer to the relevant Appendix area either at the point of reference or at the conclusion of each major section.
3. (Optional). The Appendix can again be scanned to further illustrate points made in the text through the development of charts and diagrams.

For distribution purposes, it is intended that the Appendix accompany the text.

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INTRODUCTION AND STRUCTURE OF THE PROBLEM

The intent of this project is to give all law enforcement administrators, not just sheriff's department administrators, a glimpse into the future of communications systems, and through the data collected and the scenarios constructed, to give an idea or direction of how departments may chart their future destiny.

The sheriff's departments of California were singled out as the subject of this study for data collection purposes for two reasons:

1. Since I am employed by a sheriff's department and am in charge of the patrol division in my department, the involvement of sheriff's and communications systems is of legitimate professional interest to me.

2. The sheriff's departments of the State of California present a workable number of subject departments for which data can be collected and scenarios constructed which would have relevance to sheriff's departments in other states, as well as other types of law enforcement agencies on any level both within and without California. The fifty-eight sheriff's departments representing each county of the State of California represent in that number the entire spectrum of topographic and demographic factors that impact on, or are impacted by, a law enforcement communications system. To focus upon the State agencies as the primary subject of such a study would be unrepresentative of the overall law enforcement communications problems within the state due to the specialized nature of the agencies. To focus on the municipal police departments would have resulted in too large a number to be feasible for study (in excess of 400). Thus, for the purposes of this project, while references are made in numerous areas to both municipal and state agencies, the sheriff's departments comprised an ideal representative sampling of the entirety of law enforcement communications issues.[1]

Once this topic had been decided, the next step was to further specify the parameters of the project in order to give some direction towards the eventuality of futures forecasting in the form of scenarios. For this purpose, a relevance tree was constructed. Referring the reader now to this relevance tree (refer to the appendix C-1) it will be noted that approximately half way down the relevance tree is the word California, and directly below that the word Sheriff, and then below Sheriff and to either side are two subject areas; technical issues, and administrative issues. The project addresses not only the generalized issues mentioned, but all of the specific issues listed under the subject areas of technical issues and administrative issues.

In order to define a beginning point, the first step undertaken was to conduct a survey of the sheriff's departments within the State of California in order to obtain data regarding their present communications systems. To this end I designed a survey form (refer to appendix) that was mailed out to each of the 57 other sheriff's departments within the State of California. Of the 57 surveys mailed out, 50 were completed and returned to me. The information from the surveys provided a useful base of data as a reference to be compared to the past and future emerging trends and events for the purpose of scenario construction. I shall set forth below some of the highlights of the data gathered in the survey, as the total of this information well illustrates the magnitude of the challenges facing sheriff's department communications in the State of California:

Populations served by California Sheriff's range from a low of 1,200 persons (Alpine County) to a high figure of approximately 3,000,000 persons (Los Angeles County).[2] The areas served range from a low of 258 square miles (San Mateo County) to the largest county in the United States, San Bernardino County, at 20,189 square miles.[3] Note: The smallest county in the State of California is San Francisco County with a total of 49 square miles. However, since San Francisco is both a city and a county, the sheriff's department there has no patrol responsibilities.

The number of personnel assigned to field duty also vary widely within the state, with a low of 7 in Alpine County and a high of 3,897 in Los Angeles County.[4]

The counties in California also show non-systematic variations as to which portions of the bandwidth spectrum that they occupy. In addition, some departments have been forced into the position of having frequencies in two different bandwidths, which creates a basic incompatibility.[5] In the case of using two different bandwidth areas, it may be to accommodate mobile digital terminals, to have the ability to utilize portable radios within the system, or for the acquisition of additional channels. However, at the present state of the art law enforcement radios can only function in a single portion of the bandwidth. Thus, from time to time one will find examples such as that of the San Francisco Police Department where the mobile units are dispatched using the VHF-low band portion of the spectrum, while the portable radios operate on the 400MHz UHF portion of the spectrum. Thus, the two cannot communicate with each other.

Based on the responses received, and also adding in my own county, we find the break down for departments in different bandwidths as follows:[6]

1. 29 sheriff's departments using VHF-high band.
2. 10 sheriff's departments using VHF-low band.
3. 11 sheriff's departments using 400MHz UHF.

4. 1 sheriff's department using 800MHz UHF.[7]

This random occupancy of differing bandwidths within the communications spectrum is due in part to the fact that there has been no coordinated state wide effort to place sheriff's departments within any specific bandwidth area. Historically, the FCC had never used any sort of a systematic process for the assignment of frequencies to different departments on any level. The FCC system, if it could even be termed that, had been to assign certain portions of each bandwidth spectrum to different categories of agencies, ie; city, county, state, law enforcement, fire suppression, forestry, other emergency responders. The agencies then were on their own to obtain frequencies within the areas of the bandwidth spectrum assigned to their category of agency. With this situation creating the environment for selection of frequencies, the only real criterion that could be applied was for agencies to attempt to select frequencies with sufficient geographic separation to prevent interference between two users of the same frequency. As the population of the state has increased to the point where California is the most populous state in the country, the ability to geographically separate frequencies to prevent interference from multiple users has greatly diminished.

While both sheriff departments as well as municipal police departments may have the common problem of policing densely populated urbanized and suburbanized areas, it is the sheriff's departments, with little exception, that are faced with the additional problem of communications coverage over their entire geographic area of jurisdiction. (Note: The problems of geographic radio coverage however, can also face cities that have large areas within the municipal boundaries, such as Los Angeles and San Diego).

With respect to the issue of geographic coverage, one of the questions asked in the survey was for percentage of area with no communications access. From the 51 counties included in the survey, five counties reported complete geographic coverage ("no dead" areas). 13 counties reported having areas inaccessible to communications under their present systems of 15% or more. If the criterion for communications accessibility is lowered to 10%, then 24 of the responding counties fell within that criterion. 31 counties reported this communications accessibility as being critical enough to constitute an officer safety issue.[8]

Although there are four different portions of the bandwidth spectrum in use by California Sheriff's Departments, there is no correlation between bandwidth used and portion of geographic area inaccessible to communications. Note: Only one department is using the 800MHz UHF bandwidth at this time.

The other major technological issue besides geographic coverage is that of excessive traffic for the number of available channels. 22 responding counties indicated a need for additional channels. 14 of the counties indicated the need for up to three additional channels.

Four counties indicated the need for between four and six additional channels. Four counties indicated a need for in excess of ten channels.[9] This last category bears further scrutiny, as the trends indicated by these counties may well be a bellweather trend indicative of the future of many other counties within the state. The four counties requiring in excess of ten additional channels were as follows:16 additional channels for Riverside county, 20 additional for Kern County, 25 additional channels for San Bernardino County, and 60 additional channels for Los Angeles County.[10]

All of these counties are located in Southern California and are in rapidly growing areas. The Inland Empire area comprised of Riverside and San Bernardino Counties, along with the east end of Los Angeles County, is the fastest growing area in the state. The disproportionately large number of additional channels needed by Los Angeles County is due in part to the fact that Los Angeles County has the oldest and most antiquated communications system in Southern California, and is presently involved in a total reconfiguration of their communication system to incorporate the required additional frequencies.[11] The situation faced by these counties will be faced by other counties in other parts of California as their populations increase in future years. Obviously then, the other counties within the state having lower or non-existent requirements for additional channels should still be looking to the future and observing the trends being established in Southern California.

One method of handling traffic more efficiently is the use of mobile digital terminals (MDT'S). Combining MDT'S with voice capability provides a means by which approximately four times the volume of communications traffic can be handled with the same number of channels.

In the survey, only two of the respondents indicated the present use of mobile digital terminals, with 48 responding that they were not at present using such systems. Also asked in this regard was the number of agencies that are planning the installation of mobile digital terminals prior to the year 2000. 28 of the respondents indicated that such a plan was the intention at this point, and 22 indicated that MDT'S were not in the planning stage at all.[12] Lastly, each of the respondents was requested to provide an overall indication of their perception of the quality of their communications system, on a range from poor, mediocre, acceptable, good, excellent, and superior. The results were as follows:[13]

No response	1
Poor	7
Mediocre	0
Acceptable	17
Good	12
Excellent	5
Superior	0

Thus, none of the respondents indicated from their perception that they had a superior communication system in which no changes were needed. Two of the respondents indicated that their systems would be superior when they had achieved a computerized dispatch system as well as 100% geographical coverage. At the other end of the scale, 15 counties indicated that their systems were poor to mediocre.

Based on the data gathered, the problems can be summarized as follows:

1. No state wide plan existent for California Sheriff's Department communications systems.

2. A lack of systematic coordination of the existent systems.

3. An almost universal problem with areas of communications inaccessibility creating critical officer safety hazards.

4. For many departments, an insufficient number of channels now as well as in the future.

5. A current under-utilization of the capabilities provided by a mobile digital terminal, as well as an anticipated less than optimum utilization of MDT'S in the future.

6. An overall perception of no superior existent communications systems, approximately 10% of such systems excellent, but 30% rated as mediocre and/or poor.

Further evidence of these problem areas is found in the literature pertaining to this subject.

Los Angeles County Sheriff's Department is the largest Sheriff's Department in existence, serving a population of over three million persons with nearly four thousand personnel assigned to field duties covering an area in excess of four thousand square miles. Los Angeles County Sheriff Sherman Block had this to say: "Conditions of congestion on may police radio frequencies are such that normal command and control actions cannot be maintained during busy periods. Emergency operations and other urgent activities consume available air time to the detriment of other less urgent, but necessary, radio transmissions."[14]

Somewhat more generally, Bruce M. Karr, project engineer for Associated Public Safety Communications Officers, Inc. had this to say: "In spite of these "improvements", in many departments there are problems with procurements, long-and-short-range planning, coordination between agencies, duplication of communications services and frequency shortages, too much sharing of frequencies, lack of radio coverage, and consequent officer safety concerns.[15]

It is these issues that define the problem. One of the principal goals of this project is to seek solutions to each of the dimensions

of this problem, and to demonstrate the implementation of those solutions through the scenario process.

SIGNIFICANT EVENTS AND TRENDS

Due to the technical nature of this project, it was necessary to enlist the knowledge and experience of qualified individuals located throughout the State of California, as well one as located on the east coast. In the initial stages this was a total of nine persons, which I termed an Expert Resource Group. It was this group that provided the input of significant events and trends both past and future. This group then participated in the Delphi Technique to prioritize these events and trends, by examining the totality of the group input and reassessing their individual inputs in light of the total of the group input.

The group was comprised of individuals from a number of different types of organizations, in order to provide a wider spectrum of input than might be provided by individuals involved solely with sheriff's departments within the State of California. The individuals were located through a variety of informal methods on my part; such as correspondence with authors of articles, correspondence with persons whom I had previously heard speak or met, and correspondence with persons referred to me by other contacts. Each person was individually contacted, so that none of the members of the group were aware of who the other members were. This anonymity is a necessary part of the Delphi technique.

Once the members of the Expert Resource Group had agreed to participate in this phase of the project, the next step was to structure their input. This was done through correspondence in which I specified five year periods going back 20 years and into the future 20 years. I also asked a number of additional questions intended to round out the information gathered in the time structured process. In order to make the task as simple as possible for the participants, I committed myself to contacting them on the telephone to get their input, rather than requesting that they write it out and send it to me.

CANDIDATE EVENTS AND TRENDS-PAST

The following section lists the input from all of the participants for the period approximately 20 years or more in the past:

1. Transistorized equipment.
2. Narrow band FM-5KHz.
3. Increased use of spectrum over 150MHz VHF.
4. Light weight test equipment.
5. Increased availability of Nicad batteries.
6. Development of mobile relay systems.
7. PL (private line)- to eliminate nuisance interference.

8. Radio systems start to evolve.
9. Cross-band monitoring used.
10. Lower powered mobile base stations.
11. Implementation of state-wide interagency frequencies.
12. Greater numbers of channels used; with PL tones.
13. More use of VHF-high band; less use of VHF-low band.
14. FM radio.
15. Portable radios developed.
16. Concept of 911 centers developed.
17. Mobile radios eliminated walking beats until the advent of portable radios
18. From the 1930's; FCC system of public safety spectrum allocation. Problem created by this system has compounded over the years.
19. Increased coordination of mountain top repeater systems.
20. Realization of the need for more duplex channel systems.
21. The introduction of integrated circuits.
22. Development of multi-channel portable radios.

The following section sets forth the submissions from all the participants of significant events and trends of the period approximately fifteen years in the past:

1. Increased miniaturization.
2. Availability of 450MHz UHF spectrum.
3. First use of mobile digital terminals (MDT'S)-data communication.
4. First use of computerated dispatch (CAD).
5. Down-sizing of law enforcement vehicles.
6. The ability to simulcast a number of transmissions on the same frequency.
7. Satellite receivers to boost mobile in-only transmissions using votive systems.
8. The increased use of consolidated 911 systems.
9. The availability of computerized information in a real-time frame environment (Department of Motor Vehicles, Department of Justice, National Crime Information Center).
10. Vehicular repeater systems.
11. Mobile relays for wider car-to-car communication capability.
12. The advent of the computer and integrated circuits.
13. Portable radio-only operations.
14. Automatic vehicle locator (AVL) concept developed.
15. Teleprinters in patrol vehicles.
16. Wider band radios developed.
17. Upgrading of antennae systems, base and mobile, for greater efficiency.
18. The introduction of crystal-controlled scanners.
19. Recognition of the need to utilize other areas of the communication spectrum.

The following section is the input from all participants of significant events and trends for the period of approximately 10

years in the past:

1. Solid state radio frequency (RF) amplifiers which allow a larger number of frequencies in the same radio.
2. Smaller computers with more speed and capacity.
3. Large scale integration (LSI) technology.
4. 800MHz UHF band opened up to public safety.
5. Improvements in small portable radios.
6. More vehicular repeaters.
7. 24 hours dispatch even in rural areas.
8. Development of tone-encoded squelch.
9. Integrated circuits lead to programmable radios within a bandwidth.
10. Lower powered equipment used.
11. Wide use of portable-only systems using vehicle mobile relays.
12. More widespread use of CAD systems.

The following section sets forth the input from all participants of significant events and trends for the period up to five years in the past:

1. Synthesized frequency generators.
2. High speed MDT operations.
3. Local area technology and topography applied to MDT'S.
4. Microprocessor chips common in mobile and handheld radios.
5. Voice privacy systems improved.
6. Automatic vehicle locators (AVL'S) developed to a practical extent.
7. Wide band synthesized radios available.
8. Increased usage of 800MHz UHF bandwidth.
9. Portable suitcase mobile relays developed.
10. Development of amplitude companded single side band (ACSB) to alleviate channel crowding.
11. The concept of the use of trunking to clear congestion.
12. Cellular radios developed.
13. Proposition 13 results in more consolidated 911 systems.
14. The use of non-sworn civilian dispatchers.
15. The access to telephones via radio.
16. Greater efforts towards frequency coordination through the efforts of the Associated Public Safety Communications officers (APCO).
17. Greater emphasis on the importance of dispatch centers.
18. The availability of programmable, synthesized, multi-channel, multi-bandwidth scanners.
19. Digital voice privacy systems developed.
20. The use of printed circuit boards resulting in greater efficiency, reliability, and serviceability.
21. Congressional direction to the FCC to prioritize public safety needs in spectrum acquisition.

CANDIDATE EVENTS AND TRENDS-FUTURE

The following section sets forth the input from all participants of

the emerging events and trends within the next five years:

1. Video maps integrated with MDT'S in patrol vehicles.
2. Smaller agencies will implement communication systems similar to those of larger agencies.
3. A steep increase in the use of MDT'S.
4. Major radio traffic congestion.
5. The FCC will be forced to make additional 500-800MHz UHF spectrum available to public safety.
6. More use of microprocessor chips in radios; and punch-in status buttons.
7. Large scale integration technology resulting in increased reliability of equipment.
8. Current developments will remain at a plateau.
9. More 800MHz UHF conventional and trunked systems.
10. Programmable radios.
11. Channel narrowing for more spectrum space.
12. MDT'S: Lower prices and greater applicability.
13. Pilot-copilot concept. One to drive the other to operate the electronic and avionic equipment in the unit.
14. Further refinement of 911 systems.
15. The FCC will be awaiting a public safety plan for utilization of the 800MHz UHF bands.
16. Amplitude companded single side band technology will be applied to VHF-low band.
17. There will be greater efforts at frequency coordination by the FCC and APCO.
18. There will be a greater use of microwave and cellular systems.
19. There will be a greater use of frequencies in the separation area through the limited use of off-setting.
20. The FCC will compel agencies to become more spectrum-efficient.
21. Lower power and lower antennae will be used to reduce the geographic separation distance needed to prevent user interference on the same frequency.

The following section sets forth the emerging events and trends from all participants at the approximate 10 year point in the future:

1. Radio prices will decrease due to far eastern competition making it feasible for the personal issue of portable radios to each officer.
2. Radios will have data processing capabilities-MDT integrated.
3. Greater use of ACSB to accommodate more channels in a given spectrum.
4. Mobile radios will be developed for the 1.2GHz UHF band (1200MHz UHF).
5. Automated vehicle locators more widespread.
6. Decreased use of VHF-low band.
7. Development of satellite repeaters for unique communications situations (i.e, earthquakes, and other interstate disaster communications necessities).
8. State-wide video exchange capability (for use in lineups).
9. Conventional 800MHz UHF systems to switch to trunking.

10. Fiber optics to replace landline equipment.
11. Universal use of CAD systems.
12. Universal computer interface between allied agencies.
13. Radios will transmit an identifier when transmitting to preclude the abuse of programmable radios.
14. MDT'S to be used for the preparation of crime reports in the field.
15. The phase out of crystal-controlled radios.
16. Enhanced 911 systems to be mandatory computerized dispatch.
17. Continued increase of utilization of 450,800 and 900MHz UHF bandwidths, as well as more coordination of VHF-high band.
18. More emphasis on technical training for dispatchers.
19. Portable radios will have multi-band capability, as well as integrated video display and keyboards.
20. There will be five national mutual aid channels in the 800MHz UHF bandwidth area.

The following are the emergent events and trends predicted by the participants for the time period of approximately 15 years in the future:

1. No additional spectrum available to public safety.
2. FM obsoleted by ACSB.
3. Law enforcement to use cellular technology.
4. Automated vehicle locators to be both sophisticated and commonplace.
5. Satellite repeaters for 900MHz UHF communications systems.
6. The ability to talk to anyone anywhere as needed.
7. Digital communications to conserve air time.
8. Cellular telephones in law enforcement units.

The final section lists the emergent events and trends from the participants approximately 20 years into the future:

1. Satellite repeaters developed to the point of phasing out mountain top repeaters and mobile relays.
2. Multi-band programmable synthesized radios.
3. VHF-low band obsolete and no longer used in public safety.
4. Channels further narrowed within the spectrum.
5. Continuation of prior trends.

After eliminating obvious duplications (of which there were numerous) this input totaled 74 prior emergent events and trends, and 54 forecasted events and trends for a total of 128 events and trends.

The next step involved the use of the Delphi Technique to narrow down all the candidate events and trends to a manageable number. I decided upon a total of ten past and ten future events and trends, even though we had been cautioned during the course work that this was an absolute maximum number. The reason for selecting this number was to generate a sufficient amount of data to enable three divergent scenarios to be developed.

Each participant in the Expert Resource Group was sent the total of the events and trends as previously set forth along with a suitable letter of instruction. The intent was to have each group member examine the totality of input, reassess his individual input in light of this totality, and then prioritize ten past and ten future events and trends. Each event-trend would be assigned a point value by each group member, so that the most important past as well as the most important future event or trend would receive a value of ten points, and then obviously the tenth most important would receive a value of one point. In the letter of instruction, I had advised each of the group members that I would call them to get the events and trends and the correspondent point values, again with the intent to eliminate their necessity of writing something down and sending it to me.

This step was completed in one Delphi round, since there were no ties that would have resulted in more than ten past or ten future events and trends.

Since there were no ties necessitating further Delphi rounds, the next step was to determine the consensus on these events and trends, as well as the relative values of each by having each participant chart each event and trend.

Each participant was then sent 20 charts to correspond to the total of 20 passed and forecasted events and trends. Each chart had one event or trend listed beneath it, and except for being separated into past and future categories, the distribution was random to preclude any inference of prioritization upon receipt by the participants. Accompanying the charts was an appropriate letter of instruction. This was the only stage which required written submissions from the group members. At this point, two of the members had to drop out as other professional responsibilities precluded the timely submission of the charts. In addition, one member disagreed with some of the events and trends, even though these were the results of the group, and on those items with which he disagreed, he did not chart the values.

Upon receipt of the submitted charts, I used a master chart form to plot each of the submissions. When all submissions were in, I then determined the central tendency by selecting the median value. These values can be compared between the different events and trends to determine the central tendency thus the relative strength of the groups' conviction. (Refer to Appendix C).

The charts can also give an indication of consensus by the value range between the two values immediately adjacent (above and below) to the median value.

For determination of central tendency, the higher number equates to the higher value. For determination of consensus, the smallest range around the median is indicative of the greatest degree of

consensus, and therefore the smaller numbers are the indicators of tendencies towards tight consensus.

For the purposes of this exercise, I will confine the discussion of central tendencies and consensus indicators to the future state, although each chart made provision for going back fifteen years as well as going into the future fifteen years.

The events and trends will be discussed and analyzed in a prioritized order based on their central tendency point values. For each five year period in the future, the events and trends in both categories, past and future, that have the highest point value were selected. These will be analyzed and discussed in this order, with the remainder discussed in random order subsequently.

PRIORITIZED EVENTS AND TRENDS-PAST

For reference purposes, the ten selected past events and trends, in random order, are as follows:

1. Transistorized equipment.
2. Implementation of state wide interagency frequencies.
3. PL-to eliminate nuisance interference.
4. The concept of 911 centers developed.
5. Recognition of the law enforcement need for access to additional areas of spectrum and direction by congress to the FCC to prioritize public safety needs.
6. 800MHz UHF band opened up for public safety.
7. Greater efforts at frequency coordination through the efforts of APCO.
8. Mobile relays for greater car to car communication.
9. Radio systems start to evolve.
10. From the 1930's, the FCC system of frequency allocation. Problem created by this system as compounded to a point where it is currently catastrophic.

In projecting these past events and trends into the future, the point value range on the charts was from 100 to 300, with 100 as a current value reference.

Starting at the five year period the following two events and trends had the highest point value (200) for this period:

#4. The concept of 911 centers developed.

Discussion:

The premise behind a consolidated 911 center is to simplify and facilitate the ability to render emergency service to the public. By dialing the one number, 911, the caller can report any sort of an emergency, whether it requires law enforcement, fire suppresion, or medical aid. If combinations of these emergency responders are needed, they can be simultaneously dispatched. In addition, the

caller need not be concerned about contacting the proper jurisdiction for an emergency response since the consolidated 911 center has the capability to dispatch for any of the jurisdictions it services. These centers typically are organized along city-county lines, with a single center in some instances having all dispatch responsibility for an entire county. In some areas this takes in all emergency responders within the county, although in some areas not all cities participate in dispatch through a consolidated center. At present there are no consolidated centers serving intercounty needs on the city-county level. There is however, precedent for such further consolidation, as the California Highway Patrol routinely dispatches for their units for several different areas from the same dispatch center, without regard to jurisdictional boundaries.

Besides the obvious public safety advantages, there are fiscal advantages to such consolidation. For example, any agency that has the requirement of the capability of fire dispatch must maintain a dispatcher on that position 24 hours a day, although fire dispatches tend to be sporadic with periods of absolutely no activity between such dispatches. This differs from law enforcement dispatch services which tend to be ongoing, with peaks and valleys of activity. By consolidating dispatch responsibilities and functions, a dispatcher who normally would be inactive waiting for a fire dispatch can be utilized in another dispatch position to assist with the work load during peak periods. In total, this results in fewer persons having to be utilized for any number of dispatch positions, and a more efficient utilization of personnel.

#7. Greater efforts at frequency coordination through the efforts of APCO.

Discussion:

Over the years the Associated Public Safety Communications Officers have assumed a greater role in local area frequency coordination. This coordination is necessary to insure to the maximum extent possible that public safety agencies needing additional channels are able to obtain them, but at the same time there is sufficient geographical separation between users of the same channel to prevent interference. This coordination is carried out through local frequency coordination committees comprised of qualified public safety officials in the area who have a sufficient technical knowledge of communications principals, as well as knowledge of the conditions and requirements of their particular areas.

For the ten year period, the following event had the highest point value (300), and was also tied with the two top items discussed under the five year category.

#6. 800MHz UHF band opened up for public safety.

Discussion:

The 800MHz UHF bandwidth is the most recent area of the spectrum to become accessible to public safety. The other areas of the bandwidth are VHF-low band, VHF-high band, and 450-500MHz UHF. The width of spectrum, and therefore the number of channels available to public safety, is a finite resource. Because of the increasing need for additional communications channels, and the lack of such additional space in other areas of the spectrum, it became necessary to secure bandwidth space in this 800MHz UHF area of the spectrum. The initial efforts at gaining access in this area of the spectrum were on a regional basis, because UHF television stations also broadcast in this area. Therefore, in order for public safety to gain access in a particular location, there could be no conflict with commercial television users. In addition, specialized equipment engineered specifically for communications use in this frequency area had to be developed, rather than being able to be evolved from existent designs. (Note: if the reader has not already done so, I strongly urge review of the first section of the appendix which gives a simplified explanation of some of the more complex technical principles discussed in this paper).

At the 15 year point, the following trend had the highest point value (275), as well as being tied with items 4,6,and 7 at the five year period.

#5. Recognition of the law enforcement need for access to additional areas of the spectrum and direction by Congress to the FCC to prioritize public safety needs.

Discussion:

This item relates to item #6 just discussed. Historically, the FCC has been unresponsive to the needs of public safety for access to spectrum area, favoring the needs of commercial broadcast users. This goes back as far as 1933 at which time there was a disagreement between the predecessor to the FCC, the Federal Radio Commission, (FRC) and the law enforcement community involving the allocation of police frequencies.[16]

Later that same year, "..... the FRC declared the two-way radio communications could not be authorized because of the shortage of frequencies."[17] It was not until March 1939 when the FCC declared the police an emergency service, through order #3260O-A. At that time it was decided that VHF frequencies were to be allocated for mobile use.[18]

In the intervening time, the spectrum needs of public safety have increased as has population, crime, and technological advancement. However, there have been additional demands on the spectrum, since in this same intervening period of time FM broadcast radio as well as television have been developed. All of these diverse users compete for the same limited spectrum resource. It has taken Congressional action to compel the FCC to prioritize the needs of

public safety, through the enactment of Public Law 97-259.

Current examples indicate that the situation is critical. "In an interim report regarding the future requirements of land mobile telecommunications (Docket 82-10), which includes all public safety agencies in the country, the FCC confirmed the present channel shortage and predicted a large shortfall of land mobile frequencies by the year 1990." 19

The following six items are listed in numerical order. They had values in the point range of 100 to 225. However, they were not the highest rated value for any given future.

#1. Transistorized equipment.

Discussion:

The invention of solid state equipment brought immediate advantages in terms of size, weight, power consumption, heat generated, ease and speed of maintenance, and equipment stability to communications equipment. It was this event that started the trend of miniaturization of electronic equipment, and the ability to design into ever-decreasing equipment sizes ever-increasing capabilities.

#2. The implementation of state-wide interagency frequencies.

Discussion:

This category involves two separate developments in communications on a state level:

1. The implementation of state-wide point-to-point communication ability between communications centers.
2. The development of common frequencies on a state-wide basis for intra and interagency use during mutual aid situations.

The first development enabled different geographical points within the state to communicate with one another. It was predicated upon a system of mountaintop repeaters throughout the State of California. Each county, as well as numerous state agencies and major municipal police departments, had access to this point-to-point network. When it was necessary to contact another agency using the network, the communication center would dial into the system using a telephone dial which would activate the repeaters to contact the intended recipient of the radio traffic. The flaw in this system is that it has no backup system, and it is not disaster-proof. This was well illustrated in the 1982 earthquake in Coalinga. When the earthquake struck, the ability to communicate with Coalinga was lost, with the result that allied agencies were unable to make direct contact and find out the type and magnitude of assistance needed.

The system of common frequencies applicable state-wide to local units for intra and interagency operations is known as the California Law Enforcement Mutual Aid Radio System (CLEMARS). These

are frequencies licensed by the State of California and granted to law enforcement agencies at all levels throughout the state. The intent is to allow unit-to-unit and unit-to-base station short-range communications capability in instances where units from differing departments are involved in the same mission, and there is a necessity to coordinate communication. Since this is a localized nonrepeated communications path, it is reusable within a relatively short geographical distance. The technical requirement of the system is that all units involved in a particular mission have the ability to transmit on the same bandwidth. If any involved units do not, and this is a common occurrence, then this communications capability will not be available. At the present state of the art, the only way around this obstacle, if a particular department is on a bandwidth incompatible with a CLEMARS frequency, is to have an additional and separate radio installed in each unit to allow CLEMARS operation.

#3. PL to eliminate nuisance interference.

Discussion:

The abbreviation PL stands for private line, which is a system to eliminate spurious radio signals from being received. In this system, in order for either a repeater to be activated, or a mobile or portable radio, there must be an accompanying subaudible tone with the radio signal. Thus, even though the receiver may be on the same signal wave length as an unintended transmission, that radio will not receive that transmission unless that transmission is accompanied by the requisite subaudible tone that activates the receiver to allow the signal to be broadcast. The benefit to this development is to greatly reduce spurious signals received from atmospheric skip or proximity of an agency using the same frequency. Thus, the overall result is to allow less geographic distance between users of the same frequencies.

#8. Mobile relays for greater car to car communication.

Discussion:

While a mobile radio may have the same power output as a mountaintop repeater, it does not have the advantage of height. Because of this, car-to-car communications were relatively limited to the range allowed by the ground level transmitter within the car. The development of mobile relays allowed two cars a great distance apart to communicate to one another by transmitting the signal to a mountaintop repeater which would then retransmit it such that it would propagate over a sufficiently large area for the intendent recipient to copy the signal. While this is advantageous for long distance car-to-car communication necessities, it also has the disadvantage of tying up that frequency over a large area. Thus, some departments utilize a simplex system so that when it is not necessary to communicate over long distances, two units may "talk around" to one another without utilizing a mobile relay, thus

leaving that frequency clear for other traffic.

#9. Radio systems start to evolve.

Discussion:

This relates to item #4, the development of the concept of consolidated 911 centers can be seen as administrative development, the development of radio systems is technological. In this respect, this development was the point of transition from individual agencies having individual frequencies and bandwidths not in any way interconnected, coordinated, or in communication with one another.

#10. From the 1930's, the FCC system of frequency allocation. The problem created by this system is compounded to a point where it is currently catastrophic.

Discussion:

The FCC system of frequency allocation in effect is and has been a non system. Early on the FCC assigned various portions of the available bandwidths to different categories of public and private sectors including amongst those law enforcement. However, the specific allocations of frequencies within those designated bandwidth areas was done on a first come first served basis, with no system of coordination or organization built in. The result of this non-system is that it is common now to find agencies operating contiguous to one another utilizing all four discreet bandwidth areas, and because of this separation not having the ability of interagency unit-to- unit communications. That has also resulted in inordinately costly reconfiguration costs for agencies needing additional channels, but unable to acquire them in the bandwidth area that they were using historically. A prime example of this dilemma is the situation facing the Los Angeles County Sheriff's Department. The Los Angeles Sheriff's Department currently operates in the VHF-low band area of the spectrum. The department presently needs 60 additional duplex channels (meaning that in actuality a total of 120 channels are needed).[20] This quantity of additional spectrum is simply not available in the bandwidth area being utilized by the Los Angeles County Sheriff. Therefore, they are faced with the necessity to totally reconfigure their communications system in order to acquire the additional needed spectrum. The minimum cost estimated for this reconfiguration will be 58.8 million dollars.[21] However, the department has no alternative.

On a smaller scale, but exemplifying the problem, the Tomball, Texas Police Department must share a frequency with an Arco Oil rig. Thus emergency dispatch competes with grocery orders.[22]

A mitigating effect on this FCC frequency allocations system has been the formation by APCO of local frequency allocation coordinators, who attempt to obtain additional needed channels consistent with spectrum demand in any local area. This development

came however, after the FCC system had been in effect for many years. In a extremely large and densely populated area such as Los Angeles County, regardless of the skill and normative intentions of the local area frequency coordinators, the additional spectrum is simply not available because of the large number of law enforcement agencies crowded into a relatively compact geographic area.

PRIORITIZED EVENTS AND TRENDS-FUTURE

The forecasted events and trends were charted by the participants in the same fashion as the past events and trends. The range of values for the forecasted events and trends was from 75 to 390. As was done with the past events and trends, the forecasted events and trends will be identified and discussed in priority starting with the highest values at each of the three time stages of 5, 10, and 15 years into the future.

The top ten future events and trends as identified by the group participants through the Delphi Technique it is as follows:

1. More 800MHz UHF systems-conventional and trunked.
2. Greater proliferation of programmable radios.
3. Continued increase in the usage of 450-470, 800 and 900MHz UHF spectrum, along with greater coordination of VHF-high band usage.
4. Use of satellite communications for unique disaster situations, such as earthquakes or interstate communications.
5. Enhanced consolidated 911 systems using CAD will become mandatory which will increase work output capabilities of each dispatcher by approximately 3 times. Dispatchers will have to be able to operate computers to function with this system.
6. Increased frequency coordination by FCC and APCO.
7. Major radio traffic congestion on all frequencies.
8. Far greater use of digital communications to conserve air time.
9. FCC to be forced to make additional 500-800MHz UHF spectrum available to public safety.
10. FCC to compel agencies to become more spectrum-efficient.

For the approximate period five years in the future, the following two events and trends were rated the highest by the participants in that time frame, each with a value of 200:

#3. Continued increase in usage of 450-470, 800 and 900MHz UHF spectrum, along with greater coordination of VHF-high band usage.

Discussion:

As has been previously indicated, the need and attendant demand in law enforcement for additional spectrum space far outweighs the available supply. This has resulted in utilization of the 450-470MHz UHF bandwidth starting in the early 1970's, and more recently the opening up and utilization of spectrum area in the 800 and

900MHz UHF spectrum area.

In terms of characteristics, the UHF spectrum has some advantages, especially in crowded metropolitan areas. To begin with it is strictly line of sight. Therefore, it does not have the problem with skip. Thus, reuse with minimal geographic separation is possible. It has excellent penetration characteristics, therefore is suitable for use in areas with large numbers of automobiles and buildings. Lastly, noise levels are at a minimum, which again is a benefit in metropolitan areas where there are numerous sources of spurious noise interference.[23]

The Los Angeles area is the region with the greatest need for additional spectrum space. The leader attempting to gain such additional spectrum has been Los Angeles County Sheriff, Sherman Block. In late 1986, through the efforts of the IACP, APCO, and the major cities chiefs of police, an additional six MHz (120 pairs of radio channels) of 800MHz UHF spectrum area was opened up for public safety.[24] This involved taking over the spectrum area previously occupied by two television UHF channels. Along with providing relief in congested metropolitan areas where additional spectrum is desperately needed, the additional available spectrum in the UHF bandwidth served to alleviate some of the demand for VHF frequencies. The VHF high band area of the spectrum has advantages over UHF bandwidths when larger areas must be covered. Therefore, it is advantageous to all concerned if agencies in congested areas with relatively limited geographic area responsibility can obtain additional spectrum area through reconfiguration to the UHF range, and then relinquish VHF spectrum area to agencies needing the greater distance capability.

#7. Major radio traffic congestion on all frequencies.

Discussion:

This relates to past events and trend numbers 5, 6, 7, and 10, as well as forecasted event and trend numbers 1, 3, 6, 9, and 10. From Los Angeles County Sheriff Block: "When we attempted to obtain additional radio channels for the department's new system and for mutual aid, we found that there were no compatible radio channels available and there were no plans to provide more channels in the future. Our situation was not unique. A survey of this association's members revealed many similar situations nationwide. We discovered that while there were no radio channels available to public safety or other land mobile users in areas of the nation, the television broadcast service had received large allocations of frequencies, <u>many of which remain vacant and unused."</u> (Emphasis mine.) [25]

There are actually two facets to this trend, both of which are most effectively illustrated by example:

1. Obviously frequency congestion is most severe in metropolitan

areas. Because of this, law enforcement agencies in or contiguous to such areas are being forced to attempt to gain bandwidth space in other areas of the spectrum, although all such areas are increasingly becoming more congested. A recent example of a major reconfiguration due to this congestion was that of the New Jersey State Police. The New Jersey State Police had installed an updated VHF-low band communication system in 1970. However, in the period of time since then, the necessity for additional channels had far outstripped any availability of channels, even in the less desirable VHF-low band bandwidth area. Thus, the New Jersey State Police found itself operating in three separate bandwidth areas, with the consequent necessity that some units had to have three separate radios installed. Since New Jersey is situated between two major metropolitan areas-New York City and Philadelphia-there simply were no other channels available that would allow the state police to operate in one bandwidth area.[26]

2. El Dorado County illustrates another dimension of this dilemma based on its geographic location. The El Dorado County Sheriff's Department currently operates in the VHF-low band spectrum. A reconfiguration of this communication system to more closely coincide with current state of the art is in the planning stage. It would be desirable for El Dorado County to reconfigure into the VHF-high band area of the spectrum.[27] In addition, because of the size of the department, the population served, and the amount of communications usage, the department would not need a large number of channels. However, El Dorado County has the disadvantage of being located in the Sierra Nevada mountains. Because of this, transmitters will be located on mountain tops as high as 10,000 feet. This will cause propagation over an extremely wide area, far wider than the needs of El Dorado County. El Dorado County is already suffering from an example of this propagation problem. Because the VHF-low band spectrum area is unfavorably suited to portable radio use, the El Dorado County Sheriff's Department (in common with many other departments using VHF-low band) has portable radios operating in the VHF-high band area which transmit to mobile relays located in the patrol units, which then retransmit the signal on the VHF-low band communications net. The portable radios however, transmit and receive on the VHF-high band bandwidth area. By coincidence, the VHF frequency being used by the El Dorado County Sheriff's Department for their portable radios is the same as the dispatch frequency utilized by the Livermore Police Department. Livermore is located approximately 140 miles from the 2,000 ft. elevation area of El Dorado County. It is situated southwest of the county with numerous foothills intervening. Despite this the Livermore Police Department frequency comes in so strongly in many areas of El Dorado County, that it overrides incoming signals to the Sheriff's Departments portable radios. Since this is occurring from a low powered, low elevation system located a considerable distance away with no intention

> of wide area propagation, the potential complications to such propagation are obvious. Thus, while El Dorado County Sheriff's Department many not many need VHF-high band channels to give the department an ideal reconfiguration, the channels are still not available, because their use in El Dorado County would create such a propagation pattern as to preclude their reuse over most of Central California. Since El Dorado County is situated directly east of the Sacramento metropolitan area, and in direct line with the San Francisco bay area, frequency usage in El Dorado County would undoubtedly effect users of the same frequency in the Sacramento and San Francisco Bay areas.[28]

Thus, congestion in frequencies relates not only to the amount of traffic and channels in usage in metropolitan areas, but in addition the propagation characteristics dictated by geographic factors which preclude proximate reuse of frequencies.

For the forecasted period 10 years in the future, there were three items, each tied with a median value of 300, as follows:

1. More 800MHz UHF systems-conventional and trunked.

Discussion:

Previous discussion has sufficiently illustrated the necessity and benefits to numerous agencies of reconfiguring into the 800MHz UHF spectrum. An additional benefit may be gained by trunking. "Trunking can be defined as the sharing of a small number of communications paths by a large number of users."[29] This alternative attempt at more efficient frequency utilization was first broached by the FCC in the 1970's in docket #18262.[30] "One of the initiatives in 18262 was the introduction of trunking concepts to foster radio spectrum usage efficiencies."[31] In this initiative, the FCC specified that systems utilized more than five frequencies would have to be trunked. "This introduced a term that was relatively new in land mobile radio and completely new to public safety communications. Although trunking has been used in telephone operations for almost 100 years, it took the radio spectrum shortages, FCC regulations, and enormous strides in technology to make trunking usable to the public safety community."[32] However, while trunking holds a potential for more efficient utilization of available spectrum, it should not be viewed as a panacea. While it has proven to be feasible and effective for the New Jersey State Police Department, a recent test by the Los Angeles Fire Department indicated that trunking was not suitable for the specific needs of that department.[33] Thus, the prospective user contemplating a switch to a trunked system would be well advised to rigorously test and evaluate such a system in direct relation to the projected needs of the department.

Item #3 has previously been discussed, and was tied with item #1 in the predicated 10 year period area.

#6. Increased frequency coordination by FCC and APCO.

Discussion:

This item has been discussed and analyzed within the context of the discussion and analysis of other related events and trends such that further discussion would be redundant. The significance of the item lies in its selection as one of the three most critical events and trends 10 years in the future, which is further under-scored by the literature citations listed.

For the forecasted period 15 years into the future, item #7 (major radio traffic congestion on all frequencies) was selected by the participants as the highest median value. This trend has already been discussed under the five year predicted category. What is noteworthy here, is that this predicted trend had the highest value (a median of 390) of any of the events and trends past or forecasted. This then gives an indication of its significance in the minds of the participants in the in Delphi Technique. The following forecasted events and trends were among the ten prioritorized by the group through the Delphi Technique, but were not assigned the highest median point values in any of the predicted future periods, therefore, they will be analyzed and discussed in random order.

#2. Greater proliferation of programmable radios.

Discussion:

A relatively recent development in communications systems is the use of synthesized circuits, rather than crystal controlled circuits. The purpose of either a crystal controlled or synthesized circuit is to maintain stability of frequency. In a crystal controlled circuit, in order to change the frequency of the radio, the crystal must be changed to one of the proper frequency. Thus, a greater expense is incurred both in the purchase and the installation of alternate crystals. The development of synthesized radios allows them to be programmed either by the user or by a maintenance facility, without the necessity to exchange crystals. This results in a less expensive radio design, not only for purchase but for changing of frequencies. One of the limitations that had to be overcome in order to develop synthesized radios was the limitations of older circuits to a relatively small portion of a particular bandwidth area. Synthesized radios allow programming to any frequency within a specific bandwidth area. Synthesized radios are especially advantageous in areas in which a department is decentralized, with the necessity of different frequencies (within the same bandwidth) in different areas.

A disadvantage to the proliferation of programmable radios is the violation of frequencies by non-authorized users, since programming of the radios is a simple matter. A solution to this is to engineer

radios in such a fashion that when the radio transmits, regardless of frequency, an integrated radio identifier is also transmitted. A number of respondents indicated that the predicted influence of this trend would be condition upon whether or not the potential for abuse by an unauthorized user could be engineered out of such radios.

#4. Use of satellite communications for unique disaster situations, such as earthquakes or interstate communications.

Discussion:

A current method by which long distance and interstate radio communications is provided is through networks of mountain top repeaters. By dialing in certain codes, the user keys open the requisite repeaters necessary to talk to the intended destination, and then communicates for a limited period of time that this network is keyed in the fashion. Thus, it would not be unusual to have 8 or 10 mountain top repeaters linked by microwave to enable communications between two states or across one large and/or mountainous state. Besides the obvious limitations on number of users at any given time, such a system is dependent upon all of the necessary mountain repeaters being in operation. In the event of an earthquake, if one repeater is disabled, then communication to and from sites served by the repeater would be lost.

The technology currently exists to eliminate such long distance repeater systems, in favor of using a single satellite as the repeater. Indeed, it is being looked at already. From APCO: "A major statewide agency was considering the use of a satellite for better radio coverage. The APCO advisor provided them with information and recommendations on which to base future actions." 34 This would allow communications over extremely large distances, without the necessity for dependence upon a series of mountain top repeaters. Because the paths to and from the satellite would be straight line of sight, far lower power would be necessary to accomplish a link up. In addition, the use of such satellites is ideally suited to the UHF bandwidth. The current disadvantage to such systems is the expense. Although the weight of such a system is within current launch capabilities, the present expense for a shuttle launch ranges from 70 to 140 million dollars.[35] However, it can be predicted that the economies of scale, plus continuing success at reducing weight and miniaturizing radios, as well as the development of lighter weight satellites, will reduce launch costs in the future.

As an example of the applicability of such a system, consider the situation facing the Los Angeles basin. Los Angeles basin is widely predicted to be impacted by a major earthquake within the relatively near future. Very conceivably such an earthquake would disable numerous mountain top repeaters, the result of which could be to cut Los Angeles off from communication with the rest of the state. With the installation of a satellite communication system, this communication capability could be maintained as long as there were

one 10 watt transmitter capable of transmitting on the frequency utilized by the satellite.

As development continues on satellite communications systems, besides a highly probable reduction of expense, the radiation area of the satellite will be able to be more precisely controlled. At the current state of development, the minimum "footprint" for a satellite is approximately 50 miles.[36]

#5. Enhanced consolidated 911 systems using CAD will become mandatory which will increase work output capabilities of each dispatcher by approximately three times. Dispatchers will have to be able to operate computers to function with this system.

Discussion:

For most public safety agencies, approximately 85% of the budget is consumed by employee salaries and benefits. Public safety agencies are continuously faced with an increasing work load, but without a consequent increase in personnel. Obviously, a solution is to enable the existent personnel to do more work. In the specific context of dispatch centers, this can be achieved by utilizing computerized dispatch. In addition, computerized dispatch centers lower the training time for dispatchers, as the dispatchers do not need as much specific knowledge as before, since this knowledge is stored within the memory bank of the computer. However, since this system absolutely depends upon the ability of the user to operate the computer, dispatchers will have to be able to function with computers.

One of the areas long ignored in the escalation of demands upon public safety, and the consequent professionalization of public safety agencies, has been the training for dispatchers. Currently there is no state mandated program in California for the training of dispatchers. While CAD systems will allow a single dispatcher to do approximately three times more work, this will be conditioned upon the capability of the dispatcher to function in a computer environment.

#8. Far greater use of digital communications to save air time.

Discussion:

There is no need to reiterate the evidence indicative of channel congestion and in some cases overload, previously set forth. One solution of this overload situation, especially in metropolitan areas, is the use of digital communications rather than voice for routine transmissions. It has been knowledgeably estimated that utilizing digital communications for routine traffic allows for an approximate four fold increase in available air time.[37]

There are however limitations to digital communications. To begin with, not all bandwidths are suitable for adaptation to digital

communications. The best example of this is the VHF-low band spectrum area. Due to the susceptibility to man-made noise interference and skip, VHF-low band is not considered to be compatible with digital communications. In addition, because VHF-low band will cover a greater area on its fringes, where voice may be detectable even though there is a great deal of noise, many agencies utilizing such systems depend on this fringe ability. However, this fringe ability will not allow digital communication.

Another disadvantage is the space taken up in a patrol vehicle by the mobile digital terminal (MDT). Although installation is possible in the current size patrol vehicles so as to allow two persons to occupy the two front seats in a vehicle, the installation is so crowded that the access to the MDT as well as to the other electronic equipment becomes extremely limited and inconvenient. While continued trends towards miniaturization will continue to create the ability to make MDT'S smaller, there are ergonomic factors which limit how small a screen and keyboard could be, and still be useful to the occupants of a vehicle.

At the present state of development, MDT's cost approximately $5,000.00 per car to equip it for digital communications capability. If it is conceded that the installation of an MDT will preclude the use of the right front seat is lost, this would then generate the additional expense of the acquisition of greater number of patrol vehicles as well as the necessity to equip these vehicles with MDT'S. However, if the severity of radio traffic congestion on all frequencies is to the extent forecasted by the Expert Resource Group, then this additional cost will simply be the price to pay in order to have more efficient use of available air time.

#9. The FCC will be forced to make additional 500-800MHz UHF spectrum available to public safety.

Discussion:

Since numerous areas of previous discussion and analysis have indicated increasing congestion on existent frequencies, obviously solutions must be sought. One method is through political pressure on the FCC to obtain additional spectrum from commercial users that can be dedicated to public safety. This has been the direction taken by the Los Angeles County Sheriff's Department. The following comment by Los Angeles County Sheriff Sherman Block indicates that public safety users will not be able to obtain additional UHF spectrum area without a battle: "The FCC had hoped that a joint broadcasting-land mobile committee could reach agreement on technical sharing rules. However, the television broadcasters have taken the position that no further sharing can occur without unacceptable interference, land mobile-public safety spectrum shortages can be resolved without new spectrum (although they don't say how), and television, rather than land mobile-public safety, is a service actually in need of more frequencies. Consequently, agreement could not be reached."[38] The necessity for such pressure

on the FCC was the thrust of remarks made by Los Angeles County Sheriff Sherman Block before the IACP (International Association of Chiefs of Police) in 1983.[39] Given that as the present setting, the prediction is that the FCC will be forced to take a stronger stand and compel commercial television stations to surrender more of the UHF spectrum for public safety needs.

This concludes the major forecasted events and trends.

The foregoing discussion and analysis of past as well as forecasted events and trends has revolved around the significance of those events and trends as identified by the Expert Resource Group through the Delphi Technique, and then further refined and prioritized through the charting of central tendency ranges.

As stated earlier, another method of interpretation of the charts can be utilized to indicate consensus. Consensus is indicated by the range between the median (central tendency) value, and the two values immediately adjacent to it, above and below. Taking the same charts used to analyze central tendency point values, the central tendency ranges were also calculated. For past events and trends, examining only the three future specified periods, the consensus range was from 0 (indicative of a tightest consensus) to 175 (indicative of the least degree of consensus).

At the five year future period, the following events and trends were tied in tightest consensus, each with a value of 0:

#2. Implementation of state-wide interagency frequencies.

#4. Concept of 911 centers developed.

#5. Recognition of law enforcement need for access to additional areas of spectrum, and direction by Congress to prioritize public safety needs.

For the ten year period in the future, the following trend had the tightest degree of consensus, with a value of 25:

#7. Greater efforts at frequency coordination through the efforts of APCO.

At the fifteen year point in the future, the same event had the tightest degree of consensus, this time with a value of 50.

In further analyzing past emergent events and trends forecasted into the future, the following apparent correlations between consensus and significance of value is indicated by the charts:

#4. Concept of 911 center developed.

#5. Recognition of law enforcement need for access to additional areas of spectrum, and direction by Congress to prioritize

public safety needs.

The two prior events and trends were correlated due to having the highest value in the central tendency analysis, as well as the tightest median range for the same time periods.

The following trend did not have the combination of the highest values and tightest ranges in the same years, but did have the highest median value at T+5, (5 years in the future), along with the tightest consensus at T+10 and T+15 (10 and 15 years into the future):

#7. Greater efforts at frequency coordination through the efforts of APCO.

Applying the same technique to forecasted events and trends, a consensus range of 0 to 200 resulted.

At the five year future (T+5), the trend with the tightest consensus, with a value of 0, is:

#7. Major radio traffic congestion on all frequencies.

At both the T+10 and T+15 points in the future, the same trend had the tightest consensus, with values of 35 and 25 respectively:

#6. Increased frequency coordination by FCC and APCO.

In comparing consensus with strength of value, there are correlations involving both trends between the median values, and the tightness of consensus. Trend #6 which has the tightest consensus at T+10 and T+15, has the highest value at T+10 in the central tendency analysis. Trend #7, which has the tightest consensus at T+5, has the highest value at the same time period in the central tendency analysis. (The relevant charts may be found in Appendix C).

Thus, in comparison of the two charting methods, the result is a total of five events and trends (past and future) which have a correlation between of tightness of consensus and strength of values held. In summary, those events and trends are as follows:

1. The concept of 911 centers developed.
2. Recognition of law enforcement need for access to additional areas of spectrum, and direction by Congress to prioritize public safety needs.
3. Greater efforts at frequency coordination through the efforts of APCO.
4. Increased frequency coordination by the FCC and APCO.
5. Major traffic congestion on all frequencies.

While these five events and trends should not be used for the purpose of eliminating other events and trends where such

correlations do not exist, they do assist in focusing more specifically on some of the major issues facing sheriff's departments in California in charting the future course of their communications systems.

It should be apparent to the reader by this point that clearly emerging from a data generated by the Expert Resource Group, and refined and prioritized through the Delphi Technique and the central tendency charting, is a greater emphasis on problems rather than solutions.

ADDITIONAL SELECTED FUTURE TRENDS

From the stand point of scenario development, in my judgment it is of far greater value to develop scenarios that incorporate these problems, but which in addition incorporate intelligent and feasible solutions to the problems.

Even though this was not the intent of the individual members of the Expert Resource Group, as they are not familiar with the process used here, the data supplied by the group has within it the solutions needed to solve the problems identified.

With the intent to solve these problems, the following seven events and trends were extracted from the overall data to be applied in the scenario development towards these solutions:

#1. 1.2GHz UHF spectrum opened up as well as more 400-500MHz UHF and 800-900MHz UHF.

Discussion:

The 1.2GHz UHF spectrum lies immediately adjacent to and above the 900MHz UHF spectrum. (It may also be viewed as the 1200MHz UHF spectrum). It is currently used only for point to point microwave lines. It is the next logical area of the spectrum to be made available to public safety when the state-of-the-art of communications engineering so allows. This portion of the bandwidth has characteristics similar to the other UHF spectrum area; strictly line of sight signal propagation, freedom from man-made noise interference, excellent penetration characteristics, and reuse ability within short ranges.

#2. To achieve greater spectrum efficiency, the use of amplitude companded single side band and offsetting.

Discussion:

Amplitude companded single side band (ACSB) and offsetting are two different technical methods of utilizing greater numbers of frequencies within a given bandwidth area.

Of the two, ACSB has the greater potential for universal

application. The technology for ACSB has been in existence since 1932. The application of SB obsoletes the present method of frequency width control (frequency modulation, which is more familiarly known as FM). Utilizing ACSB, each channel occupies less space within the bandwidth, with the result that five channels may be utilized by using ACSB in the spectrum area occupied by one channel utilizing FM. In addition, the propagation characteristics utilizing ACSB are more similar to UHF, than to VHF, in that there is a greater range with the same power, but absolutely no fringe ability. Thus, these characteristics are more compatible with digital communication.

Offsetting utilizes FM to achieve similar benefits to ACSB but of a lower order. Offsetting is a technical method of placing additional radio channels in between those already existence, by utilizing the so called "guard" areas between the channels which exist to prevent interchannel interference. If offsetting can be refined to a point of practical application, it will allow approximately three channels into the bandwidth area currently occupied by one channel.

#3. Decrease and/or elimination of VHF-low band bandwidth for law enforcement use.

At least one authority has made a blanket statement that VHF-low band is unacceptable for contemporary public safety use.[40] In addition, data generated from departments utilizing it indicate a strong preference to reconfigure to other areas of the bandwidth compatible with their needs as well as with current and future state-of-the-art equipment developments. As an example of the frustration faced by departments attempting to stay with current state-of-the-art engineering, the California Highway Patrol recently distributed requests for proposal (RFP's) to 151 different manufacturers and suppliers of communication equipment, as they were preparing for a scheduled ten year update on mobile communications equipment. Of the 151 RFP solicitations distributed, only two were returned, despite a projected expenditure of 23-25 million dollars. The reason behind this extraordinarily low rate of return is that the major manufacturers and suppliers see the future of public safety communications as being in the VHF-high band and the UHF areas of the spectrum, rather than in the VHF-low band, and are focusing their product development in those bandwidths. In addition, as has been indicated previously, the noise susceptibility of VHF-low band makes it unfavorable for digital communications applications. And finally, VHF-low band is incompatible with efficient portable radio operations. Thus, if the opportunity presents itself, it can be forecasted that agencies still using this area of the bandwidth spectrum will chose to reconfigure to an area of the spectrum more consistent with current and future communications equipment state-of-the-art.

#4. Mobile digital terminals (MDT's) to be used to prepare reports.

Discussion:

Law enforcement reports currently are prepared in any of several ways. The report may be handwritten or dictated by the officer on patrol in the patrol unit. Alternatively the officer may come into the station to perform the same function, or to be able to type the report.

A relatively recent development has been the introduction of a computerized typewriter which utilizes a video display and an integrated memory bank. This allows typing to be done on this portable word processor at virtually any site. At some point subsequent to use, the word processor is then connected to the computer transcriber and a hard copy is rendered of that which has been put into the portable processor.

The next logical stage of such evolution is to adapt MDT's for this same purpose; the report being prepared totally by the deputy in the patrol unit, with the capability of seeing that which has been typed on the screen. When the report is completed, a button would then be depressed which would transmit the burst of data to the station to the computer to generate a hard copy of the report. Such a method as several distinct advantages over any method presently in use:

1. It enables the deputy to stay in the field, and prepare reports between calls for service. While this can also be done by dictation, the necessity to type the report as well as the ability to see that which is typed and instaneously corrected, will yield more accurate and concise reports than by utilizing dictation.

2. Any present method of preparing reports in the field delays delivery of reports to the station until the deputies come in. For sheriff's departments in many instances it is not feasible for a deputy to drive the considerable distance back to the station until the end of the shift. For extremely decentralized departments, utilizing resident deputies, the deputy may not be into the main office more than once or twice a week. The implementation of this system for report preparation and transmission will allow a far more rapid completion of the reports, with the advantage of the shift supervisor being able to review most reports immediately after their preparation and prior to the time the deputy would go off duty. This would be a significant and positive quality control factor.

In addition, since the computer in the station would automatically generate a hard copy, the extensive clerical staff currently utilized to type dictated reports could be virtually eliminated. The ability to render the same degree of service, using fewer personnel, presents fiscal advantages too obvious to be ignored.

#5. Portable radios to incorporate a video display and keyboard to be used as an MDT as well as for voice use.

Discussion:

If the potential efficiencies of digital communication are to be fully realized, then this capability must be applied to portable radios. Much of the routine traffic involving law enforcement units takes place outside the patrol unit when the officer is conducting investigations, making vehicle stops, etc. The ability to utilize the digital ability of the communication system is an advantage in such circumstances. To begin with, it is more consistent with overall efficiencies of the system. Secondly, there is a probable officer-safety factor involved. Many times officers are assaulted when a suspect hears the radio stating that there is a warrant for the individuals' arrest. If this information comes across silently on a video display, while the officer would be aware of the information, the suspect would have no way of anticipating this.

The current advances in technology and miniaturization strongly forecast that these functions will be incorporated in future portable radios, without any attendant increase in size or weight.

#6. Satellite repeaters for 900MHz and 1.2GHz UHF bandwidths.

Discussion:

As has been previously indicated, the use of satellite repeaters has a potentiality for eliminating mountaintop repeaters. In addition, the potential satellite repeaters has some other distinct advantages not obtainable by any other methods:

1. Because the satellite repeater would "look down" at the area of coverage, the jurisdictions involved could achieve 100% coverage without the use of any repeaters.

2. Because of the line of sight characteristics being dealt with, satellite repeaters are ideal for use in the UHF bandwidth, and relatively small amounts of power (approximately 10 watts) would be necessary for effective and reliable communications.

3. A satellite has a minimum footprint of approximately 50 miles in diameter. While this precludes its use for municipal applications, it makes it ideal for wide-area geographic coverage, which is consistent with sheriff's departments needs.

4. The combination of the footprint propagation characteristic of a satellite transmitter and the lack of fringe characteristics of the UHF band would result in closer proximity of the ability of frequency reuse.

The present limitation, as previously indicated, is the cost. However, it would be shortsighted to assume that this fiscal obstacle will continue given the revolutionary advances in technology capability currently occurring,and based on all available

evidence, to continue into the future.

#7. The development of multi-bandwidth radios.

Discussion:

Since multi-channel radios within the same bandwidth are now widely available, the next logical step of progression is the development of multi-bandwidth radios. This would allow agencies using different bandwidths to communicate with one another. In addition, it would allow access to common channels for mutual aid situations. (i.e. it would allow all agencies to have access to CLEMARS, regardless of what bandwidth they use for routine communications). It would allow the use of one radio in place of the necessity currently to use as many as 8.

#8. Cellular systems.

Discussion:

A current vogue in commercial telephone usage is the development of cellular telephones. The principle operation is as follows:

Each so called "cell" is an area serviced by a very low powered repeater. Telephones operating within reception and transmission range of this low powered repeater can communicate with telephones located in other cells, which would not be possible were the signals not repeated. Since the cellular repeaters are so low powered, the same frequency can be reused within very close proximity. The trunking principle is used to allow sufficient numbers of available channels.

This same process can be duplicated using radios only, but it does not appear that such a system will be feasible in rural areas, as there is a contradiction between the cellular concept and distance coverage.

#9. Directional antennas.

Discussion:

One method by which signal propagation can be limited is to limit the angle of reception-transmission of a base station, mobile relay, or mountaintop repeater antennas. Through this method, interference to or from this antenna would not occur if the source were outside the designated angle at which the antenna functions. This is a commonly used method to limit signal propagation, and with the clearly identified problems of frequency congestion will have to be utilized more extensively in the future.

The limitation of directional antennas is that although the angle of propagation can be controlled, the distance of propagation within that angle cannot be.

#10. Video exchange capability.

Discussion:

It is anomaly in law enforcement that while we frequently see photographs in the media of natives in very primitive third world regions watching television in their huts, this technology has never been even remotely efficiently utilized by law enforcement.

The technology for video exchange capability is present at the current state-of-the-art. Using this ability would allow far more certain and instantaneous identification of criminals as well as release of detained innocent persons bearing a resemblance to wanted persons, by the ability to actually allow victims to confront suspects stopped in distance jurisdictions.

For example, on a current application of technology if an individual commits a robbery of a liquor store in San Diego County and the victim is able to get a vehicle description, the vehicle may be stopped some hours later in Kern County. Based on the description, the authorities in Kern County would arrest the suspects, and hold them for pickup by the San Diego County authorities for subsequent identification by the victims. Utilizing video exchange capability, the same arrest could be made by Kern County, and as soon as the suspects were brought into the station, the victims in San Diego County could view those suspects, either standing by themselves in the clothing worn during the commission of the robbery or if so desired, wearing jail clothing and standing with some exemplar individuals in a lineup. This would allow instantaneous identification either way.

#11. Video maps and automatic vehicle locators (AVL's).

Discussion:

Automatic vehicle locators are in the primitive but functional stage currently. Both Menlo Park and Huntington Beach have experimented with them.[41] It has been proven that it is a workable concept and such systems can be designed and set up with the flexibility for both large and small area vehicle location determination within the same system. Since this initial revolutionary step has been completed, the next few years will undoubtedly see a proliferation of such systems, and prices brought to a practical level through refinement of engineering and the economies of scale.

Coincident with the development of automatic vehicle locators, is the development of the ability to program computers to display maps, which give not only the location of a designated vehicle, but also the location of the destination of the vehicle. One has already been developed by the Sunnyvale firm of Etak, Inc.[42] This has two immediate advantages for public safety:

1. Used in a dispatch center, it would allow the dispatcher a video display of the exact location of the call for service, as well as the proximity of units to be dispatched to the location. This would allow for the dispatch of the most proximate unit, thus yielding the quickest possible response time.

2. The same display in the patrol unit would give the officers on board a graphic display of their location relative to their destination. This would allow the officers to select the most expeditious route to the location, as well as most effective deployment

The system also has obvious advantages for supervisory purposes. Without ever leaving the station, the watch commander would be able to determine that the units on patrol are patrolling in their designated beat areas, that they are moving about the beats, and that they are not congregating for the usual socialization common to law enforcement officers everywhere. This is not to say that the watch commander should remain in the station solely watching the video display, but it does provide an area of supervision previously unavailable.

I have selected these ten additional events and trends as my first input into the process of this project. Everything previous has been based on the prioritized inputs (through the Delphi Technique) of the Expert Resource Group. However, at some point I as the author must assume other than a ministerial role in the development and direction of the project. The additional events and trends that I have added are all from the data submitted by the Expert Resource Group, as well as the results of my interviews and literature searches. The difference in selectivity between myself and the group is based upon the experience of the Command College, which for approximately 1 1/2 years has stressed "looking beyond the dots" as a slogan for looking into the future, based on this educational experience, my perspective of the future is going to differ from those who have not had the same experience, even though they are experts in their fields and have been requested for the purposes of input to attempt to predict the future.

CROSS-IMPACT ANALYSES

Having combined my input of forecasted events and trends with that of the expert resource group, I then combined the total of data, and divide all the data into events versus trends. Having done this, I arbitrarily assigned my own forecast of probability by the year 2002 for each of the events. I then utilized the cross impact analysis technique (Appendix C-29) to give a quantitative estimate as to the impact that each of these events would have on the other related events and trends. This then illustrates an if-then relationship. These relationships are set forth below only using those which have a quantitative value. Thus if I did not establish an impact, I did not list the relationship between the two, although the entirety of

relationships will be found in the chart in the appendix.

If:

1. Use of video maps and automatic vehicle locators.

Then:

Pilot-copilot concept. Impact = 95.
Single unit radio to integrate voice, data processing, and MDT. Impact = 80.
Decreased usage or elimination of VHF-low band. Impact = 85.
Continued miniaturization. Impact = 90.
All dispatch centers integrated and using CAD. Impact = 90.
All routine traffic digital. Impact = 90.

If:

2. MDT's for general use.

Then:

Use of video maps and AVL'S. Impact = 75.
Portables: Multi-band with video display and keyboard. Impact = 85.
Traffic congestion throughout the spectrum. Impact = 90.
Increased usage of 500-900MHz and 1.2GHz UHF, conventional and trunked. Impact = 90.
Channel narrowing. Impact = 75.
Single unit radio to integrate voice, data processing, and MDT. Impact = 90.
Decreased or eliminated usage of VHF-low band. Impact = 95.
Use of MDT's for report preparation. Impact = 95.
Continued miniaturization. Impact = 95.
All dispatch centers integrated and using CAD. Impact = 95.
Routine traffic digital. Impact = 95.
Greater spectrum efficiency. Impact = 95.

If:

3. Satellites used for unique disaster situations. Probability = 90.

Then:

Video exchange capability. Impact = 75.
Satellite repeater for 900MHz and 1.2GHz UHF. Impact = 90.
Satellite eliminates repeaters. Impact = 85.
Five 800MHz national mutual aid channels. Impact = 95.
Increased usage of 500-900MHz and 1.2GHz UHF, conventional and trunked. Impact = 90.
Greater spectrum coordination. Impact = 75.
Decreased or eliminated usage of VHF-low band. Impact = 90.
Continued miniaturization. Impact = 90.
Greater spectrum efficiencies. Impact = 75.

If:

4. Video exchange capability. Probability = 75.

Then:

Use of video maps and AVL's. Impact = 85.
All dispatch centers integrated and using CAD. Impact = 85.
Greater spectrum efficiency. Impact = 85.

If:

5. Radios all synthesized, no crystals. Probability = 95.

Then:

Portables: Multi-band with video display and keyboard. Impact = 90.
Lower prices enable issue of radios to each officer. Impact = 90.
Single unit radio to integrate voice, data processing, and MDT. Impact = 85.
Continued miniaturization. Impact = 90.

If:

6. Satellite repeaters for 900MHz and 1.2GHz UHF band. Probability = 85.

Then:

Use of video maps and AVL's. Impact = 75.
MDT's for general use. Impact = 95.
Satellites for unique disaster situations. Impact = 95.
Video exchange capability. Impact = 95.
Portables: Multi-band with video display and keyboard. Impact = 95.
Satellite eliminates repeaters. Impact = 85.
Five 800MHz national mutual aid channels. Impact = 95.
Development of ACSB and offsetting for greater spectrum efficiency. Impact = 90.
Traffic congestion in the entire spectrum. Impact = 95.
Increase usage of 500-900MHz and 1.2GHz-conventional and trunked. Impact = 95.
Channel narrowing. Impact = 90.
Greater spectrum coordination. Impact = 95.
Directional antennas to be "good neighbors." Impact = 95.
Decreased or eliminated usage of VHF-low band. Impact = 95.
Continued miniaturization. Impact = 90.
All dispatch centers integrated and using CAD. Impact = 90.
Routine traffic digital. Impact = 95.
Greater spectrum efficiency. Impact = 95.

If:

7. Portables: Multi-band with video display and keyboard. Probability = 85.

Then:

MDT's for general use. Impact = 95.

Lower prices enable issue of radio to each officer. Impact = 75.
Single unit radio to integrate voice, data processing, and MDT. Impact = 90.
Routine traffic digital. Impact = 75.

If:

8. Satellite eliminates repeaters. Probability = 85.

Then:

Traffic congestion on all areas of spectrum. Impact = 75.
Increased usage of 500-900MHz and 1.2GHz - conventional and trunked. Impact = 95.
Channel narrowing. Impact = 95.
Pilot-copilot concept. Impact = 95.
Common use of cellular systems. Impact = 95.
Five 800MHz national mutual aid channels. Impact = 95.
Development of ACSB and offsetting for greater spectrum efficiency. Impact = 90.
Traffic congestion in the entire spectrum. Impact = 95.
Increased usage of 500-900MHz and 1.2GHz UHF, conventional and trunked. Impact = 95.
Channel narrowing. Impact = 75.
Greater spectrum coordination. Impact = 95.
Directional antennas to be "good neighbors." Impact = 95.
Decreased or eliminated usage of VHF-low band. Impact = 95.
Continued miniaturization. Impact = 80.
All dispatch centers integrated and using CAD. Impact = 95.
Routine traffic digital. Impact = 95.
Greater spectrum efficiency. Impact = 95.

If:

9. Five 800MHz UHF national mutual aid channels. Probability = 95.

Then:

Satellites for unique disaster situations. Impact = 95.
Satellite repeaters for 900MHz and 1.2GHz UHF. Impact = 80
Satellite eliminates repeaters. Impact = 80.
Increased usage of 500-900MHz and 1.2GHz - conventional and trunked. Impact = 80.
Greater spectrum coordination. Impact = 85.
Decreased or eliminated usage of VHF-low band. Impact = 85.

If:

10. Development of ACSB and offsetting for greater spectrum efficiency. Probability = 95.

Then:

MDT's for general use. Impact = 90.
Radios all synthesized, no crystals. Impact = 85.
Traffic congestion on the entire spectrum. Impact = 95.

Increased usage of 500-900MHz and 1.2GHz UHF - conventional and trunked. Impact = 90.
Channel narrowing. Impact = 95.
Greater spectrum coordination. Impact = 90.
Decreased or eliminated usage of VHF-low band. Impact = 95.
Use of MDT's for report preparation. Impact = 90.
FM obsoleted by ACSB. Impact = 95.
Routine traffic digital. Impact = 90.
Greater spectrum efficiency. Impact = 95.

This concludes the cross impact analysis of those events which will impact the events and trends.

Taking the entirety of the data collected and interpreted from prior research, the Expert Resource Group, the Delphi Technique, site visits, and my interpretation of the combination of this information, I developed three scenarios that incorporate the entire spectrum of problems and forecasted solutions.

The first scenario is based on the hypothesis of maximum technological advancements in the approximate 15 years in the future, and consequent benefits applicable to public safety.

The second scenario is a normative approach to the problem areas identified within the reasonably forecasted future, but not resorting to the most extreme possibly technological advances. In other words, benefit would be derived with less technological development.

The third scenario utilizes a more administrative approach to problem solving, utilizing that which is either currently possible in communications technology, or that which is most certain to be possible within the relatively near future. This scenario is administratively, rather than technically oriented.

These scenarios, in that order, are in the following section.

SCENARIO #1 - THE YEAR 2002

Note: Appendix information related to this scenario will be found in section D of the Appendix.

The announcement seven years ago by the State of California and the FCC that the State would sponsor the launch of a communications satellite (to be named CAL LAW) in the year 2000 stirred a great deal of interest and excitement among public safety agencies that potentially would be involved. Most numerous and influential of these agencies were the sheriff's departments - and for good reason. While the municipal police departments were concerned with channel

crowding, since it had reached the critical state between ten and fifteen years ago, the sheriff's departments had this problem as well as that of geographical coverage. While most of the rural sheriff's departments in the less densely populated counties were not plagued by channel crowding, all were affected by the problem of the geographical coverage.

The problems of channel crowding had been addressed some years prior, and while not entirely solved, considerable progress had been made. The channel congestion that peaked in the years 1987 to 1992 had forced the FCC to prioritize the needs of public safety over those of the commercial broadcast industry. This was initiated by direction of the Congress of the United States to the FCC to prioritize public safety. (Public Law 97-259). This prioritization resulted in additional areas of the spectrum being opened up for public safety use. This additional spectrum space was within the 800 to 900MHz UHF bandwidth area. This area of the spectrum is characterized by being line-of-sight, relatively immune to noise interference, skip-free and repeatable within a relatively short distance due to its propagation limits. It also performs in urban environments where it has the ability to penetrate buildings (based on its wavelength) and "bounce" off hard surfaces to provide coverage in densely urbanized areas. (This characteristic is termed "multipath"). It is ideal for handheld use as well as for digital information transmission. Thus, for limited area coverage it is close to ideal - and it was available. While these qualities proved beneficial for municipal applications, the experience of the California Department of Parks and Recreation indicated that this bandwidth area was less than ideal for extended area coverage throughout the varied terrain of the state.[43] In desert applications, where signals could "bounce" off rocks it worked outstandingly well, better than VHF according to some authorities.[44] However, when encountering vegetation this 800 - 900MHz UHF would attenuate severely. In fact, one well known and highly regarded authority stated that vegetation soaks up the 800 -900MHz UHF bandwidth "... like a sponge."[45] This portion of the UHF bandwidth then, despite its availability, was not the definitive answer for all California sheriff's departments.

Besides the opening up of more spectrum space within the 800 - 900MHz UHF area, and prior to it, there had been other significant developments towards greater spectrum - efficiency. One of the more significant developments was the use of mobile digital terminals (known as MDT's). It was determined that the use of MDT's in conjunction with (<u>not</u> replacing) voice would allow a four fold increase in the amount of traffic that could be handled on any given number of channels. For nearly all departments experiencing severe channel crowding MDT's became a significant step towards relief. The voice channels had to be retained of course, as that was the element of communication in any emergency situation. A notable enhancement of the MDT concept was the development of a practical hand-held synthesized MDT-radio by several Japanese firms. Thus, an officer could be away from his mobile radio or his MDT, and still

utilize data transmission instead of using voice.

In line with this expansion of capability, the mobile MDT's were further refined to allow the preparation and transmission of entire reports into the station. The process worked as follows: Using the MDT in the patrol vehicle, the officer would prepare his report and log it into the memory bank of the computerized MDT. When he had finished the report he would press the "transmit" button which would send the entire report to the station in one data burst and print out a hard copy. This eliminated handwriting all but the briefest of reports, the use of tape dictating machines, and most of the clerical staff previously used to transcribe dictated reports.

Several technical advancements took place in the early 1990's which further contributed to greater spectrum-efficiency. Since it was known that the spectrum was finite, the objective was to more efficiently utilize that which was available. Several methods were employed to one end; the use of more channels within the available spectrum. Thus, amplitude companded single side-band (ACSB) was implemented along with off-setting. The concept behind both developments was to place channels between existent channels with less space in between and no interference to create greater capacity within a given bandwidth area.
Thus, while significant progress had been made in the overall field of public safety communications, there really had been little or no progress in terms of improving geographical coverage.

The primary method of extended area coverage had been high power combined with numerous mountain top repeater sites. This was a less than ideal solution for several reasons. To begin with, high power and elevation did not solve all coverage problems. It was common for a county to have the capability to extend its signal a hundred or more miles beyond the boundaries of the county and yet still have areas of shadow fall within the county. To the extent this over-propagation existed, the same frequency area could not be reused by another jurisdiction, or interference would result. Additional repeaters were not the ultimate answer either. Besides compounding the problem of over propagation, repeaters were expensive, sites needed were not always available (due to county ordinance, wilderness protection, or private property restrictions) or a suitable site simply did not exist. Directional antennas were of limited benefit, because while their angle of reception and transmission could be controlled, their propagation distance within that angle could not be.

The satellite announcement promised a solution. It also provided a direction for planning by equipment manufacturers, sheriff's departments, the State of California, the FCC, APCO, and the satellite contractors.

It had been common speculation for a number of years that a satellite had the potential to be the ideal solution. However, there were a number of barriers to be overcome before such an

apparently simple solution could be implemented.

The first barrier was cost. Cost is a direct function of weight and launch distance. Since the only feasible satellite is of the synchronus equatorial type, it would have to be launched to an altitude of 22,300 miles. While the weight was within launch capabilities as far back as 1990, a launch cost was excessive at approximately $60,000,000.00.[46] However, the late 1980's saw the development of extremely lightweight (and thus low launch cost) satellites to the point where competition between satellite contractors brought prices down to a more realistic and feasible level.

Realistic and feasible though such a launch might have appeared, it was still an extremely expensive undertaking. A method to underwrite the cost of the project was needed, and since such a satellite would primarily benefit sheriff's departments, the financial plan would have to be one that was acceptable to other law enforcement and public safety agencies. Based on that concept it was agreed by the Sheriff's of California and the California Department of Justice that all asset seizures for cultivation of marijuana, importation of illegal or controlled substances, and manufacture of an illegal or controlled substance in an unincorporated area would be placed into an interest bearing account by the California Department of Justice. Once this agreement was concluded it was enacted into law by the legislature under the sponsorship of the California Sheriff's Association. An interesting part of this bill was the inclusion of the absolute prohibition against any of the encumbered funds ever going into a county general fund. Obviously the sheriff's were familiar with the workings of county government and were intent in precluding any interference with this critical project by their various boards of supervisors. Once an ongoing system of fiscal support had been established, system planning could begin.

One of the characteristics of a satellite, any satellite, is that it propagates over a relatively large area. Normally this area is about 200 miles in diameter but it can be brought down to about 50 miles in diameter.[47] It is this "footprint" characteristic that makes a satellite impractical for municipal law enforcement use, but potentially practical for extended area application. Since the footprint could be controlled in the 50 to 200 mile diameter range, it was possible to plot the circles of coverage for all counties. While there would be a degree of overlap, the coverage being in circles regardless of county configuration, it would be far less than with existent systems. In addition, since the coverage would only be within the area of the satellite footprint for any given area, the same frequency could be repeated elsewhere. For example then, while one transmitter might be directed at Shasta County, another transmitter using the same frequencies could be directed at Sutter and Yuba Counties and there would be no interference, skip or overlap. (Note: Due to the rural nature of many Northern California Counties, it was intended from the outset to consolidate some using

the same frequencies and satellite transmitter. Not only did this reduce cost, but it made for far more efficient utilization of the available spectrum). In essence this was an application of the cellular concept, each "footprint" being a cell.

This relatively close proximity of interference-free frequency repeatability resulted in the rural counties that were consolidated having a relatively large number of frequencies available to them, so that the question of the most efficient method of utilization had to be addressed. It was determined that the most efficient method was trunking. In this method, the computer operated radio system (CAD) would select which of the available frequencies was clear during any transmission and route the traffic to that channel. This eliminated the dispatcher from having to monitor a discreet series of channels to track units and insured a clear channel available to field units.

Communications equipment was destined for radical change since it could now be developed specifically for use with a satellite, and virtually all of the design changes were beneficial. The line of sight, noise free characteristics of the 800-900MHz UHF spectrum were ideal for satellite use. Consistent with this the 1.2GHz (micro-wave) portion of the UHF spectrum was opened up the public safety and specified for this use. Although the higher frequencies meant initially greater equipment costs due to working with as far higher bandwidth range, this was offset by the far lower power requirements, as well as by the eventual economies of scale.

While VHF mobile transmitters in sheriff's units were commonly 100 watts at that time (the most they could legally use), the satellite system would reliably function with 10 watts. This of course greatly reduced the cost, the size, and the power consumption requirements of mobile radios. In addition, since the satellite transmitter was in essence looking down at the area of coverage, coverage with this 10 watts was virtually 100% without the use of any repeaters. Transmission quality improved noticeably for departments that had been using VHF-high band, and dramatically for departments that had been using VHF-low band systems. For departments in mountain areas that historically had border line communications coverage, data transmission capability finally became a reality. For the first time, video transmission capability came into use in law enforcement for show-up purposes using principles identical to television signal transmission.

To coordinate sheriff and police departments in the selection of bandwidths, the FCC, APCO, the California Sheriff's Association, and the California Office of Emergency Services worked out a channel exchange buy-out system. In this arrangement sheriff's would exchange frequencies with police departments, with the sheriff's acquiring the 800-900MHz UHF spectrum they would need in exchange for giving up VHF low band, high band, and 400-500MHz UHF spectrum frequencies. Part of the arrangement was for the sheriff's to pay the cost of the trade; to include subvention of equipment changes

for participating cities. Frequencies not traded to other governmental agencies were to be surrendered back to FCC jurisdiction.

With this one change, the single most fundamental event in the history of law enforcement communications systems, the Sheriffs of California obtained full area coverage, sufficient numbers of efficiently utilized channels, universal MDT capability, and complete dependability. Once again California had set the pace for law enforcement throughout the rest of the United States.

SCENARIO #2 - THE YEAR 1998

Note: Appendix information relating to this scenario will be found in Appendix section E.

The plan initiated in 1990 to systematically plan the communications systems for the sheriff's departments in northern and central California has now been implemented. In order to more fully understand the need and basis for this plan, some historical and technical background information is necessary.

In the decade of the 1980's the public safety agencies in southern California developed an overall plan for that part of the state. The driving force behind the creation of the plan was the urgent need for more spectrum space and the total lack of any available bandwidth in the VHF-low band and high band areas. The only solution appeared to be in UHF, and that was the direction taken by Los Angeles County Sheriff Sherman Block when he set in motion the complex political process to gain additional spectrum area in the 800-900MHz UHF band width area by pre-empting the commercial use of two channels. During this same time the entirety of Orange County consolidated communications systems and reconfigured to an 400MHz UHF system. The Los Angeles County Sheriff's Department changed their system from VHF-low band to a UHF in both the 450MHz and 800-900MHz UHF bandwidths. For the Los Angeles Sheriff's Department this had been a time-intensive project to complete the reconfiguration prior to the onset of the eminent 11 year sunspot period, which so adversely affected the VHF-low band area.

Also during this period of time the San Bernardino County Sheriff's Department reconfigured their system to a trunked 800MHz UHF system. This decision was somewhat surprising since San Bernardino County is the largest geographical county in the state (in the country for that matter) with in excess of 20,000 square miles, and it was going to a bandwidth spectrum reputed to be of limited signal propagation characteristics. However, extensive testing by the San Bernardino County Sheriff's Department indicated the feasibility of such a system for their department. It was determined, through side by side testing, that the UHF signal would propagate more favorably than a VHF signal in the desert environment. The UHF signal has a tendency to bounce off hard surfaces and continue to move, such

that canyons that were previously "dead" spots now had effective and reliable communications access. Since San Bernardino County is so sparsely vegetated, this system well suited their unique needs.

San Diego County had previously reconfigured to the 450MHz UHF bandwidth as of 1982, so that left Riverside and Imperial Counties. Riverside County needed more channels than were available in VHF-high band so they too reconfigured to UHF in 1990. Riverside County like San Bernardino County is sparsely vegetated. Imperial County, although large in area (4506 square miles) is relatively sparsely populated and was resistant to change due to cost. However, in 1990 they finally did capitulate in order to have a system compatible with all other southern California Sheriff's Departments. That then covered all sheriff's departments south of the Tehachapi Mountains, an area of 36,408 square miles comprising 23% of the area of the state,[48] and all have reconfigured to the UHF range. The question still remained as to what the rest of the sheriff's departments in the state were to do to chart their own destiny. While the southern California plan covered the majority of the population of the state, it still only encompassed 6 of the 58 counties in the state.

The other 52 counties were in three different areas of the spectrum, VHF-low band, VHF-high band, and 450MHz UHF. Each county had developed its system independently with no effort at coordination with other counties. Since historically the FCC had provided no leadership in spectrum use planning, counties had more or less evolved to their state in the 1980's.

Certain basic facts were established which applied to all of these 52 counties. The counties using the 450MHz UHF bandwidth had most recently reconfigured as the state of the art had allowed, with the intent to acquire more channels, and/or to get away from VHF-low band. The counties using VHF-low band urgently wanted to reconfigure in order to escape the undesirable characteristics of VHF-low band as well as to be able to use more modern and widely available equipment and technology. The counties using VHF-high band desired to continue to use that area of the spectrum, but they were crowded for the most part and needed more spectrum area. This group of counties constituted the majority of counties, as only a relative few had reconfigured into the 450MHz UHF bandwidth area. The assumption generally held was that, given the ability to make a choice, the most desirable bandwidth area was VHF-high band. This had even been determined as far back as 1965 when the California Highway Patrol had studied their system to determine if change was needed, and if so, in what direction. The conclusion of that study had strongly indicated the overall desirability of VHF-high band, but the CHP had been unable to reconfigure due to the lack of available channels.[49]

VHF-high band combined favorable propagation characteristics, relative freedom from skip and noise interference, and excellent hand held and digital transmission abilities.[50] In addition, due to its popularity, state of the art technology was applicable and the

economies of scale kept costs down relative to other systems. Overall then, the indication was that northern California Sheriff's Departments should attempt to coordinate their efforts towards adopting the VHF-high band spectrum for prioritized sheriff's use. In order for such a plan to be feasible, two things needed to be done:

1. Greater efficiency of existent channels was needed, and;
2. Additional channels were needed.

To promote greater channel efficiency, those departments not yet using MDT systems acquired them. This then allowed most routine traffic to be handled digitally. Experience with MDT systems has proved that approximately four times the amount of traffic can be processed using digital communications.

Two technical developments, off-setting and amplitude companded single side band, allowed clear channel operation with less separation in the spectrum between channels thus allowing more channels in any given bandwidth. The development of synthesized radios to replace crystal controlled radios had paved the way for these advancements since the new circuits provided greater frequency stability.

These steps to increase the capacity of the existent spectrum were basically enhancements of that which was already there. That in itself was not sufficient as many of the affected departments sorely needed additional channels despite the technical advances allowing greater efficiency. In addition, a key part of the overall plan was to allow departments still using VHF-low band to reconfigure their systems to VHF-high band. In order to do this, additional frequencies had to be obtained.

The solution implemented was to utilize a frequency buy-out plan. Throughout northern and central California there were numerous small municipal police departments using low powered VHF-high band systems. Here then, was a source of additional VHF-high band frequencies.

Teaming up with the State of California, APCO, the regional frequency coordinators and the FCC as a group intermediary, and funded by a state grant, the sheriff's were able to establish a program of acquiring VHF-high band frequencies from municipalities in exchange for the same or greater numbers of frequencies in the 400-500MHz or 800-900MHz UHF bands, and assumption of reconfiguration costs. There was historical precedent for such a program, as many years prior the Los Angeles County Sheriff's Department had utilized the same process to acquire additional channels when they were still using the VHF-low band portion of the spectrum.[51]

This developed into a fortunate windfall for many cities. A radical change of bandwidths necessitated total equipment changes with

result that any city choosing to participate in the program ended up with an entirely new radio system. With this sort of an inducement, there was no shortage of volunteers.

The same intermediary group then assumed another important role. While there was not a problem of frequency reuse of these low powered VHF high band systems in municipal use, when they became high powered mountain top systems this did become a problem and the only solution was extremely thorough and careful coordination of frequency allocation to prevent two users of the same frequencies interfering with one another. It was only through the expertise of the committee members as individuals, and the efforts of the group as a whole with APCO with this basis of expertise that such problems were anticipated and resolved. By the middle 1990's the transformation was complete. No sheriff's department in California remained in VHF-low band. All but a few departments that had previously reconfigured to the 400MHz UHF band were utilizing VHF-high band and were well satisfied with their systems.

The problem of unit to unit communications between different departments had been overcome with the development of multiple-band synthesized radios. This was a logical outgrowth of the previous development of synthesized programmable multi-band scanners. This coincided with the establishment of five nationwide mutual aid channels in the 800mhz bandwidth. Thus, regardless of the spectrum area of the departmental communications system, other channels in other bandwidth areas could still be utilized for mutual aid situations, interagency pursuits, and other related communication needs.

SCENARIO #3 - THE YEAR 1998

Note: Appendix information relating to this scenario will be found in Appendix section F.

In 1990 a group of California Sheriff's representing the mountain and rural counties in the north and central California regions formed a planning group with the intent of streamlining the dispatch systems serving their counties. Each county had a large area of jurisdiction but was sparsely populated. Each had its own dispatch center, some dispatching only for the Sheriff, others consolidated to serve the public safety needs of the entire county. Even in the consolidated dispatch centers there were periods of slack time when dispatcher(s) literally had nothing to do when there were no calls for service.

It was agreed by this group that a possible route to more efficient utilization of dispatch personnel and facilities was to further consolidate so that a single center could service several counties.

The technical obstacles were relatively simple to overcome. The first of course was that of establishing signal paths so that communications between a particular center and the jurisdictions for

which it dispatched could take place. By arranging counties in a contiguous fashion to the maximum extent possible, avoiding as much as possible the necessity to communicate over the crest of the Sierra Nevada and Cascade Ranges to the east, and the Trinity Alps to the west, and basing center locations on favorable areas of signal propagation, it was determined that signal paths could be established.

Once the group had determined that there were no insurmountable technical barriers, the planning could become more specific.

The next step was to establish groupings of counties that would be dispatched from a single center. It was during this step that the potential for long run cost savings became most clearly evident. For 29 counties, there would be a total of nine consolidated dispatch centers. Thus, 20 existent centers eventually would be able to be eliminated. Since public sector budgets normally average approximately 85% for salaries and benefits, the potential savings over the long run become obvious.

The nine dispatch centers, and the jurisdictions each would serve were established as follows:

1. Siskiyou, Shasta and Trinity counties.
2. Del Norte, Humboldt, Mendocino counties.
3. Modoc, Lassen, Plumas, Sierra, and Nevada counties.
4. Butte, Yuba, and Tehama counties.
5. Glenn, Colusa, Lake, and Sutter counties.
6. Napa and Yolo counties.
7. Placer, El Dorado, Alpine, and Amador counties.
8. Calaveras, Tuolumne, and Mariposa counties.
9. Inyo and Mono counties.

This grouping criteria was based on a combination of factors to include contiguous nature, commonalty of interests, population to be served (present and future),topographic characteristics, and signal path propagation. An example: Alpine County could have been grouped with either Inyo and Mono counties, or (as was ultimately done) with Placer, El Dorado, and Amador counties. The signal paths for Inyo and Mono counties are predominantly north and east of the crest of the Sierra Nevada range. Part of Alpine County is on the west side of this crest, so had Alpine County been included with Inyo and Mono counties there would have been a necessity to generate a signal path extending over the crest at the extreme north end of the coverage area. Since Placer, El Dorado, and Amador counties also had to contend with transmissions over the crest and were experienced in dealing with the attendant problems, it was obvious that the most logical course of action would be to group Alpine County with El Dorado, Placer, and Amador counties since there was a common necessity in the capability of communications over the crest of the Sierra Nevada.

Once the groupings had been determined, the dispatch points for each

grouping had to be decided. Besides being at a location conducive to signal propagation, the dispatch centers also needed to be in or near relatively well populated areas. It would be pointless to have dispatch centers located in remote areas, especially considering many of the involved counties experience heavy winter snowfall.

The original planning group then subdivided itself into nine subcommittees, one for each dispatch region, in order to decide the location of the dispatch center for each of their respective regions. Using the criteria set forth, the cities for each of the dispatch regions were determined as follows:

1. Redding to dispatch for Siskiyou, Shasta, and Trinity counties.
2. Eureka to dispatch for Del Norte, Humboldt, and Mendocino counties.
3. Susanville to dispatch for Modoc, Lassen, Plumas, Sierra, and Nevada counties.
4. Chico to dispatch for Butte, Yuba, and Tehama counties.
5. Colusa to dispatch for Glenn, Colusa, Lake, and Sutter counties.
6. Woodland to dispatch for Napa and Yolo counties.
7. Placerville to dispatch for Placer, El Dorado, Alpine, and Amador counties.
8. Sonora to dispatch for Calaveras, Tuolumne, and Mariposa counties.
9. Bishop to dispatch for Inyo and Mono counties.

The locations of the dispatch centers did not confer any particular jurisdiction to the city and/or county in which they were located. Each center was to be a joint operation of all involved agencies, based on joint powers agreements. Costs were to be borne by each agency and would be based on proportion of use. Each center would have a director appointed by the user committee of the region. The chairmanship of the committee would rotate biannually between the sheriff's of the involved counties in each region. Membership of the user committee would be composed of the head or designated representative of each agency utilizing the center.

When the regional dispatch concept was first discussed, the question arose concerning the ability to render effective local service from a dispatch center that in many instances would be in a separate county a great distance from the location of an incident. One possible solution was to adopt the Los Angeles County Sheriff's Department model in which all dispatch is done from a single centralized communications center, but calls for service are received at each station and relayed to the dispatch center by computer.[52] The Los Angeles County Sheriff's Department is highly centralized, serving a population of well over 3 million persons spread over in excess of 4,000 square miles. In order to render service, the department has twenty stations, each of which has trained personnel on duty for the purpose of taking all calls for service. These operators take the information on the phone entering this information into a computer which immediately transmits the

information to a dispatcher located in the central dispatch facility. The radio dispatch is then made from this central facility, regardless of the location of the call. The Los Angeles County Sheriff's Department prefers this system as they feel it gives more individualized service to the various areas served by each of their stations.[53]

A review of this system, including a site visit, convinced the planning group that this was not the most efficient method for their particular needs. There were two reasons for this conclusion:

1. In Los Angeles County there is such a high volume of calls for service that regardless of where the incoming telephone lines are answered, the complaint operators answering the telephones and taking information are kept busy almost continuously. Thus, it would not reduce the number of personnel needed were they to be centralized. This of course was not the situation with the mountain and rural counties, which was a key factor leading to the decision to consolidate.

2. Indirectly related to item #1 was the fact that in 1987 the legislature had authorized POST to set up training programs for dispatchers, with the employing entity to be reimbursed for training costs and salaries while the dispatchers were in training, as had been done for peace officers. Once this badly needed training was made available on a state wide basis, all jurisdictions had seized upon the opportunity. The planning group reasoned that if calls were taken at one location and dispatched at another, the personnel at both locations would need to be trained. This redundancy would defeat the purpose of consolidation. Thus, it was decided that each central dispatch facility would receive and dispatch all calls for service.

The site visit to Los Angeles County was not wasted however, as the group chose to adopt the dispatch selection system used by the Sheriff's Department. In the adapted form the system would work as follows: Instead of specific personnel having a responsibility for a specific channel or channels, all dispatchers would have the capability to receive and dispatch calls for service on all channels. When a call for service came in, a computer would select a dispatcher who was clear of traffic and route the call to that dispatch position. That dispatcher would then handle the call, taking the information, entering it into the CAD system, and dispatching it. The CAD entry would automatically generate the information as to which unit(s) should be dispatched. A control switch would allow the dispatcher to hold the call and/or the radio frequency selected when necessary.[54] This was in fact a trunking system since the computer would select an available dispatcher. Radio calls from field units were handled in the same manner, thus assuring timely response to field units. As an additional benefit, it equalized the work load of the dispatchers, rather than having some dispatchers extremely busy while others had no traffic to handle. It was conceded from the outset that this system would not

allow dispatchers to handle areas familiar to them. However, it was felt that since all dispatch was computerized, that AVL'S would be installed in each center, that all dispatchers were receiving POST training prior to being allowed to solo on a dispatch position, and this system virtually insured the fastest possible response to a caller, that the advantages far outweighed the disadvantages. In the one year that these centers have been in operation, experience has indicated that the advantages do in fact far outweigh the disadvantages.

The final major issue to be resolved was that of how to handle the numerous small police departments and fire districts that needed dispatch service, but did not have high powered communications systems since they had smaller areas of coverage. A simple but effective solution was implemented.

Each of the individual police departments and fire districts had a transmitter point proximate to them under the prior system of dispatching. With the development of the consolidated systems it was determined that these transmitter locations could be retained and could be used as mobile relays. The mobile relays would then be connected to the consolidated dispatch centers by either landline or microwave links. This resulted in dispatch capabilities for distant small jurisdictions without having to develop high elevation or high powered systems which would have created a problem of excessive signal propagation.

The nine consolidated centers have been operational for just over one year. Although obviously there are problems to be solved and "bugs" to work out generated by dealing with this new concept and the attendant technological and administrative challenges, it has become obvious even in this brief span of time that a new era of rural dispatching has come of age. With government budgets remaining extremely tight, most especially in less populated areas, this is a concept that clearly has significant long term fiscal advantages. In addition, each jurisdiction now has access into a modern automated system that would have been beyond the means of any one agency. As would be expected, California has again taken the role of a pioneer, as it has in so many other areas of law enforcement and public safety. And, as in the other areas of law enforcement and public safety where California has charted a new course, the other states will surely follow.

ENVIRONMENT: PUBLIC SAFETY DISPATCH REGIONS

In discussing the environment as it relates to scenario #3, there are in fact nine separate environments, one each to correspond with each of the proposed consolidated dispatch areas. These nine areas are in turn comprised of a total of 29 separate counties. For purposes of this project, each of these nine different areas will be designated a Public Safety Dispatch Region. Each Public Safety

Dispatch Region will be numbered according to its sequence in the scenario; such that Public Safety Dispatch Region #1 will dispatch for Siskiyou, Shasta, and Trinity Counties.

As previously set forth, the grouping criteria for each of the Public Safety Dispatch Regions was based on a number of factors including contiguous nature, commonality of interests, population to be served (present and future), topographic characteristics, and signal path propagation.

Public Safety Dispatch Regions:

Region 1-Siskiyou, Shasta, and Trinity Counties.

Siskiyou County consists of 6,318.3 square miles with 22,950 residents in the unincorporated area. It has a density of 6.7 persons per square mile and ranks #51 in the state (out of 58 counties). It is projected to have a growth in the years 1980-2000 of 18.9%. 62.91% of the land area in the county is owned by government. The personal income ranking of the county is 46 (again out of 58 counties). It is one of the eight highest counties in the state for unemployment, having a rate of 22.2%.[55]

Shasta County consists of 3,850.2 square miles populated in the unincorporated areas by 72,100 persons. By density, it has 34 persons per square mile and ranks #36 in the state. It is projected to have a 48% growth between the years 1980 and 2000. 41.73% of the land within the county is government owned. Shasta County ranks #43 within the state on per capita income.[56]

Trinity County consists of 3,222.6 miles populated in the unincorporated areas by 13,300 persons. By density, it has 4.2 persons per square mile and ranks #53 in the state. It is predicted to have 47.3% growth in the years 1980 to 2000. 72.35% of the land within the county is government owned. Per capita income for Trinity County is the lowest within the state. In addition, Trinity County is one of the eight highest counties in the state for unemployment, having a rate of 23.1%. (Note: the state average of unemployment is 7.4).[57]

The Region 1 dispatch center will be located in the City of Redding, the County Seat of Shasta County. Dispatching for the three sheriff's departments, the center will dispatch over an area of 13,391.1 square miles and serving an unincorporated area resident population of 108,350 persons. Within the Public Safety Dispatch Region, there are a total of 81 sheriff's department personnel assigned to field duties on a 24 hour day, 365 days per year basis.[58](Note: the figures on personnel denote the persons assigned to field duties, not the number of personnel on duty at any given time).

Geographically, Region 1 is located in the extreme northern part of the state, inland from the coast and not contiguous on any of its

borders to the states of Nevada or Oregon. There are three mountain ranges which traverse this region, the Trinity Alps, the Siskiyous, and the Cascades. Thus, mountainous area communications capability is a requirement. The principle industries of Region 1 are timber harvest, ranching, farming, and tourism. (Note: the word tourism in this context indicates any sort of recreational use, such as hunting, fishing, camping, backpacking, sightseeing, etc.). The isolated nature of the region makes it a suitable area for the cultivation of marijuana. The marijuana cultivation and tourism aspects generate a necessity for back-country operations and communications capability by the sheriff's departments, both for enforcement as well as search and rescue functions.

Region 2-Mendocino, Humboldt, and Del Norte Counties.

Mendocino County consists of 3,510.4 square miles with an unincorporated area population of 49,100 residents. It has a density of 6.7 persons per square mile and ranks #51 in the state. It is predicted to have a population growth of 49% between the years 1980 and 2000. 17.49% of the land within the county is owned by government. It ranks #34 in the state in per capita income.[59]

Humboldt County consists of 3,599.5 square miles with 59,300 unincorporated area residents. By density, it has 34 persons per square mile and ranks #36 in the state. It is predicted to have a population growth of 15.5% in the period 1980 to 2000. 22.10% of the land within the county is owned by government. In per capita income, it ranks #36 in the state.[60]

Del Norte County consists of 1,003 square miles with 15,150 unincorporated area residents. It has a density of 4.2 persons per square mile and ranks #53 in the state. It is projected to have a 26.8% population growth in the 1980-2000 year period. 73.51% of the land within the county is government owned. In per capita income Del Norte County ranks #50 in the state.[61]

Public Safety Dispatch Region 2 is situated on the north coast of California and will be dispatched from the city of Eureka, the County Seat of Humboldt County. The region totals 8,102.9 square miles with 123,550 unincorporated area residents. There are a total of 145 sheriff's personnel available for field duties to service this population.[62]

Geographically, Region 2 is situated on the west side of the north coast, and the state of Oregon abuts the north end of Del Norte County. There are two mountain ranges, the Trinity Alps and the Siskiyous traversing Region 2.

The main industries in Region 2 are timber harvest, tourism, ranching, and farming, and commercial fishing. Region 2 also has the highest incidence of marijuana cultivation in the state, and the most violent environment surrounding that illicit industry. Between marijuana eradication and search and rescue missions, there is a

necessity for sheriff's department operations in back-country areas, and thus a consequent necessity for adequate communications.

Region 3-Modoc, Lassen, Plumas, Sierra, and Nevada.

Modoc County consists of 4,340.4 square miles, with an unincorporated resident population of 6,250 persons. In density it has 2.3 persons per square mile and ranks #56 in the state. It is forecasted to have a population growth of 26.2% between 1980 and 2000. 66.76% of the land within the county is owned by government. In per capita income, it ranks #37 in the state. Of the 36 California counties leading in agriculture production, Modoc County stands as #32.[63]

Lassen County consist of 3,510.4 square miles with a resident population in the unincorporated areas of 17,500 persons. In density it has 5.3 persons per square mile and ranks #52 in the state. It is projected to have a 30.2% population growth in the 1980-2000 year range. 63.46% of the land within the county is government owned. In per capita income, it ranks #55 in the state.[64]

Plumas County consists of 2,618.4 square miles with 16,650 unincorporated area residents. It has a density of 7.3 persons per square mile and ranks #50 in the state. It is projected to have a 43.5% population growth between 1980 and 2000. 71.20% of the land within the county is owned by government. In per capita income it ranks #53 in the state. It is one of the eight highest counties of unemployment in the state, with a percentage of 22.4.[65]

Sierra County consists of 959 square miles with 2,220 unincorporated area residents. It has a density of 3.5 persons per square mile and ranks #54 in the state. It is projected to have a 42.4% population increase between 1980 and 2000. 62.26% of the land within the county is owned by government. It ranks #45 in per capita income in the state. Sierra County also is one of the eight highest unemployment areas of the state with a percentage of 27.[66]

Nevada County consists of 992.2 square miles with 55,300 unincorporated area residents. It has 68 persons per square mile and ranks #28 in the state in density. It is projected to have a 68% population growth increase between 1980 and 2000. 28.33% of the land within the county is owned by government. It ranks #54 in per capita income in the state.[67]

Public Safety Dispatch Region 3 is situated in the northeast portion of California. It is bordered by Oregon on the north, and four of the five counties border Nevada on the east. The consolidated sheriff's dispatch center will be located in the City of Susanville, the County Seat of Lassen County. This dispatch center will serve an area of 12,420.4 square miles, with 97,920 residents.

There are a total of 42 sheriff's personnel assigned to field duties

in the Modoc, Plumas, and Sierra County areas. (Data was not received from Lassen and Nevada Counties).[68]

Region 3 has one mountain range traversing it, in a northwest-southeast orientation. The mountain range is comprised of both the Sierra Nevada, and the Cascades, which merge with one another in Lassen County to form a continuous chain.

The principle industries of Region 3 are timber, tourism, ranching, and farming. In addition to normal enforcement responsibilities, each sheriff's department must maintain a search and rescue capability.

Region4--Tehama, Butte, and Yuba Counties.

Tehama County consists of 2,976 square miles with a population in the unincorporated area of 13,300 residents. It has 15 persons per square mile and in density ranks #47 in the state. It is projected to experience a 29.8% population growth in the years 1980 to 2000. 27.12% of the land within the county is owned by government. It ranks #52 in the state in per capital income. It is also one of the 36 leading counties in the state in agriculture production, ranking #33.[69]

Butte County consists of 1,664.8 square miles with 89,900 unincorporated area residents. It has a density of 97 persons per square mile and ranks #21 in the state. It is projected to experience a 49.2% population increase between 1980 and 2000. 17.95% of the county land is owned by government. It ranks #39 in the state in per capita income. It ranks #26 in the state in leading agricultural production counties.[70]

Yuba County consists of 639.1 square miles with 41,000 unincorporated area residents. It has 84 persons per square mile to rank #26 in the state in density. It is projected to experience a 37.1% population increase between 1980 and 2000. 27% of the land within the county is owned by government. It ranks #49 in the state in per capita income.[71]

Geographically, Public Safety Dispatch Region 4 is situated in the north-northeast portion of the Sacramento Valley. The consolidated sheriff's dispatch center will be located in the City of Chico. The center will serve an area of 5,279.9 square miles with 144,200 unincorporated area residents. There are a total of 81 sheriff's personnel assigned to field duties in Tehama and Yuba Counties, Butte County not having returned a survey.[72]

The principle industries in this region are ranching, farming, timber harvest, and tourism. In addition, there is an escalating incidence of marijuana cultivation.

The western slope of the Sierra Nevada traverses the eastern

portions of this region, and the eastern foothills of the Trinity Alps partly traverse western Tehama County.

Region 5-Glenn, Colusa, Lake, and Sutter Counties.

Glenn County consists of 1,319 square miles populated by 13,250 unincorporated area residents. It has a density of 17 persons per square mile and ranks #45 in the state. It is projected to experience a 30.9% population increase between 1980 and 2000. 27.35% of the land within the county is owned by government. In per capita income, it ranks #22 in the state. Of the 36 leading agricultural production counties, Glenn County ranks #25.[73]

Colusa County consists of 1,155.8 square miles with 8,175 unincorporated area residents. It has 13 persons per square mile in density and ranks #48 in the state. It is projected to experience a 21.1% population growth between 1980 and 2000. 17.09% of the land within the county is owned by government. In per capita income, it ranks #7 within the state. It has the highest per capita income in any of the 29 counties profiled in this project, and is also only one of two in the upper 25% of counties in California in per capita income. It is also one of the 36 leading agricultural production counties, with a ranking of #24.[74]

Lake County consist of 1,460.5 square miles with 32,750 unincorporated area residents. It has 37 persons per square mile in density and ranks #37 in the state. It is projected to experience a 54.8% population growth between 1980 and 2000. 45.68% of the county land is owned by government. It ranks #41 in the state in per capita income.[75]

Sutter County consists of 607 square miles with 32,800 unincorporated area residents. It has 95 persons per square mile in density and ranks #24 in the state. It is projected to experience a 40% population increase between 1980 and 2000. Only 3.88 per cent of the land within the county is owned by government. It ranks #27 in the state in per capita income. It is also one of the leading agricultural production counties in the state, ranking #17.[76]

Region 5 is located in the central-west portion of the Sacramento Valley. The consolidated sheriff's dispatch center will be located in the City of Colusa, the County Seat of Colusa County. This dispatch center will serve a total area of 4,542.3 square miles with a resident population of 86,975 persons. There are a total of 121 sheriff's personnel available for this function.[77]

The hills of the coast range are on the west side of the region traversing Lake County and the western ends of Colusa and Glenn Counties. The remainder of the topography of the region is essentially flat. The principle industries of the region are farming and ranching, tourism, and timber harvest.

Region 6-Napa and Yolo Counties.

Napa County consists of 796.9 square miles with 35,700 unincorporated area residents. It has a density of 135 persons per square mile and ranks #17 in the state. It is projected to experience a 49.3% population growth between 1980 and 2000. 17.54% of the land within the county is owned by government. It ranks #12 in the state in per capita income. It is also one of the leading agricultural counties within the state, ranking #32.[78]

Yolo County consists of 1,034 square miles with 45,600 unincorporated area residents. It has a density of 118 persons per square mile, ranking #19 in the state. It is projected to experience a 29.1% population increase between 1980 and 2000. Only 8.97% of the land within the county is government owned. It ranks #18 in the state in per capita income. It ranks #20 in the state in agricultural production.[79]

The consolidated sheriff's dispatch center for Region 6 will be located in the City of Woodland, the County Seat of Yolo County. This dispatch center will dispatch for an area of 1,830.9 square miles with an unincorporated resident population of 81,300. For Napa County, there are 30 sheriff's deputies assigned to field duties (Yolo County did not respond with a survey).[80]

Geographically, this region is situated in the southwest portion of the Sacramento Valley. The foothills of the coast range traverse the western portion of the region, going directly through Napa County.

The principal industries of these two counties are farming, ranching, and tourism. Since both counties are situated near metropolitan areas, their population increase will to some extent change the demographic nature of the counties to being "bedroom" counties. Yolo County is situated to the west and northwest of the City of Sacramento and is a part of the Sacramento Metropolitan area. Napa County is situated with the southern tip abutting the northeast portion of the San Francisco Bay area. Both counties will be influenced by the outward growth of the Sacramento and San Francisco Metropolitan areas.

Region 7-Alpine, Amador, El Dorado, and Placer Counties.

Alpine County consists of 726.6 square miles with an unincorporated area population of 1,180 residents. It has a density of 1.6 persons per square mile and ranks lowest (#58) in the state. It is projected to have a 100% population growth between 1980 and 2000. 92.58% of the land within the county is government owned. It ranks #57 in the state in per capita income (second lowest). However, it is one of the eight lowest counties of unemployment in the state, with a percentage of 4.4.[81]

Amador County consists of 601.3 square miles with 14,750 unincorporated area residents. It has a density of 38 persons per

square mile and ranks #35 in the state. It is projected to experience a 48.2% growth rate between 1980 and 2000. 25.61% of land within the county is owned by government. It ranks #29 in the state in per capita income.[82]

El Dorado County consists of 1,804.8 square miles with 72,500 unincorporated area residents. It has 59 persons per square mile in density, and ranks #30 in the state. It is projected to experience a 96.1 per cent population growth between 1980 and 2000. 48.44% of the land within the county is owned by government. It ranks #40 in the state in per capita income.[83]

Placer County consists of 1,506.5 square miles with a total unincorporated area population 83,100 residents. It has 95 persons per square mile and ranks #25 in the state. It is projected to experience a 74.4 per cent population growth between 1980 and 2000. 34.5% of the land within the county is owned by government. It ranks #20 in per capita income in the state.[84]

The consolidated sheriff's dispatch center for Public Safety Dispatch Region 7 will be located in the City of Placerville, the County Seat of El Dorado County. This center will serve an area of 4,639.2 square miles with a resident population of 171,530 persons. Excluding Placer County which did not respond on the survey, there are a total of 276 sheriff's personnel assigned to field duties for this area.[85]

Public Safety Dispatch Region 7 is situated in the central-eastern portion of California, with three of its four counties abutting the state of Nevada on their eastern borders. All four counties within the region lie within the Sierra Nevada Mountain Range, with the western portion of the region situated in the foothills to the Sierra Nevada.

The principle industries for the region include timber harvest, tourism, ranching and farming, as well as government.

The region presents an anomaly in that it is so diversified in its functions. The eastern portion of the region is traversed by the crest of the Sierra Nevada Range. Lake Tahoe is situated within this region. Thus, it is an extremely attractive area for tourism as well as being extremely rugged in terrain. However, the western end of the region, primarily consisting of the west ends of Placer and El Dorado Counties, form a suburban area for the Sacramento Metropolitan area. It is this western area of the region that comprises the overwhelming resident population.

Because of its proximity to the San Francisco Bay area and the range of attractions it offers, this region is an extremely popular destination for recreation. Because of this, all four sheriff's departments must maintain the capability of back-country communications for search and rescue missions.

The high projected growth rates of the two most populous counties, El Dorado and Placer, is based on their increasing evolution towards becoming suburban areas of Sacramento on their western ends.

Region 8-Calaveras, Mariposa, and Toulumne Counties.

Calaveras County consists of 1,036.4 square miles with an unincorporated area population 24,100 residents. It has 26 persons per square mile and ranks #40 in density in the state. It is projected to experience a 50.5% population increase between 1980 and 2000. 23.46% of the land within the county is government owned. It ranks #56 in the state in per capita income (the third from the lowest).[86]

Mariposa County consists of 1,460.5 square miles with an unincorporated area population of 13,100 residents. It has a density of 9 persons per square mile and ranks #49 in the state. It is projected to experience a 59.5% population increase between 1980 and 2000. 48.11% of land within the county is government owned. It ranks #33 in per capita income in the state.[87]

Toulumne County consists of 2,292.7 square miles with an unincorporated area population of 35,350. It has 17 persons per square mile in density, and ranks #46 in the state. It is projected to experience a 60.2% population increase between 1980 and 2000. 77.01% of the land within the county is owned by government. It ranks #51 in the state in per capita income.[88]

The consolidated sheriff's dispatch center for Public Safety Dispatch Region 8 will be located in the City of Sonora, the County Seat of Toulumne County. The center will dispatch for an area of 4,789.6 square miles serving 72,550 residents. Excluding Mariposa County which did not respond to the survey, there are a total of 54 sheriff's personnel assigned to field duties in this region.[89]

Geographically, Region 8 is situated in the central-eastern portion of California, on the western slope of the Sierra Nevada Range. All three counties are primarily mountainous in nature.

The principle industries of these counties are tourism, ranching, and timber.

Region 9-Inyo and Mono Counties.

Inyo County has an area of 10,097.9 square miles with 14,850 unincorporated area residents. It has a density of 1.8 persons per square mile and ranks #57 in the state. It is projected to have a 40.3% population growth between 1980 and 2000. 85.68% of the land within the county is government owned. It ranks #24 in the state in per capita income.[90]

Mono County has an area of 3,028 square miles with 9,150 unincorporated area residents. It has a density of 3 persons per

square mile and ranks #55 in the state. It is projected to experience a 63.7% population growth between 1980 and 2000. 79.11% of the land within the county is owned by government. It ranks #32 in the state in per capita income.[91]

The consolidated sheriff's dispatch for Public Safety Region 9 will be located in the City of Bishop. This center will serve an area of 13,125.9 square miles and a resident population of 24,000 persons. There is a total of 38 sheriff's personnel assigned to field duties.[92]

Region 9 has the smallest resident area population to be served of all nine regions, and the second highest square mileage, being only 265.2 square miles less than Region 1. This is accurately reflected in the density of the area, with the two counties ranking #55 and #57 respectively within the state. The principle industry of both counties is tourism.

Geographically, Region 9 is on the central-eastern side of the state, with both counties meeting Nevada on their eastern borders. The crest of the Sierra Nevada Range is situated on the western edge of Region 9. This steep escarpment presents a barrier to east-west travel, with the result that there are very few roads traversing the region in that direction. Besides the high elevation of the eastern Sierra Nevada, Death Valley, the lowest point in the continental United States, is also located within the region. While the region is a popular destination for recreational purposes, its vastness and relative isolation assures that it does not have the volume of tourism found in some of the other regions (i.e. #7) which are more proximate to metropolitan areas. However, because Region 9 encompasses both the highest and lowest elevations in the country, the sheriff's departments will encounter literally every type of weather conditions. Thus, the capability for search and rescue clearly necessitates back-country communications capability.

While Inyo and Mono Counties are projected to have a growth increase of 40.3 and 63.7% respectively, overall the growth prospective of Region 9 will remain low. When these percentages are applied to the existent populations, the total numbers still do not become very great. This is due to the fact that the area does not have an economic base with the potential to attract additional residents. This is because the City of Los Angeles owns the water rights to the Owens Valley. Without this water, there is no way that the hign desert comprising much of the area can be developed for agricultural purposes.

In viewing all nine regions comprised of the 29 counties, there are certain common threads that relate them. Each region, at the very least part, if not all the region, has an attraction for tourism. I have already qualified the use of tourism as to the wide spectrum of recreational activities included. The relevance here is that the influx of tourists creates a larger area of population that the sheriff's departments must serve. Tourism has peaks and valleys; it

is not a constant. Thus, for most of the regions, it can be predicted that there will high and low periods of activity in terms of called-for-services. The flexibility to be able to adjust dispatch staffing to coincide with these peaks and valleys of activity is a benefit to the consolidated dispatch center concept.

Of the 58 counties in the state, and the 29 counties to be consolidated, only six counties are above the median in the state for population density. (Although a seventh, El Dorado County, is projected to shortly go over the median due to population growth).

With the exception of Region 6, the regions can be characterized as being below the median in per capita income. Regions 1 through 4 are all below the median. Region 5 is below the median, with the notable exception of Colusa County which ranks #7 in the state. Region 6 is the only entire region above the median, with Napa and Yolo Counties ranking 12 and 18 respectively in the state. Region 7 is below the median with the exception of Placer County ranked a 20. Region 9 is below the median, with the exception of Inyo County rated at 24. Only two counties, Colusa and Napa, are within the top 1/4 in the state of California. The per capita income has relevance to the purchasing power of the county governments.

Another relationship can be drawn by the percentage of land within the county owned by government, as this land is not taxable. The land may still produce income, as exemplified by the major timber harvesting counties, so income is generated. It is these large parcels of government owned land that account to a great extent for their attractiveness for tourism. Thus, there is an indirect generation of revenue through the tourism that is attracted to these large tracts of government owned and thus publicly accessible land.

While some of the counties are developing into more suburbanized areas, in most portions of the counties, the overall nature is still predominantly rural. None of the regions have any heavily industrialized areas that can serve as a fiscal support for the rest of the region. The areas with the greatest population and the greatest population density which are developing into bedroom communities from metropolitan areas still will not have an industrialized tax base.

There is nothing on the horizon to remotely indicate any future fiscal windfall for county governments. Counties for a number of years have been faced with a necessity to curtail or eliminate essential services because of fiscal constraints. The only way to maintain or increase the delivery of essential services is to become more efficient and do the same or more on fewer dollars. Simply put, over the long run counties must seek and implement ways to get more bang for the buck. This strongly points to the synergistic benefits that can accrue to multiple counties if they team up to pool their resources towards the attainment of commonly held goals. For the nine Public Safety Dispatch Regions, it is a means by which to achieve the economies of scale.

The following section analyzes the threats and opportunities that will manifest themselves during the process of implementation of the consolidated Public Safety Dispatch Region concept. While the terms used are threats and opportunities, in reality what is being analyzed are the opportunities, and this is being done from both negative and positive viewpoints. The decision by any one region to proceed with such a project will hinge upon the extent the positive consequences (opportunities) outweigh the negative consequences (threats). The sequence of analyses will be threats and then opportunities.

THREATS

1. Change.

The fear reaction to change is so endemic as to become a given. At the very least it is uncomfortable to those potentially affected by it, and it can become a frightening consequence. In this instance, the change will be of tremendous significance for the employees of dispatch centers in the affected counties.

With the transition to the Public Safety Dispatch Region concept, there will be a loss of jobs. One of the strongest factors of justification for such consolidation is the ability to do the same amount of work utilizing fewer personnel through the economies of scale and greater efficiency gained in consolidation. Thus, it is inevitable that a significant number of persons will be displaced from their jobs. Obviously then, this has an extremely negative affect on employee morale. Those employees who anticipate being displaced from jobs obviously will oppose such consolidation.

For the employees that will continue to work in the new centers, many of them will face the necessity to relocate to the area in which the consolidated dispatch centers are located. It is well documented that a move is in of itself a traumatic experience. Once having relocated, the employee will then face the necessity to learn how to use the new equipment and computers in the consolidated dispatch centers, and the procedures for dispatching from the centers. For those that have not yet undergone POST dispatcher training, the necessity to successfully complete the training program in order to retain employment in the consolidated dispatch center will be an additional stressor.

2. Cost.

This is a long-run versus short-run dichotomy. As has been stated, the greatest justification for such consolidation is the long-run fiscal savings. However, in the short run, and starting immediately in order to implement the consolidated dispatch centers, there will be a significant cost factor.

In relocating and consolidating dispatch centers, a great deal of technical preparation will be needed. To begin with, the appropriate base stations, repeaters, and microwave links must be set in place to allow signal transmission between the dispatch center and the field units and base stations being serviced by the center. In addition, the necessary modifications to the telephone system must be made so that any time the 911 number is dialed anywhere within a Public Safety Dispatch Region, the call will automatically go to the proper dispatch center, regardless of location.

Each of the 29 counties in the existent non-consolidated configuration has its own equipment and consoles for dispatching. It cannot be expected that this diversity of equipment will be compatible under consolidation. Thus, the necessity will arise in each of the 20 centers to equip the center with new consoles. In addition, since very few if any of the counties have computerized dispatch (CAD) systems, the new consoles will be necessary to incorporate CAD capabilities in the centers.

Lastly, while the new dispatch centers are being constructed and tested, the old dispatch center infrastructures will have to continue to function. This means that the old centers must literally continue to be on line until the precise moment when the new centers can be activated and take over the dispatch function. This period of time of redundancy will generate a considerable cost. Until these capital-intensive costs have been fully amortized, the net benefits to be derived through salary savings will not begin to be realized. The question then logically arises as to whether the potentially involved counties can afford the short run cost increment in order to realize the long range cost benefits.

3. Loss of Control.

Regardless of what management structures are developed and implemented to administer the consolidated Public Safety Dispatch Region Centers, there will be a loss of control from those who currently exercise it. Taken in the most simplistic terms, if one county joins with three other counties to consolidate dispatch centers, then mathematically each of the managers in charge of the four prior centers will lose 75% of his/her authority since he must share his authority with three other administrators. Besides the obvious loss of power by having to share it, geographic displacement can also reduce influence. Thus, for example, if the Del Norte County Sheriff has his dispatch center moved to Eureka as a part of a consolidation, clearly then his influence over even his aspect of the center would be reduced simply due to his lack of proximity to the center.

This then leads to the very obvious and critical issues of who is to be in charge of the centers, how they are to be selected, and what power or authority will they bear. Power or authority can be compared to a pie; the more persons there are to partake of it, the

slimmer each slice will be for each individual. This is a dilemma that faces each county and each potential Public Safety Dispatch Region.

4. Flexibility.

With each county dispatching for its own Sheriff's department, and perhaps for other public safety agencies within the county, the numerical codes (if used), abbreviations, terminology, and procedures can be arranged to suit local circumstances and desires. For small areas, informality may not be the rule.

With regional consolidation, such individualism becomes impractical. In a consolidated center, there must be a consistency in the codes used, as well as the other particulars of dispatching setforth above. It is an impractical expectation to believe that dispatchers can adapt to different codes or procedures for different agencies, and then changes on a daily basis.

Such consistency is possible to obtain, but it will require a lengthy process to achieve agreement, and then a further process of learning by all the users (in this instance not only the dispatchers, but the field units).

Changes in procedure and terminology will also be more time consuming and cumbersome to implement. For example, utilizing proposed Public Safety Dispatch Region 7 (Alpine, Amador, El Dorado, and Placer Counties.) Suppose the Sheriff of Amador County desired to utilize the term "Code Blue" to denote an emergency medical dispatch when advising law enforcement units in the area. If the sheriff were using his own dispatch center, which was dispatching only for his department, then he could merely cut the order incorporating the term and that would complete the process. In the consolidated Public Safety Dispatch Region concept however, the Sheriff of Amador County would have to obtain the concurrence of the sheriff's of Alpine, El Dorado, and Placer Counties. If, as anticipated, these Public Safety Regional Dispatch Centers also assume dispatch responsibilities for police departments, fire departments, and ambulance companies, then the agreement of the agency head of each of the individual agencies involved must be obtained. If this cannot be done on a unanimous basis, then there must be a process developed whereby a vote is taken from a representative group and that determines whether or not a specific change is to be made. Either way, clearly it is a far more cumbersome process when dealing with a consolidated dispatch concept.

5. Efficiency vs effectiveness.

The intangible rising in this dichotomy is the question of what is to be sacrificed for consolidation. In other words, will the cost of efficiency be too great in terms of the overall system effectiveness.

This is an area directly impacting the recipients of emergency service. Clearly, the goal of dispatch must be the most error-free and timely dispatch of the appropriate emergency responders. While the case has been well established for the more efficient utilization of dispatch staff through the consolidated concept, this becomes meaningless if the goal is in any way compromised. This then leaves the nagging questions as to whether such compromise will be implicit with the overall larger scale of the consolidated centers. It may be anticipated that during the early stages of utilization of the consolidated centers that there will be some lesser degree of effectiveness until the "bugs" are worked out of the system. It is imperative that these inefficiencies be in fact "bugs" rather than sytemic design defects that are integral with the system.

6. Local orientation.

In a given rural area, it is an accepted fact that the dispatchers are familiar with the local areas, the officers and other emergency responders they dispatch, much of the clientele that is dealt with (both good and bad) and the procedures used by agencies in the area.

With the transition to the consolidated Public Safety Dispatch Region Centers, such personal knowledge on the part of individual dispatchers will no longer be there. Even if a dispatcher has transferred in from an area that he or she knows, that does not mean that he or she will be familiar in any way with the other areas now being dispatched for by the center. One of the often stated advantages of computerized dispatch (CAD) is that the data bank of the computer can incorporate this information and thus replace the personal knowledge of the dispatcher.

However, is this really true? To put it another way, can a dispatcher in Susanville, who previously lived in Alturas, properly dispatch a unit in the vicinity of Grass Valley with the aid of the computer to substitute for the personal knowledge that the dispatcher no longer has?

Related to this of course is the reaction of the public. Will the persons calling the dispatch centers object to a more impersonalized approach to handling called-for services and emergencies due to the distance factor as well as the personal unfamiliarity of the dispatcher to the particular circumstances surrounding a reporting party.

7. System Failure.

What happens if some link in the system fails, disabling the ability of a center to dispatch for one or more of its client agencies. Related to that,is the question as to what happens if telephone service between any of the outlying areas and the dispatch center is interrupted.

Since no system can be 100% reliable, there must be sufficient planning and engineering to insure a back-up capability in the event of partial or complete system failure of any of the Public Safety Dispatch Region consolidated centers. At the very minimum, this means that every sheriff's department (as well as any police, fire, or ambulance agencies) tied into the system must have the ability to revert to some sort of a manual local dispatch process if emergency circumstances so necessitate. The same sort of system back-up must be engineered into the telephone system so that if incoming phone service to a consolidated center is interrupted, it will automatically be switched to an alternative reception site.

Another technical aspect that must be resolved is that of field maintenance. With the centralized nature of the consolidated dispatch centers, it becomes impractical to transport mobile or portable radios to a maintenance facility located at the center for routine maintenance or repairs. Thus, there must be methods devised to facilitate field maintenance and repairs so as to minimize communications equipment down time.

8. Resentment from cities and/or counties not chosen to be the site of a Public Safety Dispatch Region Consolidated Center.

Despite earnest and good faith attempts to objectively select cities most ideally suited to be the sites for the Regional Public Safety Dispatch Centers, other cities perceiving that they are as well qualified undoubtedly will be resentful for not being selected. The same may be applied to counties which feel that the dispatch center for the region should be located somewhere within their jurisdiction.

It had already been set forth in the scenario that the locations of the dispatch centers would not confer any particular jurisdiction to the city and/or county in which they were located. However, despite this objective intent, a more emotional and local community oriented reaction may not be avoided.

9. 20 communication centers to be shut down.

This one factor in essence summarizes the previous eight discussed. Ignoring for a moment (until the next section) the potential positive aspects of consolidation, it is inevitable that the closing of the 20 centers through consolidation to 9 will result in significant change for the personnel involved, higher short-run costs, a loss of local control, a lesser degree of flexibility, the unresolved question of any sacrifice of effectiveness for efficiency, a loss of local orientation by the center, the question of back-up for system failure, and the intangible of resentment from cities or counties not selected to be a dispatch center location. The question then is, would all this be worth it for the potential advantages to be gained by proceeding with the implementation of this consolidation concept?

OPPORTUNITIES

1. Financial savings resulting from consolidation.

There is no doubt about the inevitability of significant cost reductions in the long-run through the implementation of consolidated Public Safety Dispatch Region Centers.

As has been conceded previously, there undoubtedly will be a significant short-run cost increase due to the relocation, construction, and equipment changes necessitated by the move. However, assuming proper planning for future growth and system capacity, the new facility and equipment will have an extremely long service life before the requirement to replace or update.

In most public sector agencies, salaries and benefits account for approximately 85% of budget expenditures. The reason this proportion is so high is that salaries and benefits are ongoing costs, whereas equipment is only acquired periodically. Thus, once the new equipment and facilities have been amortized to 0, the lower budget expenditures resulting from the necessity to pay fewer dispatchers will be an ongoing net benefit to each participant agency.

With the reduction from 29 to 9 dispatch centers, besides the obvious reduction in numbers of dispatchers needed on duty at any given time, there is an additional elimination of the redundancies of management. Instead of having management staffs and supervisors for 29 separated centers, the only need is for management staff and supervisors for 9 such centers. Since these persons earn a higher income than line dispatchers, the potential for cost savings is considerable.

2. Computerized dispatch (CAD).

Despite some departments not responding to the survey, the generalizations can be made that for the most part CAD systems are not in use in the counties subject to this consolidation concept. 19 of the 29 counties do not have CAD systems. Three counties (El Dorado, Glenn, and Placer) indicate the use of CAD systems, to some extent.

Thus, a useful system for more efficient dispatch processing exists which is not being realized by approximately 2/3's of the potentially involved counties.

The utilization of computerized dispatch increases the work capability at each work position by approximately three times.93 This then results in the opportunity to further reduce staffing levels. Thus, in addition to the savings described under #1 above, additional savings may be realized through the implementation of computerated dispatch.

In addition, CAD systems have other efficiencies:

1. They can be used to verify incident addresses and phone numbers.
2. They can be programmed to recommend which units to dispatch to which incidents.
3. They can be programmed to identify hazards (persons as well as locations).
4. They can store incident-related data.
5. They can store field unit status data.
6. They can facilitate external data base inquiries.
7. They can store and organize statistical data for each department and/or area.
8. They can store activity reports by day, week, month, etc.
9. They can prepare management reports.[94]

The use of CAD systems also allow discretion as to whether or not to utilize mobile digital terminals (MDT's) in field units. The most compelling reason for MDT's is to more efficiently utilize the frequency. Data transmission is much more rapid than voice transmission. However, at the present time there are two limiting factors to a universal application of MDT's:

1. The current cost to group a patrol unit with an MDT is approximately $5,000.00.
2. The size of the MDT is such that it intrudes excessively into the front cabin area of the patrol vehicle. Either the right front passenger seat must be sacrificed to accommodate the MDT, or an ergonomically unacceptible situation is created by attempting to accommodate the MDT along with the other electronic gear and still leave space for a right front seat passenger. This of course is a major issue with departments that utilize double units.

However, with computerized dispatch, there is the facility to adopt a desirable and reasonably priced compromise. That is the use of status buttons. By the addition of a small device holding a row of buttons to a radio control head, routine status traffic can be data transmitted to the dispatch center by pushing the appropriate button rather than having to use voice. This device costs approximately $300.00 per unit. Thus, for departments that desire to reduce channel loading but are not at a point of needing to utilize MDT's, the status buttons provide a useful and cost-effective alternative.

3. Larger communications centers will allow more efficient utilization of new technical developments.

The larger scale and size of the consolidated dispatch centers will generate more purchasing power towards updating and further increasing center efficiency as new means become available. This is one of the economies of scale. It then becomes cyclical; as technical developments allow greater dispatch position efficiency,

staffing levels continue (up to a point) to be able to be lowered. This then reduces the number of personnel for whom salary and benefits must be paid. If the dispatch center is located in any region experiencing a rapid growth rate (such as is projected for Public Safety Dispatch Regions 6 and 7) the system will have the capacity to accomodate greater loading without the necessity to hire additional personnel.

4. All dispatchers to be POST trained.

Long overdue is a state mandated and financially subvented program for the training of emergency service dispatchers. With POST to assume this responsibility, along with reimbursement to the employing entity, there will be an overall increase in the skill level of dispatchers. This training will allow a consistency of dispatch competence throughout the state. It will also contribute to the professionalizing of the field and making it a career area.

The training time will be briefer and the process simpler by training dispatchers to be able to function with computerized dispatch systems. The knowledge previously carried in a dispatchers own mind, or notebook, as to various procedures will now be programmed into the data bank for the computer. Thus, while it will be necessary for dispatch personnel to be able to function with computers, once this skill is attained, the result will be far greater dispatcher efficiency. However, for this training to achieve the desired results in increased efficiency, the dispatchers must be returning to an area which has the equipment and the work load to efficiently utilize the training.

5. Public service.

The overall result of the implementation of this consolidated concept will be a more efficient level of service to the public. Clearly, as in all other factors, the bottom line is the quality of service rendered to the public. In this context, efficiency means the rapidity of correct dispatch.

Through the consolidated centers utilizing CAD systems, and POST trained dispatchers, there will be a consistency from area-to-area and call-to-call of timely and error-free dispatching. Because of this, and because the public is concerned with the timely and correct receipt of emergency services, it will become inmaterial where the dispatcher is located.

6. More efficient utilization of available frequencies.

There are currently many rural sheriff's departments which experience time periods with very low levels of activity, and consequently with few field units in service. For each of these departments on an individual basis, each is occupying a channel of the public safety bandwidth spectrum. This spectrum is a finite resource, the end of which we are rapidly approaching.

By consolidating the dispatch centers, mulitple small departments may share channels without creating an excessively crowded condition. In addition, the increase of departments on a given channel can be planned so as not to require an increase of dispatchers for that channel. Besides the obvious personnel cost savings, it implies the prerogative of reassigning channels to departments in need of them.

7. Favorable publicity and enhanced public image.

The implementation of this concept is a pioneering effort by the State of California and the counties involved which would again chart a new course for law enforcement throughout the United States. This is a role played by California and its law enforcement and public safety agencies many times in the past. As a consequence of this, the consolidated Public Safety Dispatch Region concept would attract a considerable amount of nationwide publicity. This would result in further enhancing the public image of California law enforcement, and California law enforcement emergency service dispatching.

CAPABILITIES AND RESOURCES (STRENGTHS AND WEAKNESSES)

This section will analyze the capabilities and resources, which can also be referred to as the strengths and weaknesses of the counties to be involved in the consolidation process. Since it is obviously impossible to determine the specific internal factors for each of the counties involved, the capabilities and resources will be discussed in terms generally applicable to all of the involved counties.

1. The Sheriff is an elected official.

The consequence of this obvious political fact of life is that the sheriff cannot attain that which he deems necessary or desirable without the political support of the community translated into fiscal support from the Board of Supervisors. It has often been stated that the job of sheriff is far more secure than the job of Chief of Police, since the sheriff cannot be fired; he only faces the electorate every four years. On the other hand, the Chief of Police has job tenure between meetings of the City Council. However, that is a somewhat short-sighted view, as the sheriff cannot implement his programs if he is at odds with the Board of Supervisors and as a consequence is not receiving adequate fiscal support.

2. Local politicians tend to be parochial.

This is an obvious factor in any geographic area large enough to serve a multiplicity of constituencies and interests. It is true in County Boards of Supervisors in which the individual Supervisors tend to follow the perceived interests of their own supervisorial

districts rather than the general welfare of the county as a whole.

Taking then Boards of Supervisors and City Councils in rural and sparsely populated counties, there is a great likelihood that they will be initially opposed to any change which would remove any given function from the immediate local level and control. If Boards of Supervisors adopt this stand, then clearly it will impact on the role of the sheriff as discussed in item #1 above.

3. The old guard opposition to change.

This relates to #2 just discussed. This is the reactive stance which says: "We've been doing it this way for 30 years so why change?" This reactive stance is endemic to law enforcement, and assumedly to other areas of government. While the adoption of the concept of Public Safety Dispatch Region consolidated centers can be justified in factually based grounds, even this does not guarantee that persons holding the reactive philosophy will change their minds. Often times, with such persons it is useless to argue facts; their minds have already been made up (perhaps for 30 years).

4. The ability to generate funds.

This factor clearly ties in with the first three discussed, and they have been discussed in the order set forth above in order to lay the ground work for this extremely critical factor. Before the long-run cost savings can begin to be realized, the entire transition process into the consolidated Public Safety Dispatch Center in any given region must be completed. As has been previously indicated, the short-run forecast during the transition period will be for a fiscal outgo to cover the costs of relocation, construction of the centers, and equipment configuration. There are a variety of methods by which such a short run cost may be subvented, since in the long-term it will more than be returned. However, it order to aggressively pursue potential funding sources, there will have to be a political environment receptive to such consolidation. It will have to be supported by the Boards of Supervisors, and this support will have to be carried to the sheriff. The obstacles to the attainment of this objective are the factors discussed in #1 through #3 above.

5. All regions are forecasted to grow.

The following are the projected average percentage growth rates for each of the nine regions in the period 1980 to 2000:

1. Region 1: Siskiyou, Shasta, and Trinity Counties: 38.06%
2. Region 2: Mendocino, Humboldt, and Del Norte Counties: 30.4%
3. Region 3: Modoc, Lassen, Plumas, Sierra, and Nevada Counties: 42.06%
4. Region 4: Tehama, Butte, and Yuba Counties: 38.7%
5. Region 5: Glenn, Colusa, Lake, and Sutter Counties: 36.7%
6. Region 6: Napa and Yolo Counties: 39.2%

7. Region 7: Alpine, Amador, El Dorado, and Placer Counties: 79.7%
8. Region 8: Calaveras, Mariposa, and Tuolumne Counties: 56.7%
9. Region 9: Inyo and Mono Counties: 52% [95]

The Public Safety Emergency Response System must be prepared to handle the increased service load to be generated by these increases in population. While the actual numbers of population increase may be relatively low, it would still result in an increase in the number of residents beyond what the present communications systems are probably designed to handle.

An example of this can be illustrated by Region 9. In 1985 figures, Inyo County had a population of 18,250 persons. Mono County had a population 9,150 persons. Thus, for 1985 there is a total regional population of 27,400 residents. With the projected growth rate, this would become 41,648 persons by the year 2000.[96] In all probability, the present sheriff's communications systems would not be sufficient to render the necessary level of public safety dispatch with this population increase.

This example can be applied to all nine regions, as even the region with the lowest projected percentage increase, Region 2 at 30.4%, would still realize an additional 61,788 residents.[97]

Not only do these growth patterns indicate the need to upgrade the capability of the communication centers, but they also indicate increased revenue sources which would help to generate the short-run funds necessary to make the transition.

6. Each region will have a wide spectrum of weather conditions, terrain, and types of incidents.

The days are long since gone when one can assume an absence of crime in rural areas because of their isolation or sparse populations. Whatever crimes are found in the largest metropolitan areas will also be found in the most sparsely populated and isolated rural areas. There will just be less incidence of such crimes. While it is obviously incumbent upon the sheriff's departments to be prepared to handle such incidents, the emphasis has not been on upgrading dispatch centers for the same challenges. In addition to handling the same types of crimes as more populated areas, the rural sheriff's departments have two other specific areas of responsibility which require efficient communications systems:

1. Marijuana eradication. The rural areas of California are used for the purpose of cultivating marijuana. This takes place on both private as well as public lands. The risk factor of arrest is somewhat lower on public lands, as there is no way to connect a particular parcel of land with ownership by a particular individual. For this reason, counties with large tracts of public owned land which is of limited accessibility become attractive areas for such cultivation. The risk to law enforcement officers engaged in such eradication is

considerable, which necessitates the instant availability of communications.

2. Search and rescue (SAR). The recreational attractiveness of many of the counties in the regional dispatch areas lies in their isolated and mountainous terrain. This however generates the need to conduct search and rescue missions for persons who are injured, trapped, or killed in the wilderness. This again creates the necessity of efficient communications.

Besides these types of incidents, the nature of the counties involved is such that all types of weather conditions will be encountered; from far below freezing to heat of such an extent that it is difficult to sustain human life. Combined with this is the terrain variations, since the counties will go from extremely high elevations in the mountainous areas to below sea level.

7. Signal path routes are available for each of the dispatch centers.

One of the critical factors on which such a concept hinges, is the ability to generate signal paths between the dispatch center and the field units and base stations that it serves. This requires that mountain top repeater sites be available so that signal paths can be created. Because of the experience that the various governmental entities in California have with developing such signal paths, the knowledge and technology to utilize such paths is present.

8. Telephone service.

This obviously is related to the previous factor. Not only is there a necessity to be able to dispatch for the field units, but there must be the ability to receive incoming calls for service throughout the region. The telephone technology to structure lines and systems so that all incoming calls regardless of location of origin will come to a specified center is present and is being applied in other areas. Thus, from a technological standpoint it can be applied to the nine projected regions. The limitation may be due to the fact that many parts of the regions are serviced by small and localized telephone companies which may not have the in-house technological and engineering background to set up the necessary systems.

STAKE HOLDER DEMANDS

The following section sets forth the stake holders and their assumptions relative to the issue. (See also Appendix G).

Although the recommended procedure in the Command College is to select seven to twelve stake holders as higher numbers tend to become cumbersome, it was not possible to use that limit within the

context of this project even generalizing by category the various stakeholders. For that reason, a total of 14 generalized categories of stakeholders have been identified. The criterion used to determine whether to select a particular category of stakeholder was the perceived importance of the stakeholder relative to the issue. Once the stakeholders had been determined, assumptions were generated for each of them as I would perceive they would view the issue. In order to maintain a degree of control, these assumptions were reduced and categorized to three per stakeholder.

1. The Public calling for service (resident as well as non-resident)
   a. Immaterial provided the service is good.
   b. Desire to save tax dollars.
   c. May desire to retain local dispatch capability.

2. Sheriff Department Administration.
   a. Favor the advantages of consolidation.
   b: Oppose the loss of control and flexibility.
   c: Want the same or better service.

3. County Administrative Officers.
   a. Want to be more efficient.
   b. Opposed to initial costs.
   c. Not subject to direct political pressure.

4. County Boards of Supervisors.
   a. Reactive to public and media.
   b. Favor cost cuts.
   c. May oppose movement of dispatch center away; loss of local control.

5. City Councils, governing boards, etc.
   a. May oppose less local control.
   b. Will favor cost savings.
   c. May join up later.

6. Police and Fire departments administrations.
   a. Will favor as a method to cut costs.
   b. Opposed to loss of local control.
   c. May decide to join later.

7. Line personnel - all agencies.
   a. Will do the job either way.
   b. Want the most capable and modern equipment.
   c. Fear change per se.

8. The Federal Communications Commission (FCC).
   a. Will favor as a more efficient frequency use.
   b. Very slow to react-typical bureaucracy.
   c. Waiting for public safety communications plan.

9. Associated Public Safety Communications Officers (APCO).

a. Can furnish technical advisers.
b. Must coordinate frequencies.
c. They are a resource as an impetus towards professionalism.

10. Equipment vendors and contractors.
    a. Favor consolidation.
    b. May give cost breaks because of pioneering efforts.
    c. Will perceive opportunity for sales.

11. Telephone companies.
    a. May oppose if reconfiguration becomes a problem.
    b. Either have the technological capabilities or access to it to complete the changeover.
    c. May need to be pressured by FCC and State PUC.

12. Dispatch center employees.
    a. Fear change: loss of jobs, move, training in new procedures and equipment.
    b. May oppose the loss of local control.
    c. May see increased and enhanced career opportunities.

13. News Media.
    a. Can be a pressure factor or catalyst for change.
    b. Can help to co-opt the public and politicians on short run costs.
    c. Local media may oppose movement of centers away.

14. Allied public safety agencies (Fish and Game, Highway Patrol, State and Federal Forestry).
    a. Accustomed to the concept.
    b. Want to receive the same level of service.
    c. Can be used as a support and information resource.

After determining the principle stakeholders and their assumptions, they were next plotted on two SAST charts.

The first chart allows the stakeholder and their particular assumption (of the three listed) to be plotted on one continuum of more important to less important (horizontal), and the other continuum (vertical) to plot the certainty to uncertainty of the perception of a particular assumption being held by each stakeholder.

The second chart deals with changes of assumption. This chart has a horizontal continuum ranging from same to change; and a vertical continuum ranging from difficult to easy. Thus, plotting on this chart can indicate what stakeholder assumptions we would want to change and how difficult this would be.

However, to gain any benefit from the two charts, they must be integrated and interpreted. Only in this manner can strategy be developed for dealing with the stakeholders.

A brief example will serve to illustrate the methodology used, which will be set forth subsequently as a suggested prioritization for dealing with certain stakeholders and their assumptions.

Example:

Concerning stakeholder group #12, dispatch center employees. They hold three assumptions;

A. Fear change: loss of jobs, move, training and new procedures and equipment.
B. May oppose the loss of local control.
C. May see increased and enhanced career opportunities.

In checking the change of assumption chart, items 12a and 12b are in the extreme lower right of the difficult-change quadrant. Before concluding from that plotting that an extremely large effort should be undertaken to change these assumptions, the same plottings should be checked on the stakeholder assumption chart. On this chart the two values are to the left of the mid-point tending more towards less important, and in the area indicating slight to considerable certainty of the perception of those assumptions being held. Based on the interpretation of the two charts then, it would appear wasteful to devote too much effort and resource to changing these assumptions, as either they may not be changeable, or the change may not be worth the effort required to implement it.

Taking the two charts in combination as exemplified above, 14 variations were derived, which formed the basis for prioritization of dealing with stakeholder assumptions.

1. Important stakeholder, certainty of assumption, change needed, difficult to implement.

2. Important stakeholder, certainty of assumption, needed to remain same, difficult to implement.

3. Important stakeholder, uncertainty of assumption, change needed, difficult to implement. (Note: By way of explanation, this factor is describing that if an assumption is held, it will be difficult to change).

4. Important stakeholder, uncertainty of assumption, needed to remain same, difficult to implement.

5. Less important stakeholder, certainty of assumption, change needed, difficult to implement.

6. Less important stakeholder, certainty of assumption, needed to remain the same, difficult to implement.

7. Less important stakeholder, uncertainty of assumption, change needed, difficult to implement.

8. Less important stakeholder, uncertainty of assumption, needed to remain the same, difficult to implement.

9. Important stakeholder, certainty of assumption, change needed, easy to implement.

10. Important stakeholder, certainty of assumption, needed to remain the same, easy to implement.

11. Less important stakeholder, certainty of assumption, change needed, easy to implement.

12. Less important stakeholder, certainty of assumption, needed to remain the same, easy to implement.

13. Less important stakeholder, uncertainty of assumption, change needed, easy to implement.

14. Less important stakeholder, uncertainty of assumption, needed to remain the same, easy to implement.

This categorization system can give a preliminary indication as to which stakeholders and which of their assumptions will be in support of or opposed to the development of the consolidated centers. From this, one can gain a rough estimate as to how easy, or how difficult, it will be to generate the necessary support. For example, were there to be a large number of factors under #1 (Important stakeholder, certainty of assumption, change needed, difficult to implement) it would be expected that the project would face an extremely strong degree of opposition. The question then may be whether to continue at all, or to see if this factor were offset by factor #10 (Important stakeholder, certainty of assumption, needed to remain the same, easy to implement). A large number of stakeholder assumptions, equally divided between categories 1 and 10 would indicate a great degree of polarization relative to this issue. Fortunately, that turned out not to be the situation.

Of the 14 combinations generated, five had a coincidence of stakeholders assumptions. The five can be divided into two areas indicative of support, two areas that a great deal of effort should be devoted to changing, and one area of opposition. They are as follows:

10. Important stakeholder, certainty of assumption, needed to remain the same, easy to implement.

    1. The public calling for service (resident as well as non-resident).
       a. Immaterial provided the service is good.

    2. Sheriff Department Administration.

a. Favor the advantages of consolidation.
c. Want the same or better service.

3. County Administrative Officers.
a. Want to be more efficient.

4. County Boards of Supervisors.
a. Reactive to the public and media.
b. Favor cost cuts.

7. Line personnel - all agencies.
a. Will do the job either way.

10. Equipment vendors and contractors.
c. Will perceive opportunity for sales.

9. Important stakeholder, certainty of assumption, change needed, easy to implement.

7. Line personnel - all agencies.
c. Fear change per se.

The above two sections would be indicative of existent or easily co-opted support. The next two items are indicative of areas in which a great deal of effort should be devoted towards implementing change.

3. Important stakeholder, uncertainty of assumption, change needed, difficulty to implement.

11. Telephone companies.
a. May oppose if reconfiguration becomes a problem.

4. Important stakeholder, uncertainty of assumption, needed to remain the same, difficult to implement.

10. Equipment vendors and contractors.
b. May give cost breaks because of pioneering efforts.

11. Telephone companies.
b. Either have the technological capability or access to it to complete the changeover.
c. May need to be pressured by the FCC and State PUC.

The following section is seen as an area of opposition:

5. Less important stakeholder, certainty of assumption, change needed, difficult to implement.

12. Dispatch center employees.
a. Fear change: loss of job, move, training in new procedures and equipment.
b. May oppose the loss of local control.

This last group may assume the "snail darter" role. A further analysis of that aspect is at the end of this section.

Thus, from a strategic standpoint it would appear that the most effective course of action relative to the stakeholders (at least in this dimension) is to emphasize the nine established or easily attainable areas of support. At the same time, devote a maximum effort to maintaining the lowest possible equipment prices, as well as working with the telephone companies. At the same time, a lesser effort should be directed towards alleviating the fear of change on the part of line personnel to use the new system, as well as the two strong areas of opposition by the dispatch employees. The only stakeholder that had all three assumptions emerge in the negative aspect was that of the telephone companies. Thus, particular emphasis should be placed on establishing early rapport and working relationships with the numerous telephone companies to be involved with the consolidation projects.

Not to be overlooked is the probability that stakeholders will lobby one another both for and against consolidation. Based on this probability, the stakeholders are listed below with the other stakeholders that they are likely to lobby:

1. The public calling for service.
   Will lobby: Other portions of the public, Sheriff's Departments Administrations, County Administrative Officers, County Boards of Supervisors, City Councils and Governing Boards, Police and Fire Department Administration, line personnel - all agencies, and the media.

2. Sheriff Department Administration.
   Will lobby: The public, County Administrative Officers, County Boards of Supervisors, line personnel - all agencies, the media, and Allied Public Safety Agencies.

3. County Administrative Officers.
   Will lobby: County Boards of Supervisors, City Councils, Governing Boards etc., equipment vendors and contractors, telephone companies, dispatch center employees, and the news media.

4. Boards of Supervisors.
   Will lobby: The public, the FCC, APCO, equipment vendors and contractors, telephone companies, and the media.

5. City Councils, Governing Boards, etc.
   Will lobby: The public, equipment vendors and contractors, telephone companies, and the news media. (Note: For the purposes of this exercise I am differentiating city and county governmental entities and public safety agencies. This is based on a presumption that those non-county agencies that do not desire to be apart of the consolidation will not

participate in lobbying. It is further assumed for hypothetical purposes that for local agencies not joining initially in the consolidation, that they will choose to exercise that option subsequently).

6. Police and Fire Departments Administrations.
Will lobby: The public, city councils, governing boards etc., line personnel (their own), equipment vendors and contractors, telephone companies, dispatch center employees, the media, and Allied Public Safety Agencies.

7. Line Personnel - all agencies.
Will lobby: The public, Sheriff Department Administrations, County Board of Supervisors, City Councils, Governing Boards, etc., Police and Fire Department Administrations, (these last three through their bargaining associations) dispatch center employees, the news media, and Allied Public Safety Agencies.

8. The FCC.
Will lobby: Telephone companies.

APCO.
Will lobby: County Administrative Officers, (indirectly), the FCC, equipment vendors and contractors, and telephone companies.

10. Equipment vendors and contractors.
Will lobby: Sheriff Department Administrations, County Administrative Officers, County Boards of Supervisors, City Councils, Governing Boards, etc., Police and Fire Department Administrations, the FCC, APCO, and the telephone companies.

11. The telephone companies.
Will lobby: The FCC.

12. Dispatch employees.
Will lobby: The public, Sheriff Department administrations, County Administrative Officers, County Boards of Supervisors, City Councils, Governing Boards, etc., Police and Fire Department Administrations, line personnel - all agencies, and the news media.

13. The news media.
Will lobby: The public, Sheriff Department Administrations, County Administrative Officers, County Boards of Supervisors, City Councils, Governing Boards, etc., Police and Fire Department Administrations, line personnel - all agencies, telephone companies, dispatch center employees, and Allied Public Safety Agencies.

14. Allied Public Safety Agencies.
Will lobby: The public, City Councils, Governing Boards, etc., Police and Fire Department Administrations, (these two via

movement to the consolidated centers) and the news media.

It should be emphasized that the environment of the stakeholders and their assumptions can be very dynamic. Thus, it is dangerous to speculate as to the degree of influence that the various stakeholders will have when attempting to lobby one another. Along these same lines, two potential "snail darters" can be identified for future reference in the event the need arises to deal with them in that context. (Note: the "snail darter" is a tiny and apparently insignificant amphibious creature which held up the construction of the Tellico Dam when it was determined that the construction of the dam and impoundment of the "snail darters" habitat would render it extinct. The term is used in this context to indicate a stakeholder who is a minor player in the overall scheme of things, but has the ability to greatly delay or stop progress on a project).

1. Dispatch employees who have been displaced from jobs.

While this is a relatively small group of persons compared to the amount of benefit to be derived from consolidation, if their lobbying efforts can find a receptive ear (especially in the media and political bodies), they may be able to delay or defeat the decision to consolidate. Thus, strategies to off set such a tactic should be developed in the event they are needed.

2. Telephone Companies.

The consolidation project will involve numerous small rural telephone companies. Although the technology exists, and is commonly used in metropolitan areas, to re-route telephone lines to regionalize centers, the small rural companies may not have in-house the requisite technology, and may be opposed to availing themselves of it in order to facilitate the transition to consolidated centers. Again, strategy should be developed in reserve in the event such a tactic is encountered.

EXECUTION-POLICY DELPHI

A policy Delphi process was utilized to solicit input for the development of the execution of the policy-strategy to implement the selected scenario. Seven proposals were submitted. Upon receipt of all seven, the authors names were deleted, and they were reproduced and sent to all participants. The participants then rated each alternative on 2 scales of 0 to 3; one scale for feasibility and the other for desirability. On this basis, alternative #4 scored the highest. This process was one round of the Delphi technique. Since there were no ties, there was no necessity to conduct further rounds.

Rather than taking just the strategy rated the highest using the Delphi technique, I chose to combine elements useful to an overall strategy derived from all seven alternatives, as well as my own

input. Thus, the policy-strategy towards implementation of this scenario is a synthesis of all these sources of input. The seven alternatives may be found in the Appendix, section G.

MISSION STATEMENT.

The mission statement of the Public Safety Regional Dispatch consolidated centers is as follows: To serve the public through the rapid, efficient, courteous and error free receipt of public safety emergency and non-emergency calls for service and the timely dispatch of the appropriate emergency service and public protection responders.

Through the regional consolidation of sheriff's dispatch centers, there will be an increase in efficiency resulting in;

1. Reduced costs through the need to utilize fewer dispatch personnel.
2. Rapid, error free dispatch of emergency service responders.
3. More efficient utilization of available frequencies.
4. More efficient utilization of personnel through state-of-the-art computerated dispatch systems (CAD).

There are seven major areas of concern to be addressed in setting forth policy and strategy towards implementation.

1. Public and political support.

The strategy to most efficiently maximize this support is derived from prior steps accomplished in the development of the project to this point. These steps were unknown to the participants in the policy Delphi process, which is why my input is necessary.

In terms of generating support, the overall strategy in this area is to consolidate and organize the areas of support through emphasis of the benefits to be derived from consolidation (the four listed above).

Using the data generated in the analysis of stakeholder assumptions, I have determined that the most likely areas of existent or potential support are as follows: (Note: listed for each section is the stakeholder and the applicable assumption)

1. The public calling for service (resident as well as non-resident)
   a. Immaterial provided the service is good.

2. Sheriff Department Administrations.
   a. Favor the advantages of consolidation.
   c. Want the same or better service.

3. County Administrative Officers.
   a. Want to be more efficient.

4. County Boards of Supervisors.
   a. Reactive to the public and media.
   b. Favor cost cuts.

7. Line personnel - all agencies.
   a. Will do the job either way.

10. Equipment vendors and contractors.
   c. Will perceive opportunity for sales.

The next listed stakeholder assumption is categorized as an important stakeholder, with a certainty of assumption, in which change is needed which is predicted to be easy to implement.

7. Line personnel - all agencies.
   c. Fear change per se.

The intent is to use this support which represents a very large number of persons and constitutes a large bloc to bring about change in the following four stakeholder assumptions. These are listed in descending order of perceived difficulty of change:

The following is an important stakeholder, with an uncertainty of assumption, a change needed, which were difficult to implement.

11. Telephone companies.
   a. May oppose if reconfiguration becomes a problem.

The following are important stakeholders with uncertainties of assumption, that are needed to remain the same, that may be difficult to implement.

10. Equipment vendors and contractors.
   b. May give cost breaks because of the pioneering efforts.

11. Telephone companies.
   b. Either have the technological capability or access to it to complete the changeover.
   c. May need to be pressured by the FCC and State PUC.

The following stakeholder assumptions are seen as a less important stakeholder, with certainty of assumptions, change is needed, and may be difficult to implement.

12. Dispatch center employees.
   a. Fear change: loss of job, move, training in new procedures and equipment.
   b. May oppose the loss of local control.

Overall, this stakeholder group is probably not needed for support, but efforts to change these assumptions, even if not successful, may preclude the assumption of "snail darter" role.

Thus, the overall strategy for generating support is to emphasis the benefits to be derived, and capitalize upon the strength of existent or relatively easily obtained support. This force of support is then mobilized against the force of opposition, with the prioritization being to concentrate on co-opting the stakeholders identified as having the strongest potential to delay or prevent the implementation of the project.

2. Funding.

Sources must be located for the short term funding necessary to initiate the project through the point of transition to where there is a net savings and costs. Within this context it must be determined whether or not a payback will be required, and what the matching fund requirements (if any) are. By criteria set forth, the most likely funding sources are as follows:

1. Revenue sharing.
   a. Follow state guidelines for law enforcement programs.
   b. The program has multi-jurisdictional impact.

2. State grants-and-aid.

3. A federal grant (via the State of California).[98]

3. Systems Design.

For the 29 involved counties there will be a total of nine systems that must be designed; one for each region. Overall, the following issues will need to be addressed in the systems design phase:

1. Radio channel considerations.
2. Telephone lines.
3. Data system capabilities.
4. System interfaces.[99]

4. Project management teams.

The project management team will initially start as one small group during the conceptual stages of the overall project. As the project progresses, the initial planning group will subdivide into nine separate groups, one for each region. However, once the nine groups are established, the original planning group must maintain its existent in order to assume the role of overall project coordinator and facilitator. This group must retain the flexibility to allow each center to be specifically designed for the region that it will serve.

5. Transition to consolidated center management.

As has been previously stated, the intent is to allow the project management teams for each of the regional dispatch centers to evolve

into becoming user committees that govern the operations of the centers. The device by which this is accomplished is a Joint Powers Agreement. The involved governmental entities should begin drafting the appropriate joint powers agreement as one of the earliest steps once the decision has been made to go ahead with a consolidation project.

Within the context of the Joint Powers Agreement, the cost-billing agreements should be determined for the participating user agencies.

6. Training and Orientation.

Personnel requirements for the consolidated centers must be determined sufficiently early to have the available personnel on board, and to have completed the POST-mandated training. Thus, the only step then left will be to orient the dispatchers to the new equipment and revised procedures as the centers near completion.

As has been set forth, the existing infrastructure will have to continue to exist and handle all dispatch responsibilities until the new center is ready to go on line. In addition, it would be foolish to place a new and complex dispatch center into service without allowing a period of time to iron out the wrinkles without the availability of a back up system. Thus, a period of time in which the old and new dispatch systems operate parallel will have to be determined and agreed upon by the users.

7. Post-implementation evaluation.

This is the last policy stage towards implementation and will address the following issues.

1. Gauge the success of the project.
2. Provide input to improve the quality and efficiency of dispatch and related services.
3. Provide a basis for continuing on-going futures planning.

ADMINISTRATION AND LOGISTICS

The following ten administrative and logistic issues must be addressed and resolved in order for the Public Safety Dispatch Center consolidation plan to be implemented. (See also Appendix H).

1. AREAS OF NECESSARY SUPPORT.

The initial areas of support needed for this project are from the public, the Sheriff's of the involved counties, the County Administrative Officers of the involved counties, and the Boards of Supervisors of the involved counties. The concerns of these stakeholders have already been extensively discussed and analyzed. While reiteration is not in order, brief recapitulation is. The operative assumption is that the Sheriff's are the initially

motivating force towards the implementation of this concept. Thus, their support is assumed. Also assumed is that there will be support (early on if not from the outset) from the public, the County Administrative Officers, and the Boards of Supervisors. It is projected that long-range cost savings, improvement of system efficiency, improved capacity for growth and flexibility, and the maintenance of the same or improved dispatch service will be strong enough to outweigh the arguments of loss of local control and the necessity to fund the system during its initial stages. Ideally, the municipalities, fire protection districts, and ambulance districts would also elect at the outset to have their dispatch services handled through the consolidated regional centers. If it is known early on in the planning process for any given region which police departments, municipal and rural fire departments, and ambulance services will be dispatched out of the consolidated center, it will give these entities the opportunity for input into the planning stages, as well as insuring down line greater cost savings due to the economy of scale. If some of the smaller political subdivisions do not desire the dispatch services of the regional centers initially, past experience would strongly indicate that provision should be engineered into the centers to accommodate the subdivisions in the future as it is almost inevitable that they will desire to join once the benefits of the system in use become more obvious. The strongest inducement to joining at the outset is the opportunity to participate in the planning process from the beginning.

2. PROGRAM FUNDING.

The Public Safety Dispatch region consolidated concept center is projected to require funding during the initial stages. This will be due to the necessity of constructing or acquiring adequate facilities at each regional dispatch point, equipping the facilities, and preparing the personnel to operate the facility. All this must be accomplished while the existent dispatch centers are still in operation, handling the entire dispatch responsibility until the consolidated centers are ready to go on line. Once the consolidated centers are on line, the cost savings generated by the far fewer personnel needed to operate them will then reverse the fiscal flow. Thus, there will actually be three phases to the overall funding issues; in the first phase funds are being expended as described above, in the second phase the cost savings being generated are off setting the funds already expended, and in the third phase the funds expended have been amortized to zero and the system is existing with a net cost savings to all participants. Thus, for the short run a funding source needs to be located.

The following are general areas to be explored as possible sources of program funding:

1. Revenue Sharing.

Revenue sharing is a method of fiscal subvention from the

state to local governmental entities. It can be in either of two forms:

1. The state government asseses and collects taxes which are the allocated to specific local political subdivisions.

2. The local subdivisions asses and collect the taxes, and then partially distribute these to state government.[100]

Obviously, in view of Proposition 13, the first alternative is clearly more advantageous.

Although there are numerous alternative means in which each state administers taxes and expenditures, it is common for law enforcement responsibilities to be maintained at a local level. Thus, the planning group must be aware of these variations and to implications that are generated by them:

1. The application for funds will follow published state guidelines for law enforcement or criminal justice programs.

2. Programs selected for funding will usually have multi-jurisdictional or statewide public safety or criminal justice scope.[101]

2. State Grants.

State grants-in-aid have the same effect on local law enforcement as does revenue sharing. The amount of tax collection determines the amount of money available. The specific factor regarding grants and aid is that they tie the shared taxes to specific programs. Thus, in considering applications for a grant and aid, it must be determined that the state guidelines for grants and aid are consistent with the goals of the consolidated public safety dispatch region concept.[102]

3. Federal Grants.

The usual practice with federal grants is that they are directed to states rather than the political subdivisions of states. Thus, if the planning group were to pursue this source of funding as an option, the state would have to be the applicant and clearly would have a far stronger role in the implementation of the concept. Another aspect of federal grants is that they are intended for the most part to encourage the attainment of suggested national standards, rather than to equalize state fiscal capacity. Thus, the influence of the FCC may be critical to whether or not such a grant is possible to

obtain. The two state agencies most likely to have a pivotal role in the interface between the federal government and the involved political subdivisions will be the Department of Justice (DOJ) and the Office of Emergency Services (OES).

In the past, grants applicable to public safety dispatch services have been available through the United States Department of Justice, the Department of Transportation, the Department of Defense, the Department of Labor, and the Department of Health, Education, and Welfare. If the decision is made to pursue federal grants, these agencies should be contacted to determine if funding opportunities currently exist.[103]

3. PLANNING SYSTEM.

Prior to determining the system and key figures in the planning process, four questions need to be answered:

1. Has the type of plan been decided?
2. Have all planning phases been completed?
3. Have implementation plans been completed?
4. Have post-implementation evaluation plans been completed?[104]

Once these questions have been answered, the planning system can be broken down into four very broad areas:

1. Capital financing plan.
2. Project management structure.
3. Operation and maintenance cost allocations.
4. Radio frequency allocation and reconfiguration.[105]
   (Note: Refer also to the next major section.)

4. MANAGEMENT SYSTEM - PLANNING, TRANSITION, AND ON-GOING MAINTENANCE.

Once the planning system has been identified, the next step is to establish the management group that will take responsibility for the project management needs during the phases up to the point where the new consolidated centers assume sole dispatch responsibility. Since this management group is analyzed in detail further on, it will not be discussed here. However, as a guideline it will be desirable for the management group having responsibility for implementation of the centers to evolve into a management group responsible for the ongoing routine operation of the centers. This affords a smoother transition and greater degree of management efficiency than to have one management group for planning and implementation purposes, and yet another for on- going system management and post-implementation evaluation.

5. IMPLEMENTATION PHASES.

The scenario presents a hypothetical date of 1998, and states that the consolidated Public Safety Regional Dispatch Centers had been in operation for just over a year. Continuing this hypothesis, the implementation phases can be divided into five phases, starting immediately and concluding with system operation in 1997. The five phases would be as follows:

Phase 1. Attainment of the necessary political support and funding to initiate the project. Time to completion is projected to be two years.

Phase 2. Establishing the project. Time to completion is projected to be two years.

Phase 3. Completion of detailed system design. Time to completion projected to be two years.

Phase 4. System procurement and installation (including dispatch facilities). Time projected for completion is three years.

Phase 5. System check out and acceptance. Time projected to be one year.

This would then be a total of ten years at which time the system would be operational, will have been checked out and accepted by the various dispatch regions.

6. JOINT POWERS AGREEMENT (JPA).

This will be the political and legal basis for the formation of the management groups that will assume responsibility for the creation and ongoing operation of the centers. As stated in #4 above, it is desirable for the purposes of consistency and continuity that this group evolve from the implementation management group.

It will be an initial responsibility of these groups to hammer out cost and billing arrangements with the various subdivisions being served by each center.

7. BUILDING SITES, DESIGN, AND CONSTRUCTION.

For the 29 counties involved, there will be a total of nine discrete sites destined to be dispatch points. For each site, a suitable building must either be located or constructed. While there is some possibility of being able to use suitably converted existing facilities, the greater probability is that a new facility will need to be constructed at each dispatch point which will be specifically designed and engineered to be suitable for the characteristics of the dispatch system for that region.

8. EQUIPMENT VENDORS AND SPECIFICATIONS.

Concurrent with facility construction or conversion will be selection of the various equipment contractors. Critical to this phase is the determination of the criterion for acceptance. For example, should a certain amount of hardware be specified at a certain cost with the expectation (and hope) that this will satisfy all projected operational requirements? Or, should the criterion be a specified level of performance, at the low bid price which would be the responsibility of the selected vendor to insure?

The performance criterion would appear to have the greater probability of conforming to the specifications set forth in the project, but may generate a higher cost since the vendor will not have satisfied the contract until the level of performance specified has been obtained. An example of this criterion is that utilized by the Los Angeles County Sheriff's Office in its projected reconfiguration from VHF-low band to UHF. The Los Angeles County Sheriff's Department has specified a performance criterion which will allow the following:

1. For a deputy wearing a portable radio on the hip, in urban areas there will be a 98% reliability of transmission ability.

2. For a deputy wearing a portable radio on the hip, in rural areas there will be a 95% reliability of transmission ability.[106]

The contracted vendor will bear the responsibility to attain this level of performance in order to satisfy the contract.

9. TRAINING.

All dispatchers to be employed in the new centers will undergo the POST-mandated dispatch training. They will next undergo an in-house training program to familiarize them with the specific dispatch procedures for each individual center, and how to operate the equipment.

At the same time, but on a far less intensive level, the various categories of field personnel will be trained to use the new equipment installed in field units as well as the revised dispatching procedures.

In order to insure a smooth and effective transition, this training will need to be completed prior to the new centers going on-line.

10. BACK-UP CAPABILITY.

The possibility of partial or complete system failure must be anticipated. Besides the obvious contingency plans to maintain center operation (such as emergency generators), there must still be an operative back-up plan available in the event of a cataclysmic

event which partially or completely disables a center. Two alternative solutions can be put forth for future evaluation:

1. An automatic switch-over of all systems to an alternate regional center.

2. Retention and maintenance of the prior systems infrastructures with the ability to activate individual systems if and when the need arises.

PLANNING SYSTEM.

TURBULENCE/PREDICTABILITY ANALYSIS.

Following the guidelines set forth in Craig Galbraith's "Institutionalizing Strategic Excellence," seven relevant dimensions were identified and then assigned a point value on a scale of one to five under the criteria of turbulence and predictability (See Appendix G-3). The turbulence scale ranges from a point value indicating no changes (1) to a point value indicating continuous change (5). The predictability scale ranges from a point value indicating recurrence (1) to a point value indicating unpredictable surprises (5).[107] With these parameters in mind, the following dimensions and the rationale for the determination of their point values are listed below:

1. Costs.

The costs are projected to escalate initially, and then as the system is in service and is reducing ongoing costs, to achieve a crossover beyond which the effect will be a net savings. The probability is that rather than the crossover being a singular point in time, there will be a crossover period during which there is a zero balance as the outflow and cost savings balance one another. The net savings would then start when the cost savings are at a point where they exceed expenditures. Using either hypothesis, there are a total of three changes that will take place; costs rising, costs leveling, and costs decreasing. Based on this the dimension of cost was assigned a turbulence value of three (regular changes) and a predictability value of two (forecast by extrapolation).

2. Public acceptance.

Public acceptance is predicted to either be immediate or to be attained once the system is in operation and the public recognizes that there has been no deterioration of service (with possibly an improvement) under the new dispatch system. Thus, the maximum

number of changes would be one; if lack of public acceptance transcends to public acceptance. The dimension of public acceptance was assigned a turbulence value of two (few changes) and a predictability value of three (predictable threats and opportunities).

3. Boards of Supervisors support.

The Boards of Supervisors have been forecasted to be (assuming a worse case scenario) initially opposed to the concept of consolidation due to the initial costs and the loss of public control. It is anticipated that the Boards would change this stance once they saw the long-run fiscal advantages, the greater efficiency and service, and the immateriality of the issue of local control. The dimension of Board of Supervisors support was assigned a turbulence value of two (few changes) and a predictability value of two (forecast by extrapolation).

4. User acceptance.

This dimension describes all the professional users of the Public Safety Regional Dispatch Centers. Thus, it includes Sheriff's departments, police departments, fire departments, ambulance districts, and dispatchers. It does not include in this context the public, as that issue is addressed in #2. It is projected that the initial stance of potential users may range from acceptance through neutrality to opposition. It is further projected that after a period of orientation and familiarization with the new system that there will be unanimity of user acceptance. Thus, the dimension of user acceptance is assigned a turbulence value of two (few changes) and a predictability value of two (forecast by extrapolation).

5. News Media.

Depending on their degree of futures orientation, the news media may initially be in favor of, neutral towards, or opposed to the regional consolidated concept. It is predicted that if the news media are initially opposed to this concept, they will change to a position of support once they have become aware of the benefits from the implementation. Due to the variations of editorial opinion amongst the individual media, this is the least certain prediction in all seven dimensions. Thus, the media is assigned a turbulence value of two (few changes) and a predictability value of four (partially predictable).

6. Technical advances.

Advances in technology are moving at an extremely rapid rate, but are fairly readily predictable, especially with regard to areas relevant to the implementation of this project. Thus, the dimension of technological advances is assigned a turbulence value of four (many changes) and a predictability value of one (recurring).

7. Dispatch procedures.

This dimension describes the process of dispatching and related functions to be performed in the consolidated centers. It is forecasted that the transition to the regionalized centers, the acquisition of current state-of-the-art equipment, the requirement of training of all dispatchers, and the necessity to standardize dispatch procedures amongst several departments will generate a large number of changes. Thus, the dimension of dispatch procedures is assigned a turbulence value of four (many changes) and a predictability value of two (forecast by extrapolation).

These dimensions were then plotted on the dimensions of environment graph.[108] This resulted in three of the dimensions (public acceptance, Board support, and user acceptance) being plotted in the operational and strategic planning quadrant, three dimensions (costs, technological advances and dispatch procedures) being plotted in the periodic planning quadrant, and one dimension (news media) being plotted in the issue planning quadrant. None of the dimensions were plotted in the signal surprise planning quadrant. Thus, the planning system utilized will be a synthesis of the elements of the operational and strategic planning mode and the periodic planning mode.

IMPLEMENTATION PLAN

NEGOTIABLE ISSUES

The following nine areas are seen as issues subject to negotiation.

1. The project itself.

A decision of fundamental importance is that of whether or not to proceed with such a consolidation project. This scenario, along with the other two presented, does not represent a forecast of an inevitable state. Rather, it is one of three futures scenarios intended to offset or mitigate certain inevitable future consequences by effectively planning for this range of futures. Thus, the consequences of maintaining the status quo must be analyzed, as it is the strength of these consequences, pro or con, that will affect the negotiable destiny of a consolidated dispatch center concept. The benefits to be derived from maintaining the status quo are as follows:

1. There will be no discomfort from change.
2. There will be no local perception of a loss of control.
3. There will be no job displacement for existent communication center personnel.
4. There will be no fiscal outlay.

The negative aspects of maintaining the status quo are as follows:

1. Long term costs for individual communication centers will continue to rise based on projected population and work load increases, and the consequent increase of personnel necessary to cope with this work load.
2. Questionable feasibility and fiscal ability to acquire computer aided dispatch systems and other state-of-the-art advantages.
3. A questionable ability to maintain the same quality of service given existent and future anticipated fiscal restraints.
4. No foreseeable increase in efficiency of frequency utilization.
5. No greater purchasing influence when dealing with vendors due to the lack of economies of scales.
6. The question is left open as to what,if any, futures planning is to take place.

2. Not all specified counties participating in consolidation.

Although the original premise set forth is that 29 counties have agreed to embark on a regional consolidation system of dispatch centers, in fact is is a negotiable issue as to whether each of the counties specified chooses to participate. Obviously, the individual decision by the various counties as to whether or not to participate has the potential to alter regional reconfiguration. The pro and con dichotomy set forth in #1 above would apply in this situation. However, there are also other considerations when dealing with the question of whether or not individual counties in a projected consolidated region decide to participate. Using Region 9 (Inyo and Mono Counties) an interesting hypothetical example can be constructed. If Mono County were to decline to be part of Region 9, that would then leave the question of what Inyo County would be best advised to do. With the loss of Mono County from a projected region, the next closest county to Inyo is Tuolumne County, some 48 miles distant. However, this distance is based on a straight line projection corner to corner. By way of vehicle travel it would be considerably longer, and the counties are not contiguous. A further complicating factor is that most of Mariposa County is on the west side of the crest to the Sierra Nevada Range, while Inyo County lies predominantly on the east side. During the winter this barrier is impassable. Inyo County, if it still desired to consolidate, could do so with either Kern or San Bernardino Counties, as it is contiguous to both, although more so to San Bernardino. However, this still raises the question as to commonality of interests. If Inyo County were to do this, and Mono County subsequently were to decide that it does desire to consolidate, that would then raise these same issues for that county. It would be of questionable feasibility to consolidate with a region utilizing Inyo County and Kern or San Bernardino Counties or both. Mono County would simply be too far away from the two most populated areas to have any commonality of interest.(Although technically the consolidation

would be possible). In addition, the topography and life style in Mono County differs greatly than that of Kern County. Mono County could of course attempt to consolidate with one of the counties contiguous to it already involved in consolidation (Alpine and Tuolumne Counties) but would then have to confront the barrier of the crest of the Sierra Nevada. Thus, from the standpoint of rational planning it is desirable for the counties initially conceptualized as consolidating into regions to do so on that basis to prevent an occurrence such as the example listed above. One of the issues raised in the above example is the question of what to do if a county desires to participate in a consolidated region after the region has been formed.

To the extent that counties eligible for and projected to participate in consolidation failed to do so, there will be fewer benefits from the economies of scale. And, along the same lines, there will be a lesser ability to coordinate frequencies, telephone lines, and data bases.

3. Other counties requesting to participate in consolidation.

The 29 counties set forth in this scenario are by no means the total number of counties that could benefit by such regional consolidation. They are presented primarily as examples of a substantial number of rural counties that would stand to benefit from such consolidation. However, the same benefits can accrued to other counties in other areas which also opt to consolidate.

The advantages to be gained are not as great in metropolitan areas as they are in rural areas, as there is the greater probability in metropolitan areas that available personnel and frequencies are already being utilized to the maximum extent, and that the communications center is more modern. However, a metropolitan area can consolidate with several small areas and each would share in the benefits of such consolidation, although obviously the greater beneficiaries would be the rural areas.

4. Participation by other public safety providers.

Considering other public safety providers (police departments, fire departments, ambulance and paramedic services) there are three paths open to them:

1. All or some of them may join at the outset of the consolidation plan.
2. All or some of them that have not already joined may elect to do so after the consolidation center is in operation.
3. All or some of them may not elect to join at any time.

Looking at this issue from the pro-con standpoint one finds the following arguments either way:

PRO.

1. Joining immediately will allow input from the start of the planning process.
2. The benefits of joining a consolidated center will start to accrue sooner.

And from the con side;

1. There is a lesser ability to plan a consolidated center.
2. There will be lesser benefits from the economy of scale.
3. There will be a question of a subsequent buy-in cost for agencies joining later.
4. There is a question of compatibility into a system down line.
5. Loss of jobs for dispatch personnel.

This aspect of the consolidation concept has been discussed in sufficient depth to have clearly established its delicate nature. Because of this delicate nature, there is the possibility that the potentially displaced employees can become "snail darters." However, the loss of jobs is not an absolute. To begin with, there is a time period of nearly ten years before any of the centers would be on-line. Over this decade, there will be a very substantial attrition of existent dispatch personnel. In addition, because of the long lead time there is more than sufficient opportunity for each entity involved to retrain the potentially affected employees into other job categories and thus retain them. Finally, not to be overlooked is the positive aspect of the career opportunities that will come with the implementation of the new consolidated dispatch centers.

6. Performance specifications and prices.

Part of the long range cost saving goal of the consolidated center concept is the more efficient utilization of dispatch personnel. This is facilitated by the current and future state of computer aided dispatch systems. It is in the best interest of each regional center to negotiate with the various vendors and contractors to obtain the most favorable prices and performance specifications. This can most effectively be done by soliciting competitive requests for proposals (RFP) using performance as a criterion.

In addition, the pioneering effort taking place in this consolidation effort should be stressed to the interested manufacturers, contractors, and vendors, as this will be a stimulus to future sales for whomever is awarded a bid. This then should be a factor in lowering bids submitted for the purposes of this project.

7. Funding sources.

Several grant sources have previously been set forth. Each of these must be thoroughly investigated to locate and obtain the most advantageous source. In addition, because this project has the ability of a payback (if necessary) in the future, other funding

possibilities are present. Thus, if a suitably attractive grant source can not be located, the assurance of more than equal pay back in the long run future makes this type of project an attractive candidate for other creative financing.

8. User charges.

The fiscal advantages of the consolidation concept are based on lower costs; lower than if the existent discrete centers had been maintained. However, even in the face of lower maintenance costs, each user must pay its fair share. However, in the consolidated concept these shares will be far smaller. They must still be determined, and that in itself is an issue of negotiation. Some of the methods of determination that may be used for determination of user charges are as follows: Proportion of time using the system, number of calls per service, number of dispatches, population served (resident as well as non-resident), and assessed valuation.

9. User management group membership, role, responsibilities, and authority.

This is closely tied in with the previous item, as this undoubtedly will be the body of authority that determines the method of assessing user charges. Prior to that however the group itself must be constituted. Thus, the following questions must be answered:

1. Who are the user group members?
2. Who chairs the group?
3. Who selects the chairman and for how long?
4. Exactly what does the group do?
5. Who is to administer the dispatch center and what will be that persons authority?

It is critical that these issues be resolved as the user management group will perpetuate as long as does the consolidated center.

10. Technological advances.

It is anticipated that some counties will have the volume of case load such that they well require the greatest degree of technological innovation in order to benefit. Thus, it can be projected that counties and agencies in this category will opt to utilize data transmission for routine traffic rather than voice. On the other hand, it can also be anticipated that smaller, more rural areas, despite teaming up with one another on common frequencies, will not need this level of technological assistance. The centers must be designed with sufficient flexibility to accommodate the spectrum of technical levels needed to service their user agencies, for the present as well as future.

NON-NEGOTIABLE ISSUES

The following three issues are seen as non-negotiable.

1. Public service.

The mission statement for the consolidated center has already been set forth. Curiously, in my research for this project I did not come across a communication center that had a specific mission statement. That does not mean that such does not exist, it only means that it was not encountered. For the purposes of this project, the mission statement set forth previously is non-negotiable. In the context of service to the public, that means that the goal of public protection is so critical that there can be no compromise of efficiency, timeliness, or precision of handling public safety dispatch responsibilities.

It has already been clearly established that the consolidated regional center concept can yield superior public service along with reduced costs. Thus, the benefits accrue on two levels. There is no way that a satisfactory trade-off can be accomplished wherein a certain level of public services is sacrificed for a certain incremental decrease of costs. It would be of questionable ethics at best to advocate some decrease of an emergency public service protection in the interests of reducing costs. Despite my ethical reservations to such a compromise, it is commonly seen in the political arena.

2. Officer-first responder safety.

One of the responsibilities of a dispatch center is to maintain awareness of the status of the various law enforcement and emergency responder units.

One of the benefits to be derived through consolidation, as well as the acquisition of computer aided dispatch systems, is the ability to combine different units on the same frequencies, as well as for a single dispatcher to handle larger numbers of units. However, this cannot be extended to the point where the ability to monitor unit status is in any way compromised. As an analogy, it would be extremely poor public policy to allow the monitoring capabilities of law enforcement dispatchers to deteriorate to the current well-publicized capability (or lack) of air traffic controllers. This is universally recognized as being a product of excessive numbers of aircraft relative to the available number of controllers. A parallel situation cannot be allowed to exist in public safety wherein there is an excessive number of public safety emergency response units (of any type) relative to the available number of dispatchers (even with computer assist).

3. Control by a particular county, or from outside the public safety dispatch region.

One of the points established in the scenario process, was that the site location of the dispatch center in a particular region would confer no particular jurisdiction upon that city and/or county.

This non-jurisdictional aspect must be maintained in order to ensure the autonomy of the regional dispatch center. The structure of the user management group must be such as to ensure this autonomy.

In addition, the public safety dispatch region itself must remain autonomous. This relates to the issue of funding, and the vigilance that must be exercised in reviewing available sources of funding to make certain that the acceptance of fiscal support does not carry with it the relinquishment of regional autonomy or any aspect of control of the dispatch center.

NEGOTIABLE AND NON-NEGOTIABLE ISSUES FOR EACH STAKEHOLDER GROUP

For the purposes of this exercise it has been the premise that the Sheriff's of the affected counties (and thus their administrations) are in favor of the consolidated regional communications center concept, and it was through there efforts individually and as a group that the decision was made to attempt to bring such a concept to a reality. Thus, the Sheriff's and their administrations will be one side of the negotiation process on the various relevant issues. The other stakeholders will be the objects of negotiations on the various issues. As the support of these other stakeholders is achieved, they will then occupy the same negotiation position as the Sheriff's Office Administrations. Thus, there will be a transition process. To illustrate by example; assuming at some point the County Boards of Supervisors has negotiated the issues of concern to them to a point of satisfaction and have become supportive of the consolidated regional communications center concept, they will be in a position to negotiate from that perspective with their counterparts on the municipal and special district level, such as city councils, governing boards, etc.

The following section sets forth the various stakeholders and lists the negotiable and non-negotiable issues from the standpoint each of these stakeholders:

1. Sheriff's Office Administrations.

Negotiable issues.

1. Loss of flexibility and control.
2. Geographic distance of communication center.
3. Technical and procedural dispatch changes.

Non-negotiable issues.

1. Quality of service to the public.
2. Officer safety.

2. The public at large.

Negotiable issues.

1. The amount of cost savings as long as it is positive.
2. Local control of dispatch.

Non-negotiable issues.

1. Quality of service as a trade off for a Public Safety Regional Dispatch Center. (This quality issue is a reference to the commitment made in the mission statement previously set forth).

3. County Administrative Officers.

Negotiable issues.

1. Local control.
2. Costs; up and/or down.
3. Overall efficiency.
4. Public safety.
5. Officer safety.

(It must be strongly emphasized that any compromises in these last two areas would be covert, and would never be acknowledged directly but rather couched in terms of affordability and other demands on public sector budgets).

Non-negotiable issues.

1. Cost savings. Although the amount of savings and the point at which fiscal outgo converts to income may be negotiable, the net result must be a cost saving.

4. Boards of Supervisors.

Negotiable issues.

1. Local control.
2. Costs, up and/or down.
3. Overall efficiency.
4. Public safety.
5. Officer safety.

(The same conditions regarding public safety and officer safety apply to Boards of Supervisors as were listed for County Administrative Officers).

Non-negotiable issues.

1. Cost savings. (With the same condition as set forth for County Administrative Officers above).

5. City Councils, Governing Boards, etc.

Negotiable issues.

1. Local Control.
2. Costs up and/or down.
3. Overall efficiency.
4. Possibly public safety.
5. Possibly officer safety. (To some extent the conditions set forth for County Administrative Officers and Boards of Supervisors can be said to apply, however the smaller and thus more accessible and community-oriented nature of these types of entities limits the area of such compromise).

Non-negotiable issues.

1. Cost savings. (Again with the condition set forth for County Administrative Officers and Boards of Supervisors).

6. Police department, Fire department, ambulance and paramedic administrations.

Negotiable issues.

1. Loss of flexibility and control.
2. Geographic distance of the dispatch center.
3. Technical and procedural changes.

Non-negotiable issues.

1. Public safety.
2. Officer-responder safety.

7. Line personnel - all categories of agencies.

Negotiable issues.

1. Change of equipment and procedures.

Non-negotiable issues.

1. Public safety.
2. Officer-responder safety.

8. The Federal Communications Commission (FCC).

Negotiable issues.

1. Frequency allocation.
2. Return and/or reassignment of any surplus frequencies through consolidation.

Non-negotiable issues.

1. In all probability, the acquisition of additional spectrum

area.

2. Decision time frames. (Bearing in mind that we are dealing with a large, amorphous federal bureaucracy).

9. The Associated Public Communications Officers (APCO).

Negotiable issues.

1. Frequency recommendations.
2. Technical recommendations and assistance.

Non-negotiable issues: None.

10. Equipment manufacturers, contractors, and vendors.

Negotiable issues.

1. Specifications, prices, performance, and features.
2. Publicity to emphasize the pioneering role of the selected contractors.
3. Time frames to completion.

Non-negotiable issues: None.

11. Telephone companies.

Negotiable issues.

1. Whether or not can be done.
2. Whether or not willing to do.
3. Time frame to completion.
4. Costs.

Non-negotiable issues: None.

12. Dispatch Center employees.

Negotiable issues.

1. Job displacement.
2. Career opportunities.
3. The need to relocate.

Non-negotiable issues.

1. POST training.
2. Orientation and mastery of new equipment and procedures.

13. News Media.

Negotiable issues.

1. Position of individual new sources for or against consolidated dispatch center concept.

2. Individual new source perception of overall good for the community.

Non-negotiable issues.

1. Media effect on governmental entities and the public.
2. Autonomy.

14. Allied agencies.

Negotiable issues.

1. Change of dispatch center location and procedures.

Non-negotiable issues.

1. Service to the public.
2. Officer-responder safety.

STAKEHOLDER NEGOTIATIONS

The following negotiations tactics were taken from the book "The Art of Negotiating" by Gerard I. Nierenberg.[109] Nierenberg is inconsistent in the premise that he sets forth for the book, and some of the examples and tactics that he utilizes. He contends that negotiations should be a win-win situation for all parties involved. However, in reading some of the examples he lists in the book, it is difficult for the reader to be convinced that indeed both sides did win. The contradiction with this win-win premise is understandable on two bases:

1. Many of the participants with whom Nierenberg negotiates will not have further contact or involvement with him after the conclusion of the negotiations. With little or no probability for a rematch, there need not be any concern for the consequences of negotiations on one issue influencing subsequent negotiations on other issues.

2. Nierenberg's orientation, despite his disclaimers, is towards an adverserial environment. This is understandable since he is an attorney by profession, and no civilized forum is more adverserial than a court of law.

The stakeholders involved in this exercise deal with various of their counterparts on an almost daily basis. That is contrary to the environment Nierenberg finds himself in with his past experiences which form the basis of his recommendations. If one does not recognize and accept the realities and subtleties of such an environment, one will be doomed to an eventual defeat in any ongoing negotiating effort.

For the sake of simplicity, it is assumed that the negotiating stakeholder in favor of implementation of the Consolidated Dispatch Center concept is the Sheriffs and their administrations. As they progress in the negotiation process, various other of the involved stakeholders will be co-opted to their position. This discussion will address stakeholder #1 (the Sheriff's and their administrations) and the negotiating tactics and strategies to be used with each of the other stakeholders for the purpose of co-opting their support. As each specific negotiation tactic is mentioned, it will be paraphrase defined so as to give the reader an understanding of how the tactic works.

1. Sheriff's Office Administrations.

    1. Forbearance. This is the technique of waiting rather than rashly responding. It is useful in situations where an immediate response would be emotionally based and would only serve to entrench the polarization.[110]
    2. Participation. This is the strategy of enlistment of other parties in ones' behalf. This will be one of main negotiating tactics of the sheriff's departments that will continue to increase in influence and utility as other stakeholders are co-opted.[111]
    3. Agency. In this context, this negotiating tactic is the use of another stakeholder to conduct the negotiating process. Obviously, it grows on the technique of participation.[112]
    4. Salami. This technique involves the taking of something bit by bit, until eventually the stakeholder has all that which he desires to attain.[113] An example where this technique will be useful is in convincing other public safety agencies to decide to participate in the consolidation concept.
    5. Crossroads. This is the technique of introducing several subjects into a particular discussion in order to make concessions on some in order to gain concessions on others.[114] This is a useful tactic in dealing with County Administrative Officers.
    6. Blanket. This is a "shotgun" approach intended to cover as large a field as possible.[115] This is a useful technique for negotiating with the total of the public safety agencies potentially willing and able to consolidate with a regional center with the intent being to co-opt as many individually as possible.
    7. Association.[116] This is the technique of using a testimonial from a stakeholder already utilizing the Consolidated Regional Dispatch Center.

The seven negotiating strategies listed above are all positively oriented. There are other strategies which are more negatively oriented, which may be anticipated to be used by other stakeholders. However, as the central issue is yea-nay as to implementation of a Consolidated Public Safety Regional Dispatch Center in each of the

nine regions, I would submit that the positive approach is that which is most likely to achieve positive results.

The following is an analysis of each of the individual stakeholders, excepting Sheriff's Administrations, with negotiating strategies from two different orientations:

1. From the orientation of the stakeholder opposed to the implementation or participation in the consolidated dispatch center concept.
2. The negotiating strategies to be used by the stakeholders favoring the implementation and participation in such a concept to offset the opposing strategies.

The public.

The public occupies a somewhat unique position amongst the stakeholders in that it is not organized as an entity, and basically it is dependent upon the ebb and flow of opinion within the constituency as to its position on any particular issue. The public may be anticipated to use the following negotiating strategies:

1. Forbearance.
2. Agency.[117] This would be in the form of various representative groups (such as tax payer associations) proporting to speak for the public.

The negotiating strategies that should be used by the stakeholders attempting to co-opt the public to support of the concept should be as follows:

1. Participation.
2. Agency.
3. Salami.
4. Association.[118]

County Administrative Officers may be anticipated to employ the following four negotiating tactics.

1. Agency.[119] In this instance using a minor functionary as a negotiating intermediary who has no substitive decision making ability.
2. Forbearance.[120]
3. Fiat accompli.[121] This is the tactic of acting, achieving the goal (in this instance at this point denial of the concept) and then seeing what the other side will do about it.[122] This is a risky strategy, and could prove embarrassing and a defeat for County Administrative Officers if other stakeholders decide to support the concept.
4. Bland withdrawal.[123] This is the "Who, me?" reaction of a person caught in an embarrassing situation.[124] This will be the negotiating strategy used by the County

Administrative Officers in the event of an attempted fiat accompli is unsuccessful.

The stakeholders supporting the implementation of the concept can be anticipated to employ the following negotiating strategies to offset the ones listed above.

1. Participation.
2. Salami.
3. Crossroads.
4. Agency.[125]

Boards of Supervisors.

Boards of Supervisors will utilize similar, but not identical negotiating strategies to County Administrative Officers. The strategies may be anticipated to employ are as follows:

1. Agency. In this instance the use of the County Administrative Officer.
2. Limits. This is the tactic of setting conditions to restrict a particular agenda.[126] An application in this instance could be the condition set that all short term outgo fiscal arrangements be made prior to Board approval.
3. Forbearance.
4. Fiat Accompli.[127]

The stakeholders supporting implementation of the concept will use the following negotiating tactics:

1. Participation.
2. Association.
3. Agency.
4. Salami.
5. Crossroads.
6. Blanket.[128]

City Councils, Fire and Special District Governing Boards.

As has already been set forth, it is anticipated that a number of these political subdivisions will not manifest the intent to participate in the consolidation project early on. The negotiating strategies likely to be used by these entities is a follows:

1. Forbearance.
2. Agency.[129]

The stakeholder advocating implementation project will use the following negotiating strategies:

1. Participation.
2. Association.
3. Agency.

4. Salami.
5. Blanket.[130]

6. Police and Fire Department Administrations(until such time as they are co-opted in support of the consolidation project).

These public safety agencies may be anticipated to utilize the following negotiating strategies:

1. Forbearance.
2. Limits. (Possibly for the purpose of limiting entry costs and/or paybacks.
3. Disassociation[131] (If some departments are opposed to the participation of other departments wherein petty jealousies exist).

The stakeholders are abdicating participation in the consolidation project will use the following negotiating strategies:

1. Participation.
2. Association.
3. Agency.
4. Salami.[132]

Line personnel - all agencies.

This category includes the line (as opposed to staff or administration) personnel in public safety agencies who actually do the work to attain the department mission. The line personnel may be anticipated to utilize the following negotiating strategies:

1. Fiat accompli (In the form of a bluff).
2. Disassociation (Expressed in the terms of not wanting to emulate other departments.
3. Agency (Perhaps through the use of bargaining units).[133]

The stakeholders advocating participation in the project will use the following negotiating strategies:

1. Association.
2. Participation.
3. Agency.
4. Salami (By co-opting individuals and small groups).
5. Forbearance.[134]

The Federal Communications Commission (FCC).

The FCC, as a federal bureaucracy, may be anticipated to use the following negotiating strategies:

1. Forbearance.
2. Fiat accompli.
3. Limits.

4. Surprise. This is a sudden shift in method or approach, and can be used to throw the opponent off balance.[135]
5. Feinting. This is movement in one direction to divert attention from a specific goal.[136] Within the context of a large bureaucracy this can be a expedient tactic to use. (Picture the effect of feinting combined with forbearance).
6. Agency.
7. Crossroads.[137]

The stakeholders advocating support of a consolidation project can use the following negotiations strategies to offset:

1. Blanket.
2. Crossroads.
3. Salami.
4. Participation.
5. Agency.
6. Apparent withdrawal. (This is the technique of appearing to withdraw without doing so. It would be used specifically to contravene the opponents strategy of feinting).[138]

The Associated Public Communications Officers (APCO).

APCO is not anticipated to have much if any opposition to the efforts of the stakeholders advocating the consolidation project. If there are any grounds for negotiation, APCO will use the negotiating strategy of limits.[139]

The advocates of the consolidation project will use the negotiation strategies of agency and participation.[140]

Equipment vendors, suppliers, and contractors.

The equipment vendors, contractors, and suppliers will use the following negotiating strategies:

1. Limits (as in x numbers of dollars gets x amount of.....)
2. Association.
3. Blanket.
4. Agency.
5. Crossroads.[141]

The proponents of the consolidation projects will use the following negotiating strategies;

1. Forbearance.
2. Apparent withdrawal.
3. Limits.
4. Agency.[142]

Telephone Companies.

Telephone companies having or anticipating technological complications in responding to the consolidation projects can be anticipated to use the following negotiating strategies;

1. Fiat accompli.
2. Forbearance.
3. Limits.
4. Disassociation.
5. Crossroads.[143]

In response, the advocates of the consolidation projects will use the following negotiation tactics:

1. Limits.
2. Surprise.
3. Agency. (FCC, PUC, etc.)
4. Participation.
5. Crossroads.
6. Salami.[144]

Dispatch Center Employees.

The dispatch center employees of the present existent dispatch centers can be anticipated to use the following negotiating strategies:

1. Fiat accompli.
2. Disassociation.
3. Surprise.
4. Limits.
5. Participation.[145]

The advocates of the consolidation projects will use the following negotiation strategies in response:

1. Agency.
2. Forbearance.
3. Participation.
4. Association.
5. Salami.[146]

News Media.

The news media are difficult to predict as to position, since the individual news sources operate independently of one another. From a general perspective, the news media may be anticipated to use the following negotiating strategies in an indirect manner:

1. Disassociation.
2. Feinting.
3. Bland withdrawl.[147]

The stakeholders advocating consolidation can use the following negotiating strategies to offset:

1. Forbearance.
2. Association.
3. Participation.[148]

Allied Agencies.

The allied agencies that will deal peripherally or indirectly with the Consolidated Dispatch Center can be anticipated to use the following:

1. Forebearance.
2. Participation.
3. Disassociation.
4. Agency.[149]

The stakeholders advocating the project can use the following negotiating strategies in response;

1. Forbearance.
2. Fiat accompli (With the knowledge that this is a risky tactic).
3. Association.
4. Participation.
5. Agency.
6. Salami.
7. Blanket.[150]

CRITICAL MASS

The critical mass were derived from the relevant subsystems, which in turn were derived from the stakeholder groups. Critical mass is defined by those people-groups, who if actively support a change, insure that the change will take place.[151] Critical mass is determined by subdivision of the stakeholders through the relevant subsystems until the critical mass is finally identified, in instances where applicable.

The following will set forth the related stakeholder-relevant subsystem-critical mass relationship for each of the nine proposed Consolidated Dispatch Regions: (See also Appendix H).

REGION 1 - Shasta, Siskiyou, and Trinity Counties.

STAKEHOLDER	RELEVANT SUBSYSTEM	CRITICAL MASS
1. The public (resident and non-resident)	The resident public in Shasta, Siskiyou, and Trinity Counties	Voters.

2. Sheriff's Office Administrations	Sheriff's Office Administrations in Shasta, Siskiyou, and Trinity Counties	Sheriffs Phil Eoff, Charles Byrd, Paul Schmidt.
3. County Administrative Officers	County Administrative Officers in Shasta, Siskiyou, and Trinity Counties	Individual Co. Administrative Officers.
4. Boards of Supervisors.	Boards of Supervisors in Shasta, Siskiyou, and Trinity Counties.	3/5th vote of each board.
5. City Councils, Governing Boards, etc.	City Councils in Tulelake, Weed, Anderson, Redding, Dorris, Dunsmuir, Yreka, Fort Jones, Montague, and Mt. Shasta	3/5th vote of each council.
6. Police Department and Fire Department Administrations	Cities listed above with the exception of Montague which contracts for these services	Chiefs of Police of the above listed cities.
7. Line personnel-all agencies	Line personnel in the above listed cities and counties.	Peace Officer Associations in each city and county.
8. The FCC	Same	FCC with the assistance of APCO Area Frequency Advisory Coordinator.
9. APCO	Regional coordinator and committee	Northern Calif coordinator.
10. Vendors	Vendors returning requests for proposal	Same.
11. Telephone Companies	Telephone companies in Shasta, Siskiyou, and Trinity Counties.	AT&T, Sierra Telephone, Siskiyou Telephone & Happy Valley telephone Co.

12. Dispatch Center Employees	Employee Bargaining Association in each county	None.
13. Media	Same	Same.
14. Allied Public Safety Agencies	CHP, F&G, CDF, FBI, INS, DPR.	None.

REGION 2 - Del Norte, Humboldt, and Mendocino Counties.

STAKEHOLDER	RELEVANT SUBSYSTEM	CRITICAL MASS
1. The public (resident as well as non-resident)	Residents of Del Norte, Humboldt, and Mendocino Counties.	Voters.
2. Sheriff's Office Administrations	Sheriff's Office Administrations in Del Norte, Humboldt, and Mendocino Counties.	Sheriffs Mike Ross, David A. Renner, & Tim Shea.
3. County Administrative Officers	County Administrative Officers in Del Norte, Humboldt, and Mendocino County	Individual Co. Administrative Officers.
4. Boards of Supervisors	Boards of Supervisors in Del Norte, Humboldt, and Mendocino Counties	3/5th vote of each Board.
5. City Councils, Governing Boards, etc.	City Councils of Cresent City, Arcata, Blue Lake, Eureka, Ferndale, Fortuna, Rio Dell, Fort Bragg, Point Arena, Ukiah, and Willits.	3/5th vote of each Council.
6. Police Department and Fire Department Administrations	Above listed cities excepting Blue Lake and Point Arena which contract for services.	Chiefs of Police of the above listed cities.
7. Line personnel-all agencies	Personnel in the above listed cities and counties	Individual Peace Officers Association in each city and county.
8. The FCC	Same as for Region 1.	
9. APCO	Same as for Region 1.	

10. Vendors	Same as for Region 1.	
11. Telephone Companies	Companies in Del Norte, Humboldt, and Mendocino Counties	AT&T, West Coast Telephone Co.
12. Dispatch Center Employees.	Employee Bargaining Association in each county.	None.
13. Media.	Same as in Region 1.	
14. Allied Public Safety Agencies	Same as for Region 1.	

REGION 3 - Lassen, Modoc, Plumas, Nevada, and Sierra Counties.

STAKEHOLDER	RELEVANT SUBSYSTEM	CRITICAL MASS
1. The public (resident as well as non-resident)	Residents of the above listed counties.	Voters in the above listed counties.
2. Sheriff's Office Administrations	Sheriff's Office Administrations in Lassen, Modoc, Plumas, Nevada, and Sierra Counties.	Sheriffs Ronald D. Jarrell, William L. Heafey, Richard MacKenzie, Kenneth M. Alexander and Bruce Mix.
3. County Administrative Officers	County Administrative Officers for the above listed counties.	Individual Co. Administrative Officers.
4. Boards of Supervisors	Boards of Supervisors for the above listed counties	3/5th vote of each board.
5. City Councils, Governing Boards, etc.	The cities of Susanville, Alturas, Grass Valley, Nevada City, Portola, and Loyalton.	3/5th vote of each council.
6. Police Department and Fire Department Administrations	Police Department and Fire Department Administrations for the above listed cities with the exception of Portola and Loyalton which contract through the county for services	Chiefs of Police.

7. Line personnel- all agencies	The above listed cities.	Peace Office Associations in each city and county.
8. The FCC	Same as for Region 1.	
9. APCO	Same as for Region 1.	
10. Vendors	Same as for Region 1.	
11. Telephone Companies	Telephone companies in the above listed counties	AT&T, Ponderosa Telephone Co., Sierra Telephone Co.
12. Dispatch Center Employees	Employee Bargaining Association in each county	None.
13. Media	Same as for Region 1.	
14. Allied Agencies	Same as for Region 1.	

REGION 4 - Butte, Sutter, Tehama, and Yuba Counties.

STAKEHOLDER	RELEVANT SUBSYSTEM	CRITICAL MASS
1. The public (resident as well as non-resident)	Residents of the above counties.	Voters in the above counties.
2. Sheriff's Office Administrations	Sheriff's Office Administrations in the above counties	Sheriffs Leroy Wood, Roy Whiteaker, Michael Bianusa, and Robert Day.
3. County Administrative Officers	County Administrative Officers in the above listed counties	Individual Co. Administrative Officers.
4. Boards of Supervisors	Boards of Supervisors in the above listed county	3/5th vote of each board.
5. City Councils, Governing Boards, etc	Cities of Biggs, Chico, Gridley, Oroville, Paradise, Live Oak, Yuba City, Corning, Red Bluff, Marysville and Wheatland	3/5th vote of each City Council.
6. Police Department	Police Department and	Chiefs of

and Fire Department Administrations	Fire Department Administrations for the above cities excepting Biggs, and Live Oak which contract through the county for services	Police.
7. Line personnel- all agencies	Line personnel for the above listed cities and counties	Peace Officer Associations in above listed cities and counties.
8. The FCC	Same as for Region 1.	
9. APCO	Same as for Region 1.	
10. Vendors	Same as for Region 1.	
11. Telephone Companies	Telephone companies in the above listed counties	AT&T
12. Dispatch Center Employees	County bargaining associations in each of the above listed counties	None.
13. Media	Same as for Region 1.	
14. Allied Public Safety Agencies	Same as for Region 1.	

REGION 5 - Colusa, Glenn, and Lake Counties.

STAKEHOLDER	RELEVANT SUBSYSTEM	CRITICAL MASS
1. The public (resident as well as non-resident)	Residents of the above listed counties	Voters in the above listed counties.
2. Sheriff's Office Adminstrations	Sheriff's Office Administrations in the above listed counties	Sheriffs B.D. McWatters, Roger Lee Roberts, and Raymond Benevedes.
3. County Administrative Officers	County Administrative Officers in the above listed counties	Individual Co. Administrative Officers in each counties.
4. Boards of Supervisors	Boards of Supervisors in the above listed	3/5th vote of each Board.

	counties	
5. City Councils, Governing Boards, etc.	The cities of Colusa, Williams, Orland, Willows, Clear Lake, and Lakeport.	3/5th vote of each City Council.
6. Police Department and Fire Department Administrations	Police Department Administrations in each of the above listed cities.	Chiefs of Police.
7. Line personnel-all agencies	Line personnel in the above listed cities and counties	Peace Officer Associations in the above listed cities & counties.
8. The FCC	Same as in Region 1.	
9. APCO	Same as in Region 1.	
10. Vendors	Same as in Region 1.	
11. Telephone Companies	Telephne companies in the above listed counties	AT&T.
12. Dispatch Center Employees	County Bargaining Associations	None.
13. Media	Same as in Region 1.	
14. Allied Agencies	Same as in Region 1.	

Region 6 - Napa and Yolo Counties.

STAKEHOLDER	RELEVANT SUBSYSTEM	CRITICAL MASS
1. The public (resident as well as non-resident)	Residents of Napa and Yolo Counties	Voters in Napa and Yolo Counties.
2. Sheriff's Office Administrations	Sheriff's Office Administrations in Napa and Yolo Counties	Sheriffs Gary Simpson, and Rod Graham.
3. County Administrative Officers	County Administrative Officers in Napa and Yolo Counties	Individual Co. Administrative Officers in each county.
4. Boards of Supervisors	Boards of Supervisors in Napa and Yolo Counties	3/5th vote of each Board.
5. City Councils,	Cities of Calistoga, Napa,	3/5th vote of

Governing Boards, etc.	St. Helena, Yountville, Davis, Winters, and Woodland	each city council.
6. Police Department and Fire Department Administrations	Police Department and Fire Department Administrations of the above listed cities	Chiefs of Police.
7. Line personnel- all agencies	Line personnel for the above listed cities and counties	Peace Officer Associations in the above listed city & counties.
8. The FCC	Same as for Region 1.	
9. APCO	Same as for Region 1.	
10. Vendors	Same as for Region 1.	
11. Telephone Companies	Telephone companies in Napa and Yolo Counties	AT&T
12. Dispatch Center Employees	County Bargaining Associations	None.
13. Media	Same as for Region 1.	
14. Allied Agencies	Same as for Region 1.	

REGION 7 - Alpine, Amador, El Dorado, and Placer Counties.

STAKEHOLDER	RELEVANT SUBSYSTEM	CRITICAL MASS
1. The public (resident as well as non-resident)	Residents of the above listed counties	Voters in the above listed counties.
2. Sheriff's Office Administrations	Sheriff's Office Administrations in the above listed counties	Sheriffs Lawrence Kuhl, Robt. T. Campbell, Richard F. Pacileo, Donald J. Nunes.
3. County Administrative Officers	County Administrative Officers in the above listed counties	Individual Co. Administrative Officers in each county.
4. Boards of Supervisors	Boards of Supervisors in the above listed	3/5th vote of each county

	counties	board.
5. City Councils, Governing Boards, etc.	Amador City, Ione, Jackson, Plymouth, Sutter Creek, Placer-ville, South Lake Tahoe, Auburn, Colfax, Lincoln, Rocklin, and Roseville	3/5th vote of each Council.
6. Police Department and Fire Department Administrations	Police Department and Fire Department Admin-istrations in the above cities with the exception of Plymouth which contracts with the county.	Chiefs of Police.
7. Line personnel-all agencies	Line personnel working for the above cities and counties	Police Officer Associations for the above listed cities & counties.
8. The FCC	Same as for Region 1.	
9. APCO	Same as for Region 1.	
10. Vendors	Same as for Region 1.	
11. Telephone Companies	Telephone companies in the above listed counties	AT&T, Rose-ville Tele-phone Co., Sierra Tele-phone Co, and Volcano Tele-phone Co.
12. Dispatch Center Employees	County Bargaining Associations	None.
13. Media	Same as for Region 1.	
14. Allied Agencies	Same as for Region 1.	

REGION 8 - Calaveras, Mariposa, and Touloumne Counties.

STAKEHOLDER	RELEVANT SUBSYSTEM	CRITICAL MASS
1. The public (res-ident as well as non-resident)	Residents of the above listed counties	Voters of the above listed counties.
2. Sheriff's Office	Sheriff's Office	Sheriffs Fred

Administrations	Administrations in the above listed counties	Garrison, Roger Matlock, and Robert Coane.
3. County Administrative Officers	County Administrative Officers in the above listed counties	Individual Co. Administrative Officers in each county.
4. Boards of Supervisors	Boards of Supervisors in the above listed counties	3/5th vote of each board.
5. City Councils, Governing Boards, etc.	The cities of Angels Camp, and Sonora	3/5th vote in each council.
6. Police Department and Fire Department Administrations	Police Department and Fire Department Administrations in Angels Camp and Sonora.	Chiefs of Police.
7. Line personnel- all agencies	Line personnel in Angels Camp and Sonora	Peace Officer Associations for above cities and counties.
8. The FCC	Same as for Region 1.	
9. APCO	Same as for Region 1.	
10. Vendors	Same as for Region 1.	
11. Telephone Companies	Telephone comoanies in the above listed counties	AT&T, Mariposa County Telephone Company, Tuoloumne Telephone Co.
12. Dispatch Center Employees	County Bargaining Associations	None.
13. Media	Same as for Region 1.	
14. Allied Agencies	Same as for Region 1.	

REGION 9 - Inyo and Mono Counties.

STAKEHOLDER	RELEVANT SUBSYSTEM	CRITICAL MASS
1. The public (resident as well as non-resident)	Residents of Inyo and Mono Counties	Voters in Inyo and Mono Counties.

2. Sheriff's Office Administrations	Sheriff's Office Administrations in Inyo and Mono Counties	Sheriffs Don Dorsey and Martin Strelnick.
3. County Administrative Officers	County Administrative Officers in Inyo and Mono Counties	Individual Co. Administrative Officers.
4. Boards of Supervisors	Boards of Supervisors in Inyo and Mono Counties	3/5th vote of each board.
5. City Coucils, Governing Boards, etc.	The cities of Bishop and Mammoth Lakes	3/5th vote of each council.
6. Police Deparment and Fire Department Administrations	The cities of Bishop and Mammoth Lakes	Chiefs of Police.
7. Line personnel-all agencies	Line personnel for the cities of Bishop and Mammoth Lakes, Inyo and Mono Counties.	Peace Officer Associations for these cities and counties.
8. The FCC	Same as for Region 1.	
9. APCO	Regional coordinating committees	Frequency co-ordinators for Northern and Southern California.
10. Vendors	Same as for Region 1.	
11. Telephone Companies	Telephone companies in Inyo and Mono Counties	AT&T, Pacific Bell, General Telephone Company of California.
12. Dispatch Center Employees	County Bargaining Associations	None.
13. Media	Same as for Region 1.	
14. Allied Agencies	Same as for Region 1.	

DISCUSSION OF CRITICAL MASS

Richard Beckhard and Reuben T. Harris define critical mass "... As those individuals or groups whose active support will insure that the change will take place. Their number may be small, but it is the critical number."[52] Enlarging upon this definition, they state "Experience indicates strongly that in any complex change process, there is a critical mass of people whose commitment is necessary to provide the energy for change to occur. It is impossible to quantify the number of people or the roles necessary to make the critical difference."[53]

As already indicated, I have identified the critical mass for all of the stakeholders where such specific identification is possible. This represents an expansion of Beckhard and Harris' definition. The expanded definition that I have used is that the critical mass consists of individuals or small groups who can bring in the support of a specific stakeholder group. This was definition used during the Transition Management Seminar in the Command College. As will be set forth subsequently, it is necessary to identify the critical mass, where applicable, of the lesser prioritized stakeholders.

Using Beckhard and Harris' definition, after having identified the critical mass where possible for each relevant subsystem of each stakeholder, it is then possible to prioritize the critical masses necessary to insure the change.

For discussion as well as organizational purposes, this critical mass prioritization is a bifurcated process; the first portion being on the county level, and the second portion being on the municipal and special district level.

The Sheriff's Office administrations of the projected involved counties are assumed to start with a neutral but receptive stance. The premise of the scenario from the outset has been that they decide that the change is needed, and become the primary initiating agents of change. Thus, the critical mass is each of the individuals sheriffs of the counties involved.

The charts referred to in the following analyses may be found in the appendix - section H.

A readiness assessment chart entitled "Assessing your Organizations (key leaders) Readiness for Major Change" was used to develop a generic estimate of Sheriff's Department administrations in this dimension. Based on this chart, the Sheriff's Department Administrations in each of the 18 different dimensions were plotted at the two highest values ("great degree", and "very great degree"). The only exception to this, with a value of "some degree" was the motivational dimension of the willingness to assess own theory of organizational behavior. This was plotted lower because of my interpretation that this particular dimension addresses the issue of the potential loss of control by the displacement of communications centers. One additional comment; the skill and resource dimension

of possession of ready access to resources is plotted as a "great degree" based on the exclusion of access to budget as a resource.

A Readiness Capability Chart was also completed for each of the critical mass members. Taking the two dimensions of readiness and capability, each of the two dimensions has three possible values that can be assigned, high, medium, and low. For the Sheriff's administrations, they are rated high in readiness for change, and high in capability for change (this is assuming approval from the Boards of Supervisors).

Lastly, a "Commitment Planning" chart was completed for each of the critical mass members. This chart asks two questions;

1. What do you need from the critical mass?

2. Where does critical mass (individually) stand now regarding the change?

The answers to these questions are plotted under the heading of Type of Commitment. There are four possibilities; block change, let change happen, help change happen, make change happen. The individual Sheriffs were plotted on the assumption of the beginning point of the scenario, and thus are listed as currently being under the category of let change happen, but are needed to move to the category of make change happen.

The County Administrative Officers occupy a critical role in the commitment process as it is they who are the interface with the Boards of Supervisors, who ultimately have the authority to allow the Sheriff's to initiate the project, as well as to locate and contract for funding for the program. Thus, the support of the County Administrative Officers to the Board of Supervisors would bear great influence on their ultimate decision. It is possible to obtain Board Of Supervisor support without the support of the County Administrative Officers, or even in the face of their opposition. However, this is far more difficult to do, and should be avoided if possible. The critical mass is the individual County Administrative Officer in each of the involved counties.

The chart, "Assessing your Organizations (key leaders) Readiness for Major Change" was also filled out as a generic estimate of the readiness assessment for change of the County Administrative Officers. With one exception, the values ranged from "some degree" through "great degree" to "very great degree" (the single highest value). The single exception to these values was the motivational dimension of willingness to assess own theory of organizational behavior. This was assigned a value of "little degree." This value was assigned on the contingent possibility that some county administrative officers may be unwilling to recommend something to the Board of Supervisors, although they may acknowledge its benefits on one dimension, they oppose it based on their own theories of organizational behavior. If this contingency were to take place, it

can be rebutted.

On the Readiness-Capability Chart, the County Administrative Officers are rated at medium in readiness for change, and high for capability of change (again referring to the influence they would have with the Boards of Supervisors).

On the Commitment Planning Chart, the County Administrative Officers are plotted initially in the category of block change, with a commitment to the category of help change happen. This movement is predicated upon a change of position once the Administrative Officers become aware of the overall benefits of the program.

The Board of Supervisors of each of the involved counties is the legislative body that would authorize the sheriff in each county to participate in the consolidation program. In addition, it is the Board of Supervisors that is responsible for the allocation of funding, even if that funding is from an outside source. The Boards of Supervisors must be convinced that the overall long term benefits and cost savings of consolidation justifiably outweigh the short range costs. The critical mass is a 3/5th vote of each county Board of Supervisors.

On the Readiness-Capability Chart, the Boards of Supervisors are rated at low for readiness for change. This is based upon the assumption that they have no specific knowledge or expertise in this particular subject area. The Board of Supervisors is rated high for capability of change based on the projection that once they become aware of the benefits of the project they will support it.

On the Commitment Planning Chart, the Boards of Supervisors are plotted to need to be moved from the block change column to the make change happen column. This is the single furthest horizontal movement needed of a critical mass. The Boards of Supervisors are initially plotted in the block change column for the same reason as the County Administrative Officers. The authority of the Board to authorize participation in the consolidation program, as well as to fund it (either from within or without) is the reason that movement is needed to the make change column.

Based on the authority of the Board, and the type of commitment needed on the county level the critical mass of the Boards of Supervisors for each county is the single most important entity whose support is needed in order to initiate the consolidation project. (Assuming the support of the Sheriffs since they have initiated the project.

The voters occupy a somewhat ambivalent position as a critical mass. This is due to the probability that the project will not generate a degree of interest or controversy such as to create public input or involvement.

In the Readiness-Capability Chart the public is estimated as medium

in readiness for change, and high in capability for change. This is based on the estimate that the change would have so little actual effect on the public that they would least have a neutral readiness for it and a high capability to adjust to it (if in fact any adjustment were to be needed.) The probable non-controversial public impact of the consolidation project is further underscored in the Commitment Planning Chart. In both the dimensions of current stance of the critical mass as well as what is needed from the critical mass, the voters are plotted in the let change happen column under type of commitment for each of the two dimensions. This indicates that no horizontal movement is needed for this critical mass.

The first three critical masses analyzed, the Sheriffs, the individual County Administrative Officers, and the majority vote in each county Boards of Supervisors is sufficient to insure that the transition to the consolidated dispatch centers can take place on a county level. The next step is then to enlist other governmental units such as municipalities and special districts. As previously pointed out, these other governmental entities for the most part will have the option to participate in the project at a later time, even after the transition period. However, it is to their advantage, as well as to the advantage of each of the involved counties if the other governmental entities decide early on to participate in the project. On this level, the individual critical masses can also be prioritized.

The police department and fire department administrations have interests similar to the Sheriff's Office administrations. The critical mass for this category of stakeholder is determined to be the individual Chiefs of Police. It is felt that if the individual Police Chiefs decide to participate in the consolidation this would strongly influence the fire departments to do so as in most small areas police and fire dispatch is combined. It would not be cost effective for fire departments to maintain separate and independent dispatch facilities if the police departments have departed to join a consolidated center.

On the Readiness-Capability Chart, the Chiefs of Police are rated as medium in readiness for change, and medium in capability for change. This must be qualified. There is a strong possibility that the Chiefs of Police will be high in readiness for change if there is a delay in participating in the project to a point where the chiefs become more strongly aware of the benefits to be derived from participation. The capability for change can also be interpreted as high if the individual city councils approve participation in the consolidation projects.

In the commitment planning chart, the Chiefs of Police occupy a less critical role than do the Sheriff's. This is due to the fact that at the point where the Chiefs of Police are being analyzed as a critical mass, the project is already insured of realization on a county level. Thus, the Chiefs of Police are initially plotted

under type of commitment in the let change happen column, with movement needed to the help change happen column.

The city councils are, in their areas of jurisdiction, equivalent to the boards of supervisors. The critical mass for each city council is a 3/5ths vote.

On the Readiness-Capability Chart, the city councils are rated low for readiness for change, and high for capability of change. This is the same ratings assigned to boards of supervisors, and for the same reasons.

On the Commitment Planning Chart, under type of commitment the city councils are initially rated under the block change column. This is for the same reasons of the boards of supervisors. However, the movement needed from city councils is only to the column of let change happen. This is reflective of the fact that the change would be taking place even without the participation of the cities, and that the movement on the part of the city councils would only be to enable their specific police and fire departments to become participants.

The public can again be analyzed from the municipal and special district governing entity level, and would be in a similar position to the voters on the county level. The only possible unanticipated voting involvement on either the county or municipal-special district level could be in the extremely unlikely event that sufficient controversy is generated about the project that the voters are subjected to a referendum to approve or disapprove. Were this unlikely eventuality to take place, it most probably would be in a situation in which the Sheriff attempts to overcome the refusal of the Board of Supervisors through using his political power to muster public support for the project.

With the support of the critical mass of the Police Chief and the 3/5ths vote of the City Council of each individual municipality and/or special district, that would then insure the participation of that governmental entity in the consolidation project. The only exceptions then would be the individual municipalities and/or special districts that opt not to join at the outset.

Since each of the listed critical masses is a part of a relevant subsystem which is part (overall) of a stakeholder, the negotiating strategies previously set forth in stakeholder negotiations will be used to co-opt the needed support.

Although the above listed critical masses are those necessary to insure the change on two different governmental levels, critical masses were also determined (where applicable) for all the other stakeholders. This was as a contingency, on a lower basis of prioritization. It is not that the support of these other critical masses is needed, but it is desired to have support in order to mitigate and/or reduce potential opposition. The manager

looking to initiate transition to such a project must bear in mind two facts relating to these lower-prioritized critical masses;

1. The stakeholders (and thus the critical masses) will lobby one another.

2. There is a need to avoid the possibility of any critical mass occupying a "snail darter" role.

There are several classes of stakeholders in which it is impossible to separate and identify a critical mass. A brief explanation follows:

1. Vendors. Since the various vendors are in competition with one another, there is no one particular vendor that could be identified as a critical mass that can influence the others. Assumedly, at the procurement stages, particular contractors or vendors will be awarded a contract. Thus, this precludes application of the critical mass theory.

2. Rural telephone companies. The potential situation regarding rural telephone companies have already been set forth. Since these are independent companies not operating in concurrence with one another, a critical mass cannot be identified.

3. Dispatch Center Employees. The Dispatch Center Employees can be subdivided to a relevant subsystem, County Bargaining Associations, but beyond that it is not possible to further subdivide using the definition of a critical mass.

4. News media. The news media operate in a competitive and autonomous environment. Not only do they compete with one another for news, but they also take editorial stances independent of one another. Because of these two strong characteristics, no critical mass can be established for the news media.

5. Allied Public Safety Agencies. While the Allied Public Safety Agencies do not operate in competition with one another, in fact there is a high degree of cooperation, they are all separate and independent carrying out their own specific responsibilities towards attainment of their department missions. This then precludes the possibility of identifying a critical mass.

MANAGEMENT STRUCTURE

This section will follow the principle set forth by Beckhard and Harris wherein they state: "If the transition state is unique or different from either the pre-change or the post-change condition, a

separate structure and management congruent with the tasks and organization of resources required for this unique state are needed."[154] (See also Appendix I).

Phase I - Estimated time to completion - two years.

The initial step in phase I is a decision by the sheriffs of the involved counties to go ahead with the project, and a public announcement of this decision. The announcement should make maximum utilization of available media coverage, in order to get the most favorable possible publicity.

Since this will be the first public exposure to this concept, there must be a considerable degree of ground work laid. This will begin with an analysis of the present communication systems, their limitations, and future anticipated demands. This would then lead to a specific description of the future state, once the transition period is completed. This is an appropriate point at which to introduce the mission statement previously defined. Also included in this announcement should be the rationale for change, the parameters of the change, and the benefits to accrue as a result of the change.

The next step will be to enlist the necessary political support to insure that the project can proceed. The stakeholders, relevant subsystems, and critical masses have already been identified and prioritized. It is at this point that the negotiation strategies previously identified to be used with each of the stakeholders are to be implemented. This entire strategic process must be brought to bear at this precise point, as the requisite degree of political support must be attained in order to proceed with the consolidation project.

Various potential funding sources have already been listed and discussed as to their applicability to this type of a project. At this point specific sources must be located, the necessary grant applications completed and submitted such that there will be a stable and assured funding source, at least through the end of Phase I, at which time a Joint Powers Agreement will have established a legal entity.

The transition management group for this phase will consist of:

1. The Sheriffs of the involved counties, with one to be elected as chairman.

2. A representative from the auditor-controllers office of each of the involved counties.

3. A deputy county council from each of the involved counties.

4. Representatives from APCO and the FCC.

5. A technical representative from each of the existent county dispatch centers.

6. A representative from each additional constituent agency (i.e., police departments and/or fire departments).

The final step in this phase is the creation of a new legal entity, separate from any of the participating counties, but under their control. This legal entity will become the authority that governs the Public Safety Regional Dispatch Center. The device by which such an entity is created is a Joint Powers Agreement. The Joint Powers Agreement is necessary for two specific reasons:

1. Frequencies can only be assigned to a legal entity.

2. Federal grants can only be made to a legal entity.155

The Joint Powers Agreement will set forth in resolution form the circumstances compelling its creation by its signatories. Following that resolution, the Joint Powers Agreement will set forth these specific points agreed to by the signatories:

1. That the Public Safety Regional Dispatch Center is established pursuant to standard codified Joint Powers Agreement authorization.

2. The by-laws governing operation of the new legal entity administering the Regional Public Safety Dispatch Center.

3. The purpose of the Joint Powers Agreement (in this instance a reiteration of that which was stated in the resolution).

4. The membership criterion of the new legal entity. In this instance each public safety signatory would be a member.

5. Provisions for termination of membership in the legal entity.

6. The administration of the legal entity.

7. The powers of the Public Safety Regional Dispatch Center authority.

8. The procedures to amend the Joint Powers Agreement.

9. The duration of the Joint Powers Agreement.

10. The enforcement authority of the Joint Powers Agreement.

11. The effective date of the Joint Powers Agreement.156

At the concluding point of phase I, the political, fiscal, and legal framework for the Public Safety Regional Dispatch Center will be in

place.

For purpose of brevity, the legal entity created by the Joint Powers Agreement, the Public Safety Regional Dispatch Center, will be abbreviated as the Dispatch Authority during discussion references.

PHASE II - TIME TO COMPLETION - TWO YEARS

Phase I was the phase during which the concept of a Public Safety Regional Dispatch Center for each region received the requisite political support and funding to allow continuation to this stage. Phase II will be concerned with initiating the project. This process can be reduced to four separate functional areas:

1. Establishment of a project staff.

2. Selection and hiring of the program manager.

3. Analysis, definition, and specifications of system requirements.

4. Securing funding commitment for the rest of the project.[157]

The management team will be termed the Public Safety Communications Coordinating Committee. It will consist of the following membership:

1. The Sheriff of each involved county or his designate.

2. The Chief of Police - agency head from each municipality or special district, or his designate.

3. A legal representative.

4. A fiscal representative to function as auditor.

5. A purchasing agent representative.

(Note: The legal, fiscal, and purchasing representatives normally will be derived from existent county employees. It is not anticipated that each involved county will have to supply each of these representatives. A more effective method is for the counties to alternate among themselves such that one county may supply a deputy county council, another county would supply an auditor-controller, and a third county would supply a purchasing agent. What is critical in this instance is the expertise of each of these persons and the necessity that they maintain communications with their counterparts in the other counties. Clearly, this requires an element of trust. However, without this element of trust the entire concept is doomed to failure).

6. An engineering representative. (Also known as the consulting

engineer).

(Note: In phase I a technical representative from one of the existent dispatch centers fulfilled this responsibility. If that individual has sufficient engineering background and technical capability, then he can continue in that capacity. If such an individual is not available from within any of the involved counties, then it is strongly recommended that a consultant with the requisite credentials be hired. This is not the person destined to be the overall project manager).

7. An Associated Public Safety Communications Officers (APCO) technical adviser.

(Note: This is a short term interim assignment under an APCO program in which a technical adviser can be assigned to a project such as this for a short period of time to provide technical assistance in the overall design of the system).

This Public Safety Communications Coordinating Committee must then establish and specify the goals objectives and requirements of the project. This must be done in far greater detail than that of the previously completed conceptual perception, as it will be the charter that guides the transition management team as well as the project manager. Since the project manager has not at this point been selected and hired, this specification of project goals, objectives and requirements will be the means of communications to the project manager as to what he must accomplish. Clearly the management team must have been able to specify the objectives and goals of the project prior to hiring a manager to attain them. The following step is to select and hire the project manager. The project manager will report to the Public Safety Communications Coordinating Committee, and take direction from that group. The background and qualifications of the project manager must be such that he is capable of meeting the objectives and goals of the project. This will require abilities in diverse areas. For example, while a project manager must have a technical background and orientation, it is not mandatory that he be an engineer. However, it is critical that he have the management skills requisite to successful completion to the project. For technical consultation beyond his background, the consulting engineer on the management team will be available. One of the reasons for hiring this consultant is to have the availability of this technical resource for the project manager.

As soon as the project manager is on board he will carry out the following three activities:

1. He will review the schedules of completion of all phases of the project plan.

2. He will review and revise (if necessary) the project plan itself.

3. He will establish a fiscal and performance control program.[158]

Once the above steps have been completed, the next stage will be to establish the specifications for the Request For Proposals. This is a critical stage as this will be the written description of the Public Safety Regional Dispatch Center. This is divided into two stages; (1) procurement methods, and (2) system design.

Procurement methods.

There are four general procurement methods, as catagorized by APCO which can be used either individually or in combination in designing a request for proposal. They are as follows:

1. "System function specification method. Describes only what the system will do. It places the least constraint on hardware and costs and is seldom used alone in public safety system procurements."

2. "System performance specification method. Described parametrically how well a system shall perform specified functions. It is used where performance can be defined but technical expertise is not available to specify equipment system certain to provide the needed performance."

3. "System design specification method. Describes equipment characteristics, system configuration, equipment-system testing. A high degree of technical competence is required to successfully employ this method of procurement."

4. "Specifying equipment by model number. This procurement method describes the needed equipment by make, model number or the equivalent. It calls for intimate knowledge of the technical characteristics of available equipment and implies that these characteristics are certain to provide the needed system performance. Suppliers not named in the specifications often take exception to this procurement method."[159]

The decision as to which procurement method to use will be made by the Public Safety Communications Coordinating Committee. Since there will be nine separate Public Safety Dispatch Regions, each management team in each region can make the procurement method decision based on its analysis of its own specific circumstances and requirements. For the purposes of this discussion, it will be assumed that the procurement method will be a combination of numbers of two and three (system performance specification method and system design specification method). The advantage to using the combination of these two methods, with the emphasis on the system performance specification method, is that the bid contractor will not have satisfied the agreed upon contract (and thus be eligible for payment) until the entire system performs to the specifications. The Los Angeles County Sheriff's Department provides an example of the application of this method. The Los Angeles County Sheriff's

Department is currently in the design phase of a total reconfiguration of its communications system. The existent communications system is based on the VHF-low band spectrum. The reconfigured syste will be based upon the UHF frequency spectrum. The propagation characteristics differ greatly between VHF-low band and UHF. Due to these greatly differing propagation characteristics, as well as the greater system capabilities intended for the reconfigured system, the Los Angeles County Sheriff's Department has decided to pursue a performance specification method of procurement. For example, the communications access by a field unit is as follows:

For a deputy sheriff using a portable radio on the hip, transmission access shall be as follows:

1. 98% coverage capability in urban areas.

2. 95% coverage capability in rural areas.

It will be the responsibility of the bid contractor to satisfy these performance requirements.160

After the procurement method has been decided, the system design must be established. In designing the system, the following issues must be addressed and resolved:

1. Channels. The number of channels, the bandwidths involved, and the utilization-distribution of these channels must be specified. (Note: It is anticipated that there will be a need for fewer channels in the regional center as compared to the separate communication centers).

2. The telephone line and/or channel accessibility and loading characteristics must be determined. The intent is to allow the public maximum telephone accessibility to the center.

3. Projected queueing times. These are defined as waiting periods. The waiting period for the public until an incoming line is answered, and the waiting time from receipt of a call until a unit is dispatched.

4. Mutual aid capabilities.

5. Use of the dispatch center as an emergency command and control system.

(Note: These last two issues apply to the ability of the center to function as a command and coordination center during a cataclysmic event requiring the response of numerous public safety agencies. An earthquake would be an example of the type of event that would trigger the center to this mode of response).

6. Geographic coverage. This relates to the geographic coverage

for wide area radio and digital communications. It will not only include the coverage of the repeaters, and the reception from field units, but in addition the land line and/or microwave links between repeaters and the dispatch center.

7. System reliability and redundancy. This will address the fail safe aspect of the communication system.

8. The specification for information systems for the individual departments.

9. Personnel requirements; to include number of personnel, management structure, and training requirements (POST and In-service).

10. System and field unit technical maintenance. [61]

Once the procurement method and system design have been determined, the consulting engineer and project management team will prepare a request for proposals (RFP). He will then issue a bid package (which is the request for proposal and any additional terms and conditions) and establish a procedure for evaluation of submitted proposals.

The final stage of this phase is site selection for the dispatch center. Although the city in or near where the center is to be located has already been determined, the site selection within the city is critical. The Public Safety Communications Coordinating Committee acting as the Dispatch Authority will acquire the dispatch center site. The following factors must be considered in site selection:

1. The real estate cost. There will be options here such as purchase of the site or lease. In addition the question must be resolved at to whether a site can and should be obtained which is vacant, or whether existent buildings will have to be leveled.

2. Access for signal propagation. It is highly preferable that the site be situated such that repeaters and microwave towers are oriented towards it and will have communications access. To the extent that such orientation is impossible, there will be a requirement of landline links between the center and the affected repeaters and microwave towers.

3. Access for utilities. There must be sufficient access for both power and telephone utilities to satisfy the needs of the center.

4. Parking and physical security of the plant. The dispatch center must be located such that there will be sufficient employee access, and reasonable assurances of their safety not only at work, but to and from their vehicles. It is not

anticipated that this will be a problem area for any of the nine regions. However, it should be anticipated and addressed for other prospective regions that may encompass urban areas.

5. Building space. This is a general overall specification of the projected square footage needed in the entire dispatch center. It can only be a general estimate as the specific facility design and specifications will be part of the bid. It must however make provision for future expansion.

PHASE III - TIME TO COMPLETION - TWO YEARS

Phase III will consist of five stages, which are as follows:

1. Expand project staff as necessary.

2. Develop a detailed a radio frequency plan (including microwave frequencies) and secure the necessary state and federal approvals.

3. Select a system design contractor.

4. Finalize site selection.

5. Select facility contractor.[162]

The Public Safety Communications Coordinating Committee (also known as the transition management group) will evolve and expand by the end of this phase in response to the demands placed upon it.

For purposes of organization,due to its expansion and to reduce the complexity of communications, the transition management group can be divided at this point into sub-groups; administrative and technical. The administrative group would consist of the sheriff's, the police and fire chiefs, the legal, accounting, and purchasing representatives from each county as well as their municipal counterparts, and an administrative analyst from each county and city.

For routine, day-to-day decisions, a certain degree of delegation within this administrative sub-group is possible. It would be anticipated that each of the sheriff's departments, police departments, and fire departments would have a command level officer (rather than the agency head) assigned as liaison to the administrative management sub-group. By the same token, The presence of an administrative analyst from each county administrative office and each city managers office can obviate the ongoing presence of the legal, accounting, and purchasing representatives since the administrative analyst will be reporting to these individuals.

During phase III a system design engineering contractor will have

been selected and hired and will become the key member of the technical management sub-group. It is optional at this point once this system design engineer is hired as to whether to retain the engineering consultant utilized during phase II, although for this example he will be retained and subsequently used as an external project evaluator. In addition, a facility contractor and the architectural and engineering subcontractors for the dispatch center will have been selected. The APCO technical advisor is no longer a member of this group, as that was a short term assignment.

A detailed radio frequency plan must be developed early on to insure that the necessary approval and licensing will take place in a timely enough manner so as to preclude the necessity to have to alter the basic configuration of the communication system at a later date. For the purpose of the consolidated centers, not only must a radio frequency plan be developed but a microwave plan must also be developed for submission as this will be the method of choice where feasible for signal transmission from various repeaters to and from the dispatch center. For planning purposes this radio frequency and microwave plan can take place in three stages.

1. A review of existing frequency resources.[163]

The consolidation project will bring under the one legal entity a number of different existing frequencies, most probably on differing bandwidths. This planning step is to conduct an inventory of those frequencies that will be available through consolidation to the communication center.

2. Applicability of existing frequencies in the consolidated center.[164]

Using the data generated in the inventory of existing radio frequencies, this step expands on that by projecting the use of these frequencies for the purposes of the consolidated communication center. It is at this point that the issue of modification of existing licenses, if necessary, must be anticipated.

3. Determination of new or modified license requirements.[165]

It is anticipated that the consolidation project will necessitate certain frequency changes to allow system compatibility within a dispatch region. This determination must be made at this point in order to initiate the necessary changes.

A hypothetical example utilizing dispatch Region 9 illustrates these principles. Region 9 consists of Inyo and Mono Counties. The Inyo County Sheriff's Office is on VHF-low band frequency spectrum. The Mono County Sheriff's Office is on the VHF-high band frequency spectrum. The consolidation project would provide the opportunity to place both these Sheriff's departments into the same spectrum area, and if desired on the same frequency. Use of the same frequency would be feasible because of the relatively few numbers of

units on the air at any given time, their distance apart and consequent different repeater use. It would also expedite communications between the two departments in any sort of a mutual aid situation. Given the advantages of VHF-high band over VHF-low band, this would present an opportunity for Inyo County to change bandwidths. This would then require a modification of an existent license. This would also free the VHF-low band frequency currently utilized by Inyo County. The disposition by this frequency would also need to be determined; whether it would be turned back over to the FCC, utilized for some other function of the communications center, or perhaps (if possible) traded for an additional VHF-high band frequency. Clearly it would be advantageous for the two sheriff's departments to both be on the same frequency, both benefit from the advantages of being on VHF-High band, and have an additional VHF-high band channel available for tactical and search and rescue operations.

In brief summary there are five steps to the application process just described:

1. Determination of system requirements.

2. Filing a letter of intent with the FCC.

3. Selections of frequency.

4. Frequency coordination.

5. Submission of the application to the FCC.[166]

The selection of a system design contractor is one of the most critical steps in the implementation process, as it will be the responsibility of this contractor to shape the consolidation communications system from concept to reality. While it can be anticipated that there will be "bugs" to be worked out of the system during the initial operation phase, design defects are nearly impossible to remove once a system is finalized. To the extent that these "bugs" are or are not design defects will be based solely upon the professional competence of the system design contractor.

APCO suggests the following criteria to be used in the evaluation of system design contractor candidates:

1. The contractors managerial ability.

2. The candidates technical capability and approach in meeting the specifications.

3. The reasonableness of the cost estimate.

4. The experience and reputation of the contractor candidate.

5. The financial integrity of the contractor candidate.[167]

It has already been recommended that the procurement criteria for contractor selection will use the combination of system performance specifications and system design specifications. Using a combination of these two procurement methods, the bidder is in a position to specify what the system will do without having to specify how this system will do it. In addition, the bidder can specify certain pre-existent specifications intrinsic to the performance criterion. For example, again referring to Public Safety Region 9 (Inyo and Mono Counties), the design specification could include the fact that both Sheriff's Departments are to operate on VHF-high band frequencies.

APCO suggests the following general criteria to be used for performance specifications:

1. Minimum radio coverage over the specified geographical area of operation in terms of minimum signal level.

2. Maximum delay in answering a incoming complaint call.

3. Average delay in obtaining a clear radio channel.

4. Maximum system down time for fixed facilities in a specified period of time.

5. Maximum repair-replacement time for mobile and portable equipment.

6. Interagency communication coordination requirements.

7. Channel configuration needed, such as simplex, duplex, mobile relays, repeaters, etc.

8. Microwave subsystem interface.

9. Transmission methods such as voice, data, video and facsimile considerations.

10. Maximum delay time for field units to receive law enforcement information system data.[168]

Since the responsibility for meeting these performance criteria would rest upon the system design contractor, and the subsequent contractors, there will be some degree of loss of control to the bidder. One method by which to preclude this loss of control is to specify certain system design features. This is possible through using this combination method of procurement.

Phase II discussed the preliminary aspects of site selection. Each of the criteria under site selection in phase II must be satisfied in order for a site to remain in the candidate pool. At this point a decision must be made as to the specific site to be developed for

the communication dispatch center. Given a relative equality between differing available sites, the decision would most probably would be based on lowest available cost. For example, if a clear site is available on government owned land such that the only cost would be the construction of the facility, then clearly that is a far more advantageous option then having to purchase a site and possibly to clear the site before the facility can be constructed.

The consolidated dispatch center site acquisition phase is also the appropriate time to identify and acquire other sites that will be needed for the system. Thus, any remote base station, repeater, votive receiver, or microwave sites necessary to the system that are not currently in possession of or accessible to the member counties must be anticipated and acquired. For the most part, it can be assumed that additional remote sites that needed to be acquired are already being used by other public safety agencies. Going further on this assumption, where possible it would be cost-advantageous to "piggy back" with agencies already on site. Using this method, the incoming agency (in this case the consolidated communication center) would be allowed to utilize the existent facilities to install its own. Thus, the incoming Dispatch Authority need only to install a transmitter-receiver and antenna at an existent repeater site, using the established building and tower which by their presence would have already anticipated and addressed the issues of adequate public utilities, site security, and right-of-way easements.

The final stage of this phase is the selection of a facility contractor. In fact the facility contractor is a sub-contractor working for the system design engineering contractor. This is because the individual ultimately responsible for the performance of the system (and thus satisfaction of the contract) is the system design contractor. The ultimately accepted site design bid would be based upon the most cost- effective satisfaction of the following objectives:

1. Adequate space in the center presently as well as for anticipated growth.

2. A construction method compatible with the technical nature of the facility.

3. There must be adequate record and storage space. For example, dispatch-telephone record tapes are legally mandated to be stored a minimum of 100 days. The storage of these tapes must be anticipated and will require a considerable quantity of space.

4. Computer rooms. The anticipated CAD system orientation will require rooms specifically designed for housing computers. Again, the design must anticipate future needs for the growth of the system.

5. Employee lounge areas. An often overlooked area of dispatch

centers is the availability of a separate lounge for employee breaks. Public safety dispatching is a tedious and stressful occupation. The wise planner will not overlook the people aspects of facility design.

6. Ergonomic characteristics of the dispatch facility. This is associated with the previous item in that it relates to the creature comforts of the working dispatch personnel. It is especially important in the dispatch area to have an adequate level of sound conditioning as well as restful lighting.

7. A suitable maintenance shop must be a part of the dispatch facility. This is not only for the maintenance of the equipment within the facility itself, but also for maintenance and installation of portable and mobile equipment.[169]

Once these criteria have been evaluated, then the facility contractor can be selected.

PHASE IV - TIME TO COMPLETION - THREE YEARS

Phase IV consists of three stages, which are as follows:

1. Selection and hiring of the hardware and software contractors by the system design contractor.

2. Bringing the telephone company engineers on-board once the hardware and software contractors have been hired.

3. Selection and hiring of the communications center director.

During this phase the system procurement and installation will be completed, as will the construction of the dispatch facility and any necessary remote sites. This is the lengthiest phase of implementation due to the extensive technical tasks to be accomplished.

The Public Safety Regional Dispatch Center management staff is still divided into two management sub-groups. During this phase the administrative sub-group will consist of the Sheriff or designates of each involved county, the Chief of Police or designate of each involved city, the Fire Chief or designate of each involved city or fire protection district, and an administrative analyst from each involved county and city, and a personnel representative from each involved county. The technical management sub-group will consist of the system design contractor, the facility contractor, the architectural and engineering subcontractors, the hardware contractor, the software contractor, and the telephone company engineers. In addition, there will be an external project evaluator. This is an evolution of the role originally occupied by the consulting engineer prior to the selection and hiring of the

system design contractor. The external project evaluator serves as an interface between the two management sub-groups. He is a part of, and reports to the administrative management group, but has the technical expertise possessed by the technical management sub-group. The external project evaluator advises and assists in the monitoring and evaluating of the project.

In the first stage of this phase the system design contractor selects the hardware and software contractors. Since the primary method of procurement is based on system performance specifications, the Public Safety Regional Dispatch Center administrative management sub-group is not in direct control of this selection process. Since the system design contractor is the individual responsible for satisfaction of the contract, he bears ultimate responsibility for selection of the hardware and software contractors. The system design contractor sets hardware and software specifications and parameters based on required system performance and established system design criteria. Thus, a system design contractor is the nexus between satisfaction of performance criteria and hardware and software system design specifications.

Once the hardware and software contractors have been selected, the telephone company engineers are introduced into the process. Obviously, there must be a close working relationship between the hardware and software contractors and the telephone company engineers, under the supervision of the system design contractor. At this point the external project evaluator is monitoring progress and reporting to the administrative management sub-group.

The second stage of phase IV is the construction of the dispatch facility site, as well as any construction or modification of remote sites. This stage brings the largest number of technical experts working together at any time during the project. The architect and engineering contractors will have already prepared the drawings and specifications for the dispatch center site, as well as for any off-site facility necessary. The system design engineer, facility contractor, the hardware and software contractors, and the telephone company engineering representatives will be working together at this point to integrate the facility construction with system completion. The architectural and engineering subcontractors will monitor the work of the facility contractor. This stage requires a great degree of coordination in extremely technically complex areas.

The third and final stage of phase IV consists of selecting a communications center director, and making the change from a transition management structure to a permanent dispatch center management structure.

The administrative sub-group specifically utilizing the resources and expertise of the personnel representatives will develop a specified job description for the dispatch center director. Once the employment criteria have been established, the screening and selection process can taken place with the ultimate objective being

to hire the individual destined to be the communications center director.

Once the communication director is hired, the process of transition to the permanent management structure of the dispatch center can begin.

There are an almost infinite variety of management structures comprising the Dispatch Authority that can be designed, based upon the size of the dispatch center and the multiplicity of jurisdictions being served. The following can serve as a simplified exemplar for a planning starting point:

A Board of Directors consisting of:

The Sheriff's of each county.
The Chiefs of Police from each city.
The Fire Chiefs from each city or fire protection district.

An executive committee consisting of:

A representative of the county administrative office in each county.
A representative of the city manager in each city.

The communications center director.

In this simplified chain of command, the board of directors is the highest authority for administration of the center, with the executive committee being the next highest authority, both of which exert authority over the communication center director. It must be understood that the day to day operation of the communication center is the responsibility of the director, and he must be granted the authority to carry out that responsibility. Using this basic structure, it is possible when necessary for the Dispatch Authority to convene other categories of temporary or special use committees when necessary for specific projects or issues facing the dispatch center.

Once the communication center director is on board, he will have the responsibility of determining staffing levels of the center. Thus, he will have to familiarize himself with the dispatch work loads of all the member agencies. Once this information is acquired, then he can address the more specific issues of shift-by-shift staffing levels. As a general rule, 24 hour a day coverage of any single position will acquire five full time personnel (in actuality 4.68). However, since the dispatch center is a 24 hour a day operation, and there are well documented and relatively accurately predictable peaks and valleys of activity, the personnel requirements will be tailored to the anticipated work load on any given shift and/or days.

In addition to determining dispatch staffing levels, the extent of

middle management (if necessary) and supervision must be determined. Obviously, the length of this chain of command will be dependent upon the size and scope of operation of the dispatch center. Within the nine projected regions, there is a great variation as to population served and projected activity loads. Thus, the chain of command should be tailored to each specific center.

At the point where staffing is addressed, and it becomes necessary to gain employee commitments for upcoming dispatch openings, the existent dispatch personnel from the centers to be phased out can be polled as to whether or not they desire to transfer to the new center. Since phase IV will not have started until the beginning of the seventh year of the transition project, those employees potentially to be displaced by the movement to the consolidated centers will have greatly decreased through attrition. A basic principle of equity would dictate that dispatch center employees still remaining, who desire to transfer, and are qualified to operate the computer aided dispatch systems should be given preferential treatment for employment in the new center. To the extent that the incumbent employees can be brought over to the new center, this will preclude the necessity for getting POST mandated training for new employees, as the experienced employees will have already undergone this training. The director will then have to coordinate the POST training for those that will need it, and the inservice training on the new systems for the entire dispatch staff. This training must be completed to coincide with the system going on-line at the beginning of phase V.

The final staffing task will be to select and hire technical and maintenance personnel for the center. These personnel will not only have the responsibility for maintenance of the center, but also for the maintenance and installation of mobile and portable equipment, and remote site equipment.

PHASE V - TIME TO COMPLETION - ONE YEAR.

Phase V consists of three stages, which are as follows:

1. Installation of mobile and remote site equipment, and start of system testing.

2. Hiring and training of dispatch center staff.

3. Final Testing of system on-line and acceptance by the Dispatch Authority.

This is the briefest of the phases, and completes the entire project cycle.

The dispatch center management group would now consist of that which was established during phase IV; the board of directors, the executive committee, and the dispatch center director. During this

phase only, the management group will also consist of the system design contractor and the external project evaluator.

The first stage of phase V is the installation of the mobile and satellite equipment. The term satellite in this instance means equipment located at remote site (repeaters, mobile relays, and microwave links). Once these installations have been completed system testing can begin. At this stage there is no reliance on the system; it is still in the test phase. That means that the existent dispatch infrastructures must remain in place, as the new system will not have been accepted by the Dispatch Authority.

The second stage of phase V will take place concurrent with the beginning of testing, which will be the completion of the hiring and training of the dispatch center staff. Thus, the dispatch center staff will have an integral role in the initial test phase of the system.

Once the system has successfully acquitted itself in the initial test phases, it will be brought on line and assume the communications responsibility. It is strongly suggested at this point that the old but existent infrastructures remain in a ready back-up capacity availability.

Once the entire system is up, it can then be extensively tested for compliance with the original performance specifications. It is at this point that the wisdom of utilizing a performance specification criterion will become evident, as the responsibility for satisfaction of the performance criteria will rest entirely upon the system design contractor. If the system fails to meet any of the specified performance criteria, then the board of directors simply will not accept the system until the deficiencies have been corrected.

Once the system performance has been successfully tested for compliance with all performance specifications, then the board of directors can accept the system and release the system design contractor from the contract. The legal entity created through the Joint Powers Agreement, the Dispatch Authority now owns the Public Safety Regional Dispatch Center. The transition management process is complete.

MANAGEMENT TECHNOLOGY DURING TRANSITION

A previous section described the management structures involved from the inception of the concept by the Sheriffs of the involved counties to final acceptance of the completed consolidated dispatch center. The purpose of this section is to analyze the intervention technologies used to achieve that objective.

Beckhard and Harris describe a seven phase system of open-systems

planning. This system is as follows:

1. "Determine the "core mission" of the organization;"170

As previously noted, my research indicated that this is a step seldom taken with regard to Public Safety Dispatch Centers. However, in this instance it was determined to be a necessity so that the individuals who were destined to be long term stakeholders would understand and have a consensus on what it was that the Consolidated Dispatch Center was supposed to accomplish.

2. "Map the current demand system;" 171

This equates to identification of the current stakeholders and their assumptions. It is directly related to the next item (number 3) and the two in combination form a groundwork for item number four.

3. "Map the current response system;"172

This was the step taken by the Sheriffs in indicating the present state from which they intended to progress.

4. "Project the probable demand system, given no change in organizational impact;"173

This was the stage in which population and demand growth by percentage was forecasted for each of the potentially involved counties to illustrate the future demands on the Public Safety Dispatch Systems.

5. "Identify the desired state;"174

This was discussed in brief form at several points, but its' most complete statement it is the scenario that was initially constructed which subsequently has been the basis for the development of the remainder of this project.

6. "List activities necessary to achieve the desired state;"175

A preface to this phase was the analysis of the stakeholders and their assumptions along with negotiations strategies to co-opt the needed degree of support. The specific activities necessary, once the requisite support was present, are those set forth in the section on management structure.

7. "Define cost effective options."176

This phase has been analyzed at several different points. Two immediately obvious examples are the savings to be generated by the necessity for lower personnel levels in one consolidated center, and the equality of dispatch work load created by the use of the computer aided dispatch system.

At the outset of the project, the Sheriffs were the initial project managers until the necessary political and fiscal support had been secured, allowing the system design contractor to be hired.

Once the project had been approved to progress, the horizontal management system underwent a significant increase in width based on the following criteria:

1. Membership of representatives of major systems.
2. Membership of representatives of major subsystems.
3. Membership of representatives based on differing constituencies.

In addition to these criteria, it can also be seen that membership was based on diagonal slicing, as the specific individuals from different systems, subsystems, and constituencies occupied differing positions within their respective hierarchies. However, for the purposes of the transition management phase, these were the appropriate persons to be assigned to the transition management team.

As the transition management team was assembled, and the tasks identified which would lead to attainment of the project goals, it became necessary to allocate work responsibilities. In order to graphically illustrate this in a simple and easily understood fashion, a responsibility chart was constructed. This chart was developed consistent with the recommendations of Beckhard and Harris, with the relevant actors being listed on the horizontal axis and the critical decisions listed on the vertical axis. This then allows each particular actor to be identified (if applicable) with the assigned behavior with each decision.[177] The four classes of behavior are:

1. "Responsibilities. The responsibility to initiate action to insure that the decision is carried out.

2. Approval required, or the right to veto. The particular item must be reviewed by the particular role occupant, and this person has the option of either vetoing or approving it.

3. Support. Providing logistical support and resources for the particular item.

4. Inform. Must be informed and, by inference, cannot influence."[178]

Since this chart is quite extensive, it can be found in its entirety in the Appendix ppI-1 and 2. However, for illustrative purposes several areas of role evolution can be briefly discussed.

The Boards of Supervisors of the involved counties start with the responsibility to be informed as the project is initiated by the Sheriffs. Their support is necessary to authorize and initially

fund the project, which means they have the assigned behavior of approval. Once the project is under way, their role becomes that of being informed of the progress of the project. The reason for this evolution towards less influential behavior is because they have delegated responsibility, and the commensurate authority, and then have been removed from it through the Joint Powers Agreement creating the Dispatch Authority.

A second example of role evolution is that of the system design contractor. At the outset, this individual has not even been selected and hired. However, once he is on board, he undertakes the responsibility for ultimate satisfaction of the performance specification criteria agreed to in the contract. For this reason he exerts a great deal of control in numerous specific areas of construction and development of the center and the system. At the decision point of system acceptance, the system design contractor is not at all involved, as he has no part in making the decision as to whether or not to accept the system. His responsibility has been to insure that the system will be acceptable at this stage.

A third example, on a more minor note, is that of the consulting engineer. This individual is brought on board early in the project development process to supply a source of technical expertise. As previously discussed it is optional as to whether or not to retain this individual once the system design contractor has been hired. In this example, this individual has been retained and his role evolves to being the external project evaluator. In this capacity, he bears the technical expertise of the system design engineer, but reports to the administrative management subgroup functioning as an observer and monitor of the development and construction of the system and facility.

The last example is that of the role of the communications center director. The communications center director is not selected and hired until the project development is in an advanced stage. Thus, for many of the earlier decisions he has no standing as he does not exist as a part of the transition management team. However, once this person has been selected and hired, he immediately assumes a highly influential role as it will be his responsibility to staff and operate the communications center.

Beckhard and Harris also discuss and illustrate a number of different applicable management mechanisms for maintaining and updating change. During the long term development of the project, a number of these mechanisms will be used by the transition management team. Some brief examples:

1. Periodic team meetings.[179]

As stated these are meetings that are scheduled periodically so that each member can anticipate when the group will convene, and what the agenda will be. The basic purpose of these types of meetings is to assess progress thus far, and to anticipate and plan for the

following stages. In addition, it would be during these meetings that the stages are broken down as subdivisions of each transition management phase.

2. Organization sensing meetings.[100]

These are meetings to involve the top personnel within the management structure. For example, if each sheriff has designated a command level individual to represent him during the transition management phases, the organization sensing meetings would provide the forum for the sheriff's themselves to assemble, and to be briefed by the rest of the transition management group as to progress of the project.

3. Periodic intergroup meetings.[101]

These types of meetings are useful for integrating the two management subgroups; administrative management and technical management. The interface between the two subgroups of course is the consulting engineer-external project evaluator. However, during such intergroup meetings the specific technical personnel involved in the project at any given phase should meet face to face with the administrative management group counterparts.

4. Goal directed performance review.[102]

These are meetings specifically intended for the administrative group management to review the accomplishments to date, to determine progress towards completion of the center and the system. Compared to periodic team meetings, although they may be combined, the intent here is to utilize the "big-picture" view to gain an overview of progress thus far rather than looking at more detailed aspects with the intent of planning the next short-term detailed aspect.

5. Outside consultant visits.[103]

These types of meetings are coordinated by the external project evaluator. During various stages of the project, there will be visits from the APCO representative, representatives of the FCC, representatives from the various subcontractors, the California Office of Emergency Services, the California Department of Justice, other dispatch regions engaged in the same project for comparison purposes, other potentially interested dispatch regions (both in and out of California), interested politicians, and the media.

It would be shortsighted to arbitrarily exclude individuals who do not have a contribution of administrative or technical expertise. The goodwill engendered by receptiveness to political and journalistic representatives can be of immense long term benefit to the Public Safety Dispatch Region.

Early on, Beckhard and Harris make the statement: "In essence, the focus of planned-change technologies has shifted from an orientation

of primarily human-resource development to one of more comprehensive system development."[184] In review of the entirety of this project through the transition management plan and the technologies to implement the plan, that prophecy is underscored. The goal of any such project, best expressed in the Mission Statement, must not become obscured in the process of transition. This ultimate goal, which justifies the endeavor, is to better serve humanity, regardless of whatever degree of sophistication may be directed towards its attainment.

CONCLUSION

This project started with the question "What will be the State of California Sheriff Department Communications Systems in the late 1990's?" The obvious implication is that this also speaks to the twenty first century. The use of the term year 2000 has become such a cliche that I chose to avoid it for that reason.

The answer is not singular; numerous alternatives are possible. I have constructed three, all of which represent solutions to present and future problems. One alternative I chose not to present was that of the doomsday scenario. One of the sources I interviewed, who brainstormed events and trends as well as participating in the Delphi technique had said: "If we don't make some changes soon, we will all strangle on our own communications traffic." A worthwhile observation, but I do not think it will come pass. It is simply inconsistent with the human spirit, at least with mine, so I elected to develop three positive scenarios that not only cure known or forecasted problems but in of themselves improve the state of the art.

Of the three scenarios I developed I had a specific intent for the one which I selected to carry through the entirety of the developmental process which forms the remainder (and bulk) of the paper. My first two scenarios dealt predominantly with technological changes or improvements which, if implemented, would certainly improve the state of the art. The third scenario was selected for further project development not on the basis of greater likelihood or technological feasibility, but because it combines, more that the first two, human as well as technological aspects. For example, it confronts the issue of "turf" and loss of political control. In this respect it reflects reality. It also illustrates how technology can perform tasks we may be used to having the human brain perform, i.e. selection of which units where to dispatch on what type of call regardless of jurisdiction or distance. As a consequence it also illustrates how people must change to accommodate technological advances, i.e. all dispatchers of the future must learn to function with computers. But, perhaps most important, it illustrates the synergistic benefits to accrue through this human-technical teamwork. These benefits will be in human terms; faster and more thorough public safety dispatching, greater safety for officers and first responders, a better-served and safer community. If we don't achieve this, the high tech bells and whistles are meaningless.

The overall goal of the implementation plan I set forth is that the combination of technological advances combined with improved and forward thinking administrative processes and management techniques will achieve the benefits I listed above, and do so at lower cost.

As law enforcement managers we cannot be content to react to changes in our environment. We must, to the maximum of our individual and collective ability, control our present and future environments so that we may chart the destiny of our profession, not the other way around. This will never be easy, but it can be done through the combination of intelligent and motivated human beings properly utilizing technological advances to achieve goals. Without this combination of both critical elements, we may indeed strangle on our own communications traffic. As I have already stated however, that is incompatible with the human spirit. The underlying and unstated (until this point) strength, will and tenacity of that spirit has been the fundamental premise of this endeavor.

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APPENDIX A

Introduction

The body of this paper has been written with the intent that it be understandable by lay readership, rather than requiring a technical background in the field of radio communications. However, of necessity, technical terminology is used and referred to in the paper as there is simply no other way to communicate the information. In order to simplify understanding at least the basic concepts behind that which is discussed, what follows here is a brief explanation of the history and development of law enforcement public service emergency radio systems.

Considering the current highly evolved state of the art of law enforcement radio communications, it is interesting to note that in an article in the March 1927 issue of Police Journal, it was stated emphatically that radio was not for the police.[1]

However, there were number of law enforcement officials and engineers who were looking more to the future and did in fact see both the need and the feasibility for radio communications within law enforcement. In the late 1920's there was some experimentation with one way radio transmitters in the cities of Berkeley, California and Detroit, Michigan. These transmitters communicated with receivers placed in patrol vehicles.[2] At this point in time there was no capability, nor even a foreseen capability, of the ability to have two way communications.

In October of 1930 the Michigan State Police began broadcasting, and was the first state police system to do so. This system had an output of 5000 watts during the daytime and 1000 watts at night.[3] What is relevant for the purposes of this paper is that this was the first long range system to go into service.

Four years later the Bayonne, New Jersey Police Department went on the air with a two-way radio system between the station and the four patrol vehicles.[4] It should be pointed out that being an urban area, this was a relatively close range communications system. This system was on 33.1 Mhz, and was probably the first use of what came to be known as low band VHF.[5] That same year, the Federal Radio Commission, the forerunner of the Federal Communications Commission, declared that two-way police radio communications would not be authorized because there were insufficient frequencies available.[6]

Despite the fact that there were some pioneering systems, and even a few short range systems allowing two-way communications, the overall concept had not really caught on with law enforcement. "In 1935 there were still a total of 164 municipal police transmitters in operation."

In March of 1939, the FCC through order #32600A, countermanded the earlier stand of the FRC and declared the police to be an emergency service which was to have VHF frequencies allocated for mobile use.[8]

This of course was the impetus needed to spur development of feasible and reliable two-way radio systems. One such system was introduced in 1939 by Motorola. It was a 20 watt low band combination transmitter/receiver.[9] This then allowed reliable two-way radio communications, provided the mobile transmitter was sufficiently close to the base station to effectively transmit with the available power. It should be noted that while the mobile transmitter had an output of 20 watts, base stations could have outputs of as much as 5000 watts. Clearly then, over long ranges communications was strictly a one way proposition.

Since mention has been made of one of the four bandwidths currently in use in law enforcement communications, it is appropriate at this point to enter into a brief discussion of different bandwidths and their characteristics as applied to law enforcement radio communications.

As already stated, VHF-low band was the first two-way system developed to prove practical. The low band area of the spectrum exits between 30 and 50 MHz. For early systems, this portion of the spectrum had some advantages. The propagation characteristics of VHF-low band signals are such that the signal path tends to crawl along the gentle contours of the earth.[10] An additional characteristic of VHF-low band is sky wave propagation, in which the signal off the antenna travels upwards into the atmosphere until it is reflected back to earth at a complimentary angle.[11] This phenomenon is commonly known as skip. The point on earth where the signal is reflected back may be many hundreds or even over a thousand miles away from the point of original transmission. In the early stages of law enforcement communications development, when there wee not a lot of radio systems competing for similar areas within the spectrum, the skip phenomenon did not create a problem. In fact, it added to the long range capability of the system. considering the long range systems were strictly a one-way proposition at that time, a simple solution to effective communication was to have a high powered transmitter utilizing VHF-low band. Of course, communications from the vehicle back to the base station were impossible at that point of development.

All this changed with the advent of the repeater (which in this generalized context includes a remote base station as well as a mobile relay). The repeater is nothing more than a transceiver. It receives a signal and then retransmits it. Generally a repeater is placed on top of a mountain, or in some cities on top of a tall building. The elevation of a repeater greatly improves the propagation characteristics of the signal.[12] The inception of the repeater created two immediate advantages. First of all, long range mobile to base communications were now feasible. This was because the lower powered transmission from the mobile only needed to get to the repeater at which point it would be re-transmitted to the base station. By the same token, higher powered base stations were no longer necessary, since the repeater could be used to extend the range of the signal. Because of this, coverage could now be cut off beyond a certain point. Although this was not a concern during the early development of law enforcement communication systems, it became apparent when such systems became common, that much sharing of frequencies was going to have to take place. The only way this could happen without interference was to rely on geographic separation, along with controlling power outputs to preclude a frequency from interfering

for good reason. It does not have the skip and man-made interference disadvantages of VHF-low band, but it does have excellent propagation characteristics. With the use of repeaters, the propagation advantages of VHF-low band relative to VHF-high band are so greatly diminished as to be inconsequential. In addition, despite the crawling characteristic of VHF-low band, it along with all the other bandwidths in use is still subject to shadow falling.[17] Although the effects differ with frequency. Shadow falling is what is commonly referred to as "dead spots," areas in which a mobile either cannot transmit to the repeater, cannot receive from the repeater, or both. The only cure to such shadow falling is the installation of an additional repeater which provides coverage to the affected area.

In my survey of California Sheriff's Departments radio communications systems, I determined that at least 31 of the 58 counties in California utilized the VHF-high band portion of the spectrum.

Jurisdictions having responsibility for large geographic areas, counties and the state, face a contradiction in the overall design of communications systems. Obviously it is clear that the jurisdiction in question will work towards obtaining the goal of complete coverage for its area of jurisdiction. However, the spectrum available to public safety is so limited, that no one jurisdiction can have a monopoly on what ever frequencies it is using. Frequencies must be shared, and must be shared without interference from other users of the same frequency. The method most commonly used to insure non-interference is geographic separation. However, this flies in the face of attempting to achieve maximum coverage of the jurisdictional area through the use of high power, universal radiation of signal, and numerous repeaters.

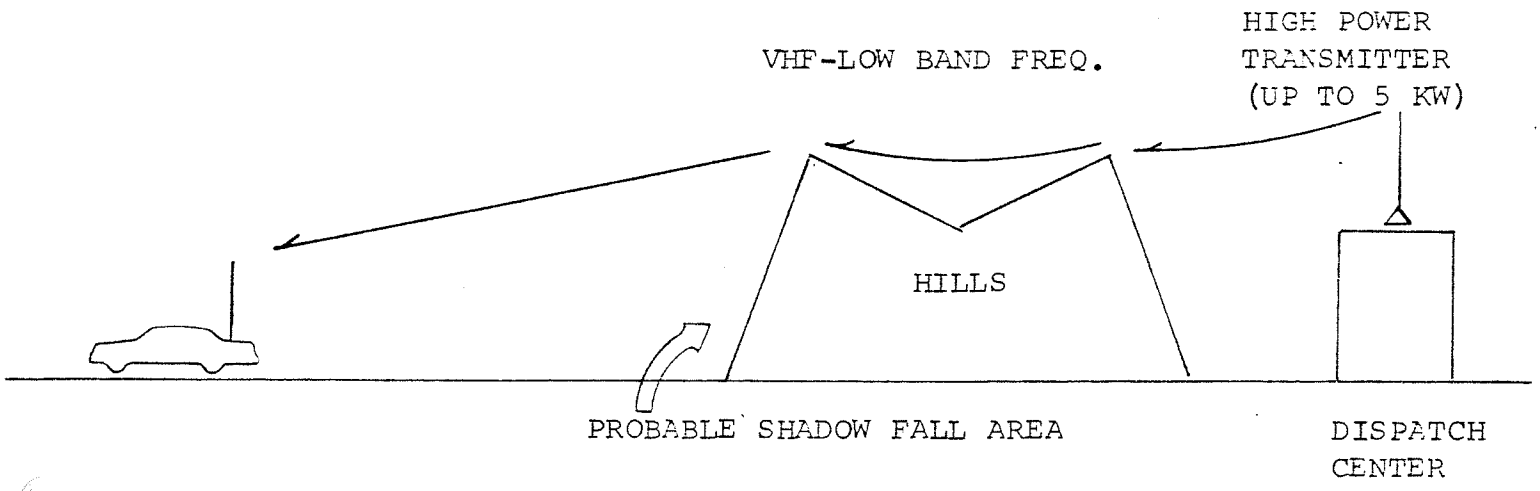
The California Highway Patrol, although not the object of the study surrounding this project, was still utilized as a resource, since they encounter all of the communications conditions throughout the State of California. In the 1940's, the California Highway Patrol along with all other law enforcement agencies, used the VHF-low band end of the spectrum. When the VHF-high band portion was first developed, the California Highway Patrol at that time opted to stay with their existent system on the theory that for their type of operation low band would continue to be most suitable. In 1965 the CHP conducted a study on the possibility of reassessing their position. Based on their study, they determined that the most feasible portion of the spectrum from an overall statewide standpoint for the CHP operation was VHF-high band. However, even then, 22 years ago, less that half the frequencies the CHP would need to made the conversion were available. Obviously, this situation has grown even more severe in the intervening years. Thus, CHP finds itself in the position of being trapped in the VHF-low band area of the spectrum.[18]

The next area of the spectrum to be opened up for public safety communication was what is termed as UHF (ultra high frequencies). The UHF band covers from 300 to 3,000MHz. The first incursion of public safety into this bandwidth was in 1971 when the FCC granted permission for mobile users in ten urban areas to share the bottom seven UHF television channels (470 to 512MHz) on a non-interference basis.[19] The UHF bandwidth is strictly line of sight. This means that there is no problem with skip. In addition, frequency reusage with limited

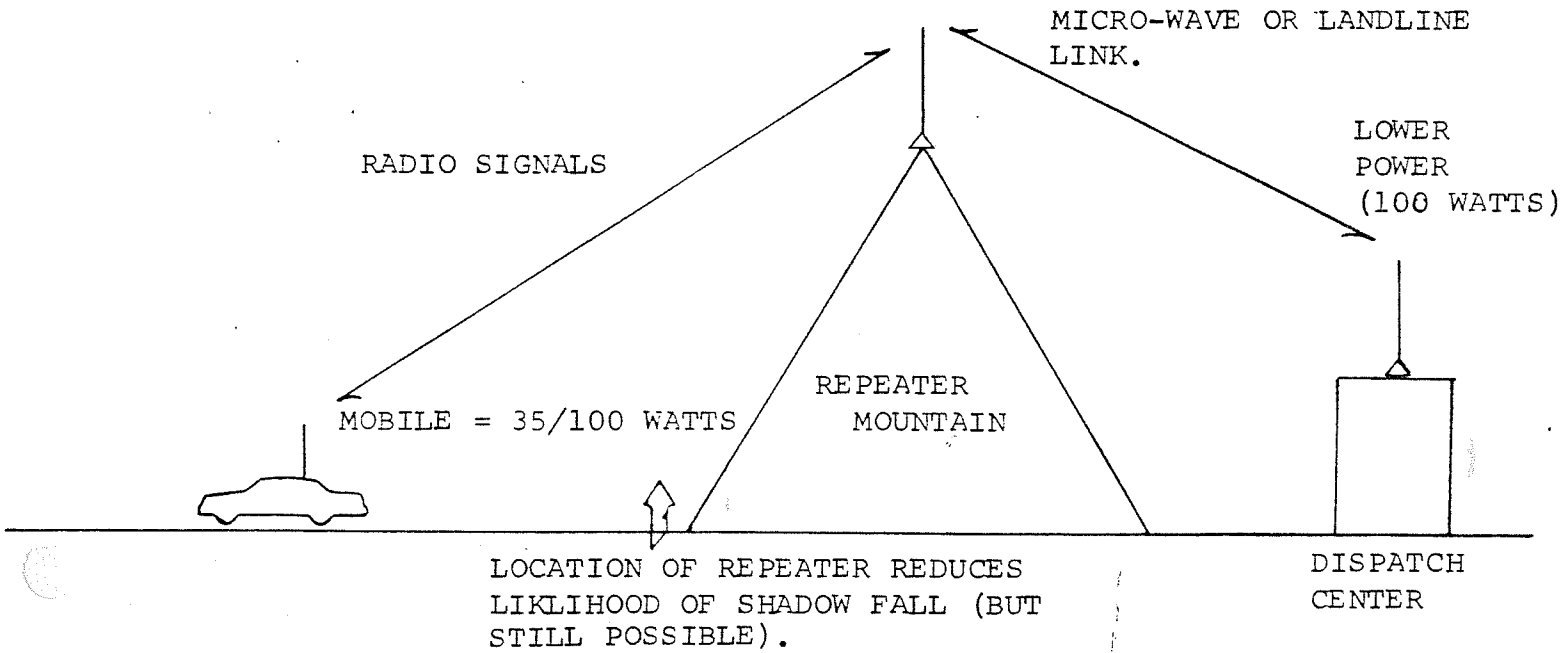
800MHz system for adaptation. This is the largest geographic county in California, having over twenty thousand square miles. Testing is still in its early stages, but San Bernardino County reports that they are getting superior propagation in their desert environment from 800MHz than with the VHF-high band in side by side tests. It would appear from this that the "bounce" characteristics (multipath) of 800MHz are a benefit when dealing with sparse foliage. If anything, this proves how little we really know about frequency characteristics and predicted performance in a given environment.

The following series of diagrams further explain and illustrate the principles and theories discussed in this section. An understanding of this material will greatly simplify reading and evaluating the information in the text of the project.

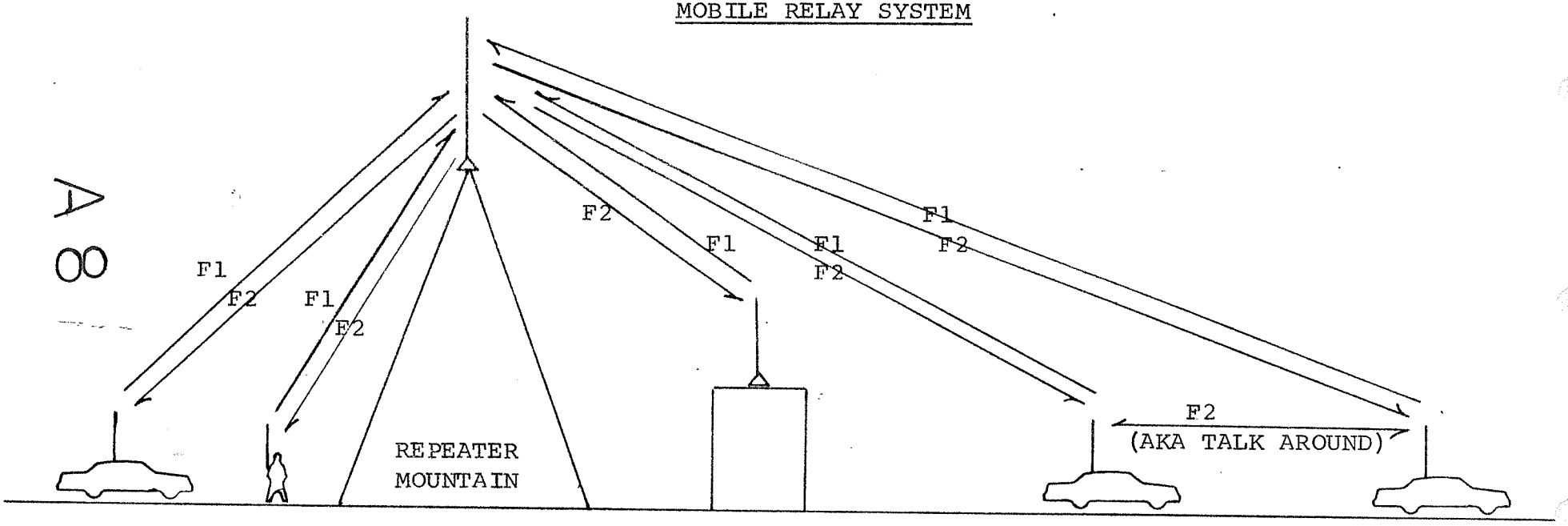
TYPICAL EARLY LONG-RANGE, ONE-WAY SYSTEM.
USING VERY HIGH POWER, DISPATCH CENTER CAN TRANSMIT TO UNIT,
BUT UNIT CAN ONLY RECEIVE.



TYPICAL REPEATER, MOBILE RELAY OR REMOTE BASE SYSTEM USING A HIGH ELEVATION TO RELAY A SIGNAL TO AND FROM DISPATCH CENTER AND MOBILES OVER LONG DISTANCES AND/OR GEOGRAPHIC BARRIERS.

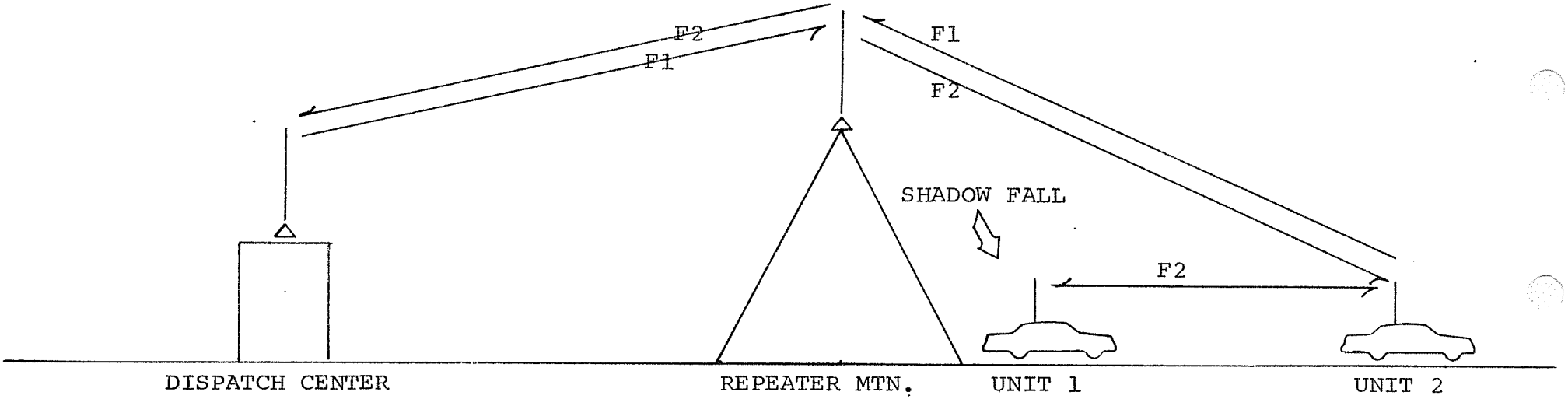


MOBILE RELAY SYSTEM



In this system, the mobiles, portables, and base station (if base station is not using a microwave or landline link to the repeater) all transmit on frequency 1 (F1). The repeater or mobile relay receives the signal transmitted on frequency 1 and automatically retransmits (repeats) it on frequency 2 (F2). The mobile, portable and base station receivers are set up to receive on frequency 2, and thus receive this retransmitted signal. Only the repeater can receive frequency 1 signals. If mobiles and/or portables are equipped to also transmit on frequency 2, they can communicate directly with one another. This is known as simplex or talk around. This has the advantage of unit to unit communication without using the repeater, and it allows units to communicate in "dead" or shadow fall areas. While units in such areas could not reach the repeater (and thus the dispatch center) they could at least communicate with each other. Using this system, if one unit were in a shadow fall area, but another unit were not, the unit not in the shadow fall area could relay traffic for the unit unable to reach the repeater. (see following diagram).

MOBILE RELAY SYSTEM (CONTINUED)



This illustrates using simplex or talk around to relay traffic for a unit in a "dead" or shadow fall area. Unit 1 is right at the base of repeater mountain and is unable to transmit and contact the repeater. Unit 2 is not in this shadow fall area and thus can contact the repeater. If unit 1 uses F1, unit 2 will not be able to copy since unit 1 is not within range of the repeater. However, if unit 1 uses F2 to transmit, unit 2 will copy since unit 1 is now transmitting on the receive frequency. Unit 2 could then relay traffic back and forth between unit 1 and the dispatch center.

A
69

TYPICAL LONG-RANGE SYSTEM UTILIZING TWO REPEATERS (SIMPLIFIED).

1. Dispatch center uses repeater 1 to communicate with unit 1. (can vary, but typical)
2. Dispatch center uses repeaters 1 & 2 to communicate with unit 3.
3. Unit 2, depending on location, may communicate with dispatch center using either repeater 1, or repeaters 2 & 1. Unit 2 may select which repeater(s) by toning the appropriate repeater(s), or the repeater(s) may select which receives the strongest signal (votive system).
4. Since both repeaters propagate into the area between the two mountain tops, the potential shadow fall area is greatly reduced. If the area at the base of the mountain where repeater 1 is located is susceptible to shadow fall from repeater 1, the propagation pattern from repeater 2 would allow communications. If then, unit 2 was right at the base of repeater 1 mountain, the repeater most likely to be selected (manually or votive) would be repeater 2.

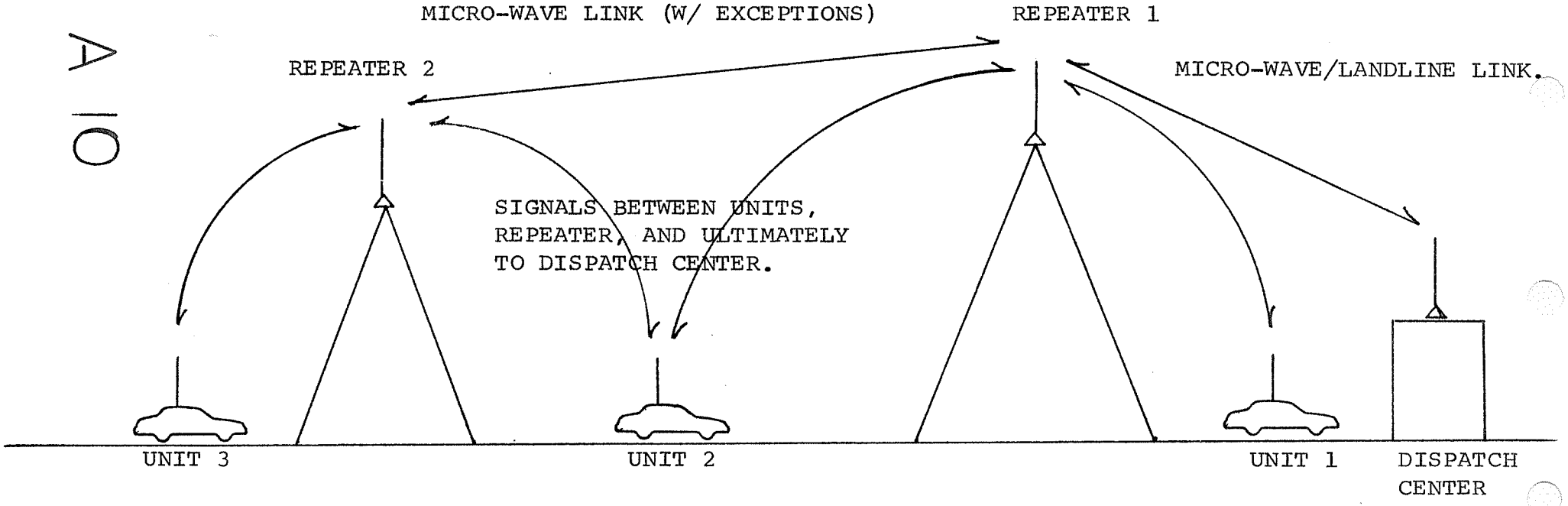
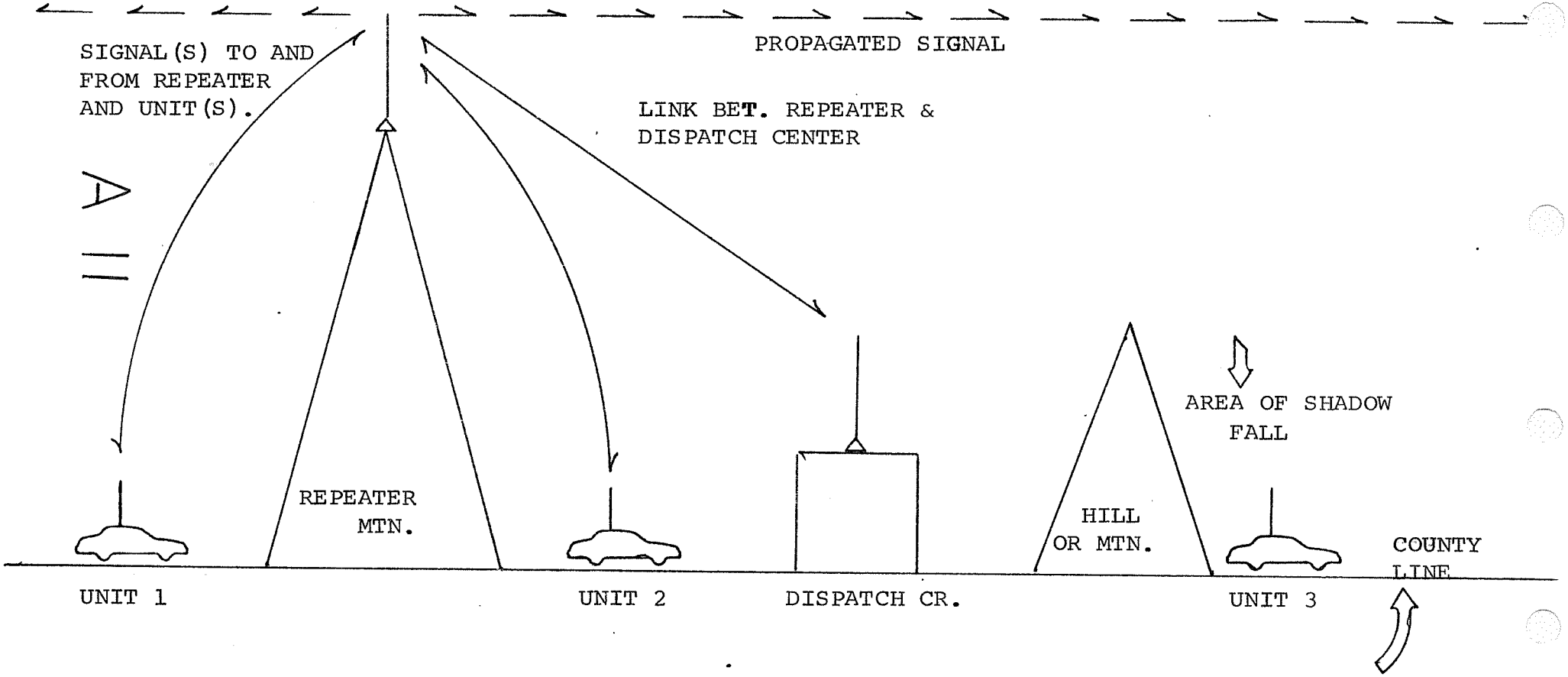


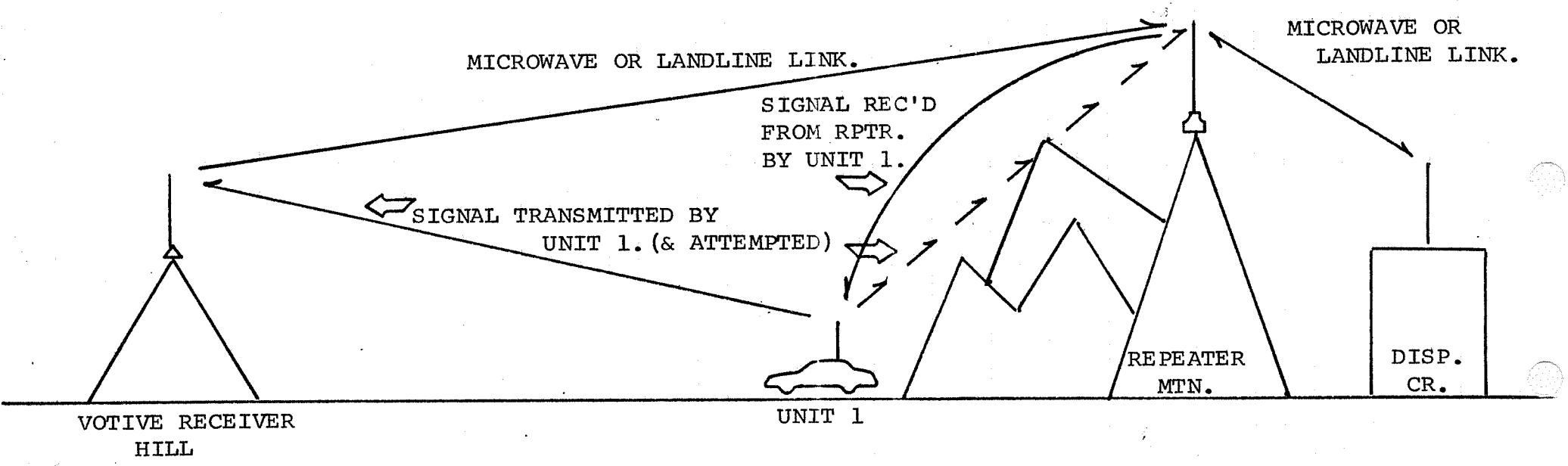
DIAGRAM ILLUSTRATING SIGNAL EXTENDING BEYOND JURISDICTIONAL BOUNDARIES DUE TO ATTEMPTING TO ACHIEVE FULL AREA COVERAGE.

In this illustration, unit 3 most probably would not have contact with the dispatch center due to being in a shadow fall area, despite the fact that the signal extends beyond the county line. The solution is to have a repeater on the hill shown; or better yet, on a mountain or hill off to the right of the diagram to have a more favorable line-of-sight relationship to unit 3. This should be a directional repeater to preclude further propagation of the signal. To the extent that the signal from the existent repeater will travel, the re-use of that frequency within that area is precluded.



USE OF VOTIVE REPEATER FOR USE IN FRINGE TRANSMISSION AREAS.

In many areas, a unit can receive from the repeater but cannot transmit and hit it. This is due to the height advantage of the repeater relative to the unit. Rather than use an additional repeater or mobile relay, a simpler and lower cost option is the use of a votive receiver. In this application, when the unit transmits a comparator analyzes signal strength to determine if it is stronger at the repeater or at the votive receiver. If it is stronger at the repeater, then the repeater relays it to the dispatch center as previously described. If the signal is stronger at the votive receiver, the votive receiver relays it to the repeater via microwave or landline. The repeater then sends it to the dispatch center. The votive receiver is a one-way; it does NOT handle transmissions from the dispatch center to the unit. This alternative is frequently used where the distance from the unit to the repeater may not be great, but there are geographical obstructions which create the fringe transmission condition.



MONTEREY COUNTY

SHERIFF - MARSHAL - CORONER - PUBLIC ADMINISTRATOR'S DEPARTMENT

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D. B. "BUD" COOK
SHERIFF - MARSHAL - CORONER - PUBLIC ADMINISTRATOR

September 15, 1986

Dear Sheriff,

My name is Roger Chatterton, and I am a Captain with the Monterey County Sheriff's Department. I am the Commander of the Patrol Division.

I am also a member of the Post Command College, Class 4. It is within this capacity that I am writing to request the assistance of someone within your department.

As a final project in the Command College I am conducting research directed towards forecasting the futures of California Sheriff's Department Radio Communications in the year 2000. Towards this end I have enclosed a questionnaire that I respectfully request be assigned to someone to complete and return to me in the attached envelope prior to October 15, 1986.

The person assigned need not have an technical knowledge of radio communications, but should be a management person with a field operations assignment or background.

I know that surveys generally are an annoyance and are given the most superficial response, if any at all. I ask that your representative make an exception with this questionnaire. My intent with this project, beside the obvious goal of satisfying the Command College requirement, is to produce a document that will be of interest and use of each Sheriff's Department in the state. Thus, I need a one hundred percent return rate. I can offer as an inducement the commitment to sent to any department so choosing a copy of the finished document. There is a space on the questionnaire for the name and address of the contact person. In addition I will be available to return the favor for any of your personnel that become Command College members in the future.

I thank you for the time committed to the completion of this questionnaire.

Very truly yours,

Roger Chatterton, Captain

Commander Patrol Division

B 1

FBINA - 126
Post Command College IV

QUESTIONAIRE

This questionaire is a part of my overall Command College Project for class four of the POST Command College. It is intended to gather data for this project. The questionaire is being distributed to each Sheriff's Department in the state. In order for the project to achieve it's intended goals, it is necessary that I get a response from each of the fifty-seven other departments besides my own. The questionaire is intended to be filled out by a managerial level sworn employee who either is or has experience in operations and patrol. The questionaire does not assume or require any technical expertise. Any questions that call for a judgement conclusion are such that the judgement conclusion of the individual responding to the questionaire will satisfy that question.

1. Population served (unincorporated area) 1200 - 3,100,000

2. Area covered. 49 - 20,189 square miles.

3. Number of sworn personnel engaged in field duties 7 - 3,897.

4. Communications band width (check one).
   Low band VHF 10
   High band VHF 29
   UHF-400MHZ 11
   UHF-800MHZ 1.

5. Do you plan or desire to change band widths YES: 11 NO: 38.

6. The number of channels you currently utilize 1 - 32.

7. The number of repeaters you currently utilize 1 - 14.

8. Do you have any "dead" areas? Yes 45 No 5.
   UP TO 30%

8a. If yes, what estimated percentage of your area 15%=13, 10%=24.

8b. Serving approximately how many persons 0 - 8,000.

8c. Is this critical enough to be an officer safety issue?
Yes 31 No 19

9. Do you use your own dispatch center?
Yes 43 No 5

10. When was the last general upgrade of your communications system?
1970 - CURRENT.

11. Do you use a regionalized and centralized dispatch center serving agencies other than your own? Yes 31 No 18

12. Do you utilize a computer aided dispatch (CAD) system?
Yes 12 No 38

12a. If yes, state the year implemented. _____

12b. If no, are you in the planning stage for such a system?
Yes 18 No 20

12c. If no, is that due to fiscal constraints. Yes 20 No 5.

13. Can your units communicate with all other law enforcement units in your area? Yes 35 No 14.

14. If yes, is it via CLEMARS? Yes 24 No 19.

14a. If no, is such a plan being developed for your county?
Yes 4 No 12

15. Do you have sufficient numbers of channels for the maximum number of units on the air at any given time? Yes 24 No 26

15a. If no, how many channels do you estimate are needed?
1 - 60 MEDIAN = 3

16. Can you name an agency with a better communications system than yours YES: 33 NO: 8

17. Can you name an agency with a worse communications system that yours YES: 20 NO: 16

18. Overall how would you rate your radio communications system?
Poor 7 Mediocre 8 Acceptable 17
Good 12 Excellent 5 Superior (no changes at all you can think of as improvements) 0

19. Has your communication system kept pace with your departmental growth? Yes 25 No 25

20. Do you utilize portable radioes? Yes 48 No 2

20a. If no, do you plan on acquiring them in the future?
Yes 2 No

20b. If yes, do they activate a repeater or utilize a transmitter in the vehicle? Repeater 38 Vehicle 8 (2 SIMPLEX)

21. Do you utilize digital communications units in your vehicles?
Yes 2 No 48

21a. If no, are you planning for them in the future (by the year 2000)?
Yes 19 No 29

21b. If yes, are they a clear benefit over voice only communications systems? Yes ____12_____ No ___3_____

Name and address of individual as contact person if your department desires a copy of the finished project.

name _____49 OF 50 RESPONDENTS REQUESTED A COPY OF THE FINISHED PROJECT AND INDICATED A CONTACT PERSON._____

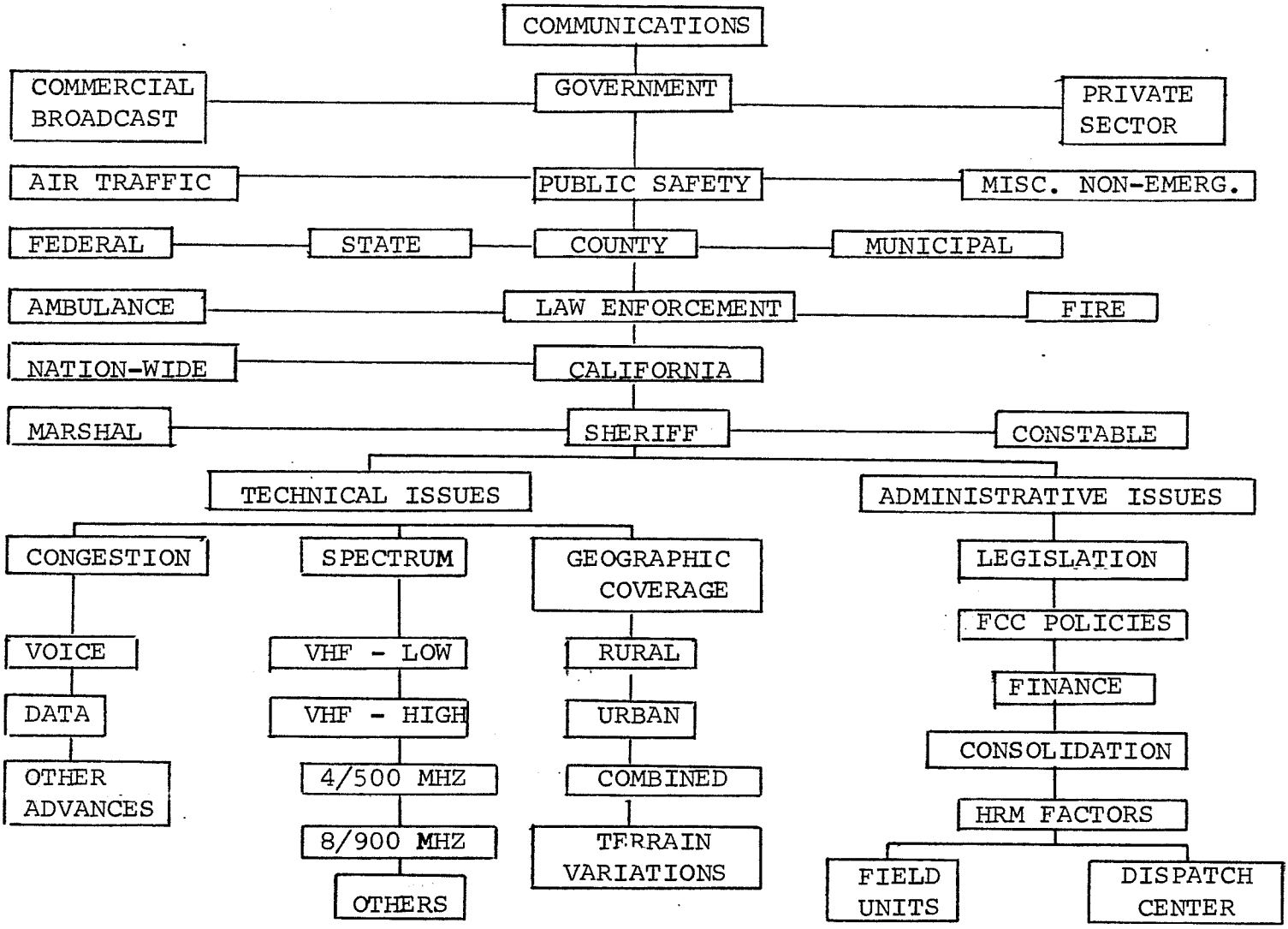
address _____

city _____

Please return completed questionaire no later than Friday, October 10th to:

Captain Roger Chatterton
Commander - Patrol Division
Monterey County Sheriff's Department
P.O. Box 809
Salinas, California 93902

RELEVANCE TREE



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D. B. "BUD" COOK
SHERIFF - MARSHAL - CORONER - PUBLIC ADMINISTRATOR

EXEMPLAR

Dear

My name is Roger Chatterton and I am a Captain with the Monterey County Sheriff's Department. As part of my long-term development, I am a participant in the POST Command College. This is a career intensive two year executive level educational program. During the last part of the program, each participant must complete a major project. That is why I am contacting you. Before you read further, let me assure you that this will not consume very much time on your part. I need your expertise, but not much of your time, and no work.

In the project I must complete, I am going to follow a prescribed process to generate three scenarios of three possible future states of Sheriff's Department Radio Communications in California in the late 1990's and beyond. As a part of this process I will want to contact you on the telephone, at a day and time convenient to you, to ask you a series of questions. These questions will be designed to determine, from your individual perspective, the most significant events and trends in the law enforcement radio communications field in the last 20, 15, 10, and 5 years. I will then ask you to give me what you forecast as the most significant events and trends in the next 5, 10, 15 and 20 years. I will then ask you approximately ten additional questions which will be fairly brief, but which will allow me to "pick your brain" and round out the trend and event responses. I will take these responses down in abbreviated form. I will be contacting a total of six persons and asking these identical questions. In all probability that will be the only direct conversation necessary. The next step will be what is called a Delphi Technique. I will take all responses from the respondents (I am referring to you to POST as the 'Technical Expert Resource Group') and total them up under each of the categories listed above. I will then mail each of you a list and ask you to vote by point value for those you think are most significant (e.g., If I need ten in a category, then the most significant would have that point value; the least would be

valued at one, and the others at zero). If, out of this, I get the rank orders needed, I would have no further need to conduct another round. If, however, there are ties, which is likely, I would conduct another round with only the tied factors to vote and break the tie. The rounds continue until there are no ties. However, all each Delphi participant must do is consider the available alternatives and assign a point value. So, as you can see, the time commitment is very slight. In addition, the process is anonymous, so I don't weigh one source's value judgment against another's. That is all there is to it for you. For me there is far more, but that is my work. So, what I need from you is the benefit of your expertise.

As a return for your contribution, I would be glad to send you a copy of the finished document, and then you can see just where your contribution fits in.

After all this explanation, would you assist me in this challenge? I am enclosing a self-explanatory card as well as a stamped and self-addressed envelope. With your concurrence, I will be contacting you shortly.

Very truly yours,

D. B. "BUD" COOK, SHERIFF

BY: Roger Chatterton, Captain
Commander Patrol Division

RC/dg

MONTEREY COUNTY

SHERIFF - MARSHAL - CORONER - PUBLIC ADMINISTRATOR'S DEPARTMENT

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D. B. "BUD" COOK
SHERIFF - MARSHAL - CORONER - PUBLIC ADMINISTRATOR

EXEMPLAR

Dear Mr _____

Thank you very much for agreeing to be a part of the expert resource team for my Command College project. Because of the unique nature of this project, I need the specific expertise of persons who specialize in this field.

To start the process off, I am enclosing a list of questions which each member of the group will receive. Approximately a week to ten days after you have received this list of questions I will call you to get your responses. This will give you time to reflect on your responses, but you need not write anything since I will be taking your responses over the phone.

When I have completed this process for the entire group, I will categorize all the responses. I will then send each of you the entire list of responses by categories, and ask you to assign a number of them a point value and then return the list to me. I will then total up the points. I expect there will be some ties. to break ties, I will send out the tied responses, and again ask for a specified point value assignment by each of you. I will do this until the ties are broken. This process is called a Delphi Technique and is an accepted technique when it is not feasible to try to bring the individuals involved together for a series of meetings.

There may be an instance in which you decide that a particular question or issue ought to be discussed with me. If you so decide, I encourage you to call. I work Monday through Friday, 0800 - 1700 hours. I am in and out quite a bit since I have a county-wide responsibility for three stations, so if I am not here I will get back to you. Again, I thank you for your contribution. Without this expert resource I would not be able to do this project.

Very truly yours,

D. B. "BUD" COOK, SHERIFF

BY: Roger Chatterton, Captain
Commander Patrol Division

RC/dg

Letter - Roger Chatterton

I am interested in significant events and trends in the evolution of law enforcement radio communications, specifically as it relates to Sheriff Departments in the State of California. An event is defined as a noteworthy happening. A trend is a general direction or movement. When relating trends and events, one can generalize that in most instances an event precedes a trend and may be the occurrence that triggers a trend.

1. Based on your experience and professional judgment, name 5 - 8 trends and/or events of 20 years prior. NOTE: You may identify 1 or more events in this category which evolve to trends in subsequent, more recent years.

2. Do the same for 15 years prior.

3. Do the same for 10 years prior.

4. Do the same for 5 years prior.

5. Utilizing the same criteria, please forecast 5 - 8 trends and/or events for the period of up to 5 years in the future. NOTE: Since this is the opposite of the first four questions, in this category you may forecast events in the near future which evolve into trends in the more distant future.

6. Do the same for 10 years into the future.

7. Do the same for 15 years into the future.

8. Do the same for 20 years into the future.

9. If not discussed in 1 - 8, specifically ask the futures of the following from the perspective of the respondent:

10. Which bands will be in increasing use by California Sheriff Departments in the future. Why?

11. Which bands will be used less. Why?

12. Will we continue to use mountain top repeaters to generate radio paths for long distance and mountain communications? Yes. If no, why?

13. What do you see as a solution to the problem of channel loading?

14. If we can assume that centralized 900 centers are here to stay, do you see a future of further centralization so that one center may serve several counties, especially in rural areas?

15. Can you foresee the application of cellular technology to California Sheriff Departments? In urban areas? In rural areas?

16. What do you see as the value of MDT's in patrol units for field use given that the officer must look at the MDT to send/receive messages?

17. The fifty-eight (58) Sheriff Departments in California represent, in total, the entire spectrum of communications problems that can confront law enforcement. There are departments in crowded urban areas as well as departments that cover vast areas that are sparsely populated, but which have geographic barriers to radio coverage. A number of state agencies, California Highway Patrol, Department of Fish and Game, California Division of Forestry, etc., share these same challenges. Each of these agencies uses a uniform radio system all over the state. They use the same band width, but may vary communication centers and repeater locations to satisfy local conditions. Should California Sheriff Departments attempt the same degree of standardization state-wide, or should individual Sheriff Departments attempt to tailor their communications systems to their specific needs without regard to inter-county coordination or standardization?

18. If you choose the second alternative above, what do you see as a solution to the problem of communications between units of different agencies?

Letter - Roger Chatterton

19. Given your experience and travels, could you name for me three Sheriff communications (or state or local) anywhere in the nation that you consider absolute state of the art?

20. Using the same criteria, can you name three that are rock bottom. Remember, your response is anonymous.

MONTEREY COUNTY

SHERIFF - MARSHAL - CORONER - PUBLIC ADMINISTRATOR'S DEPARTMENT

P.O. BOX 809 • SALINAS, CALIFORNIA 93902 • AREA CODE (408)
EMERGENCY ONLY - DIAL 911

RECORDS SECTION - 424-0421
WARRANTS SECTION - 758-2744
CIVIL/PUBLIC ADMINISTRATOR - 424-0578
CORONER DIVISION - 758-3878
PATROL DIVISION - 424-0421

COUNTY JAIL AND
ADULT REHABILITATION - 757-1073
INVESTIGATIONS DIVISION - 424-0352
CRIME PREVENTION - 757-8975
ADMINISTRATION & BUSINESS - 424-6487

D. B. "BUD" COOK
SHERIFF - MARSHAL - CORONER - PUBLIC ADMINISTRATOR

Letter - Roger Chatterton

EXAMPLAR

Thanks to the generous help of each of you, the first stage of gathering information has been completed. Enclosed is the total of past events and trends, as well as the total of predicted events and trends.

The next step is as follows:

1. Read the entire list of events and trends, past and future.
2. Select ten past events and trends that you think are most significant. Place these in rank order by putting the number 10 next to Most Important, 9 next to second Most Important, and so on, until you have placed number 1 point value next to the tenth Most Important trend and/or event.
3. Do exactly the same for predicted events and trends, again with a point value of 10 for the Most Important.
4. I will call you during the week of December 8-12 to get your point values. All I will need is your assigned point value (e.g. you could say: "Roman numeral III, number 4 is 6 points). Which I will take down for each of 20 trends and events (10 past, 10 future).
5. Once I have the totals, I will repeat the process as many times as is needed to break any ties. This is known as the Delphi Process. This will complete the second step of the process.

Letter - Roger Chatterton

The third step will involve plotting a chart for each of the trends and events. I will describe this more fully when the time comes to do so, along with (obviously) sending you the charts. Again, this will not be time-consuming, and I will be able to get the information from you over the phone as I will have a duplicate chart in front of me. Just so you are aware of my time constraints, I would like to have this process completed no later than the third week of January.

Again, gentlemen, thank you very much.

Roger Chatterton
Captain

Commander
Patrol Division

MONTEREY COUNTY

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D. B. "BUD" COOK
SHERIFF - MARSHAL - CORONER - PUBLIC ADMINISTRATOR

December 13, 1986

Dear Resource Group Member:

We are now ready to go on to the next stage of development of this project, which again, could not be done without your contributions.

Let me take just a moment and tell you what you have done thus far as I have received a number of questions from you as to what this process is all about.

In the first stage you each generated groups of past and future candidate events and trends. This was done anonymously by each of you. I then collated the entire group, editing out only the duplications. I then sent out this entire group of candidate events and trends, past and future, to each of you and asked you to pare this down to ten past and ten future total. This required you to reconsider your initial inputs along with the input of all the other group members, and prioritize them. Since this was also done anonymously and as individuals, and you had to reconsider your input in the light of others' input, in order to prioritize, you have participated in a process called a Delphi. It is a requirement of this project that either this or another process called Nominal Group Technique be used. I chose the Delphi Process because the Nominal Group Technique requires bringing all the participants together at the same time. You can see why I chose the Delphi. The next step in the Delphi would be to break any ties. Since I needed ten and ten, if I had a tie in either category resulting in two or more trends or events with equal scores that could not fit into the group of ten, I would have to get back to each of you with the two tied items, have you vote and then break the tie(s). As it turned out, this did not occur.

Now for the next step. This will require a little more work on your part, and since you may find it somewhat inconvenient to give me the data over the telephone, I am including a stamped self-addressed envelope to use if you would rather mail the completed charts back to me. Since you have gathered by this time that I am (of necessity) moving rapidly on this, you know that I will be calling you soon after you receive this.

You have a total of 20 charts - ten past, ten future, to reflect the ten past and ten future events and trends. There is one chart for each event or trend. Although I determined through your voting the prioritization of these events and trends, they are listed here in random order. This is intentional as I must use this charting process (called mathematical extrapolation) to determine consensus. For each chart, do the following:

1. On the space below each chart, you assign a number to the event or trend of 1 to 10. This is your own personal estimate of its current significance and is intended to be individually subjective.

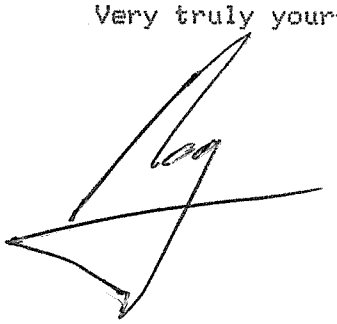
2. On the chart you will start at "Now" at the value of 100. I have marked a "0" at that point. Regardless of the point value listed below the chart, you start at this point. then you plot the relative importance of this event or trend back 5, 10, and 15 years, and the same into the future. You can see faint graph lines between the main lines of the chart to aid you in plotting and then being able to accurately describe it to me over the phone.

3. That is all there is to it. However, to forestall any confusion, let me give you a couple of examples. If you were plotting an event that you do not think will even occur for seven years, the number below the chart would be 1 (the lowest in the range). On the chart, from where I have the zero at "How" qo5 wOuld phacd a line straight down to the bottom horizontal line of the chart, and then across to between T+5 and T+10 where it would emerge vertically. Remember, there is no direct relationship between the number you assigned at the bottom of the chart and subsequent plotting on the chart. Once the line has emerged vertically, you would then guess at how significant the event or trend will be at 10 and 15 out. If you decide that the trend or event is of minimal importance at 10 years out (T+10) then you might cross the T+10 line at between 100 and 200. If you decide that the event or trend will gain in significance at 15 years out (T+15) then you might cross that line at 400. If you foresee great significance you would of course cross the T+15 line at 600. Since this is a forecasted event or trend, that you have determined is non-existent at present, you would list the past by taking your horizontal line at the bottom of the scale and extending it on this same line to the left side of the chart (T-15). I am enclosing a sample chart illustrating this.

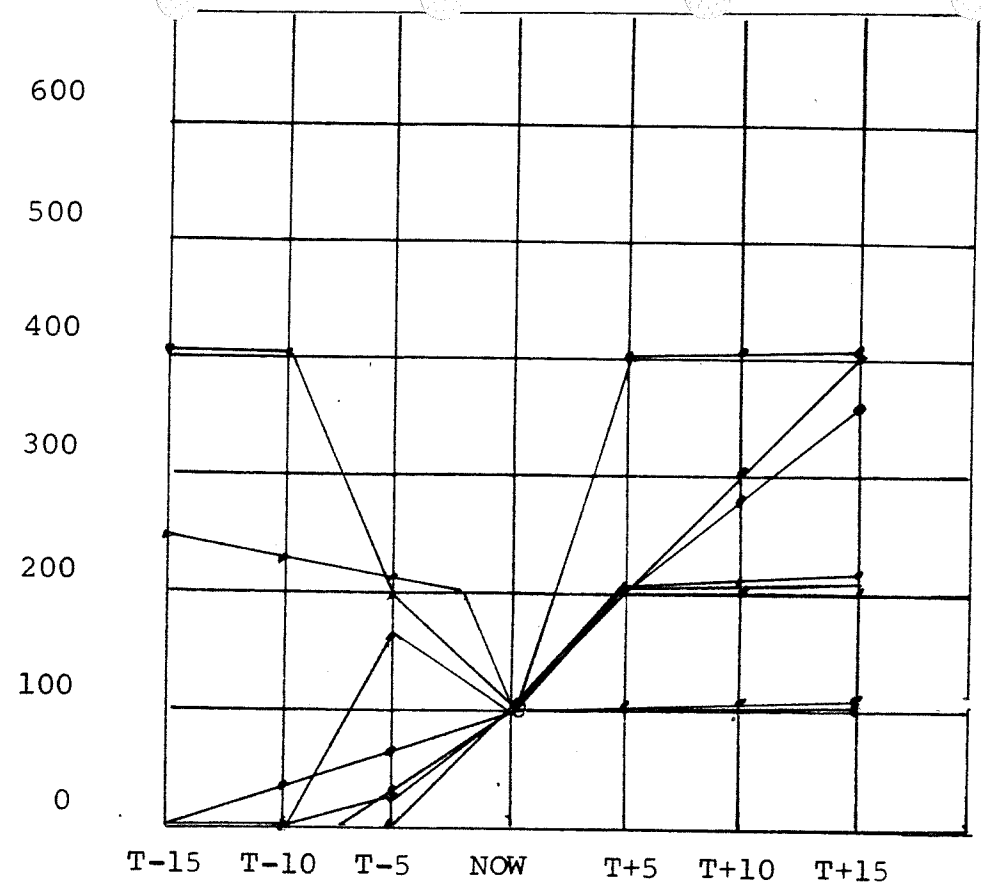
4. If your event or trend is from the past, then of course you start at 15 years back (T-15) at estimating importance, and this is relative to your starting point of the 100/now quadrant. If the past event or trend was twice as important five years ago as now, then your plot at T-5 would be at 200, and so forth. Do not try to read too much into this process. I know it is abstract and it is supposed to be. However, it works as you will see when you see the finished product (your copies will include the appendix).

I request that you try to get to this early on as I will be calling soon. Again, my appreciation because without you this could not be done.

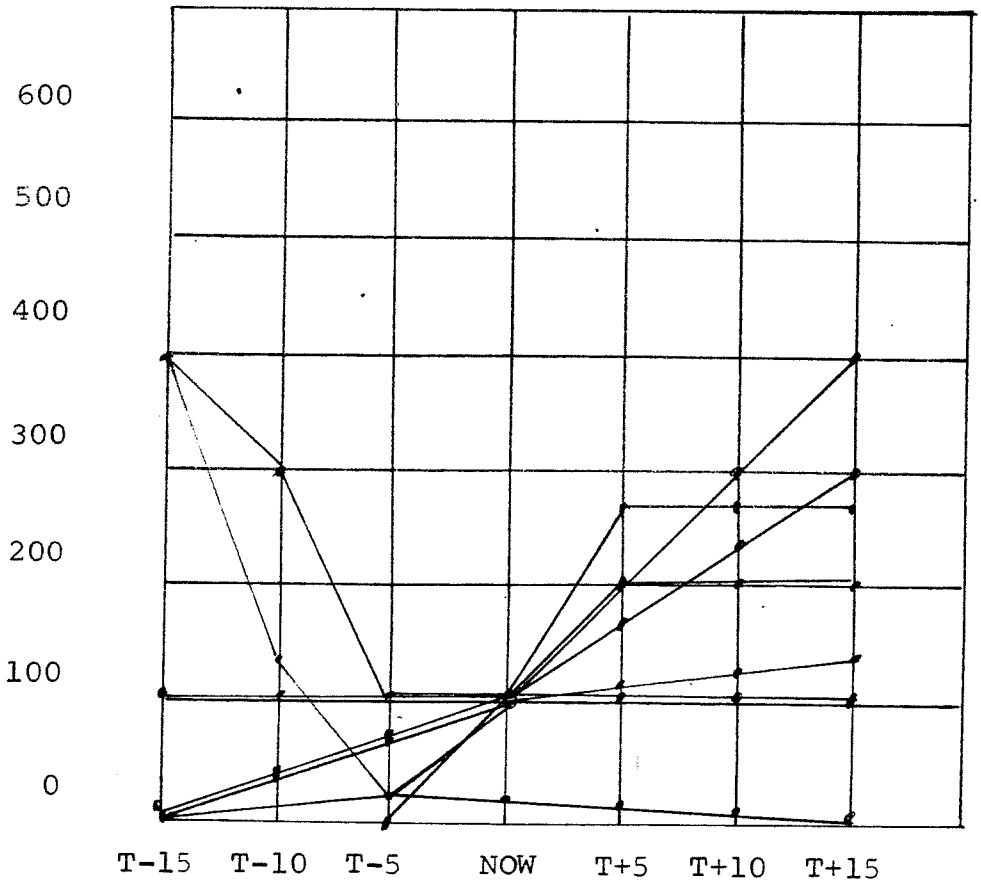
Very truly yours,



RC/mdb

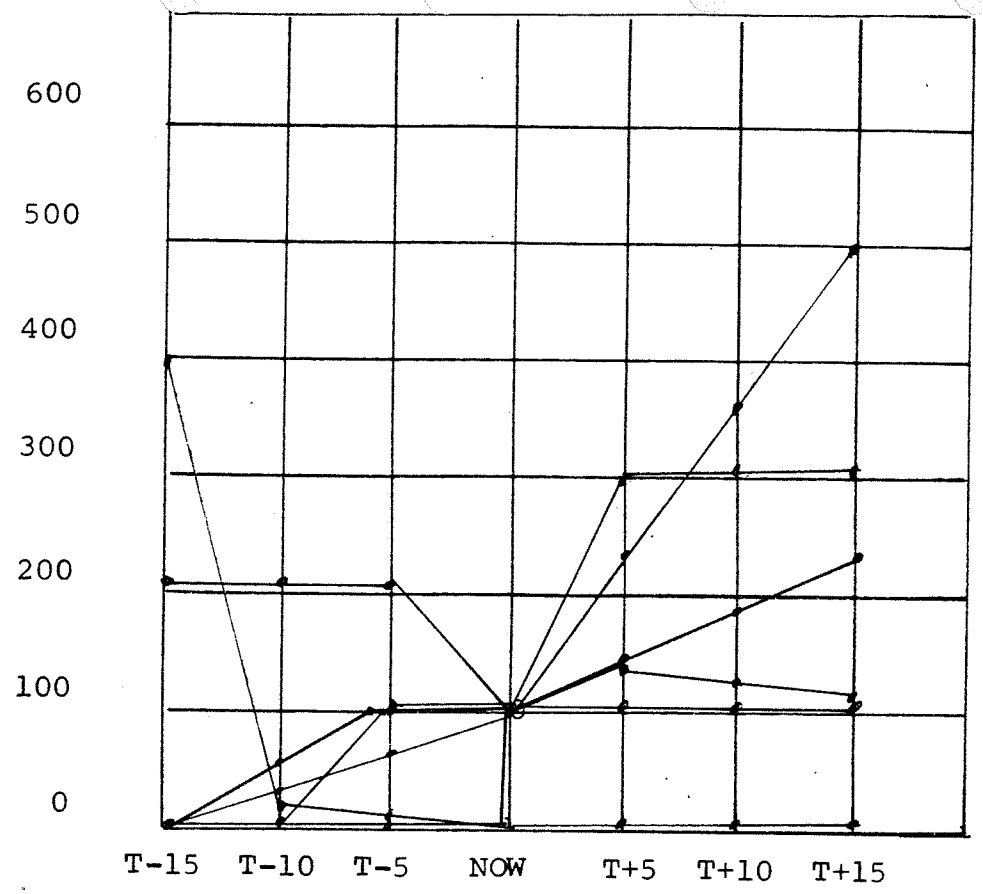


PAST
CONCEPT OF 911 CENTERS DEVELOPED.

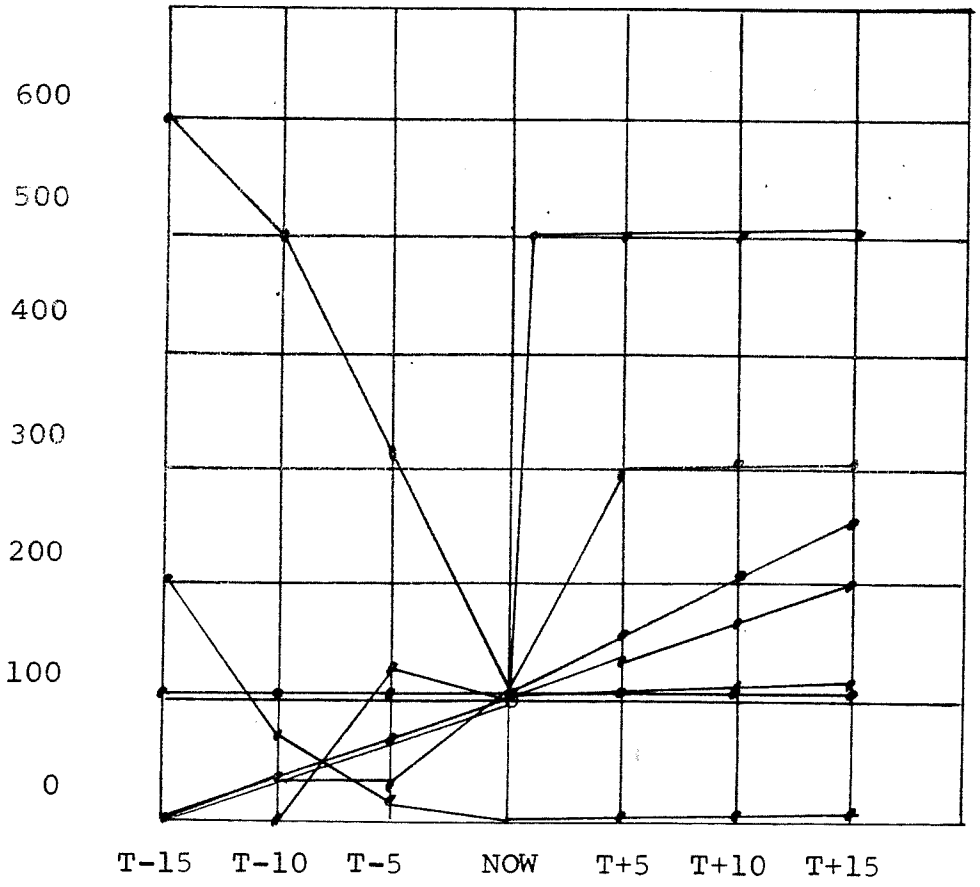


PAST
PL TO ELIMINATE NUISANCE INTERFERENCE.

C 14

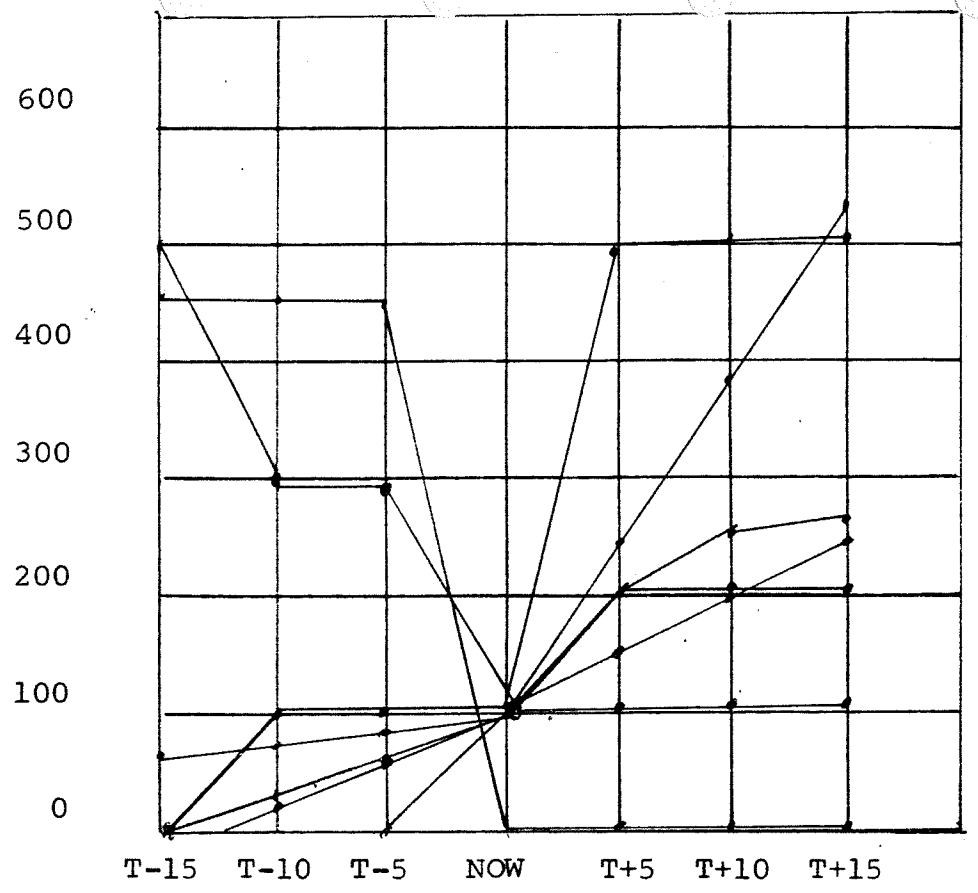


PAST
IMPLEMENTATION OF STATE-WIDE
INTERAGENCY FREQUENCIES.

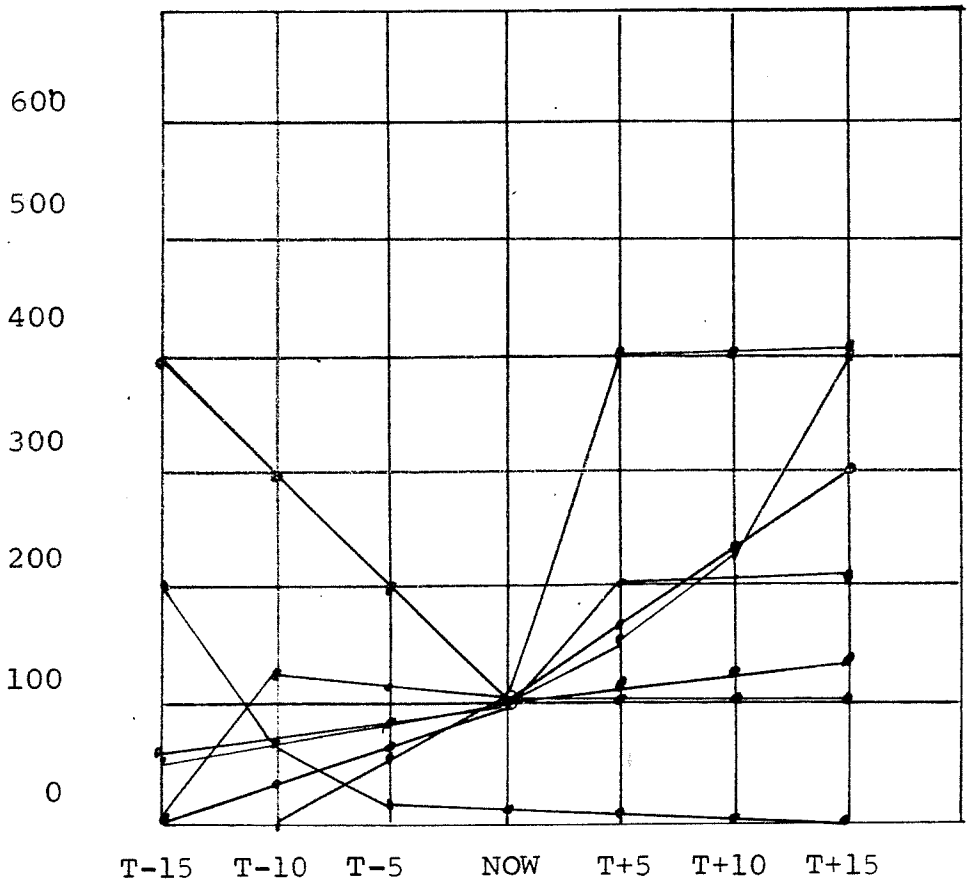


PAST
TRANSISTORIZED EQUIPMENT.

C 15

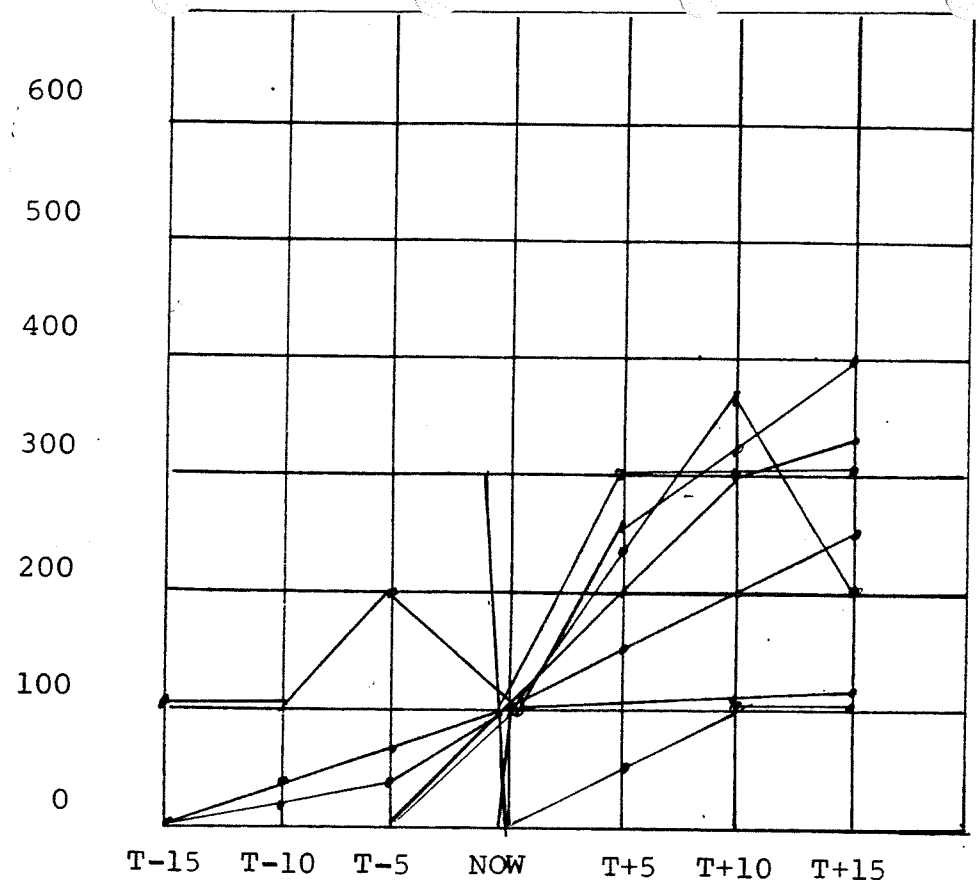


PAST
FROM THE 1930's, THE FCC SYSTEM OF PUBLIC SAFETY SPECTRUM ALLOCATION. PROBLEMS CREATED BY THIS SYSTEM HAVE COMPOUNDED TO A POINT WHERE THEY ARE CURRENTLY CATASTROPHIC.

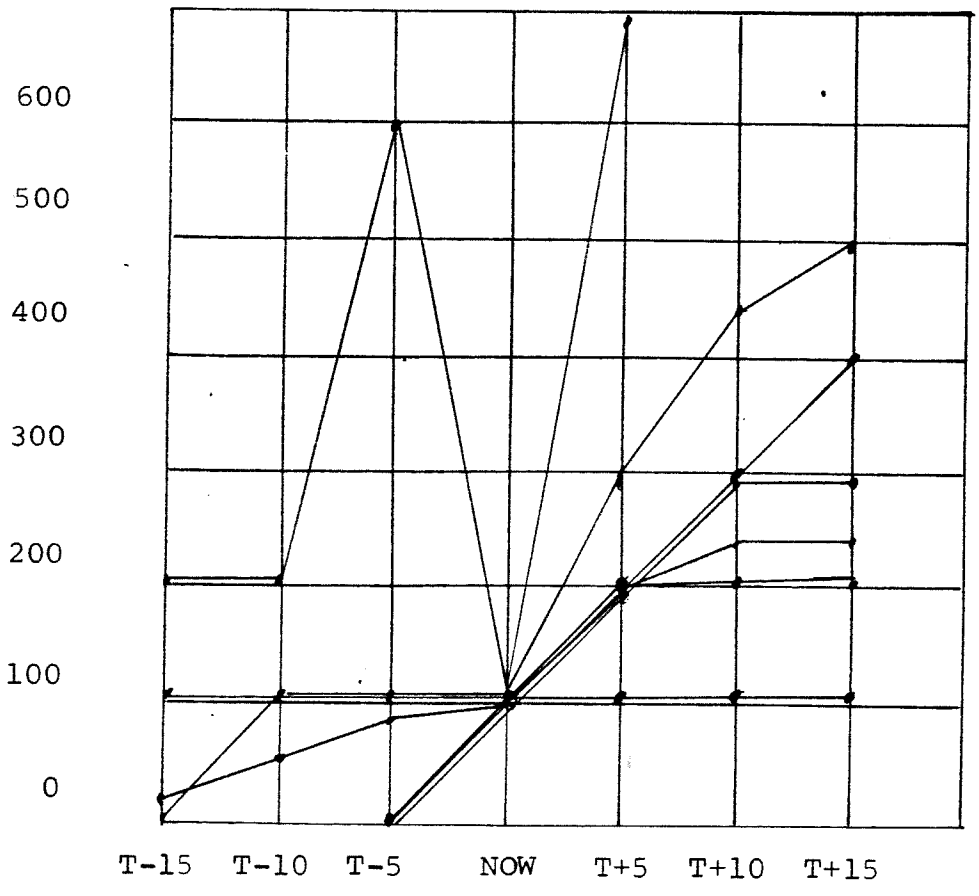


PAST
RADIO SYSTEMS START TO EVOLVE.

C 16

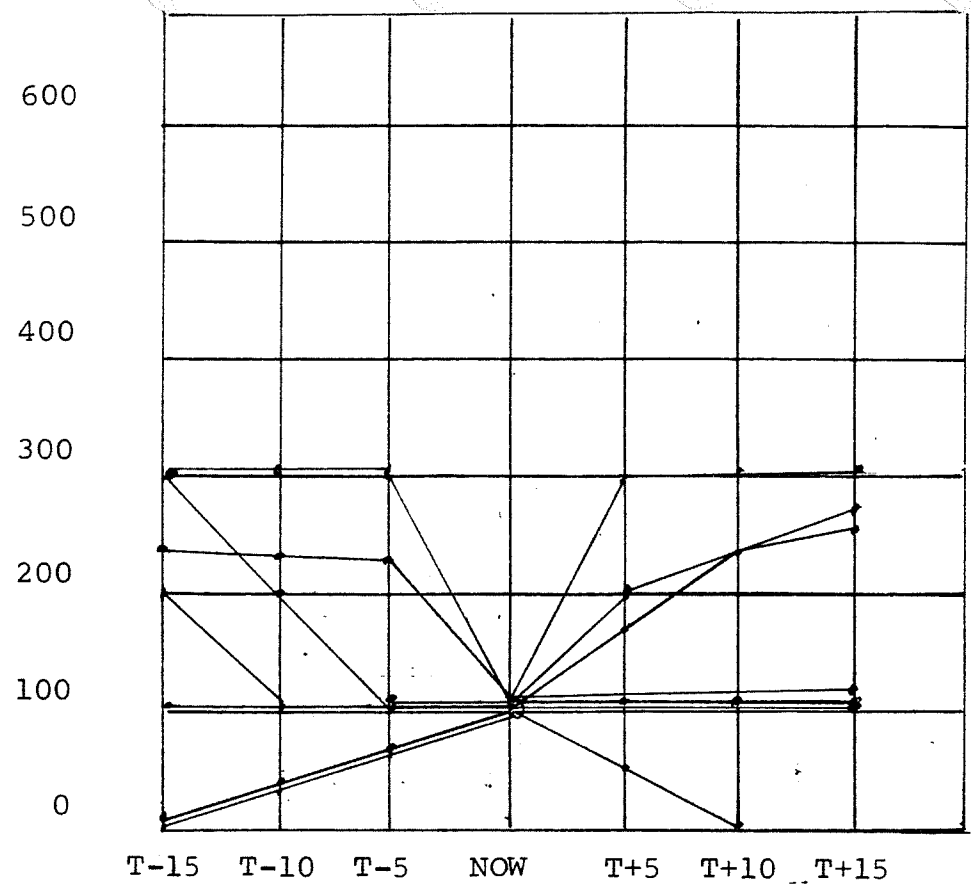


PAST
800 MHZ BAND OPENED UP FOR PUBLIC SAFETY.

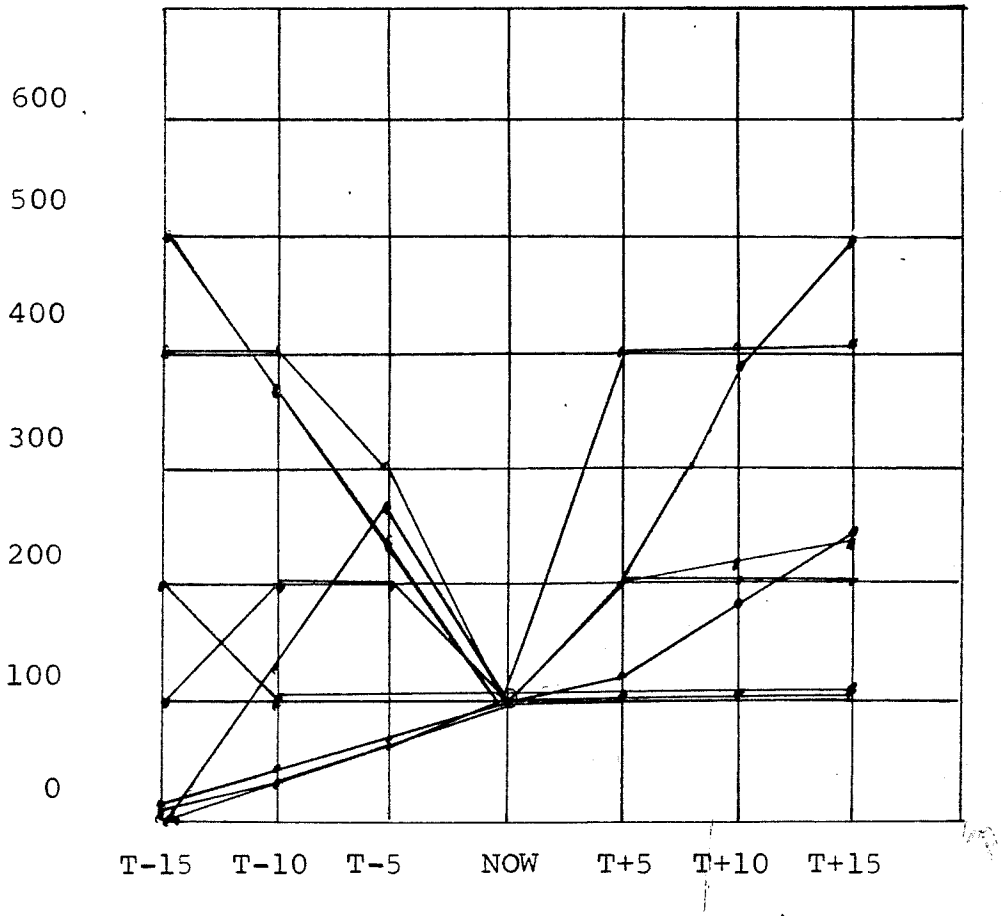


PAST
RECOGNITION OF THE NEED FOR LAW ENFORCEMENT PRIORITY FOR ACCESS TO ADDITIONAL AREAS OF SPECTRUM, AND A DIRECTION BY CONGRESS TO FCC TO PRIORITIZE PUBLIC SAFETY NEEDS.

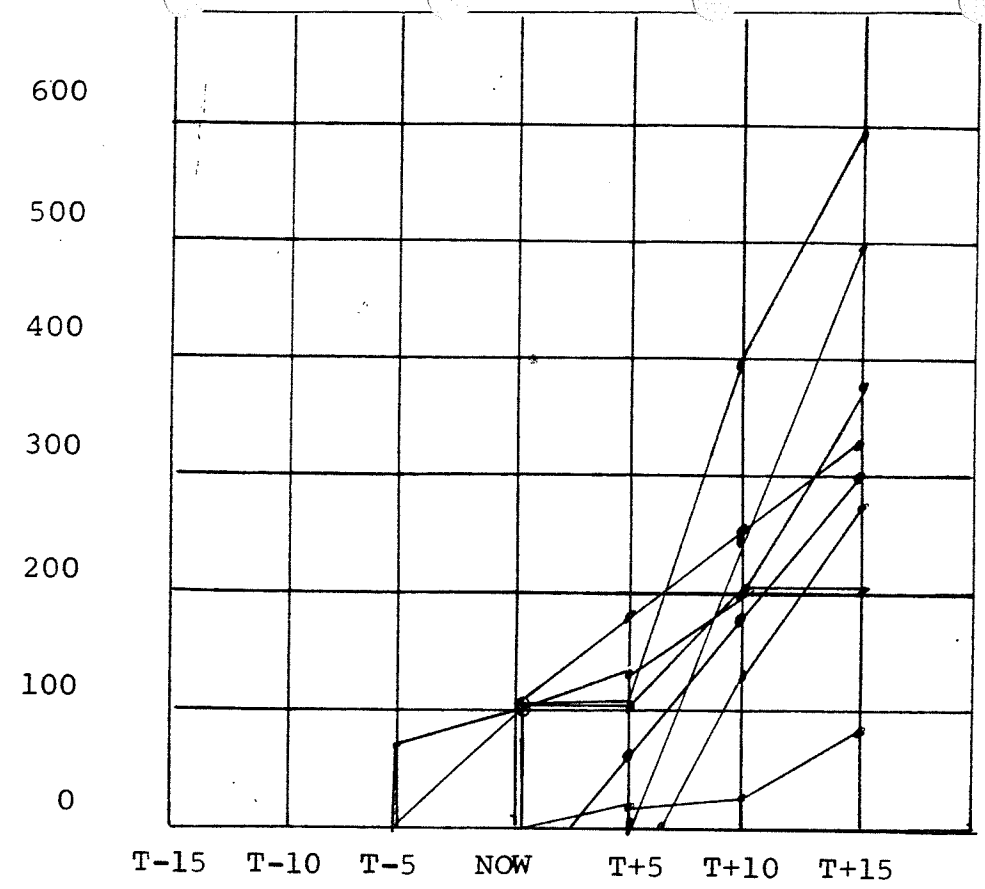
C 17



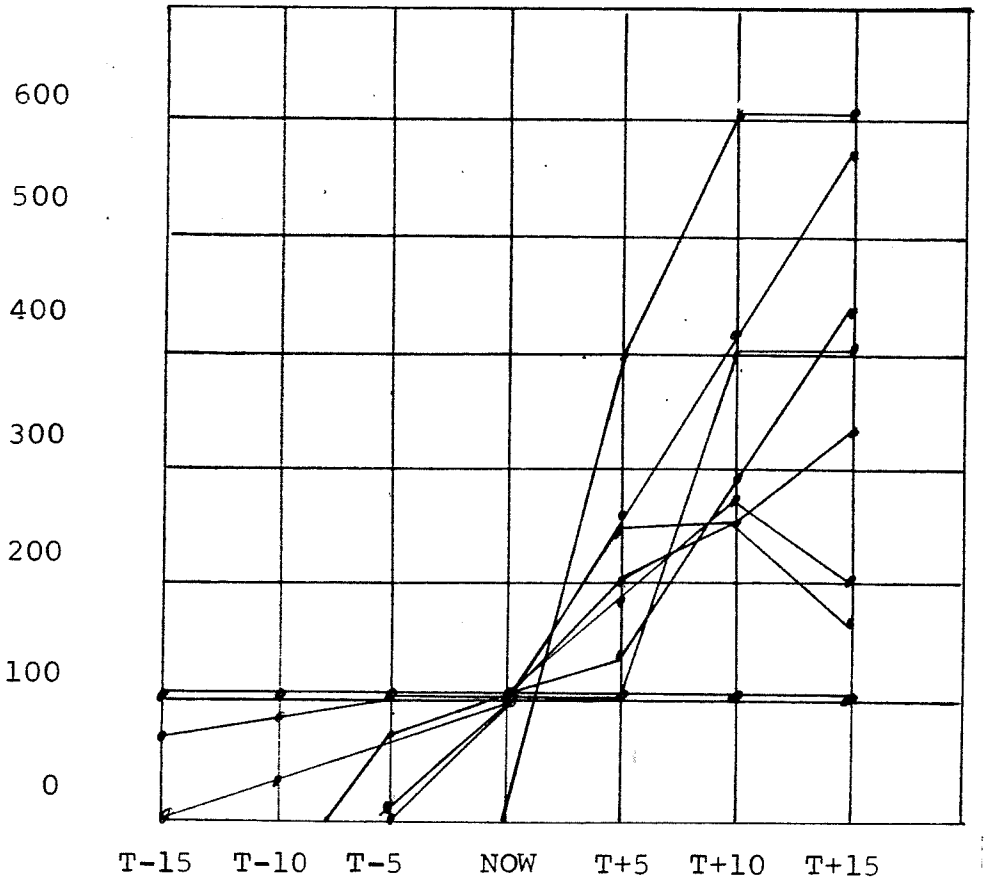
PAST
MOBILE RELAYS FOR GREATER CAR TO CAR COMMUNICATION.



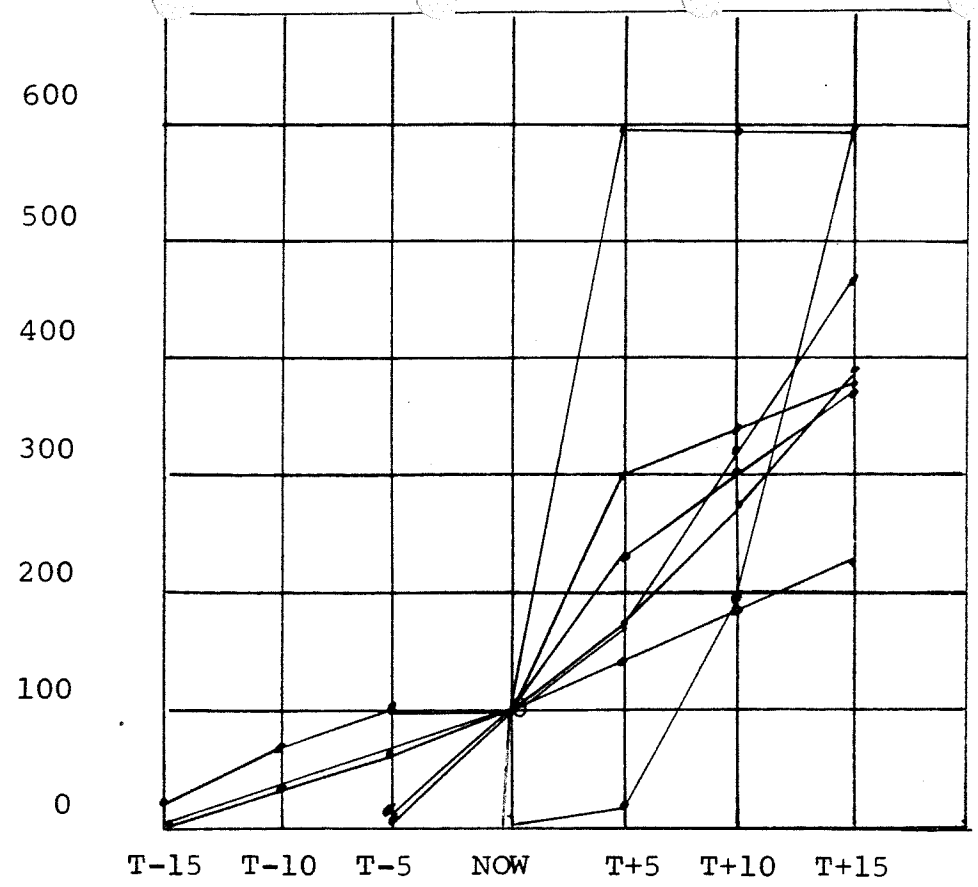
PAST
GREATER EFFORTS AT FREQUENCY COORDINATION THROUGH THE EFFORTS OF APCO.



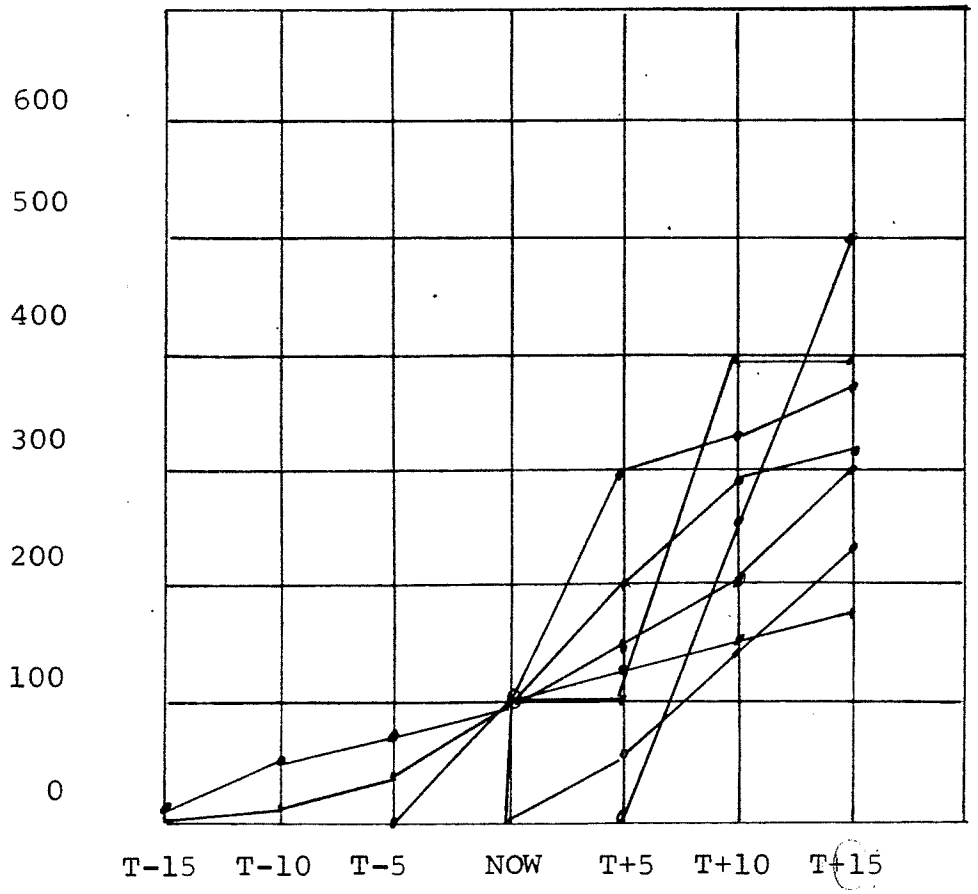
FUTURE
USE OF SATELLITE COMMUNICATIONS FOR UNIQUE DISASTER SITUATIONS, SUCH AS EARTHQUAKES OR INTERSTATE COMMUNICATIONS.



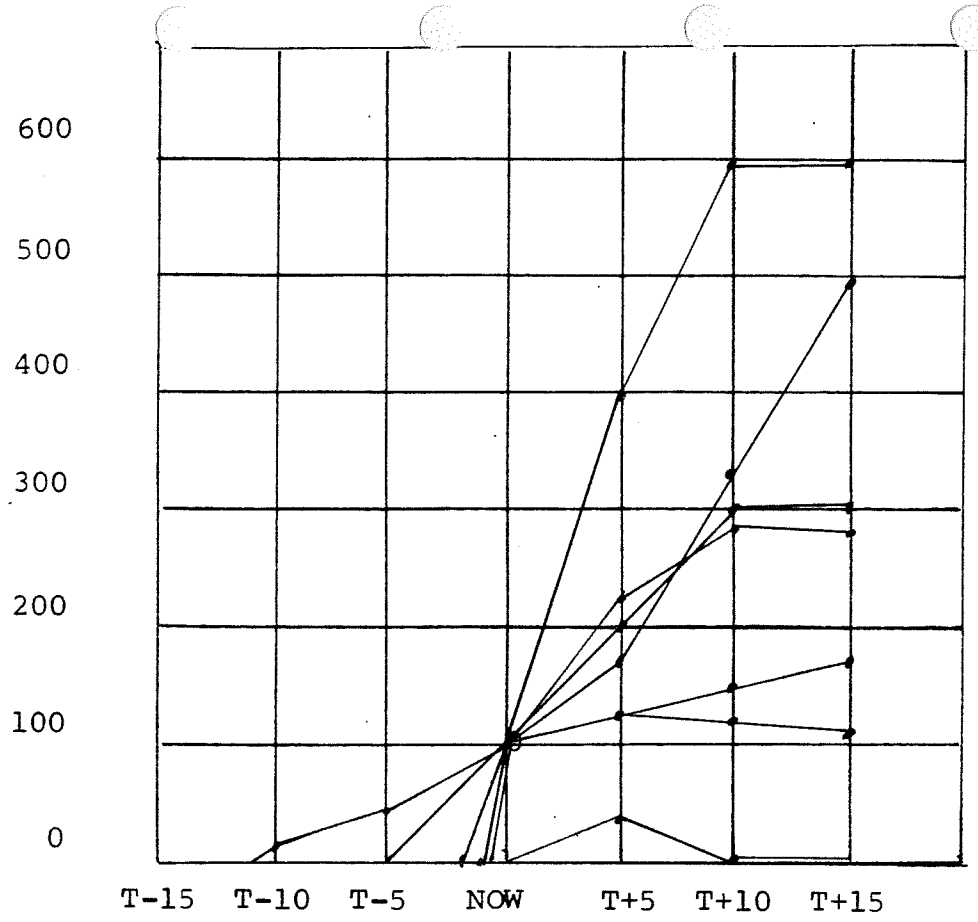
FUTURE
CONTINUED INCREASE IN USAGE OF 450-470, 800 & 900 MHZ AREAS OF THE SPECTRUM, ALONG WITH GREATER COORDINATION OF VHF HIGH BAND USAGE.



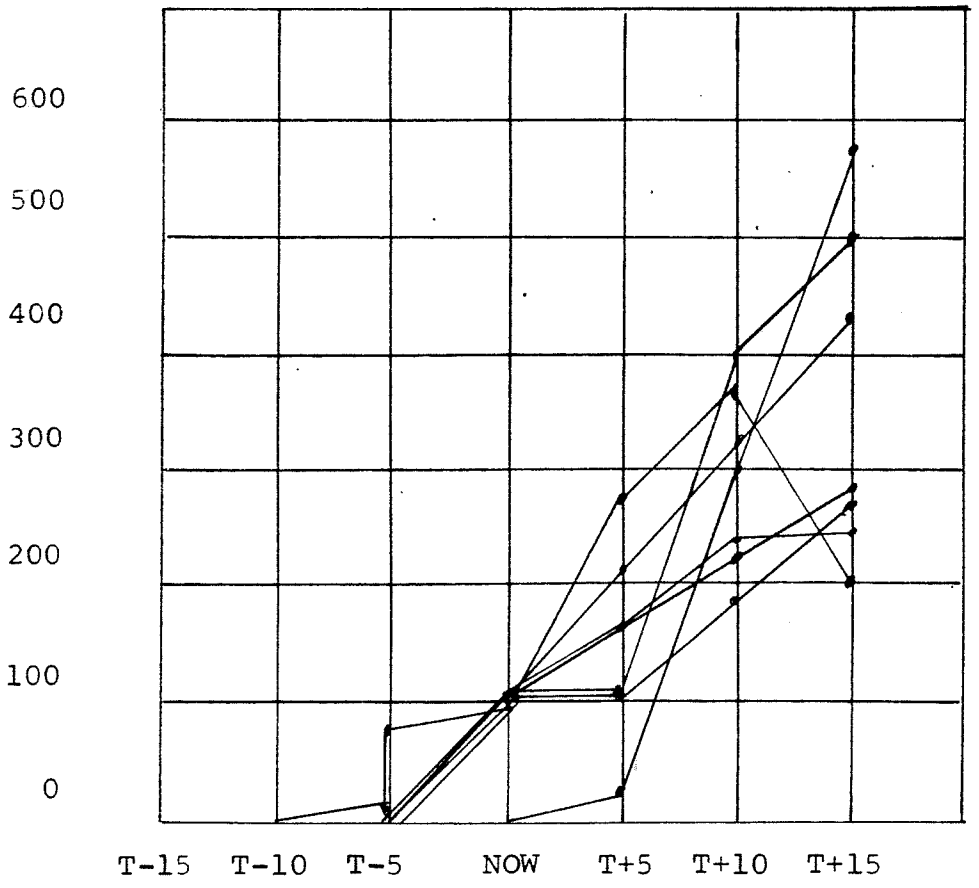
FUTURE
THERE WILL BE INCREASED FREQUENCY COORDINATION BY FCC AND APCO.



FUTURE
ENHANCED 911 SYSTEMS UTILIZING CAD, WILL BECOME MANDATORY WHICH WILL INCREASE THE WORK OUTPUT CAPABILITY OF EACH PERSON BY @ THREE TIMES. DISPATCHERS WILL HAVE TO BE ABLE TO OPERATE COMPUTERS TO FUNCTION WITH THIS SYSTEM.

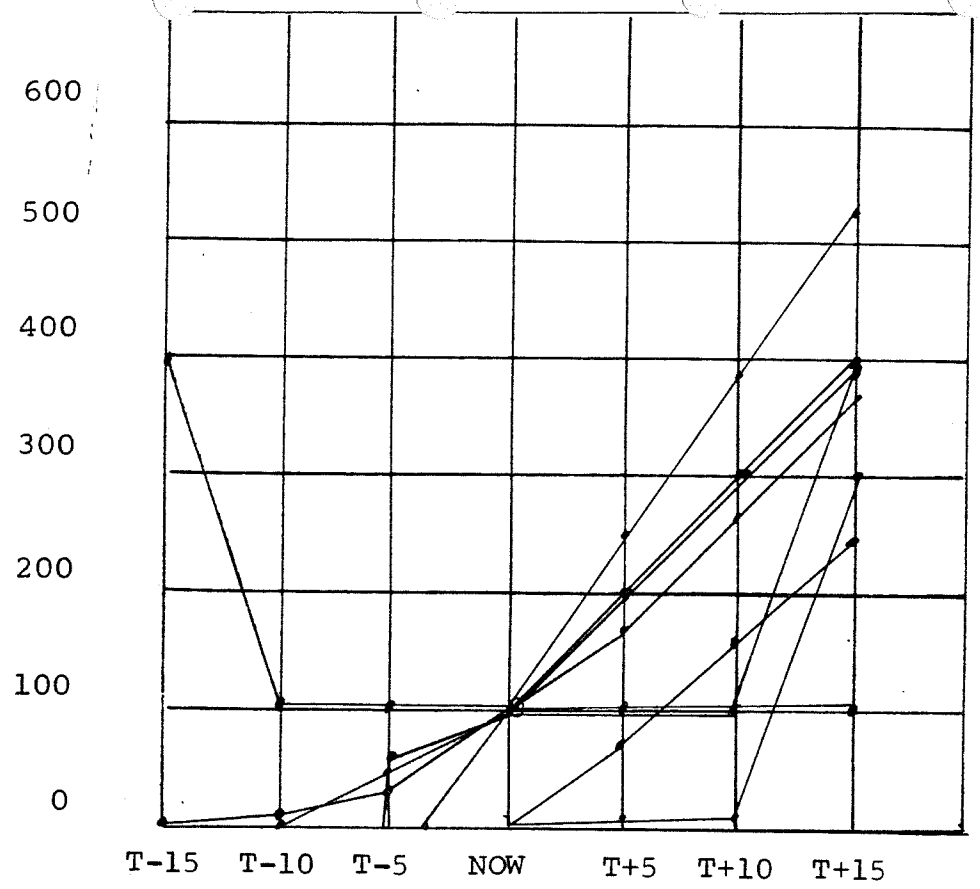


FUTURE
GREATER PROLIFERATION OF PROGRAMMABLE RADIOS.

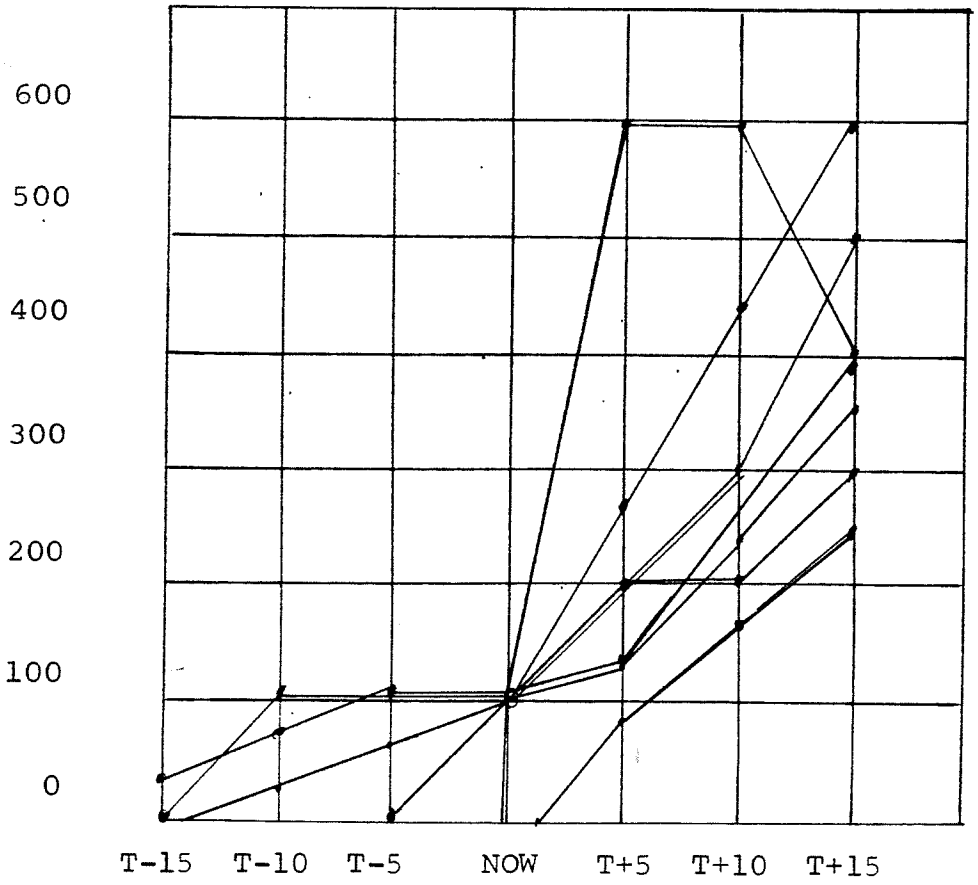


FUTURE
THERE WILL BE MORE 800 MHZ SYSTEMS, BOTH CONVENTIONAL AND TRUNKED.

C21

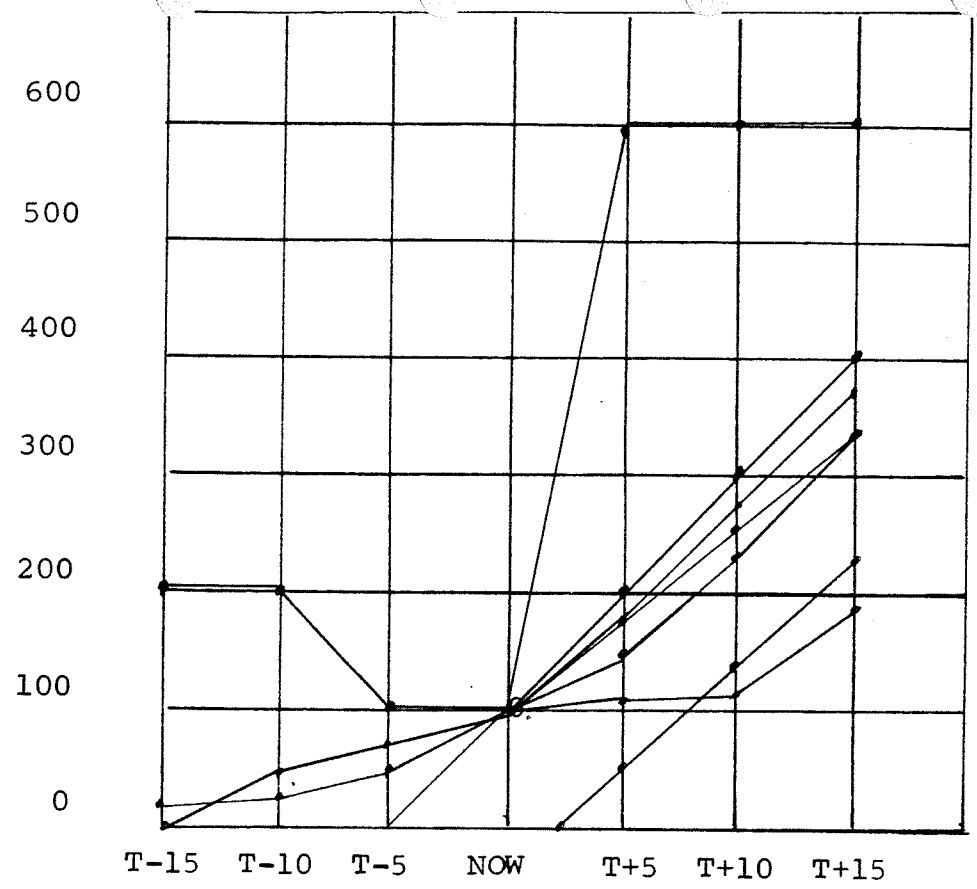


FUTURE
FAR GREATER USE OF DIGITAL COMMUNICATIONS TO SAVE AIR TIME.

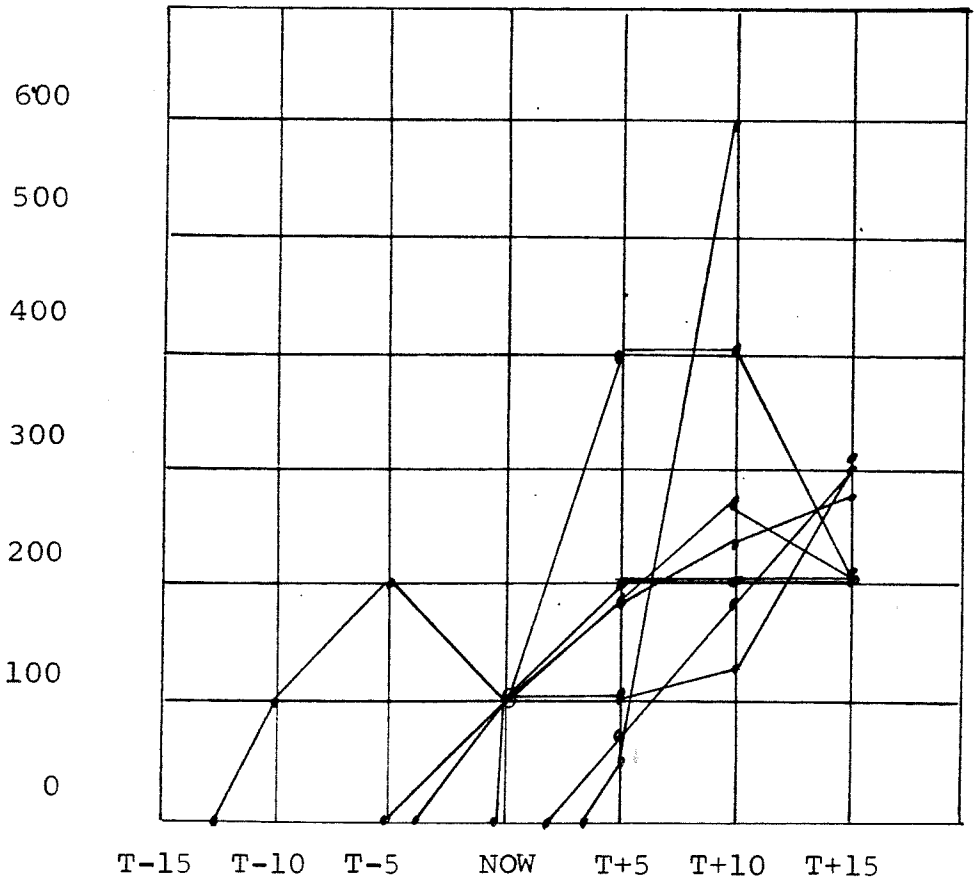


FUTURE
THERE WILL BE MAJOR RADIO TRAFFIC CONGESTION ON ALL FREQUENCIES.

C22



FUTURE
FCC WILL COMPEL AGENCIES TO BECOME MORE SPECTRUM-EFFICIENT.



FUTURE
THE FCC WILL BE FORCED TO MAKE ADDITIONAL 500 & 800 MHZ SPECTRUM AVAILABLE TO PUBLIC SAFETY.

C23

CENTRAL TENDENCY RANGE

PAST EVENTS AND TRENDS	T-15	T-10	T-5	0	T+5	T+10	T+15
1. Transistorized equipment.	200	75	25	0	50	100	125
2. Implementation of state-wide interagency frequencies.	0	25	90	0	0	60	110
3. PL to eliminate nuisance interference.	300	175	75	0	90	100	150
4. Concept of 911 centers developed.	0	25	150	0	0	90	150
5. Recognition of law enforcement need for access to additional areas of spectrum, and direction by congress to prioritize public safety needs	0	100	500	0	0	75	75
6. 800 MHz band opened up for public safety.	0	90	175	0	75	100	100
7. Greater efforts at frequency coordination through the efforts of APCO.	190	250	125	0	90	25	50
8. Mobile relays for greater car to car communication.	125	100	25	0	75	125	150
9. Radio systems start to evolve.	150	50	25	0	50	100	175
10. From the 1930's, the FCC system of frequency allocation. Problem created by this system has compounded to a point where it is currently catastrophic.	75	225	40	0	50	50	75

FORECASTED EVENTS AND TRENDS							
1. More 800MHz UHF systems - conventional and trunked.	0	0	10	0	90	75	150
2. Greater proliferation of programmable radios.	0	0	35	0	75	150	125
3. Continued increase in usage of 450-470, 800 & 900MHz UHF spectrum, along with greater coordination of VHF high band usage.	0	0	25	0	75	125	200
4. Use of satellite communications for unique disaster situations, such as earthquakes or inter-state communications.	0	0	0	0	90	60	50
5. Enhanced 911 systems using CAD will become mandatory which will increase work output capability of each person by @ 3x. Dispatchers will have to be able to operate computers to function with this system.	0	0	0	0	50	90	75
6. Increased frequency coordination by FCC and APCO.	0	0	10	0	50	35	25
7. Major radio traffic congestion on all frequencies.	0	75	100	0	0	75	50
8. Far greater use of digital communications to save air time.	0	10	50	0	100	175	100
9. FCC to be forced to make additional 500-800MHz UHF spectrum available to public safety.	0	0	0	0	100	75	90
10. FCC to compel agencies to become more spectrum-efficient.	10	150	50	0	25	50	50

PAST EVENTS / TRENDS	CONSENSUS VALUES						
	T-15	T-10	T-5	NOW	T+5	T+10	T+15
1. Transistorized equipment.	100	75	10	100	25	100	150
2. Implementation of state-wide interagency frequencies.	0	25	12	100	0	75	115
3. PL to eliminate nuisance interference.	0	75	75	100	90	110	150
4. Concept of 911 centers developed.	0	25	150	100	0	75	150
5. Recognition of the need for law enforcement priority for access to additional areas of spectrum, and a direction by Congress to the FCC to prioritize public safety needs.	10	10	10	100	0	75	75
6. 800MHz band opened up for public safety.	100	100	200	100	100	200	100
7. Greater efforts at frequency coordination through the efforts of APCO.	100	25	125	100	90	25	10
8. Mobile relays for greater car to car communication.	125	100	0	100	75	125	100
9. Radio systems start to evolve.	50	10	0	100	65	100	175
10. From the 1930's, the FCC system of public safety spectrum allocation. Problems created by this system have compounded to a point where they are currently catastrophic.	75	75	25	100	0	50	75

FUTURE TRENDS / EVENTS	CONSENSUS VALUES						
	T-15	T-10	T-5	NOW	T+5	T+10	T+15
1. There will be more 800MHz systems, both conventional and trunked.	0	0	0	100	0	100	150
2. Greater proliferation of programmable radios.	0	0	0	100	75	150	125
3. Continued increase in usage of 450-470MHz and 800-900MHz UHF areas of the spectrum, along with greater coordination of VHF high band use.	0	25	75	100	110	125	200
4. Use of satellite communications for unique disaster situations, such as earthquakes or interstate communications.	0	0	0	100	25	0	50
5. Enhanced 911 systems utilizing CAD, will become mandatory which will increase the work output capability of each person by @ three times. Dispatchers will have to be able to operate computers to function with this system.	0	0	0	100	50	90	75
6. There will be increased frequency coordination by FCC and APCO.	0	0	10	100	50	25	75
7. There will be major radio traffic congestion on all frequencies.	0	25	75	100	75	60	50
8. Far greater use of digital communications to save air time.	0	0	75	100	100	200	90
9. The FCC will be forced to make additional 500 & 800MHz UHF spectrum available to public safety.	0	0	0	100	100	75	75
10. FCC will compel agencies to become more spectrum-efficient.	25	25	50	100	30	50	50

FUTURE TRENDS / EVENTS	MEDIAN VALUES						
	T-15	T-10	T-5	NOW	T+5	T+10	T+15
1. There will be more 800MHz systems, both conventional and trunked.	0	0	0	100	150	300	275
2. Greater proliferation of programmable radios.	0	0	0	100	175	290	275
3. Continued increase in usage of 450-470MHz and 800-900MHz UHF areas of the spectrum, along with greater coordination of VHF high band use.	0	0	0	100	190	300	325
4. Use of satellite communications for unique disaster situations, such as earthquakes or interstate communications.	0	0	0	100	75	200	300
5. Enhanced 911 systems utilizing CAD, will become mandatory which will increase the work output capability of each person by @ three times. Dispatchers will have to be able to operate computers to function with this system.	0	0	0	100	125	250	310
6. There will be increased frequency coordination by FCC and APCO.	0	0	10	100	175	300	375
7. There will be major radio traffic congestion on all frequencies.	0	25	75	100	200	275	390
8. Far greater use of digital communications to save air time.	0	0	25	100	100	175	375
9. The FCC will be forced to make additional 500 & 800MHz UHF spectrum available to public safety.	0	0	0	100	190	225	275
10. FCC will compel agencies to become more spectrum-efficient.	0	50	75	100	175	250	325

PAST EVENTS / TRENDS	MEDIAN VALUES						
	T-15	T-10	T-5	NOW	T+5	T+10	T+15
1. Transistorized equipment.	100	75	75	100	125	175	200
2. Implementation of State-Wide Interagency frequencies.	0	25	75	100	35	50	35
3. PL to eliminate nuisance interference.	0	125	75	100	175	200	200
4. Concept of 911 centers developed.	0	0	75	100	200	200	200
5. Recognition of the need for law enforcement priority for access to additional areas of spectrum, and a direction by congress to the FCC to prioritize public safety needs.	0	100	100	100	200	275	275
6. 800MHz band opened up for public safety.	0	25	75	100	200	300	250
7. Greater efforts at frequency coordination through the efforts of APCO.	50	125	225	100	200	200	225
8. Mobile relays for greater car to car communication.	200	100	100	100	100	100	100
9. Radio systems start to evolve.	60	75	90	100	150	225	200
10. From the 1930's, the FCC system of public safety spectrum allocation. Problems created by this system have compounded to a point where they are currently catastophic.	0	100	90	100	200	200	250

EVENTS

1. Use of video maps and AVL'S.
2. MDT'S for general use.
3. Satellites for unique disaster situations.
4. Video exchange capability.
5. Radios all syntehsized, no crystals.
6. Satellite repeaters for 900MHz & 1.2 GHz
7. Portables: Multi-band with video display and keyboard.
8. Satellite eliminates repeaters.
9. 5 800MHz Nat. mutual aid channels.
10. Development of AC/SSB and off setting for greater spectrum efficiency.

TRENDS

1. Traffic congestion on all spectrum.
2. Increased usage of 500/900MHz and 1.2GHz - conventional and trunked.
3. Channel narrowing.
4. Pilot/co-pilot concept.
5. Greater spectrum coordination.
6. Common use of cellular systems.
7. Directional antennae. To be "good neighbors." Lower power.
8. Lower prices enable issue of radio to each officer.
9. Single unit radio to integrate voice, data processing and MDT.
10. Decreased usage of VHF-low band.
11. Use of MDT for report preparation.
12. FM obsoleted by AC/SSB.
13. Continued mineaturization.
14. All centers integrated and using CAD.
15. Routine traffic digital.
16. Greater spectrum efficiency.

By 2002 Probability

	EVENTS										TRENDS													
	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	T16
E1	75		0	0	0	0	0	0	0	0	0	0	0	0	95	0	0	0	0	80	85	0	0	90	90	90	0
E2	95	75		0	0	0	0	85	0	0	0	90	90	75	90	0	0	0	0	90	95	95	0	95	95	95	95
E3	90	0	0		75	0	90	0	85	95	0	0	90	0	0	75	0	0	0	0	90	0	0	90	0	0	75
E4	75	85	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	85	0	85
E5	95	0	0	0	0		0	90	0	0	0	0	0	0	0	0	0	0	0	90	85	0	0	0	90	0	0	0
E6	85	75	95	95	95	0		95	85	95	90	95	95	90	0	95	0	95	0	0	95	0	0	90	90	95	95
E7	85	0	95	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	75	90	0	0	0	0	0	75	0
E8	85	75	95	95	95	0	95	0		95	90	95	95	75	0	95	0	95	0	0	95	0	0	80	95	95	95
E9	95	0	0	95	0	0	80	0	80		0	0	80	0	0	85	0	0	0	0	85	0	0	0	0	0	0
E10	95	0	90	0	0	85	0	0	0	0		95	90	95	0	90	0	0	0	0	95	90	95	0	0	90	95

SIGNAL NET AREAS (DIAGRAMS D-2 to D-5)

The following four map diagrams illustrate one possible exemplar application of satellite coverage. In each region, the entire spectrum can be re-used in each arc. Thus, whatever frequencies Los Angeles County Sheriff would be using could be re-used by the San Diego County Sheriff. Actually re-use is far greater than illustrated as not all areas would need to use all the available frequencies in their portion of the spectrum. Thus, in practice overall spectrum could probably be divided into 2 or 3 bandwidths rather than the illustrated 4. In SIGNAL NET 'A' for example, while Los angeles County Sheriff might well need all available frequencies in the bandwidth, most of the other regions would not (such as Inyo County Sheriff, and Siskiyou and Del Norte County Sheriffs). Specific engineering for each area would allow greater efficiency of spectrum utilization. The purpose of these maps is to indicate how such a system could be designed to work.

SIGNAL NET 'A' COUNTIES

A-1. SISKIYOU, DEL NORTE

A-2. MENDOCINO, LAKE.

A-3. PLUMAS, BUTTE, SIERRA YUBA, NEVADA.

A-4. ALAMEDA, CONTRA COSTA, SAN MATEO, SANTA CLARA, SANTA CRUZ, SAN FRANCISCO.

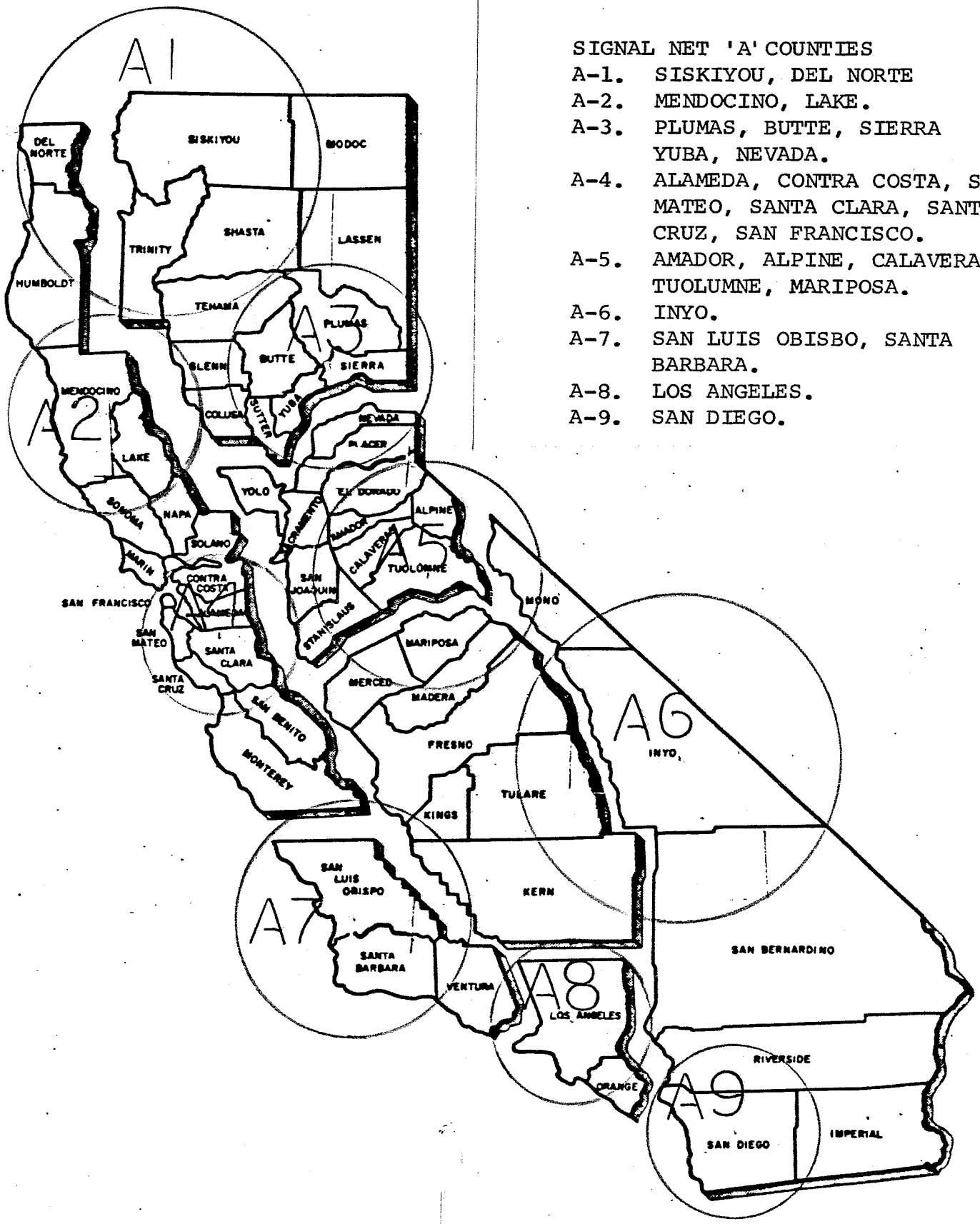
A-5. AMADOR, ALPINE, CALAVERAS, TUOLUMNE, MARIPOSA.

A-6. INYO.

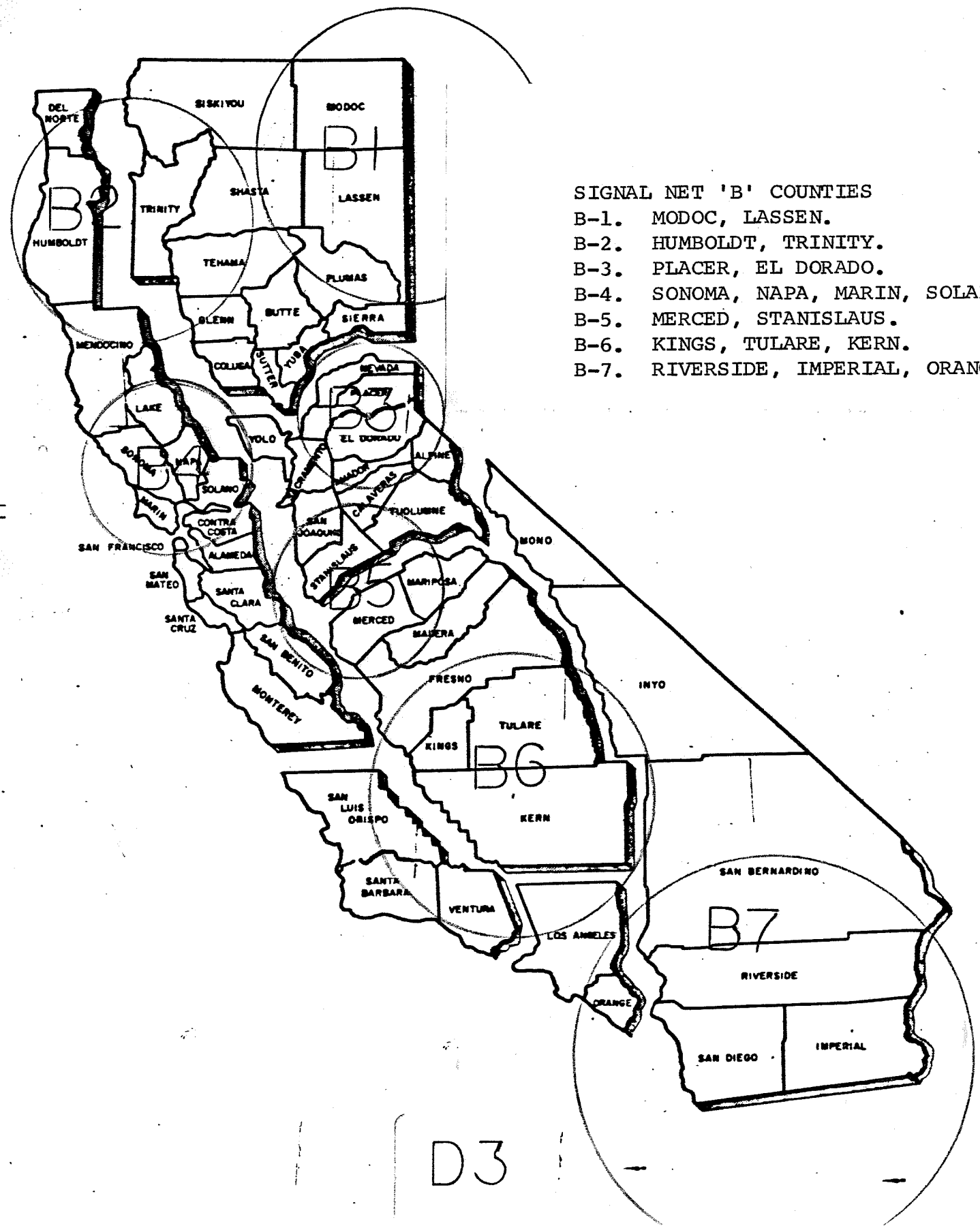
A-7. SAN LUIS OBISBO, SANTA BARBARA.

A-8. LOS ANGELES.

A-9. SAN DIEGO.



D2



SIGNAL NET 'B' COUNTIES

B-1. MODOC, LASSEN.
B-2. HUMBOLDT, TRINITY.
B-3. PLACER, EL DORADO.
B-4. SONOMA, NAPA, MARIN, SOLANO.
B-5. MERCED, STANISLAUS.
B-6. KINGS, TULARE, KERN.
B-7. RIVERSIDE, IMPERIAL, ORANGE.

D3

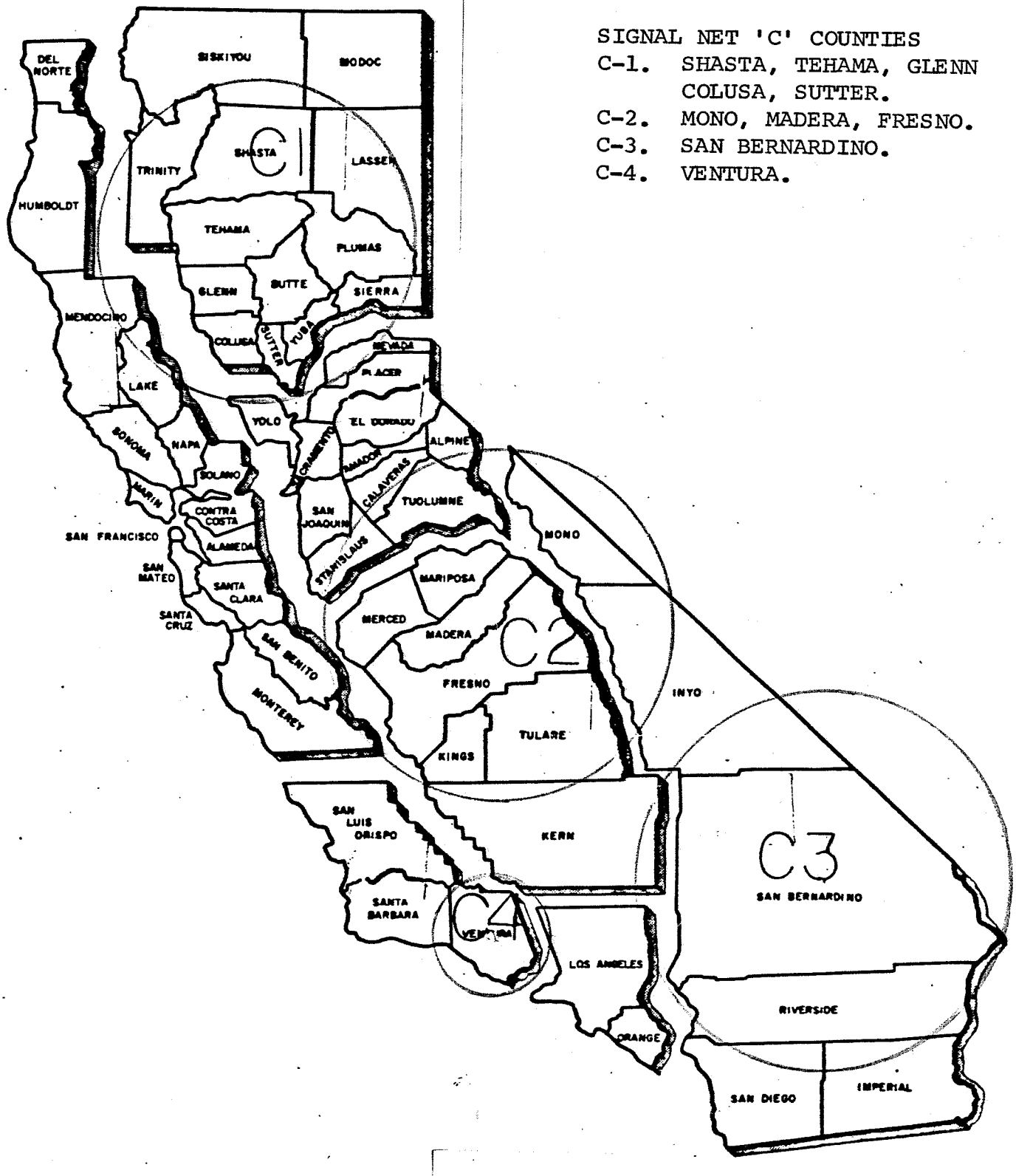
SIGNAL NET 'C' COUNTIES

C-1. SHASTA, TEHAMA, GLENN COLUSA, SUTTER.

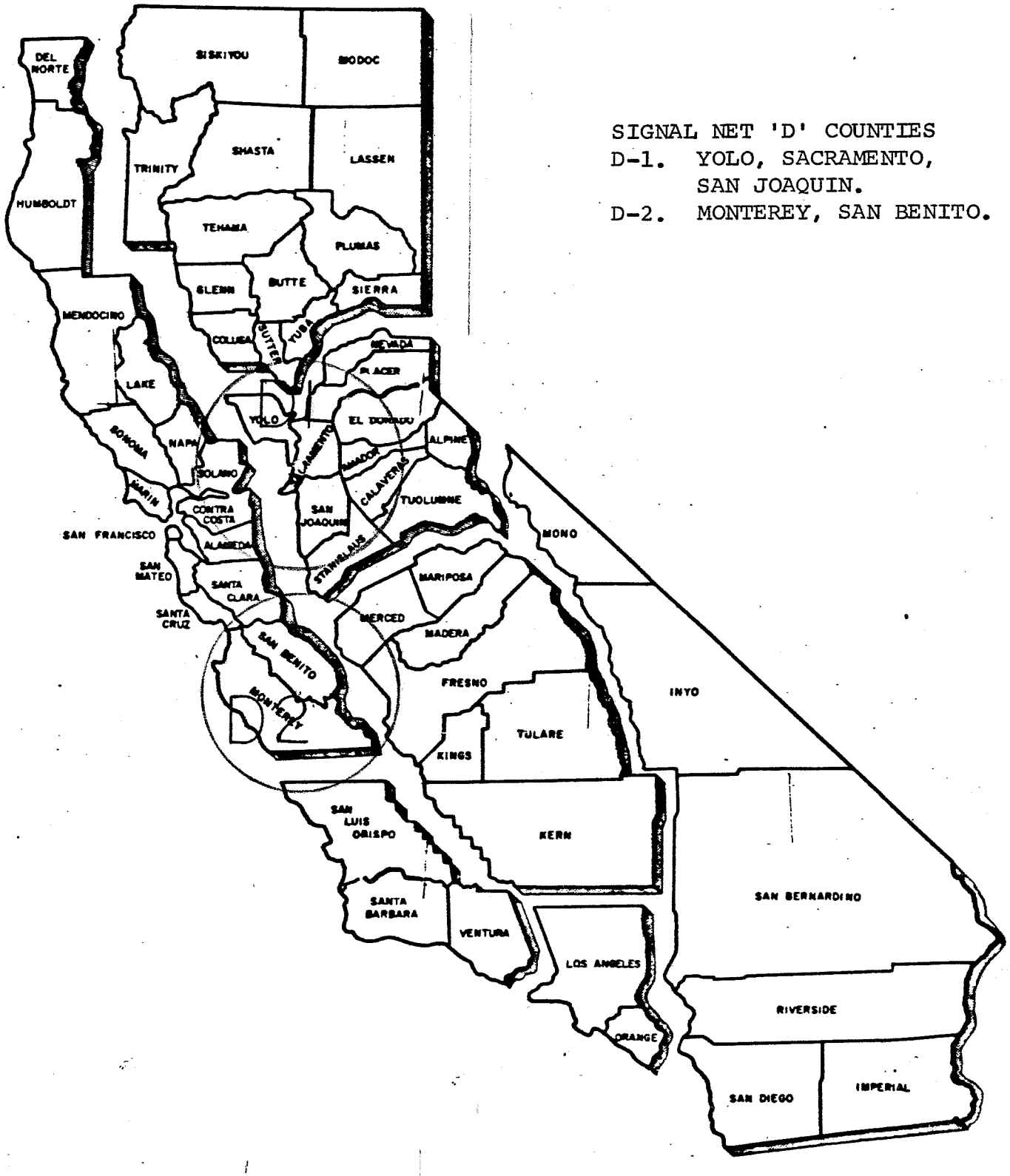
C-2. MONO, MADERA, FRESNO.

C-3. SAN BERNARDINO.

C-4. VENTURA.



D4

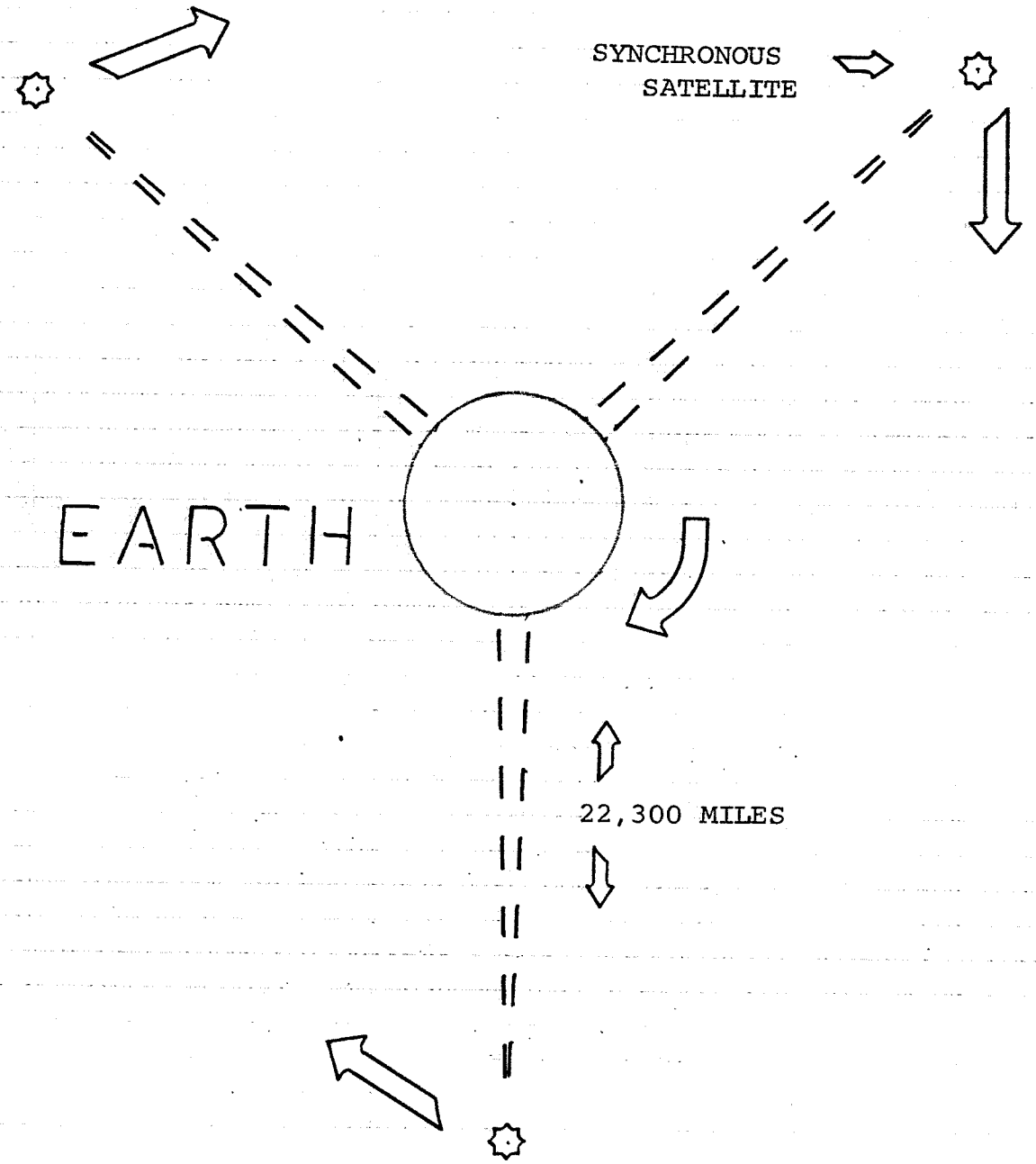


SIGNAL NET 'D' COUNTIES

D-1. YOLO, SACRAMENTO, SAN JOAQUIN.

D-2. MONTEREY, SAN BENITO.

GEOSTATIONARY ORBIT

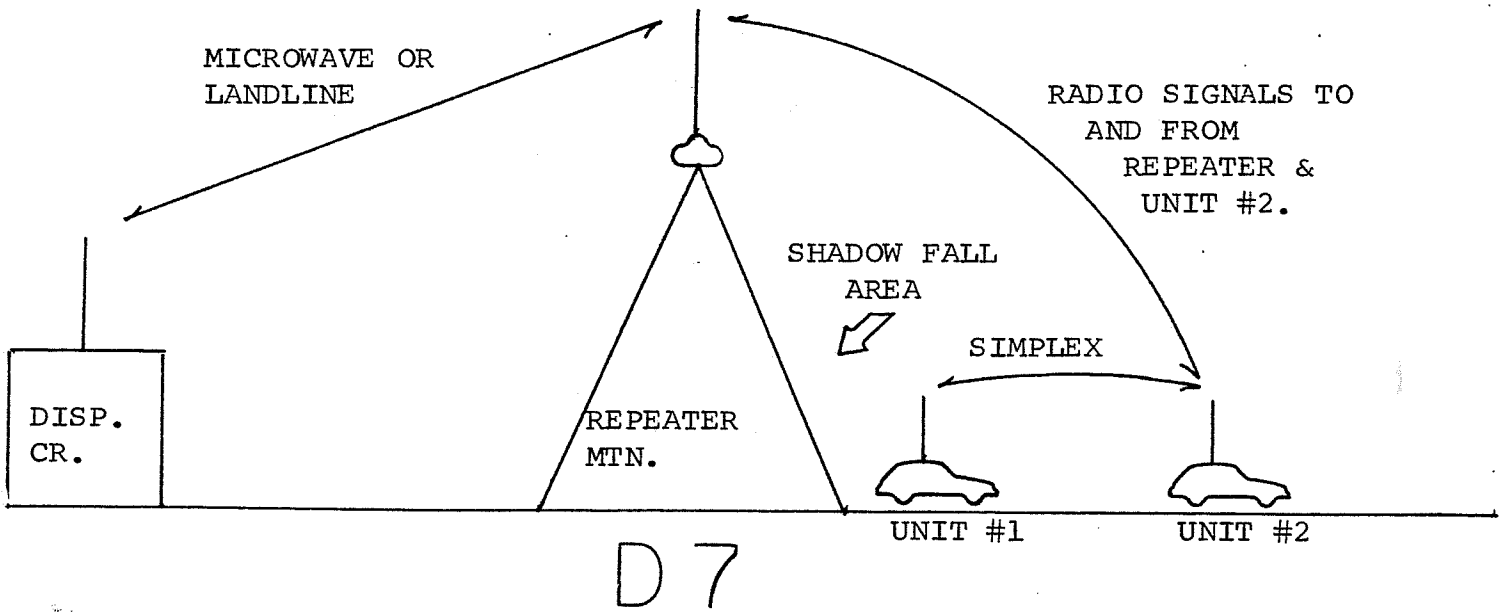


Although the satellite is in synchronous orbit, it will still need periodic adjustment to keep it exactly where it is needed. By equipping the satellite with small gas jets, these adjustments can be can be made from an earth station. Typically a communications satellite will have four such jets powered by hydrogen peroxide.

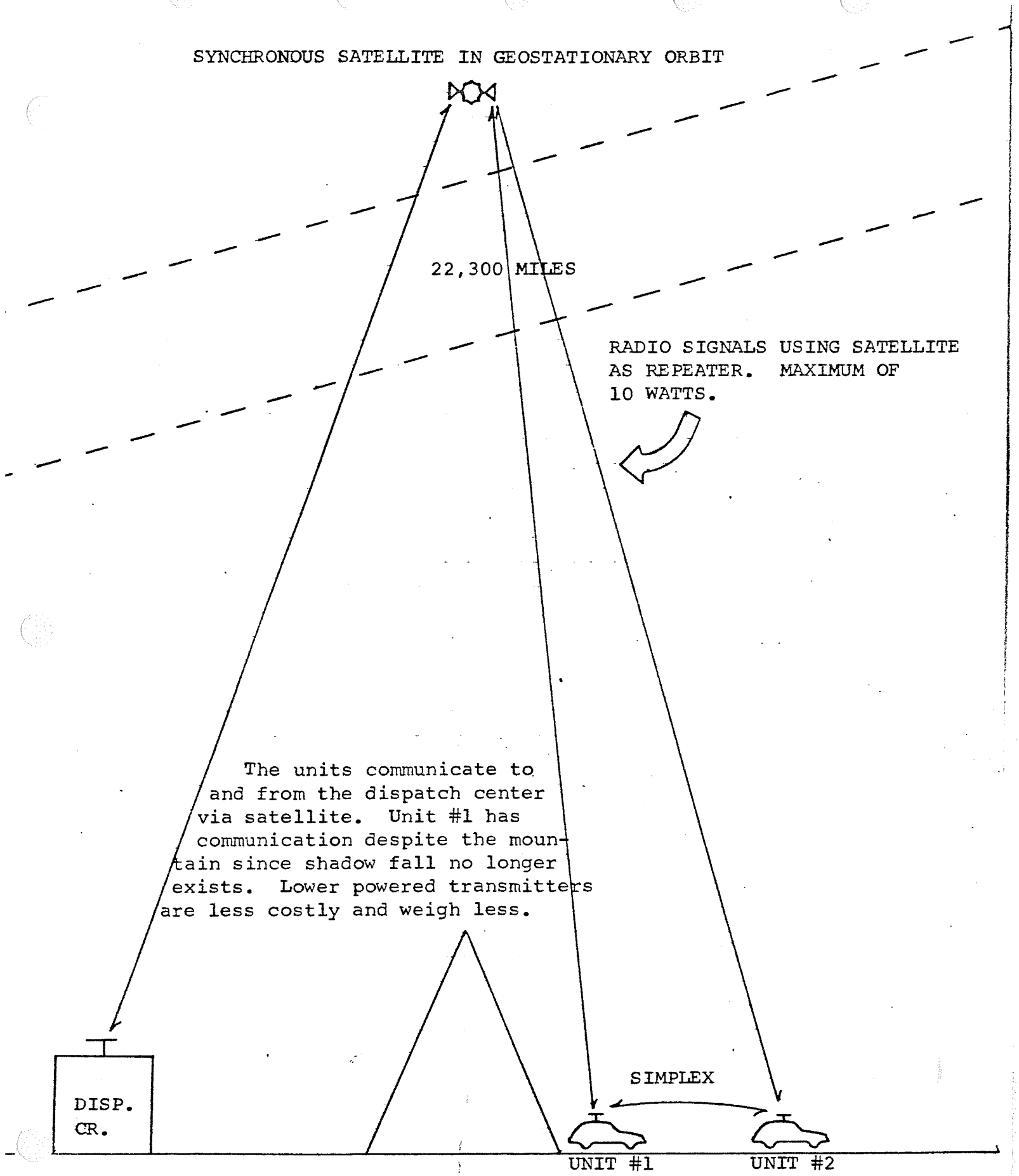
D6

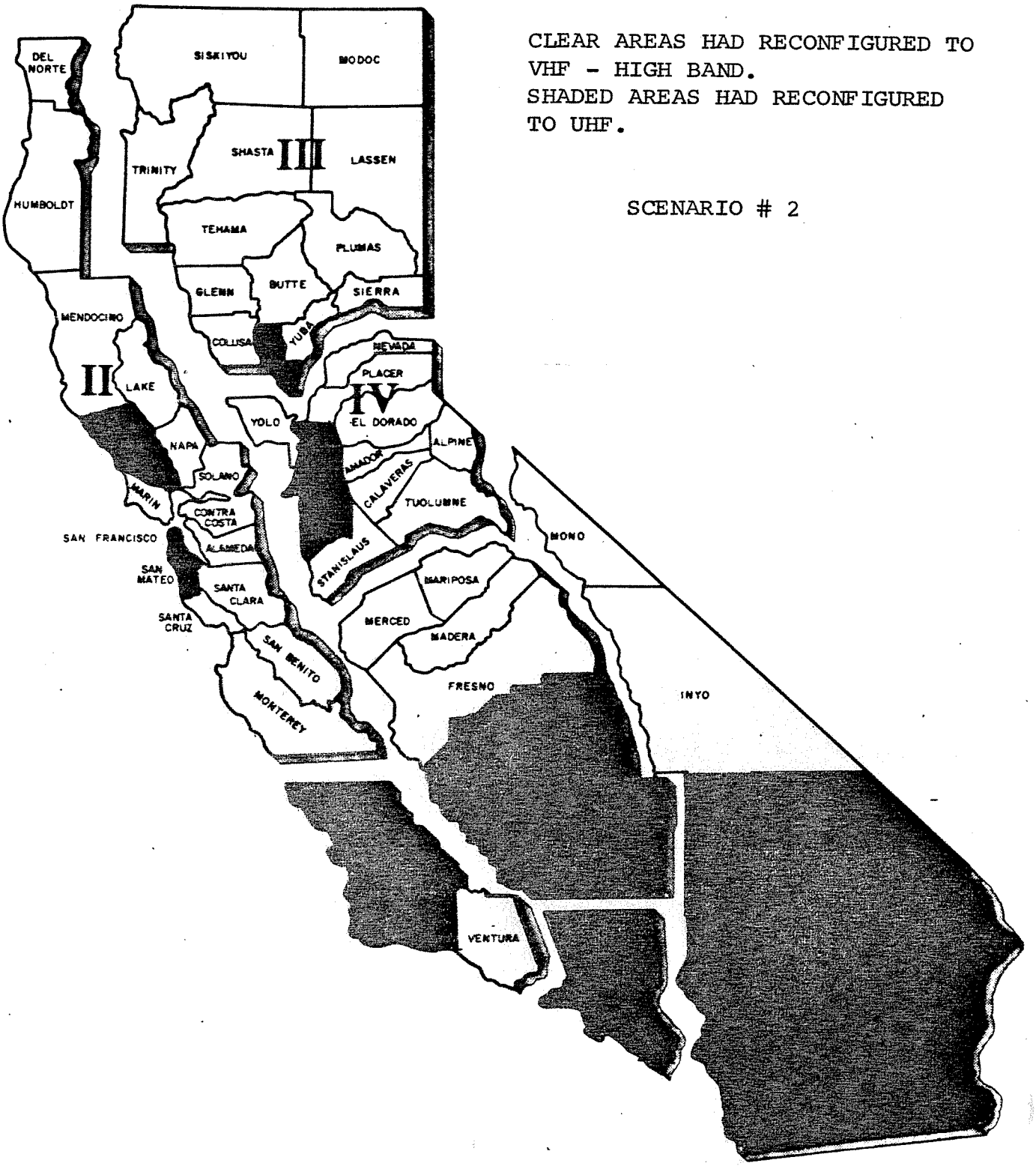
REPEATER SYSTEM PRIOR TO SATELLITE REPLACEMENT

In this illustration the units transmit to and from the repeater which repeats the signal to and from the dispatch center. Without the repeater the mountain would preclude contact. Unit #1 is too close to the mountain, and would be in an area of shadow fall. Unit #1 would not be able to transmit and hit the repeater, and probably could not hear it either. To cure the problem, another repeater is needed, or, if the repeater can be heard, a votive receiver to pick up the signal transmitted by unit #1. Units #s 1 and 2 would be able to communicate with each other if they are equipped for simplex operation (transmission on the receive frequency). The repeater and the units use 100 watt transmitters to try to reduce the shadow fall areas. Diagram D 8 shows exactly the same system if a satellite were introduced to replace the mountain top repeater.



D 7

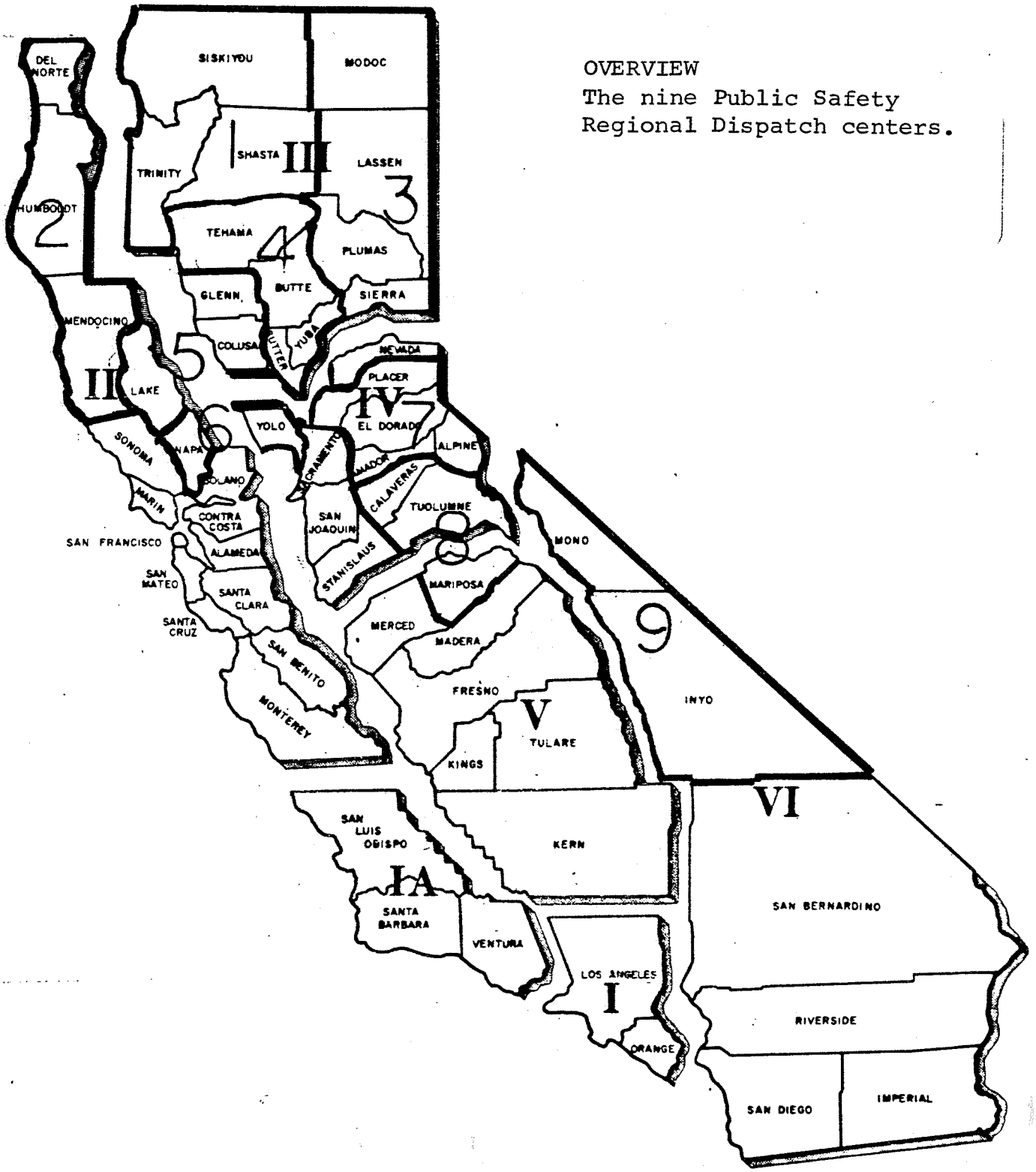

SYNCHRONOUS SATELLITE IN GEOSTATIONARY ORBIT
22,300 MILES
RADIO SIGNALS USING SATELLITE AS REPEATER. MAXIMUM OF 10 WATTS.
The units communicate to and from the dispatch center via satellite. Unit #1 has communication despite the mountain since shadow fall no longer exists. Lower powered transmitters are less costly and weigh less.
DISP. CR.
SIMPLEX
UNIT #1
UNIT #2

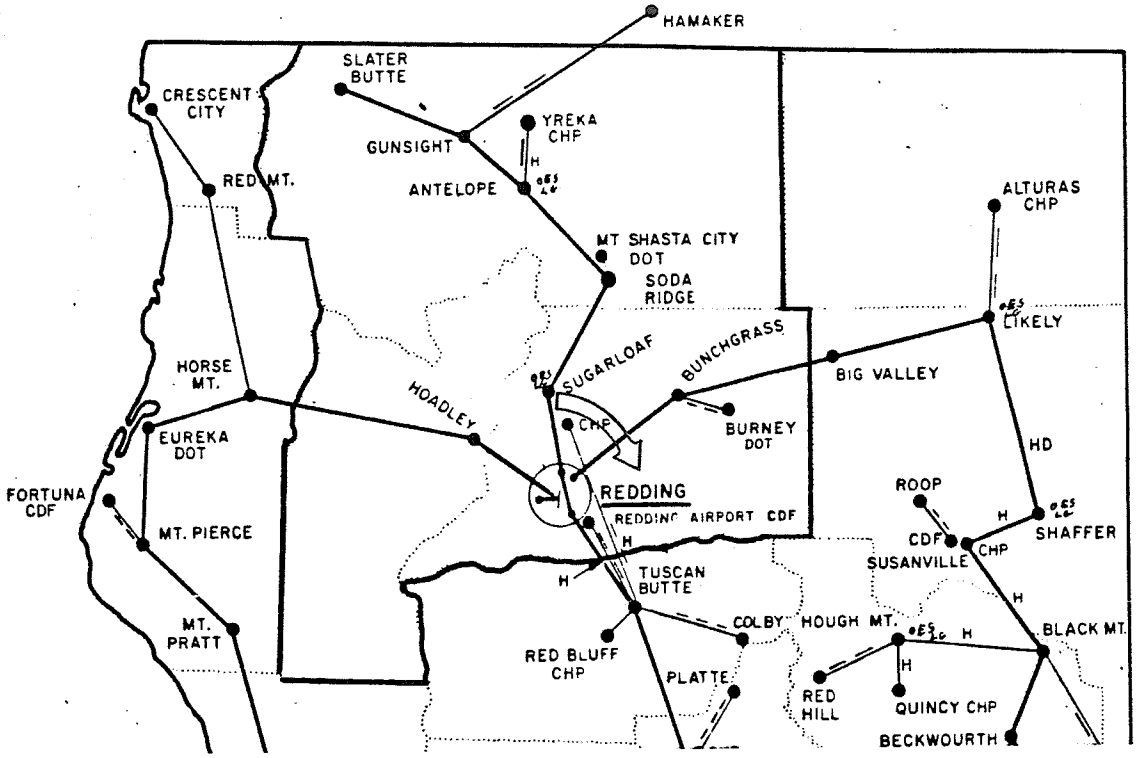


CLEAR AREAS HAD RECONFIGURED TO VHF - HIGH BAND.
SHADED AREAS HAD RECONFIGURED TO UHF.

SCENARIO # 2

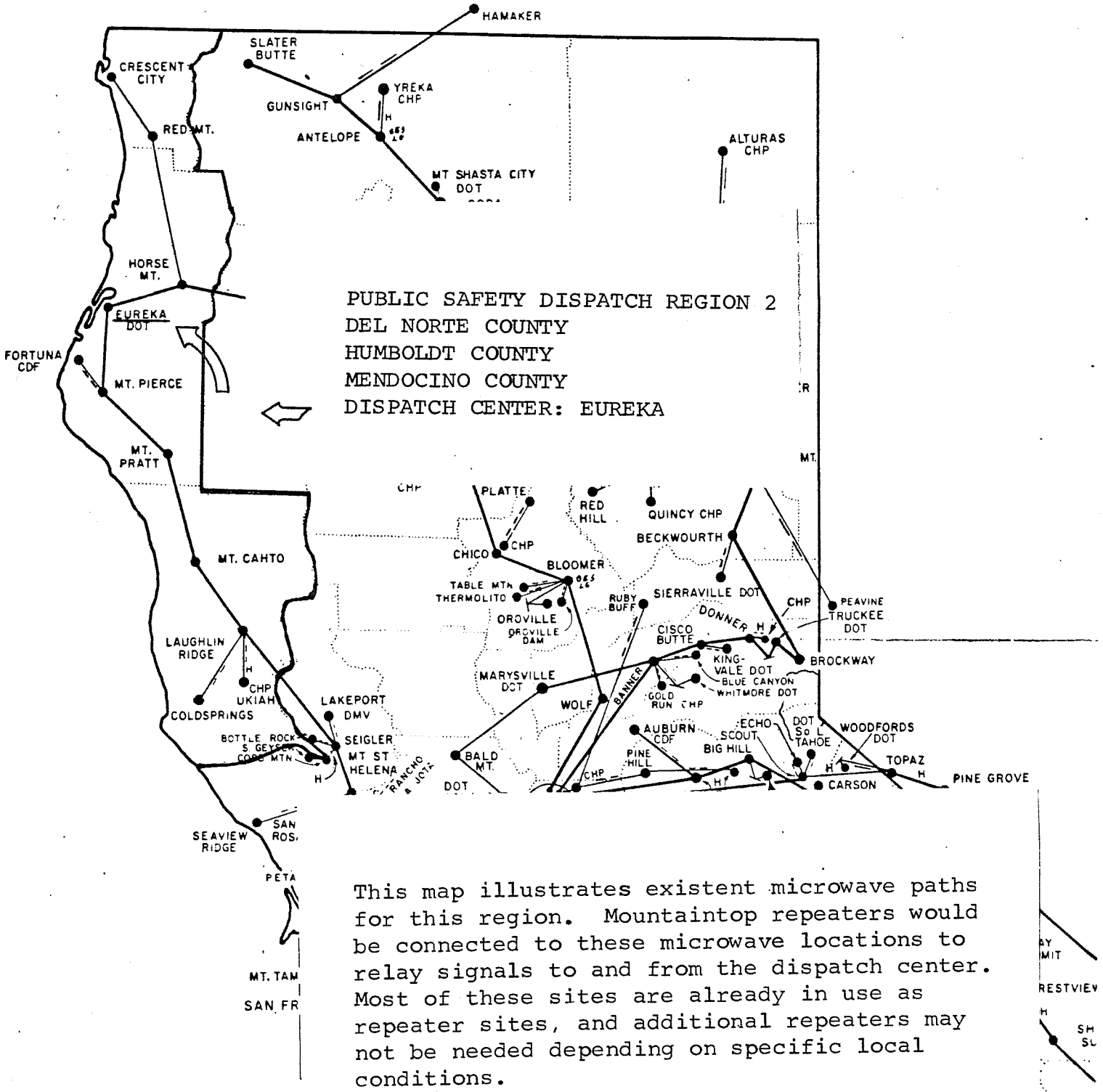
OVERVIEW
The nine Public Safety
Regional Dispatch centers.





PUBLIC SAFETY DISPATCH REGION 1
SHASTA COUNTY
SISKIYOU COUNTY
TRINITY COUNTY
DISPATCH CENTER: REDDING

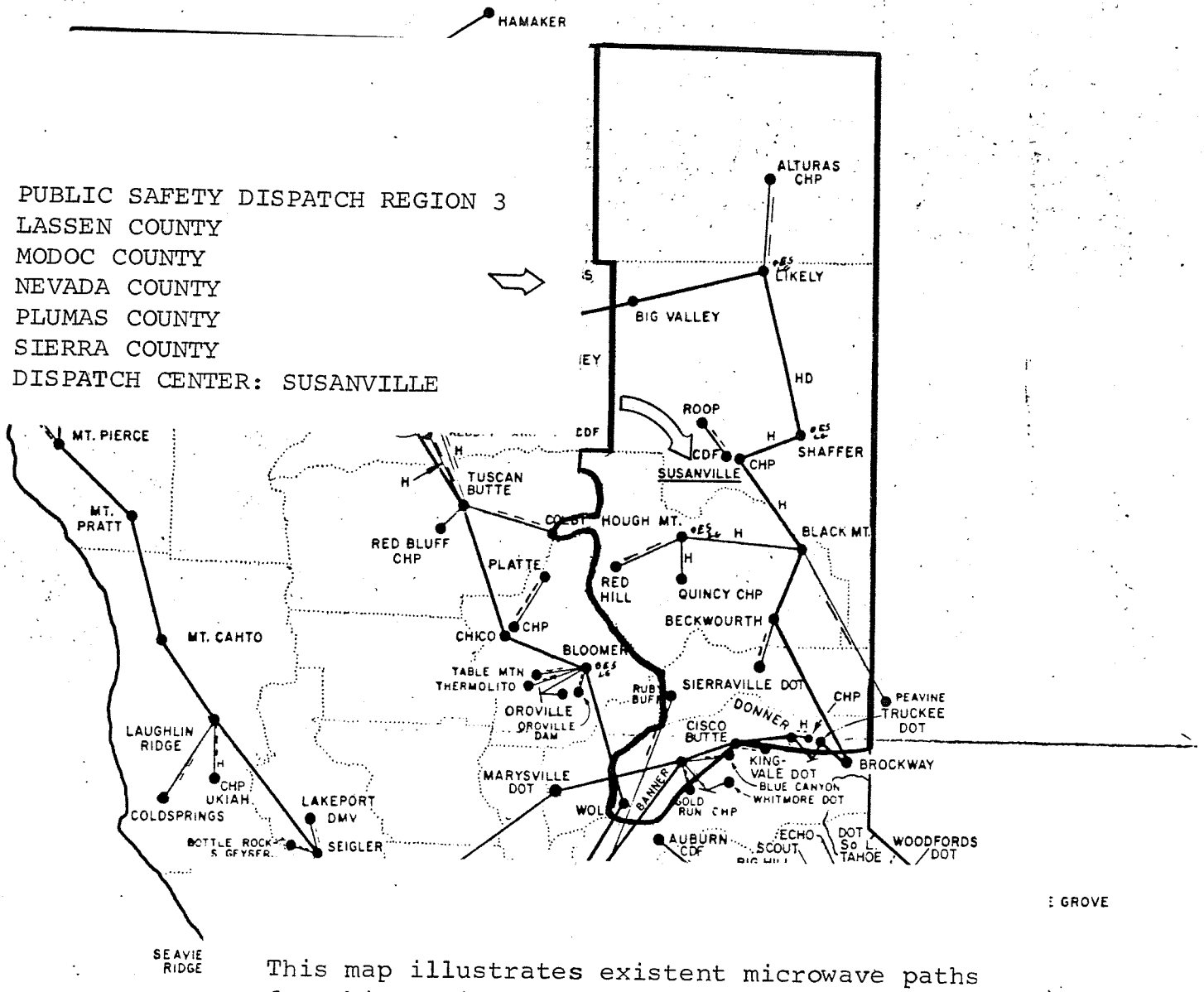
This map illustrates existent microwave paths for this region. Mountaintop repeaters would be connected to these microwave locations to relay signals to and from the dispatch center. Most of these sites are already in use as repeater sites, and additional repeaters may not be needed depending on specific local conditions.



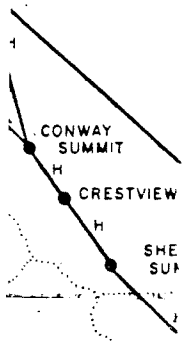
This map illustrates existent microwave paths for this region. Mountaintop repeaters would be connected to these microwave locations to relay signals to and from the dispatch center. Most of these sites are already in use as repeater sites, and additional repeaters may not be needed depending on specific local conditions.

F3

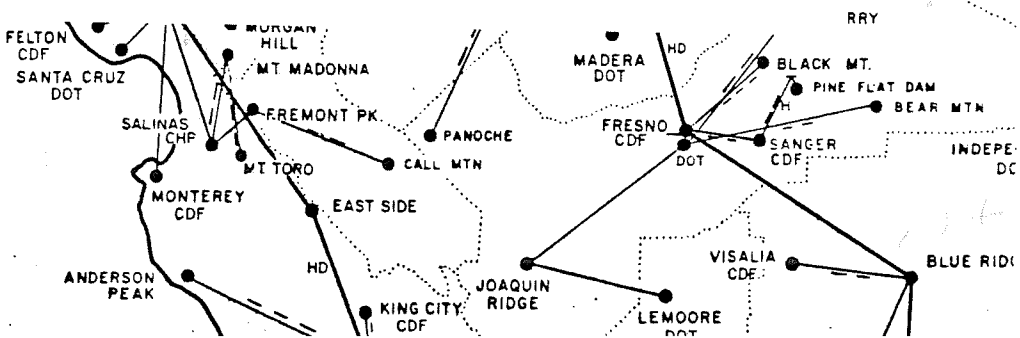
PUBLIC SAFETY DISPATCH REGION 3
LASSEN COUNTY
MODOC COUNTY
NEVADA COUNTY
PLUMAS COUNTY
SIERRA COUNTY
DISPATCH CENTER: SUSANVILLE

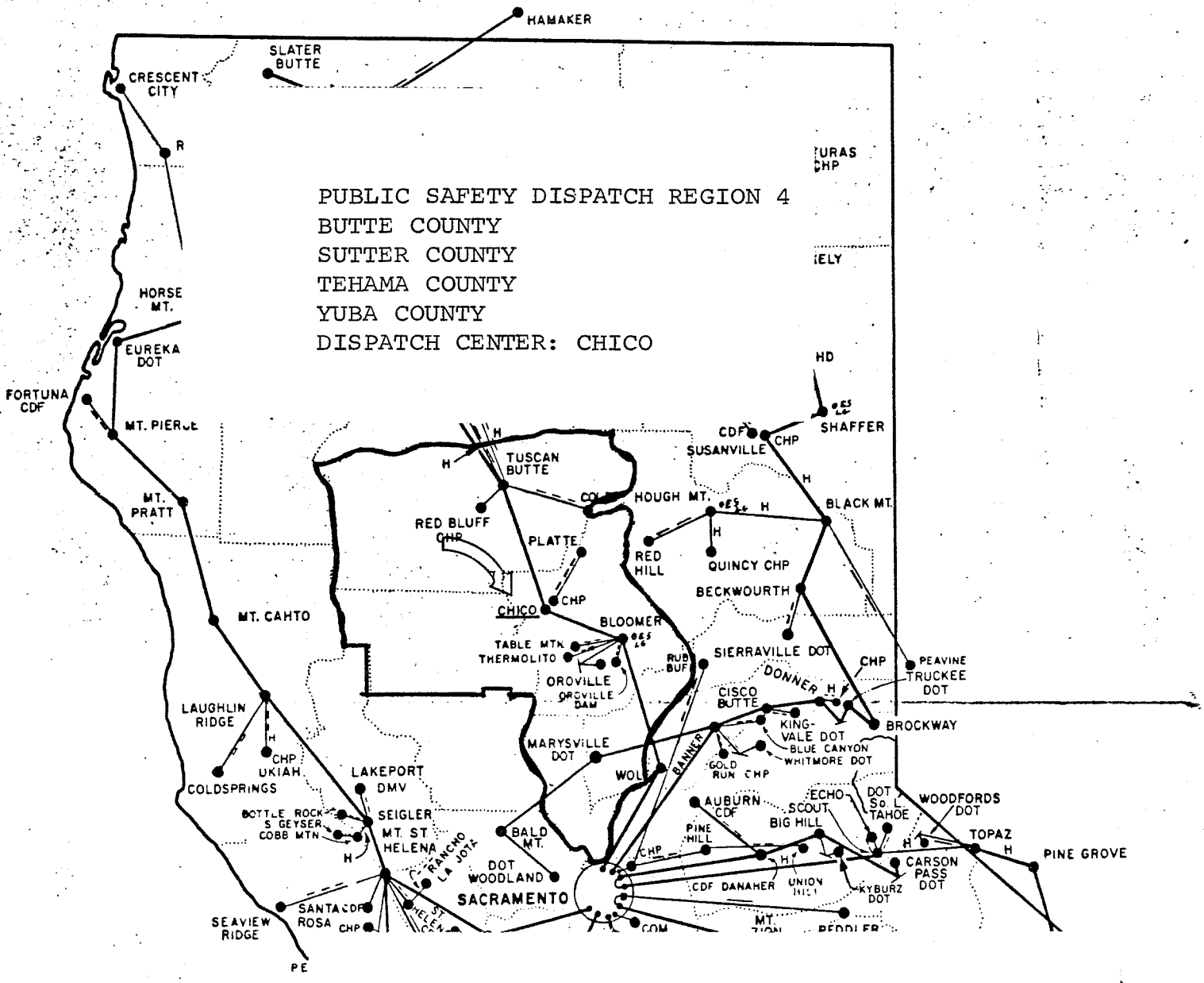


This map illustrates existent microwave paths for this region. Mountaintop repeaters would be connected to these microwave locations to relay signals to and from the dispatch center. Most of these sites are already in use as repeater sites, and additional repeaters may not be needed depending on specific local conditions.



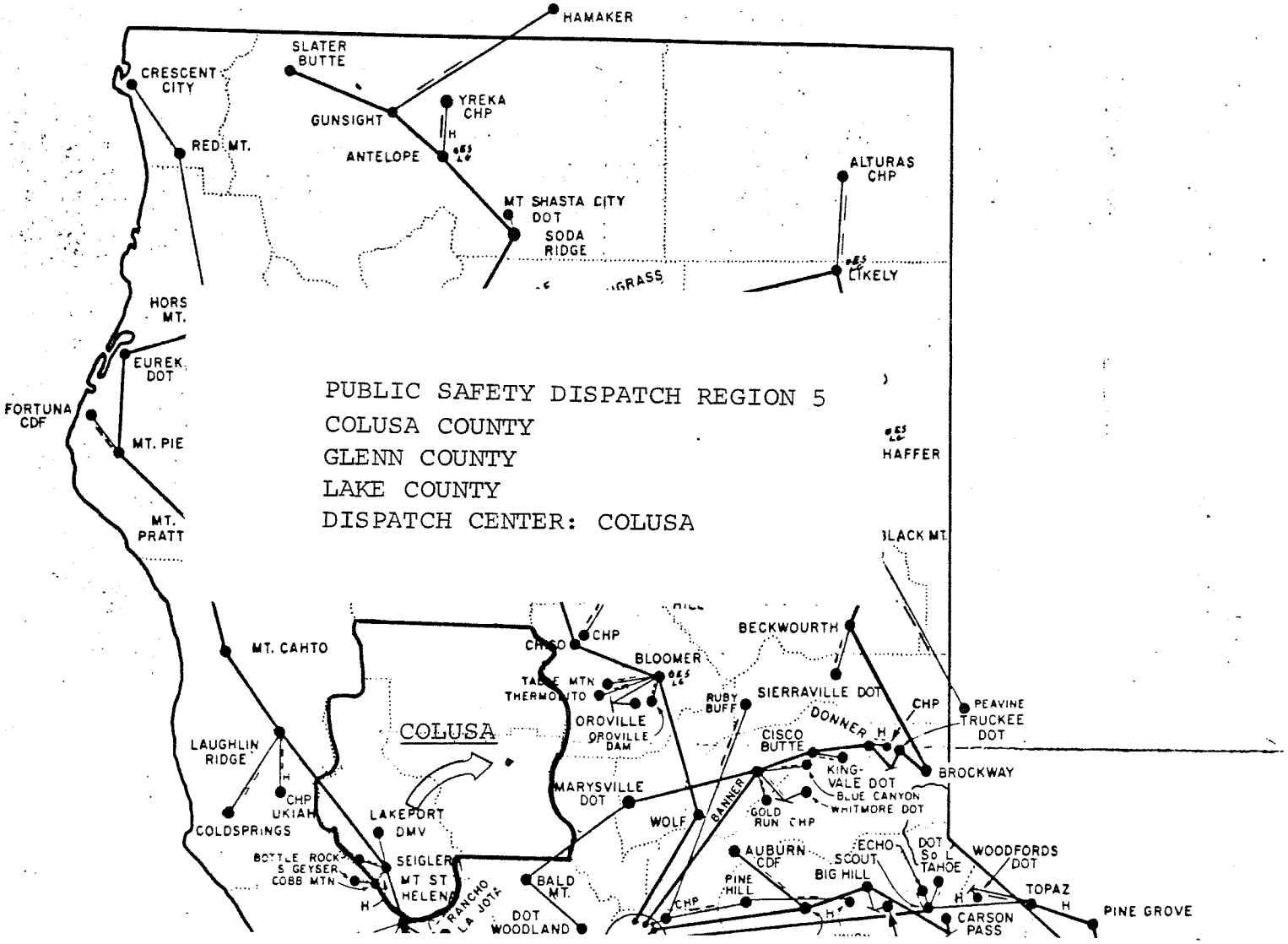
F-4



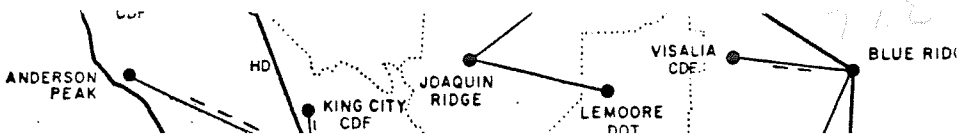


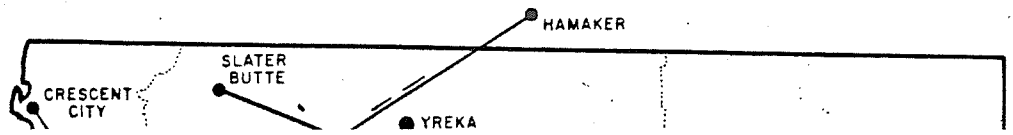
This map illustrates existent microwave paths for this region. Mountaintop repeaters would be connected to these microwave locations to relay signals to and from the dispatch center. Most of these sites are already in use as repeater sites, and additional repeaters may not be needed depending on specific local conditions.

F-5



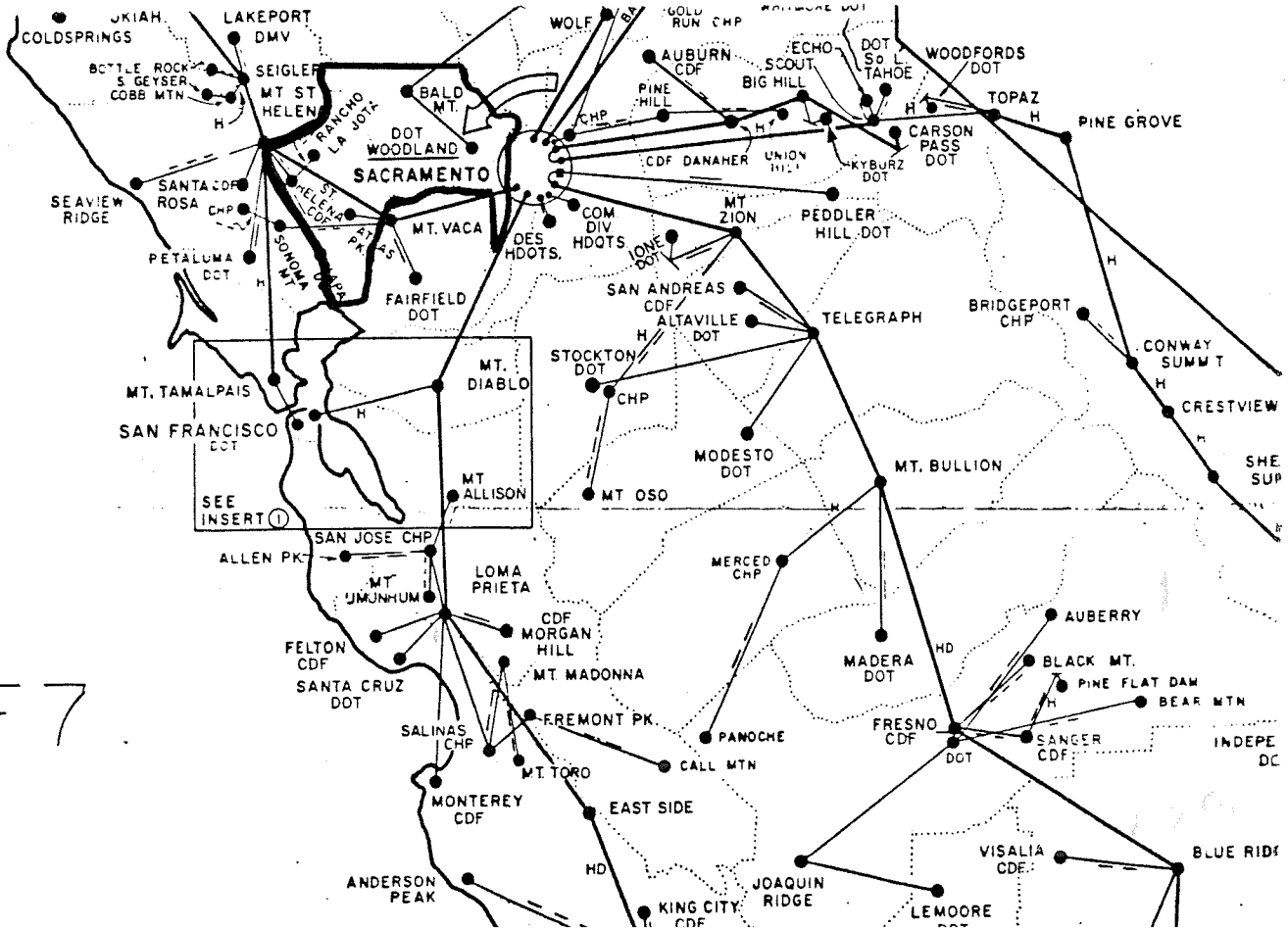
Note that except for Lakeport and environs, there are no existent microwave links established for this region. Thus, microwave links will have to be established to provide coverage in Colusa and Glenn Counties, as well as to provide a link to and from the dispatch center at Colusa. Since this is essentially a flat area, this should not create a technical barrier. It is intended that there will be a direct microwave link from the dispatch center at Colusa to the microwave point at Lakeport, using one or more mountaintop repeaters as necessary.

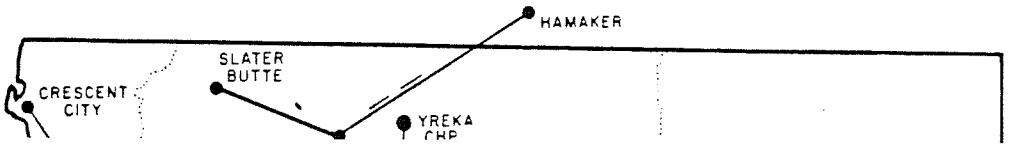




PUBLIC SAFETY DISPATCH REGION 6
NAPA COUNTY
YOLO COUNTY
DISPATCH CENTER: WOODLAND

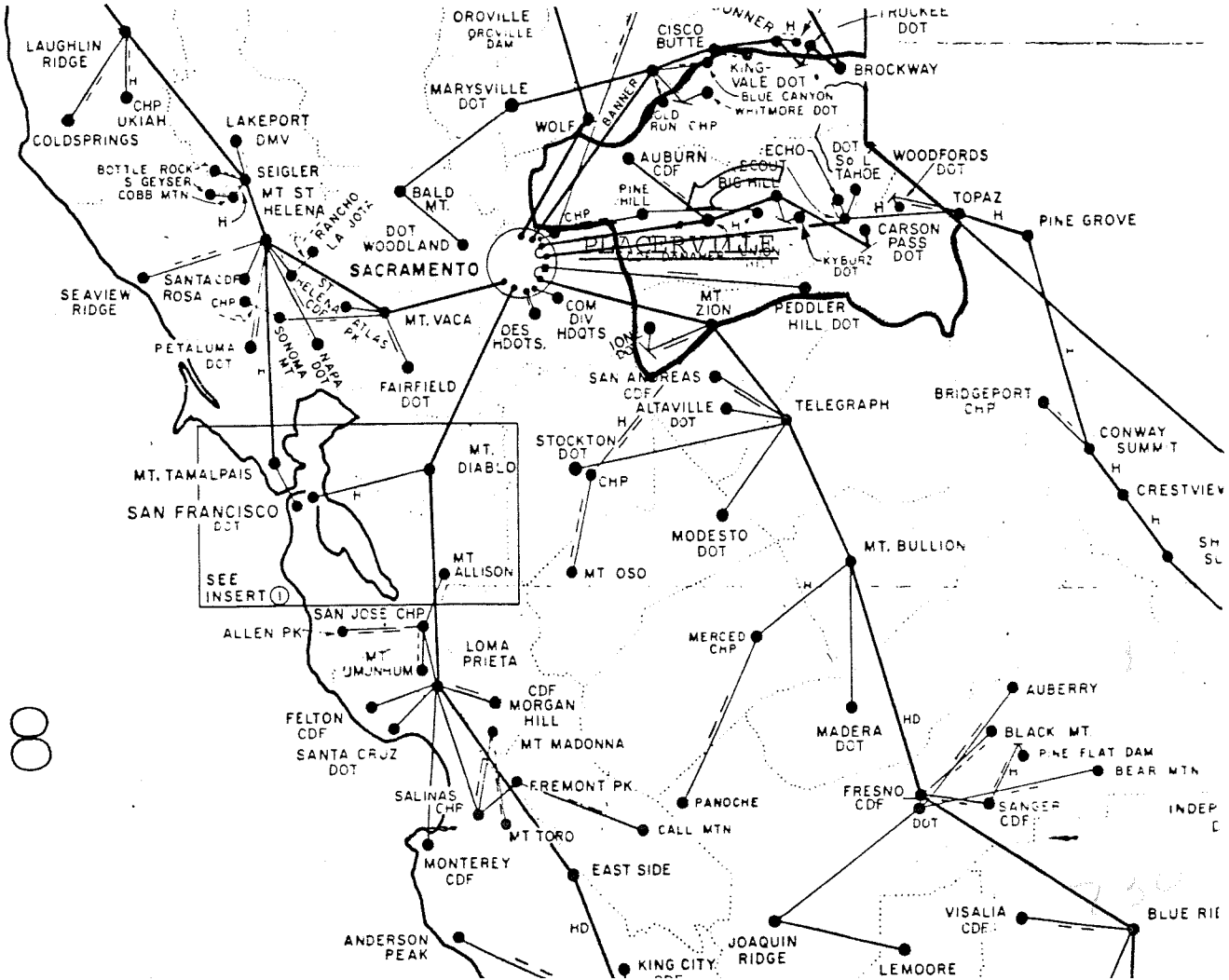
One additional microwave link is needed for this region to provide a link between the dispatch center at Woodland and Napa County. This can most simply be accomplished by a link between Woodland and Mt. Vaca.

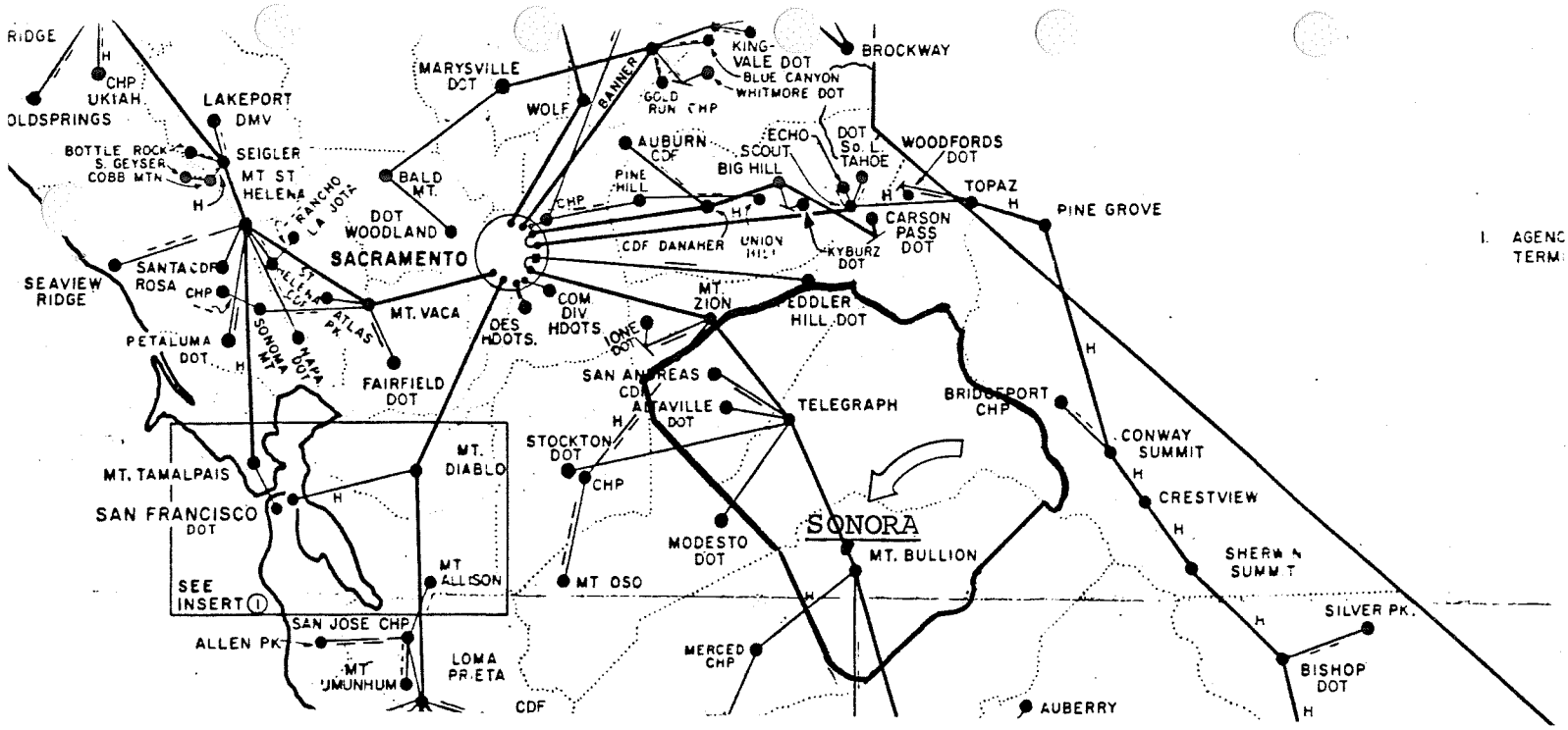




PUBLIC SAFETY DISPATCH REGION 7
ALPINE COUNTY
AMADOR COUNTY
EL DORADO COUNTY
PLACER COUNTY
DISPATCH CENTER: PLACERVILLE

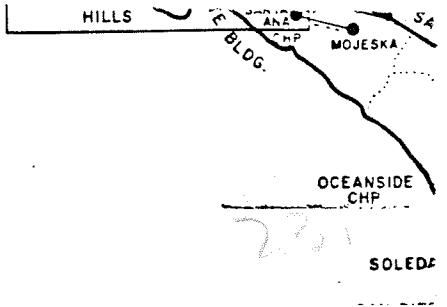
Placerville does not have a microwave terminal. However, it is located directly on an existent microwave path. Thus, installation of a terminal will complete the link.

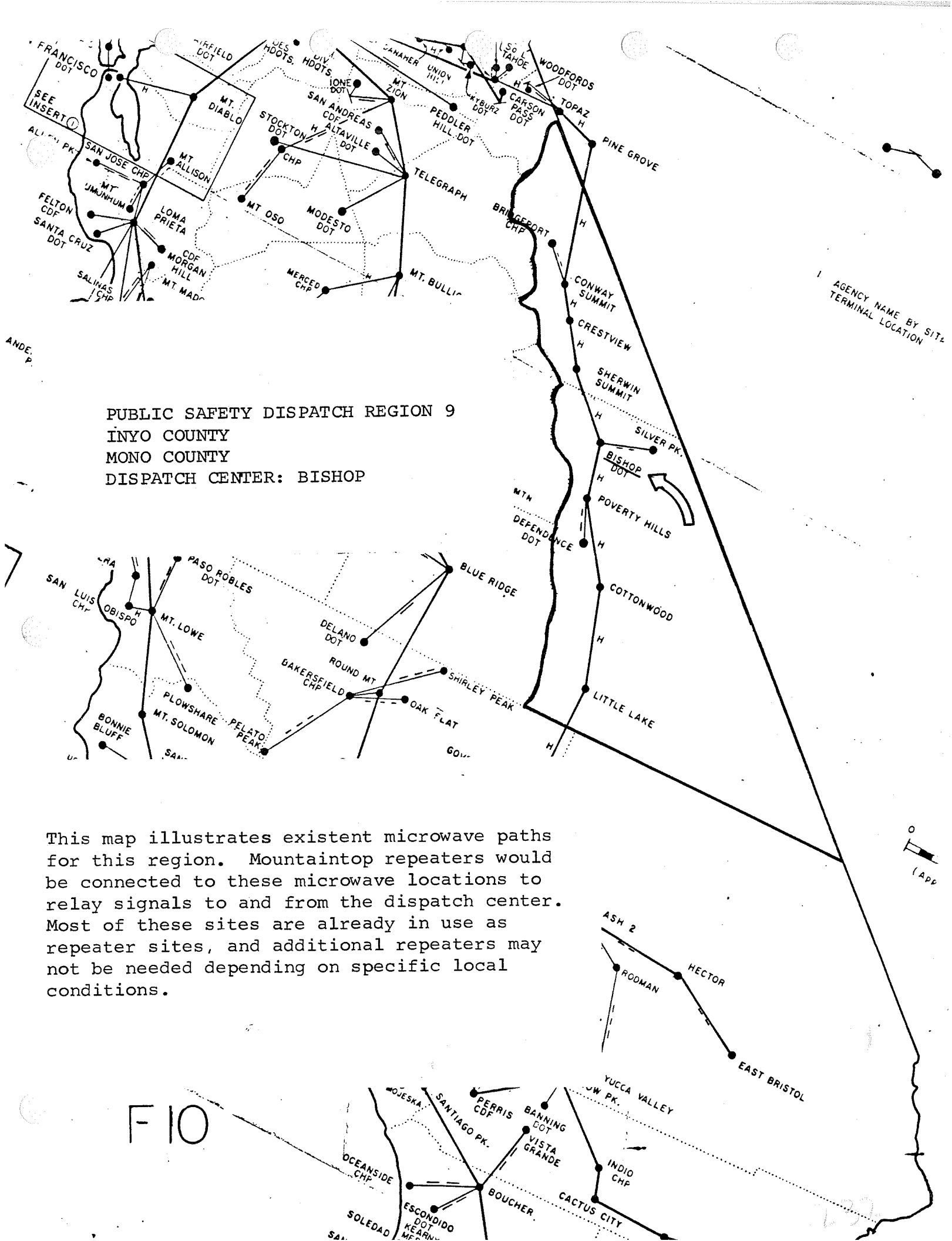




PUBLIC SAFETY DISPATCH REGION 8
CALAVERAS COUNTY
MARIPOSA COUNTY
TUOLUMNE COUNTY
DISPATCH CENTER: SONORA

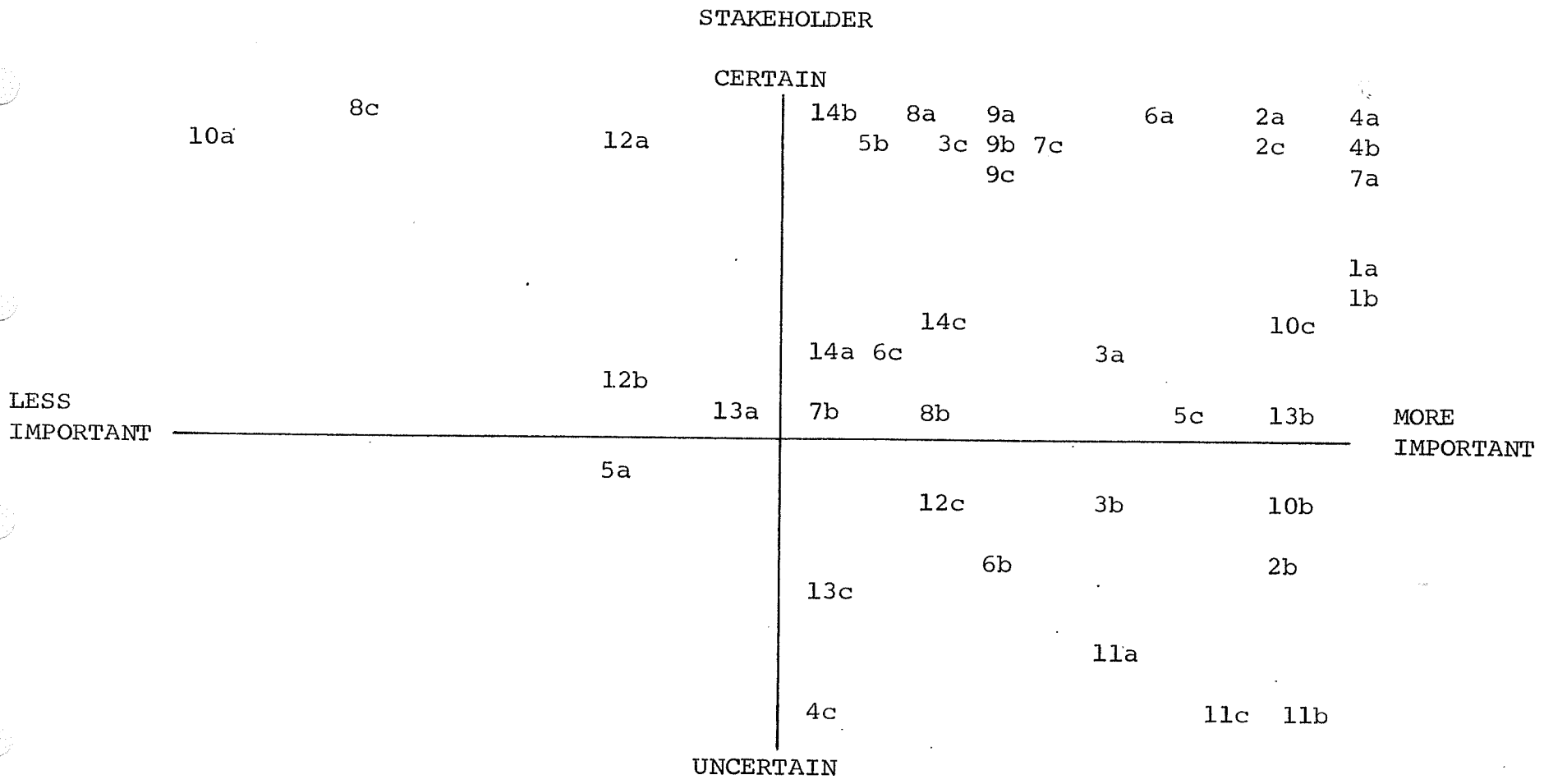
Sonora does not have a microwave terminal. However it is right on the signal path between Mt. Bullion and Telegraph. Thus, a terminal at Sonora with a link to Mt. Bullion will complete the link.



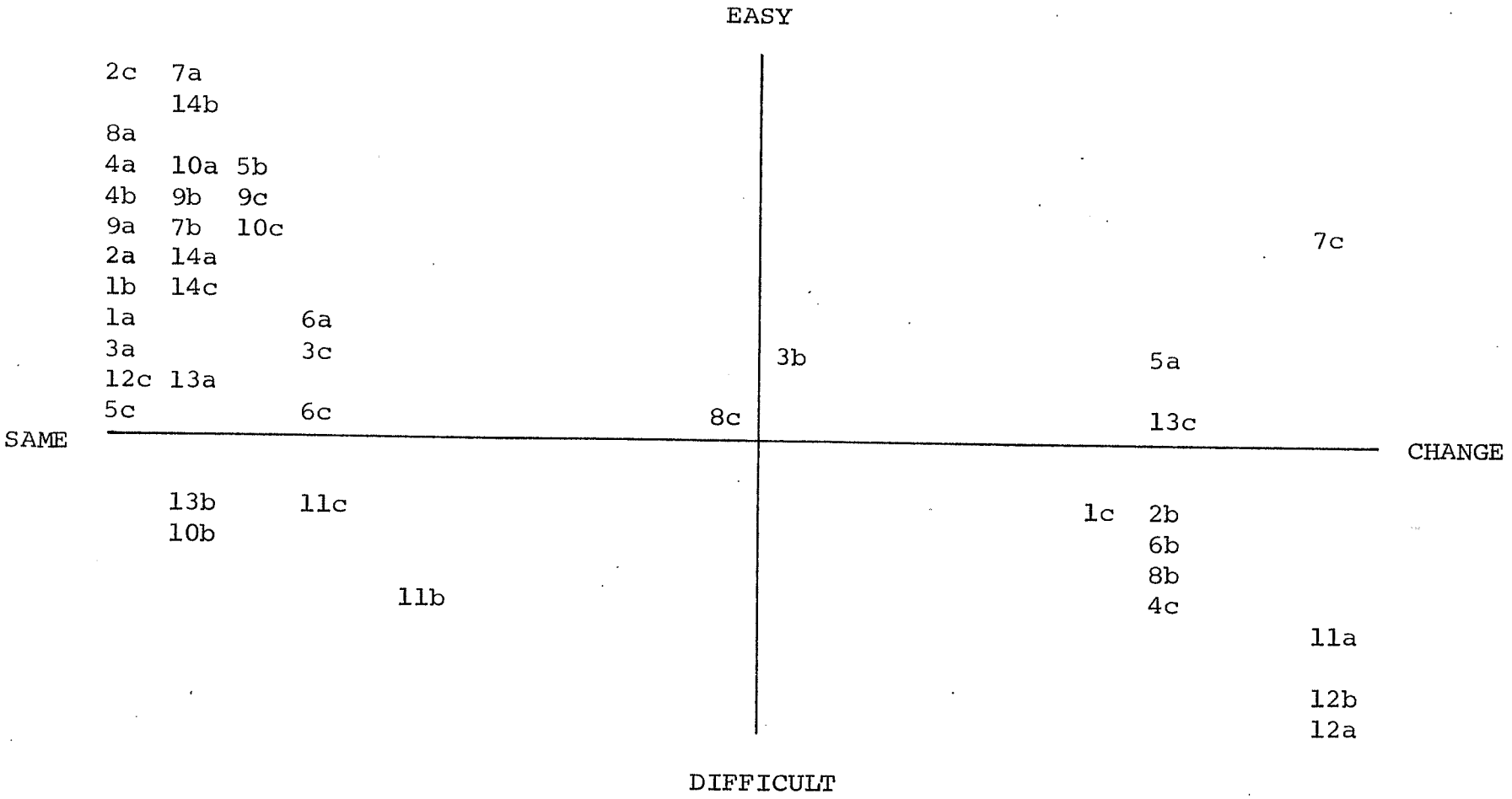


This map illustrates existent microwave paths for this region. Mountaintop repeaters would be connected to these microwave locations to relay signals to and from the dispatch center. Most of these sites are already in use as repeater sites, and additional repeaters may not be needed depending on specific local conditions.

STAKEHOLDER ASSUMPTIONS (AS PERCEIVED TO BE HELD)

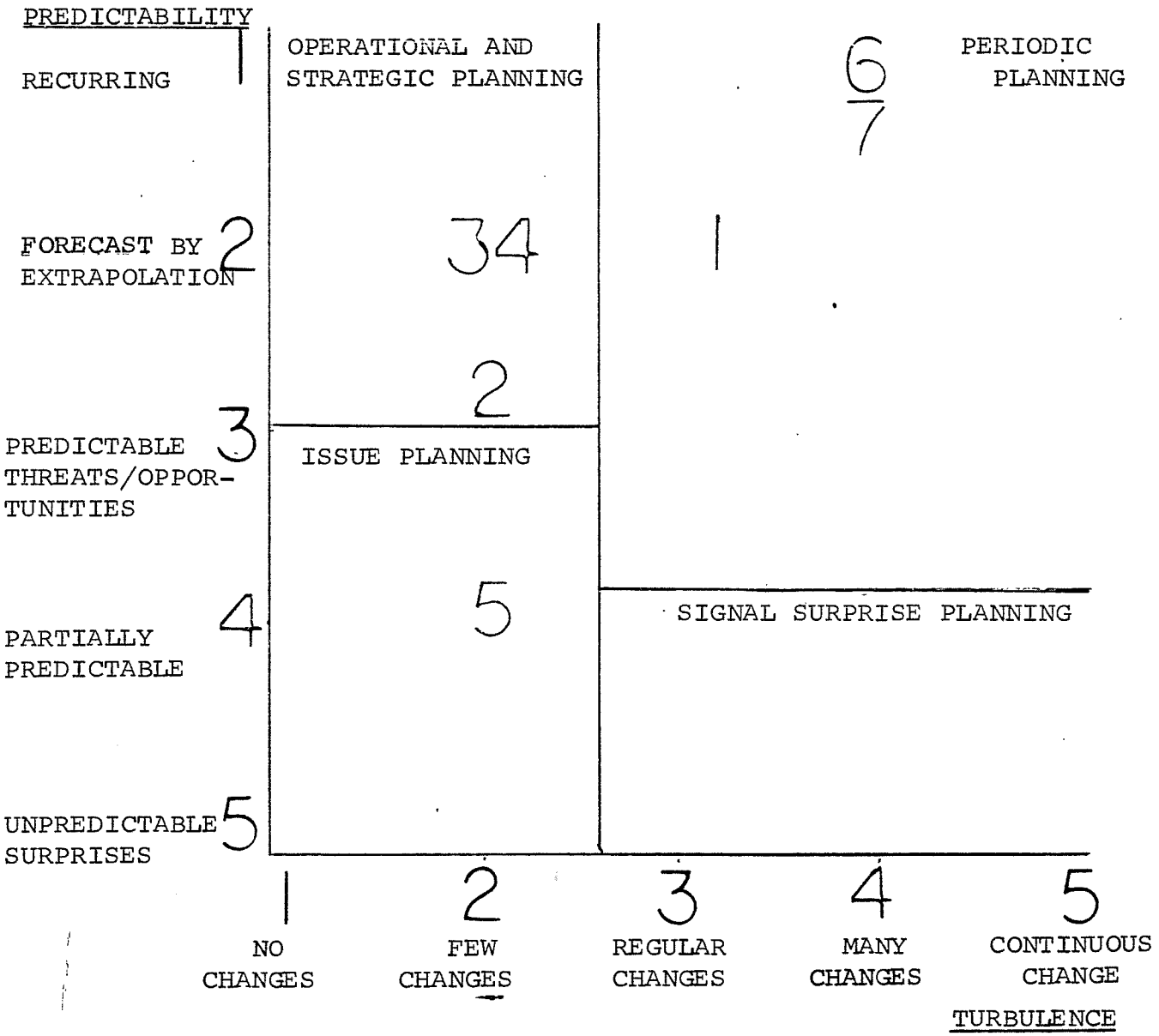


CHANGES OF ASSUMPTIONS
(WHAT DO WE WANT TO CHANGE/HOW DIFFICULT?)



DIMENSIONS OF ENVIRONMENT

	TURBULENCE	PREDICTABILITY
1. FINANCIAL COSTS (UP & DOWN).	3	2
2. PUBLIC ACCEPTANCE.	2	3
3. BOARDS OF SUPERVISORS SUPPORT.	2	2
4. USER ACCEPTANCE.	2	2
5. NEWS MEDIA.	2	4
6. TECHNOLOGICAL ADVANCES.	4	1
7. DISPATCH PROCEDURES.	4	2



MONTEREY COUNTY

SHERIFF - MARSHAL - CORONER - PUBLIC ADMINISTRATOR'S DEPARTMENT

P.O. BOX 809 • SALINAS, CALIFORNIA 93902 • AREA CODE (408)
EMERGENCY ONLY - DIAL 911

RECORDS SECTION - 424-0421
WARRANTS SECTION - 758-2744
CIVIL/PUBLIC ADMINISTRATOR - 424-0578
CORONER DIVISION - 758-3878
PATROL DIVISION - 424-0421

COUNTY JAIL AND
ADULT REHABILITATION - 757-1073
INVESTIGATIONS DIVISION - 424-0352
CRIME PREVENTION - 757-8975
ADMINISTRATION & BUSINESS - 424-6487

D. B. "BUD" COOK
SHERIFF - MARSHAL - CORONER - PUBLIC ADMINISTRATOR

I AM WORKING ON A MAJOR PROJECT AS A REQUIREMENT FOR GRADUATION FROM THE POST COMMAND COLLEGE. THE TITLE OF THIS PROJECT IS:

THE FUTURE OF CALIFORNIA SHERIFF'S DEPARTMENT COMMUNICATIONS SYSTEMS IN THE LATE 1990's.

AS A PART OF THIS PROJECT I HAVE HAD TO DEVELOP THREE SCENARIOS BASED ON DATA FROM A VARIETY OF SOURCES. I THEN HAD TO SELECT ONE OF THE THREE SCENARIOS TO DEVELOP THROUGH THE REMAINDER OF THE PROJECT. ATTACHED IS A COPY OF THAT SCENARIO.

WHAT I NEED FROM EACH OF YOU IS AS FOLLOWS:
1. CAREFULLY READ THE SCENARIO.
2. READ THE REFERENCE MATERIAL. AS A GUIDELINE ONLY (INTERPRET THAT LOOSELY, I WANT YOUR INPUT BASED ON YOUR THINKING), I AM ATTACHING A SIMILAR EXERCISE DONE FOR AN EARLIER PAPER.
3. DEVELOP A 1 - 2 PAGE TYPEWRITTEN STRATEGY/POLICY FOR IMPLEMENTATION OF THIS SCENARIO. IT MUST BE TYPED AS EACH OF YOU WILL SUBSEQUENTLY RECEIVE COPIES OF ALL INPUT TO BE VOTED ON BY A METHOD I WILL DESCRIBE WHEN THE TIME COMES.

THE ORIGINAL ASSIGNMENT STATED: "...A STRATEGIC PLAN" - A DOCUMENT THAT CAN BE USED TO GUIDE AN ORGANIZATION INTO THE FUTURE SCENARIO.

LASTLY, I AM UNDER EXTREMELY TIGHT TIME CONSTRAINTS. I NEED TO HAVE THIS BACK IN A WEEK FROM THE TIME YOU RECEIVE IT.

THANKS!

MONTEREY COUNTY

SHERIFF - MARSHAL - CORONER - PUBLIC ADMINISTRATOR'S DEPARTMENT

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ADMINISTRATION & BUSINESS - 424-6487

D. B. "BUD" COOK
SHERIFF - MARSHAL - CORONER - PUBLIC ADMINISTRATOR

DELPHI GROUP MEMBERS:
I AM TERMING YOU DELPHI GROUP MEMBERS AS THAT IS THE TECHNIQUE YOU ARE USING IN THIS EXERCISE.
YOU EACH HAVE GENERATED A POLICY TO IMPLEMENT THE SCENARIO THAT I SUPPLIED TO YOU.
THE NEXT STEP IS TO GRADE ALL OF THE SUBMISSIONS USING THE FORMAT I HAVE ATTACHED. IF THIS RESULTS IN A TIE FOR FIRST PLACE, I WILL CIRCULATE THE TOP TWO POLICIES SO YOU CAN VOTE TO BREAK THE TIE.
SO, I ASK THAT YOU REVIEW FIRST THE GRADING FORMAT, INCLUDING THE DEFINITIONS, AS THEY WILL BE YOUR CRITERIA FOR EVALUATION. THEN, REVIEW EACH OF THE SUBMISSIONS, INCLUDING YOURS, AND GRADE EACH ACCORDINGLY. RETURN TO ME ONLY THE COMPLETED GRADING SHEETS.
DUE TO THE TIME CONSTRAINTS ON ME I ASK THAT YOU DO THIS AS SOON AS POSSIBLE. I CANNOT PROGRESS FROM THIS POINT UNTIL I HAVE ALL THE RESULTS BACK. PLEASE TRY TO GET THE SCORE SHEETS BACK TO ME NO LATER THAN 17 FEB 87.

THANKS,

#1 1-1

PROPOSAL

The goal of centralizing the dispatch functions of several counties with the purpose of increasing the public's life and safety services while decreasing the overall operating cost will only be accomplished by setting real achievable targets.

The main committee must set a basic system design requirement. Although each county will be different the basic system characteristics must be standardized thereby allowing the possibility of further consolidation in the future or the interconnect of systems if the need should arise.

The selection of the director for each sub-unit must occur as quickly as possible. This director must, with the backing of the Boards, align the communications directors or communications supervisors to find their specific needs and wants as well as the equipment that is available. The current systems must be analysed and an equipment list be generated so that a system maybe engineered. The overall system must be developed to meet the needs of all the agencies involved. This may require that some agencies make minor concessions, however, the overall purpose must not be lost in complexities. With this information a time table must be made that will allow any equipment to be ordered to begin a switchover without a service interruption.

A complete checklist of all peoples, companies, and organizations that may or may not have any input to the system must be made and incorporated in the beginning action plan. This will make possible any and all special grants or fundings for such a system may be found and utilised.

The improved coordination, a great advantage, will be a great benefit to the public. Any agency in the three counties may be dispatched and coordinated with a substantial time savings. This type of system has the benefit of further cost savings in the future. With the interconnect of the counties by microwave, if there is sufficient space planned for in the system design, additional telephone lines maybe incorporated allowing a low cost county interconnect similar to the States system. Another cost and public benefit will be the " high tech " equipment, with the high price tag, would be now available.

In closing with the State moving to private companies running the prison system, and small communities using, " rent a cops ", the possibility of the protection the the cities going to public concerns is a consideration. By going to a multiple county consolidated dispatching system would give the maximum benefit to the public with a decrease in the required manpower and cost.

#2 2-1

TOPIC: THE CONSOLIDATION OF COMMUNCATIONS FOR THE NORTHERN AND CENTRAL CALIFORNIA COUNTIES

This scenario is based on the concept of economy of size. The consolidation of numerous communications facilities into centralized regional centers would better distribute the work-load among personnel and would make a more efficient use of supervisory and management personnel.

The first area of concern in this proposal is that of hardware and equipment needed to establish a network over the distances involved. There is a very high initial cost, amortization and maintenance of microwave and landwire communication links. This system would have to take into account the different regional phone systems for the 911 program. The dominate system in California is Pacific Bell, but there area other small systems remaining in the rural areas. Some assistance may be had by utilizing the State Public Safety Microwave Network that is in place now. One possiblity also lies in the use of satellite relay.

Another consideration in the change of hardware would be to leave the original ifrastructure intact as a back up system. It is acceptable practice to have both the old system and the new on-line during converstion. This allows for the necessary redundency for back-up when bringing a new system on-line.

The second area of conerne is that of the transition of existing personnel into new positions. While the total number of personnel should decress in the consolidation program, new management positions would be made. Of critical importance is the time of switch over. I would recommend that the indidual regional areas be brought on-line in a staggard manner. This would allow for the shakedown of the new systems in one region and the analysis of the the transition problems to be be made prior to establishing the next. As each region is brought on-line there would hopefully be less problems.

Overal development and implementation of this type of system would reqiure the formation of a Regional Communications Authority. This would provide of revenue control and hiring-management ability. In effect, a new multi-jurisdicional government agency would be established to provide for this service. The other option would be for the county government unit in each regional dispatch location to contract with the other county agencies that would be served.

OUTLINE

I. Equipment

a) high cost of microwave and landline systems
b) swithhh over problems
   1) the need for system redundency for reliability

II. Personnel
a) incorporation of exisiting personnel into the new system.
b) creation of new management ~~kxxxx~~ personnel

development of GANTT CHARTS for system transition
implimentation in a staggard manner
work out the problems in one region first, learning process and debugging, prior to going to next region

Problems:

system cost
command and control
personnel
who handles hiring and other personnel problems?
legal?
formation of multi-jurisdictional agency
cooperative personnel department.
transition period

the Governement Code provides for Community Servie Area (CSA) that crosses county lines.
Who pays, how, who is in charge/responsible.
special legislation might be necessary for establishment of joint service area agency (examples BART, EastBay Regional Parks or Municipal Utility Districts)

exampel: Monterey County Communications Department would contract services to the the Tri-County area (Monterey- San Benito-Santa Cruse) to provide services. This is an extension of what is now being done within Monterey County for the local agencies.

#3 3-1

California Automated Public Safety Telecommunications And Navigation System (CAPSTAN)

CONCEPT: THE **CAPSTAN** SYSTEM WOULD CONSIST OF ONE, OR SEVERAL, STRATEGICALLY PLACED TELECOMMUNICATIONS SATELLITES WHICH WOULD BE IN LOW-ALTITUDE, GEO-STATIONARY ORBIT OVER THE STATE, AND WHICH WOULD ALLOW SYNCHRONOUS AND ASYNCHRONOUS TRANSMISSION OF VOICE AND DATA OVER SUFFICIENT CHANNELS FOR ALL PUBLIC SAFETY AGENCIES TO OPERATE THEIR OWN INDEPENDENT NETS, AS WELL AS CHANNELS FOR COMBINED, OR COMMON-USE NETS. ADMINISTRATION OF **CAPSTAN** WOULD BE BY THE O.E.S.

THE SYSTEM WOULD TIE INTO INDIVIDUAL AND AGENCY COMMUNICATIONS UNITS VIA MICROWAVE TRANCEIVERS CAPABLE OF SATELLITE ACCESS, REPLACING REPEATERS. THIS WOULD ALLOW UNITS AND COMMANDS IN EVEN THE MOST REMOTE LOCATIONS TO HAVE HIGH-QUALITY, RELIABLE, MULTI-MODAL COMMUNICATIONS ABILITY. THE BACKBONE OF THE **CAPSTAN** SYSTEM AT THE USER-LEVEL WOULD BE THE INDIVIDUAL SYSTEMS CENTRAL PROCESSING UNIT, BUREAUCRATICALLY TERMED "Law Enforcement Administrative Dispatch & Emergency Receiver" AKA: **"LEADER"** UNIT. THIS LAP-TOP SIZE PERSONAL-STYLE COMPUTER/COMMUNICATIONS DEVICE WOULD BE INDIVIDUALLY ASSIGNED AND WOULD HAVE THE FOLLOWING FEATURES:

-FLIP-UP HIGH-RESOLUTION COLOR GAS-PLASMA VIDEO DISPLAY TERMINAL.

-OPERABLE ON LITHIUM BATTERY, VEHICLE POWER, OR A.C.

-CAPABLE OF ON-DEMAND MULTIPLE-SCREEN IMAGES, ALLOWING SIMULTANEOUS VIEWING OF MAPS, DISPATCH INFO, PICTURES, AND RECORDS DATA.

-INTEGRAL LASER PRINTER W/FULL GRAPHICS CAPABILITY.

-"EPROM"-BASED PROGRAMMABLE, USER-MODIFIABLE AND CHANGEABLE CARTRIDGE CONTAINING ALL NECESSARY STANDARD REPORT AND FORM FORMATS, AS WELL AS INDUSTRY-STANDARD WORDPROCESSING DATABASE AND PERSONAL UTILITY PROGRAMS (IE: MEMOS, PERSONAL CALENDER, ON-SCREEN CALCULATOR, PHONE LIST, ETC).

-READABLE/WRITABLE 3.5" MINI-COMPACT LASER DISKDRIVE FOR ACTUAL RECORDING OF REPORTS, LOGS, MEMOS, AND OTHER ADMINISTRATIVE PAPERWORK FOR END-OF SHIFT TURN-IN TO DEPARTMENT DATA-BASE CENTRAL.

-CAPABLE OF ESTABLISHING A COM-LINK BETWEEN DATA-BASE CENTRAL (WITH SPECIFIED LEVELS OF ACCESS) AND OTHER COMPUTER-ACCESSIBLE CONTACTS.

THE **LEADER** UNIT WOULD FULLY PORTABLE, AND WOULD EASILY BE INSTALLED/REMOVED FROM PATROL VEHICLES WHERE THEY WOULD BE

PLUGGED INTO A FULLY-ADJUSTABLE MOUNT WITHIN THE DASHBOARD OR IN A LOW-PROFILE LOCATION WITHIN UNMARKED CARS. THE UNIT WOULD BECOME AN INDISPENSABLE TOOL IN THE OFFICE, OR IN THE FIELD, AND WOULD ELIMINATE MANY OF THE COMMUNICATIONS PROBLEMS EXPERIENCED TODAY.

DISPATCH WOULD BE CAPABLE IN BOTH VOICE & TEXT MODES, WITH THE UNIT BEING SWITCHABLE FROM PUSH-TO-TALK, VOICE-ACTIVATED (FOR PURSUITS & SHOOT-OUTS, ETC), AND TEXT ONLY (10-36 & CODE 5 SITUATIONS). THE GAS-PLASMA DISPLAY WOULD ALLOW FOR CLEAR EASILY-READ IMAGES TO INCLUDE PHOTOS, MAPS, AND FACSIMILES. THE PRINTER COULD PROVIDE HARD COPY AS NEEDED IN THE FIELD. THE SATELLITE SYSTEM WOULD ALLOW NOT ONLY IMPROVED COMMUNICATIONS REGARDLESS OF TERRAIN, BUT WOULD BE CAPABLE OF PINPOINTING UNIT LOCATIONS AND STATUS, TRANSPOSING SAME ONTO BEAT OR AREA MAPS, SWITCHABLE FROM A CONTINUOUS OR AS-TRANSMITTED BASIS. THE CONTINOUS BASIS WOULD MAKE THE LOCATION & DIRECTION OF TRAVEL OF A UNIT CLEAR DURING A PURSUIT, AND WOULD REDUCE THE CONFUSION OF RADIO TRAFFIC DUE TO CONSTANT UPDATES ON LOCATION.

SUCH MAPPING ABILITY COULD PROVE OF GREAT VALUE TO DISPATCHERS, SUPERVISORS AND COMMAND PERSONNEL WHETHER IT IS ROUTINE OPERATIONS SUPERVISION, OR A TACTICAL OPERATION. THE **LEADER** UNIT COULD NOT ONLY TELL THE DRIVER EXACTLY WHERE HE/SHE IS AT ON THE MAP DISPLAY, BUT COULD ALSO COMPUTE THE MOST EXPEDITIOUS ROUTE TO THE DESTINATION. IN ADDITION, HANDPACK RADIOS WOULD BE ABLE TO ACCESS INTO **CAPSTAN** , VIA A RETRANSMISSION CAPABILITY WITHIN THE **LEADER** UNIT, MAKING EVEN HANDPACK COMMUNICATIONS ACCURATE AND RELIABLE.

LASTLY, THE **LEADER** UNIT WOULD INCREASE EFFICIENCY AND STREAMLINE RECORDS, DUE TO THE SINGLE-ENTRY DATA RECORDING & STORAGE WHICH IS DONE ON-SITE. THERE WOULD BE NO DUPLICATION OF DATA ENTRY OR STATISTICAL COMPILATION. THERE WOULD BE NO MORE "PAPER-SHUFFLING" IN THE TRADITONAL SENSE. CLERICAL WORK AT THE DATA-BASE CENTRAL WOULD CONSIST PRIMARILY OF DATABASE MANAGEMENT OF EXISTING & INCOMING DATA, QUALITY CONTROL AND CORRECTION OF ERRORS. IN CASES OF EMERGENCY, OR NECESSITY, REPORTS, FI'S, PROPERTY SHEETS, AND PATROL LOG DATA, ETC, COULD BE TRANSMITTED IMMEDIATELY FROM THE FIELD TO DATA-BASE CENTRAL VIA THE **LEADER** UNIT, RATHER THAN WAIT FOR THE LASER-DISK ENTRY AT THE END OF THE DAY. THE COMPUTER-BASED SYSTEM WOULD ALLOW FOR AUTOMATIC POSTING OF DISPATCHES, CASE #'S AND OFFICER NAMES TO LOGS AND RECURRING REPORTS DURING THE WATCH, ELIMINATING THE NEED FOR THE OFFICER TO DUPLICATE ENTRY INFO.

I HAVE OUTLINED BRIEFLY A FEW OF THE **CAPSTAN/LEADER** SYSTEM'S POTENTIALS. THE FOUNDATION OF THE TECHNOLOGY LISTED ABOVE EXISTS NOW, AND IT'S APPLICATIONS ARE LIMITED ONLY TO ONE'S IMAGINATION (AND BUDGET). I AM CONFIDENT WE SHALL SEE BY THE YEAR 2000 A RE-THINKING OF PUBLIC-SAFETY COMMUNICATIONS ON THE BASIS OF SYSTEMS ANALYSIS IN THE FACE OF TECHNOLOGICAL BREAKTHROUGHS IN PRACTICAL DATA MANAGEMENT AND APPLICATION.

#1 4-1

COMPUTER ASSISTED DISPATCH AND
MULTI-COUNTY COMMUNICATIONS SYSTEMS

THE MAIN CONCERN IN IMPLEMENTING THIS PROJECT APPEARS TO BE REDUCTION OF MANPOWER TO REDUCE OPERATING COSTS. AFTER DESIGNING A BI, TRI, OR QUAD-COUNTY 911 EMERGENCY SYSTEM AND BUILDING THE FACILITIES, THE MAJOR OBSTACLE WOULD BE TO DESIGN AND INSTITUTE A SATISFACTORY COMPUTER ASSISTED DISPATCH SYSTEM THAT WOULD REDUCE THE AMOUNT OF VERBAL RADIO TRAFFIC BEING TRANSMITTED TO AND FROM THE COMMUNICATIONS STATION.

AN INFORMAL SURVEY OF RADIO TRAFFIC IN MONTEREY COUNTY IN JANUARY OF 1987 SHOWED THAT APPROX. 75% OF THE RADIO TRAFFIC CONSISTED OF "ROUTINE TRAFFIC". THIS IS VERBAL TRAFFIC CONSISTING OF ROUTINE INFORMATION SUCH AS UNITS GOING INTO AND OUT OF SERVICE, VEHICLE REGISTRATION AND HOT CHECKS, DRIVERS LICENSE CHECKS, ETC. THIS TRAFFIC COULD BE ELIMINATED WITH A WELL DESIGNED COMPUTER ASSISTED DISPATCH SYSTEM. CAR TO CAR TRAFFIC WAS NOT INCLUDED IN THIS SURVEY SINCE DISPATCHERS ARE NOT NORMALLY CONCERNED WITH THIS RADIO TRAFFIC. MOST OF THE OTHER 25% OF THE VERBAL RADIO TRAFFIC IN THE SURVEY WAS MISCELLANEOUS TRAFFIC THAT CONSISTED LARGELY OF REQUESTS FOR REPEATED INFORMATION FROM AN ORIGINAL DISPATCH.

CAR TO CAR RADIO TRAFFIC TAKES LITTLE OR NONE OF A DISPATCHERS TIME. IT IS THE CAR TO COMM. AND COMM. TO CAR TRAFFIC THAT REQUIRES A DISPATCHERS TIME AND ATTENTION. BY ELIMINATING THIS VERBAL COMMUNICATION, A SINGLE DISPATCHER CAN EASILY HANDLE NUMEROUS AGENCIES. THIS WILL BE ACCOMPLISHED WITH THE AID OF A COMPUTER ASSISTED DISPATCH SYSTEM (C.A.D.).

WHERE, IN THE PAST, THE SIMPLE ACT OF HAVING A MOBILE UNIT GO INTO SERVICE REQUIRED AT LEAST TWO AND OFTEN THREE VERBAL EXCHANGES ON THE RADIO, THE C.A.D. WILL ALLOW THE UNIT TO GO IN SERVICE WITH THE PUSH OF A BUTTON AND NO VERBAL COMMUNICATION. THIS SYSTEM CAN BE USED FOR IN SERVICE, OUT OF SERVICE, ARRIVED AT SCENE AND ALMOST ALL OTHER ROUTINE TRAFFIC. WITH THE AID OF A TRIANGULATION LOCATOR AND A COMPUTER MAP IN COMMUNICATIONS THE DEPUTY NEED NOT ADVISE OF HIS LOCATION AS THIS WILL AUTOMATICALLY BE GIVEN ANY TIME THE CAR RADIO TRANSMITTS A SIGNAL. TRAFFIC STOPS AND VEHICLE CHECKS ARE ALSO NON-VERBAL COMMUNICATIONS WITH THIS SYSTEM AS THE DEPUTY WILL ENTER ON A KEYBOARD THE LICENSE NUMBER OF THE VEHICLE BEING STOPPED. THE TRIANGULATION LOCATOR WILL GIVE THE LOCATION OF THE STOP.

TO HELP IN ELIMINATING VERBAL RADIO TRAFFIC PATROL CARS WILL NEED TO BE EQUIPPED WITH COMPUTERS THAT WILL ALLOW THE DEPUTIES IN THE STREET TO OBTAIN THEIR OWN REGISTRATION, DRIVERS LICENSE, AND WARRANTS INFORMATION, WITHOUT VERBAL COMMUNICATONS.

THESE SAME COMPUTERS WILL BE USED TO RECIEVE DETAILS AND INFORMATION FROM DISPATCHERS. SINCE THE INFORMATION IS RECIEVED AS A PRINTOUT ON PAPER, MUCH OF THE MISCELLANEOUS VERBAL TRAFFIC NOTED IN THE ABOVE MENTIONED SURVEY WILL BE ELIMINATED. A PRINTED DISPATCH CAN BE REFERRED TO BY THE DEPUTY WHILE RESPONDING TO THE DETAIL AND ELIMINATES THE NEED FOR THE DEPUTY TO WRITE DOWN THE INFORMATION AND REQUEST REPEATS OF THE INFORMATION.

THE NUMBER OF FREQUENCIES ARE REDUCED, THUS THE NUMBER OF OPERATORS NEEDED TO MONITOR THEM ARE REDUCED. THIS IS DONE BY HAVING ALL THE COMPUTER TRAFFIC FOR AGENCIES SERVED BY ONE DISPATCH CENTER ON A SINGLE FREQUENCY. ONE OPERATOR IS THEN RESPONSIBLE FOR TYPING AND DISPATCHING DETAILS WHILE ALSO MONITORING THE COMPUTER SYSTEM. ALL PAPER WILL BE GENERATED BY THE COMPUTER AND ONE OPERATOR WILL BE ABLE TO FILE THIS PAPER.

EACH COUNTY WILL THEN HAVE ONE OR TWO FREQUENCIES DESIGNATED FOR CAR TO CAR AND EMERGENCY VERBAL TRAFFIC. THE NUMBER OF FREQUENCIES DESIGNATED WILL DEPEND UPON THE POPULATION AND WORKLOAD OF THE COUNTY AND THE NEED FOR THESE ADDITIONAL FREQUENCIES. THE APPROPRIATE NUMBER OF OPERATORS WILL THEN BE ASSIGNED TO MONITOR THESE FREQUENCIES. THESE ADDITIONAL OPERATORS WILL ASSIST THE MAIN DISPATCHER WITH TYPING AND DISPATCHING DETAILS WHEN NOT INVOLVED WITH VERBAL RADIO TRAFFIC. AS FIRE AND AMBULANCE SERVICES ARE NOT FREQUENTLY USED IN THESE AREAS THEY CAN SHARE VERBAL FREQENCIES WITH SHERIFF'S AGENCIES. FIRE AND AMBULANCE WILL SHARE THE COMPUTER FREQUENCY ALSO.

PROBABLY THE MOST DIFFICULT ASPECT OF THIS SYSTEM WILL BE TO CONVINCE THE PERSONNEL INVOLVED THAT THEIR VERBAL INFORMATION IS NOT NECESSARY FOR THE OPERATION OF THIER DEPARTMENT. TYPING SKILLS WILL ENHANCE THEIR ABILITY TO DO THIER JOB SINCE EACH PATROL CAR WILL BE EQUIPPED WITH A KEYBOARD THAT IS USED TO FEED INFORMATION INTO THE COMPUTER. WITH DAILY USE, DEPUTIES WILL BECOME PROFICIENT WITH THE KEYBOARD AND EVENTIALLY FIND IT AS FAST TO USE AS THE VERBAL EXCHANGES WITH COMMUNICATIONS SYSTEMS OF THE PAST.

#5 5-1

STRATEGIC PLAN FOR THE IMPLEMENTATION OF SCENARIO #3

A strategy for implementation of this consolidated rural dispatch system should accomplish three major purposes:

1. A detailed definition of the work to be accomplished, to include specific tasks relative to the overall project.

2. A schedule of the specific tasks and time frames in which they must be completed, to ensure progress toward the completion of defined work.

3. The assignment of management responsibility with authority to procure the resources needed to accomplish the specified tasks.

The detailed definition of work to be completed should cover the complete project. This breakdown of work into a structured form is the basis for the manager's planning and control. The authorized budget and the number of staff available will determine the overall schedule. An example of a detailed work breakdown is provided in appendix A.

As seen in the work breakdown each major division should be broken down into smaller tasks for individuals to address and achieve. An illustration of the breakdown of major divisions into a smaller subdivision follows:

Training - Responsible for all functions of training activities related to the overall project.

Dispatcher Training - The establishment of criteria for individual dispatcher training as needed to supply each person with the basic tools to perform the job. This should be followed by advanced training to ensure dispatch personnel retain a high level of proficiency.

Maintenance Training - The preparation of equipment standards and the maintenance needed to meet the established standards must be provided. This would include sending personnel to technical schools or holding on-site training as part of the procurement requirements.

The scheduling of the specific tasks should be done with certain thoughts in mind. Be realistic, do not set goals you can not meet. Identify areas of potential delay and determine if they are critical tasks or events that can be rescheduled to minimize

the impact on the overall project. The use of Gantt Charts, Milestone Charts, and Network (PERT) Charts are examples of excellent tools available to monitor the progress of complex projects.

This implementation strategy must define the total project and how it will be coordinated overall and the responsibilities of the managers for each center and the control at each level. If a Users Council is established as the overall coordinator, each level of control and responsibility must be assigned down to the individual dispatch centers. The program manager/director at each center must be given the authority and responsibility to implement the program, keeping in mind the budgetary constraints and the time elements proposed. This individual will be the person "where the buck stops". It will be their responsibility to report to the Users Council on progress of the project, any delays that will interfere with project completion and ensure that operational and technical policies are established. The task of establishing policies will most certainly involve the Users Council.

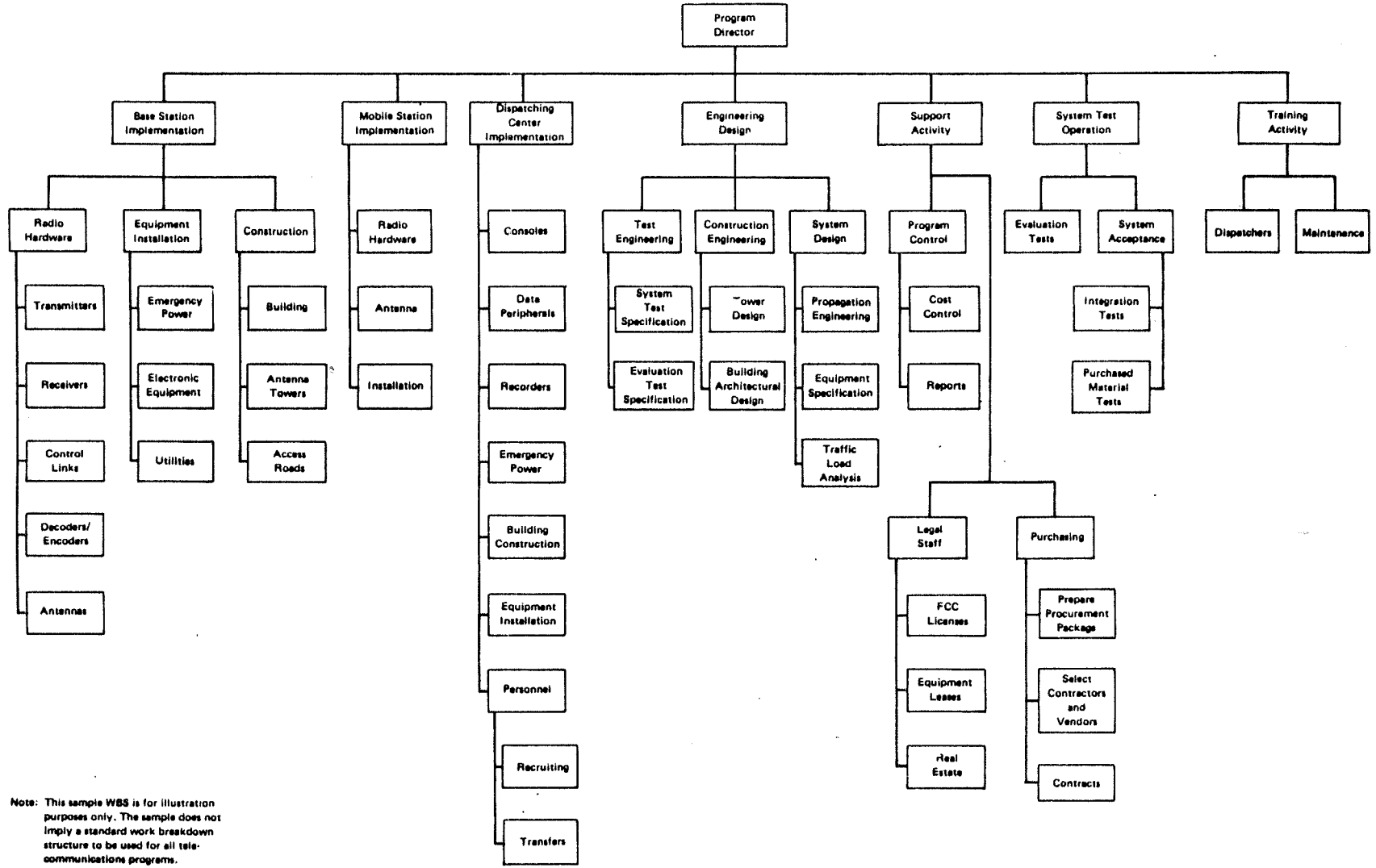
One last area of consideration, which is addressed by itself and not as one of the major purposes for implementation, is the post-implementation evaluation. The post-implementation evaluation is important for many reasons;

1) To gauge the success of project implementation;

2) To provide input to improve the quality of dispatch and related services; and

3) To provide a basis for updating and revising future plans.

Many things should be considered when reviewing the scope of the evaluation process. Some of these include system effectiveness, technical evaluation, financial evaluation, and management evaluation. An appropriate post-implementation evaluation is second in importance only to the implementation strategy. An established set of criteria for evaluation will enable the program manager/director to ensure that the goals and objectives are attained as specified in the implementation plan.



Note: This sample WBS is for illustration purposes only. The sample does not imply a standard work breakdown structure to be used for all telecommunications programs.

FIGURE 6
Work Breakdown Structure

Appendix A

#6 6-1

TOPIC: THE FUTURE OF CALIFORNIA SHERIFF'S DEPARTMENT COMMUNICATIONS SYSTEMS IN THE LATE 1990'S.

In theory, Scenario #3 would certainly enable Sheriff's Department Communications to arrive at the highest degree of professionalism and effectiveness.

Cost factor, once in operation, would be highly impacted; i.e. one radio center as compared to several, savings in personnel payroll, and radio repair service to one central location.

In reality, the probability of implementing this major project would be extremely remote unless the following obstacles could be overcome:

I. "Territorial" zealousness
   a. Fear of losing control
II. Getting all involved government agencies (members of Boards of Supervisors, county administrators, county counsels), Sheriffs and communications directors together for meetings.
   a. Personality conflicts with the various government heads who would have the power to agree to this project.
III. Employee morale
   a. Communications Department Head conflicts
      a. Each Communications Center has a Director or Head Supervisor. Who would decide which Director will command the Central Communications Center and what is to be done with the others?
      b. Same question with the shift supervisors with each location.
      c. Who will decide which dispatchers will go to the Central Center and which dispatchers will be laid off? Also, many dispatchers would have to relocate.
IV. Initial cost factor
   a. Would the State of California be receptive to financial assistance to these counties?
   b. Would the counties involved be able to carry their financial share?
   c. Getting prices for radio equipment and transferring existing equipment to centralized location.

Again, in theory, centralized communications would be the ideal solution in solving financial difficulties, and producing effectiveness and efficiency in smaller counties.

With a computer selecting an available dispatcher for a call, the chances of a serious mistake by an overworked dispatcher are minimized considerably, and the workload would be distributed equally, thereby justifying effectiveness and efficiency.

The major barrier would be overcoming the fear of losing or giving up something (territorial) in order to realize a gain (long term cost savings and effectiveness).

For the implementation of the scenario, we must assume that between this time and the late 1990's significant developments in electronics, miniaturization and satellite communications have been made.

We must believe that with the successful launch of the "new shuttle" in 1988 and with NASA striving to show the practicality of the shuttle program, we can obtain Federal government sponsorship for satellite communications that, while not state-of-the-art for late 1990's, reflects technology developed in the early 1980's that has now filtered down to law enforcement.

Based on that premise, let us assume that the availability of satellite communications is now available to local governments. Taking that premise and expanding upon it, we find that perhaps nine communication centers can be reduced to three, two or one large basically unmanned center.

To get there, we are going to use the equipment available in the late 1990's. The patrol car itself becomes its own dispatch center. There are no more requests to "check the fire maps" for a particular residence or business because those maps are now on a computer chip that can be updated weekly, monthly, or any other appropriate time. The chips instantly call up a map displayed on a video screen showing the location to which the driver needs to respond. The map is triggered by the call of the reporting party since our new "911" system immediately knows by a computer from whence the call came. Not only does this map display the location to which the unit should respond, it also shows the unit's location (this capability being given to the unit continually from navigational satellites which pinpoint the unit's location to within five feet not only anywhere within its jurisdiction but to anywhere on earth--an adaption of the military unit available in the early 1980's.) This same video display allows a zoom effect so that the unit may view his entire jurisdiction and, as he approaches a location, continually zooms down to an area the size of a city block.

We must assume that in the late 1990's, once again due to communication satellites, cellular phones are now available worldwide and, just as digital watches, calculators, etc. dropped tremendously in price during the previous two or three decades, the cellular phone has likewise become more than affordable and increasingly sophisticated. Each patrol unit obviously is equipped with such a phone. The "now non-manned dispatch center" consists of the "911" circuits and a new "811" system. The "911" is, as always, known through advertising to the general public as THE emergency number. The "811" system, once again through massive advertising, is known to the public as the number to call for non-emergency police service. Our dispatch center upon receipt of a "911" call and knowing the location of every emergency unit within its range (conceivably the entire state) and knowing from where the call was emanated, immediately (within nanoseconds) transfers that call to the cellular phone in the patrol unit closest and most available to respond to the call. This allows the officer to talk directly to the RP, eliminates "the middle man or dispatcher," and allows the responding unit to receive first-hand information and to get a better comprehension of the situation he/she is facing. The officer can immediately determine if backup is required and can summon backup with a push of a button on his on-board computer terminal. The backup unit is immediately notified and can

immediately join in a conference call with both the RP and the initial responding unit. Callers on the "811" system, will either immediately be transferred to a unit in the field if one is available or will be told by recording to leave a call-back number which will be displayed to the first unit free in that particular area. The "811" call may then be handled either by phone directly from the patrol car or by a physical response if necessary.

Perhaps the most remarkable achievement is in the area of miniaturization. Our video display, cellular phone, and almost obsolete voice radio, which will seldom, be used is contained in a package half the size of today's small briefcase. It is totally portable and can go with the officer to coffee shops, residences, or whatever. Of course included would be an emergency buzzer which will alert the officer even if the rest of the system is turned down or off.

Almost forgotten is one of the major sources of voice radio traffic today, that being the request for 10-28 and 10-29 information of all sorts. This of course will be handled in our new units directly from the unit via satellite to Sacramento. While not possible at this point (1990 plus) but within a very few years, communications with the central information computers in Sacramento will be done by voice. Unfortunately, our officers now must type their requests using the wellknown computer terminal keyboard. However, our cars now do have a limited understanding of vocal commands. As we know we can now say "telephone on" and the telephone is activated as in the unit. We can then have hands free communication with our RP's or anyone else to whom we wish to have a telephone conversation. Of course, the radio which is seldom used can be likewise activated. These are not tremendous advances or even state-of-the-art in the latter 1990's since as early as 1985 voice activated speed controls were going from the prototype to the consumer availability stage (Sears will offer a system described by Christmas of 1987 where the vehicle operator will command his speed control by voice).

Our 1990 Sheriffs having decided on the practicality of regional dispatch centers then having delved deeper, decided that not only may California lead the way in modern emergency communication but take the additional step into the 21st Century and truly be a model for the rest of the nation. McDonnell-Douglas, NASA, and the European Space Agency are more than happy to supply not only technical advise but actual hardware to show the rest of the world the miracle of modern electronics and to open vast new marketplaces for the services they can provide.

ASSESSING YOUR ORGANIZATION'S (KEY LEADERS') READINESS FOR MAJOR CHANGE

Sheriff Dept Administrations (Generic - Estimated)

	VERY LITTLE DEGREE	LITTLE DEGREE	SOME DEGREE	GREAT DEGREE	VERY GREAT DEGREE	DO NOT KNOW
AWARENESS DIMENSIONS	1	2	3	4	5	0
1. Awareness of the nature of the organization's current environment	☐	☐	☐	☐	X	☐
2. Understanding of the nature of inter-relationships among organizational dimensions (e.g. people, culture, structure, technology, etc.)	☐	☐	☐	☐	X	☐
3. Appreciation that the change situation has some unique and anxiety-producing characteristics	☐	☐	☐	☐	X	☐
4. Appreciation of the complexity of the nature of inter-relationships among organizational dimensions (e.g. people, culture, structure, technology, etc.)	☐	☐	☐	☐	X	☐
MOTIVATIONAL DIMENSIONS	1	2	3	4	5	0
5. Willingness to specify a detailed "vision" of the future for the organization	☐	☐	☐	☐	X	☐
6. Willingness to act under uncertainty	☐	☐	☐	X	☐	☐
7. Willingness to develop contingency plans	☐	☐	☐	☐	X	☐
8. Willingness to activate (follow) contingency plans	☐	☐	☐	☐	X	☐
9. Willingness to make achievement of the "vision" a top priority	☐	☐	☐	☐	X	☐
10. Willingness to assess own theory of organizational behavior	☐	☐	☐	☐	X	☐
11. Willingness to increase organizational discatisfaction with current situation	☐	☐	X	☐	☐	☐
12. Willingness to use non-authority bases of power and influence	☐	☐	☐	X	☐	☐
13. Willingness to share responsibility for managing change with other key leaders in organization.	☐	☐	☐	X	☐	☐
SKILL AND RESOURCE DIMENSIONS	1	2	3	4	5	0
14. Possesses the conceptual skills to specify a detailed "vision" of the future for the organization	☐	☐	☐	X	☐	☐
15. Possesses assessment skills to know when to activate contingency plan(s)	☐	☐	☐	X	☐	☐
16. Possesses interpersonal skills to effectively employ non-authority based power and influence	☐	☐	☐	X	☐	☐
17. Possesses personal relationships with other key leaders in the organization	☐	☐	☐	☐	X	☐
18. Possesses ready access to resources (time, budget, information, people, etc.)	☐	☐	☐	X	☐	☐

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READINESS ASSESSMENT
HANDOUT NO. 3

ASSESSING YOUR ORGANIZATION'S (KEY LEADERS') READINESS FOR MAJOR CHANGE

County Administrative Officers (Generic - Estimate)

	VERY LITTLE DEGREE	LITTLE DEGREE	SOME DEGREE	GREAT DEGREE	VERY GREAT DEGREE	DO NOT KNOW
AWARENESS DIMENSIONS	1	2	3	4	5	0
1. Awareness of the nature of the organization's current environment			X			
2. Understanding of the nature of inter-relationships among organizational dimensions (e.g. people, culture, structure, technology, etc.)				X		
3. Appreciation that the change situation has some unique and anxiety-producing characteristics					X	
4. Appreciation of the complexity of the nature of inter-relationships among organizational dimensions (e.g. people, culture, structure, technology, etc.)					X	
MOTIVATIONAL DIMENSIONS	1	2	3	4	5	0
5. Willingness to specify a detailed "vision" of the future for the organization					X	
6. Willingness to act under uncertainty			X			
7. Willingness to develop contingency plans				X		
8. Willingness to activate (follow) contingency plans				X		
9. Willingness to make achievement of the "vision" a top priority			X			
10. Willingness to assess own theory of organizational behavior		X				
11. Willingness to increase organizational dissatisfaction with current situation			X			
12. Willingness to use non-authority bases of power and influence			X			
13. Willingness to share responsibility for managing change with other key leaders in organization.				X		
SKILL AND RESOURCE DIMENSIONS	1	2	3	4	5	0
14. Possesses the conceptual skills to specify a detailed "vision" of the future for the organization					X	
15. Possesses assessment skills to know when to activate contingency plan(s)				X		
16. Possesses interpersonal skills to effectively employ non-authority based power and influence			X			
17. Possesses personal relationships with other key leaders in the organization				X		
18. Possesses ready access to resources (time, budget, information, people, etc.)				X		

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READINESS ASSESSMENT
HANDOUT NO. 3

H2

READINESS/CAPABILITY CHART

Generic estimate for all 9 Public Safety Regional Dispatch Center areas.

Fill in the following chart as it applies to your situation. In the left-hand column, list the individuals or groups who are critical to your own change effort. Then rank each (high, medium, or low) according to their readiness and capability with respect to the change.

	Readiness			Capability		
	High	Medium	Low	High	Medium	Low
1. Public		x		x		
2. S.O. Admins	x			x (If Bd OK's)		
3. CAO'S		x		x (To + Rel)		
4. Bd of Sups			x	x (key)		
5. City Councils			x	x		
6. PD/FD Admins	x			x		
7. Line personnel - All agencies			x	x		
8. FCC		x			x	
9. APCO	x			x		
10. Equip Vendors	x			x		
11. Telephone Co's			x		x	x
12. Disp Cr Emps.			x		x	
13. News Media		x			x	
14. Allied Agencies		x		x		
15.						
16.						
17.						
18.						

COMMITMENT PLANNING

GENERIC: Applies to all 9 Public Safety Regional Dispatch Center areas

1) o WHAT DO YOU NEED FROM THE "CRITICAL MASS"?

2) o WHERE DOES "CRITICAL MASS" (INDIVIDUALLY) STAND NOW REGARDING THE CHANGE?

TYPE OF COMMITMENT

Actors in Critical Mass	Block Change	Let Change Happen	Help Change Happen	Make Change Happen
Voting Public		1,2		
Individual Sheriffs		2		
CAO's	2	(Initially, until	1	
Bds of Sups (3/5)	2	convinced of benefits)		1
City Councils (3/5)	2	1		
Line Personnel - POA'S		1,2		
Chiefs of Police		2	1	
FCC (via APCO)		2		1
APCO Coordinator		2		1

#2 assumes critical mass initially more concerned with short-term cost than long run fiscal savings.

COMMITMENT PLANNING

1) o WHAT DO YOU NEED FROM THE "CRITICAL MASS"?

2) o WHERE DOES "CRITICAL MASS" (INDIVIDUALLY) STAND NOW REGARDING THE CHANGE?

TYPE OF COMMITMENT

Actors in Critical Mass	Block Change	Let Change Happen	Help Change Happen	Make Change Happen
Vendors Ret. RFP			1	2
Rusal Ph Co's (individual)	2		1	
Disp Cr. Emps - Ea. Co.	2	1		
Media		1,2		
Allied Agencies (ind.)		1,2		

RESPONSIBILITY CHART - key

The vertical axis lists the major decisions to be made from start to finish. The horizontal axis lists the major actors from start to finish. The horizontal axis is too wide to be accomodated on a single page, and the vertical axis is too long. Thus, the first two pages show all the decisions, and the actors up to and including the hardware and software contractors. The third and fourth pages again show all decisions for reference purposes, and then show the actors to the Communications Center Director (the last one in the transition process). In practice this chart would be restored to its' original large single page chart format and posted. Used in this intended fashion it provides a ready reference to who has what responsibility at any decision point in the project.

RESPONSIBILITY CHART

R = Responsibility (not necessarily authority)
A = Approval (right to veto)
S = Support (put resources toward)
I = Inform (to be consulted)
- = Irrelevant to this item

Actors

Decision	Sheriff's	Cop's F/C's	Auditor	Local Counsel	Purh. Agent	Admin & Pers Analyst	System Design Cont.	Fac- ility Cont.	A&E Cont	Hdwre/ Sftwre Cont.
To start project	R	I	-	-	-	-	-	-	-	-
To go ahead w/ project	R	S	-	-	-	-	-	-	-	-
To make JPA	R	R	-	R/A	-	-	-	-	-	-
Sel sys desgn ctr	A	A	-	-	S	-	-	-	-	-
Select site & acquire	A/R	A/R	I	A/I	A/S	I	R	-	-	-
Est fiscal & perf ctrl	I	I	I/S	I	I	I	R	-	-	-
Det. procure ment method	A	A	I/S	I/S	I/S	I/S	-	-	-	-
Hire fac- ility cont.	A/I	A/I	I	I	I	I	R/A	-	-	-
Hire A&E contractor	I	I	I	I	I	I	R/A	R	-	-
Hire hard/ software contrs.	I	I	I	I	I	I	R/A	I	I	-
Det size & layout of facility	I/A	I/A	I	I	I/A	I/A	R/A	R	I	I

Sel of Com Cr Dir	I	I/S	I/S	I/S	-	I	-	-
Det of staff requirements	I	I	I	I	-	-	-	R/A
Staff hiring -	-	-	-	-	-	-	-	R/A
Remote/mobile equip-inst.	I	I	I	I	A	I/S	I	I
Staff training	I	-	-	-	-	I	-	R/A
Sys test process	I/S	I	I	I	I	I	I	R/A
System acceptance	S	S	S	S	-	I	-	R/A
Disp auth admin -	-	A	I	I	-	-	-	R/A

Decision	Ext/Proj Evaluator	Consult Eng	CAO/ C.M.	Boards of Sups	City Coun-ils	FCC	APCO Rep	Telephone Co Cont.	Com Cr. Dir
To start project	(t r a n s i t i o n)		I	I	I	I	I	-	-
To go ahead w/ project	-	-	S	A	S	I	I	-	-
To make JPA	-	-	S	A	S	I	I	-	-
Sel sys desgn ctr	I	I	S	I	I	I	I	-	-
Select site & acquire	I	I	I	I	I	-	I	-	-
Est fiscal & perf ctrl	I	I	I	-	-	-	-	-	-
Det. procure ment method	I	I	I/S	I/S	I/S	-	I	-	-
Hire fac-ility cont.	I	I	I	I	I	-	-	-	-
Hire A&E contractor	I/S	I/S	I	I	I	-	-	-	-
Hire hard/ software contrs.	I/S	I/S	I	I	I	-	-	-	-
Det size & layout of facility	I/S	I/S	I	I	I	-	-	I	-
Acquire re-mote sites		I	I	I	I	A	I	I	-
Dev. R/F plan	R	R	I	I	I	A	I/A/S	-	-
Det. per-formance specs	R / A		I	I	I	-	I	I	-
Obtain nec FCC licenses	R	R	-	-	-	A	S	-	-

Acquire remote sites	I/A	I/A	I	I/A	I/S	I/S	A/R	R	I	I
Dev. R/F plan	I/A	I/A	-	-	-	-	R	-	I	I
Det. performance specs	R/A	R/A	-	-	I	I	R	I	I	I
Obtain nec FCC licenses	I/A	I/A	-	I	-	I	R	-	I	I
Sel of Com Cr Dir	R/A	R/A	-	-	-	I/S	-	-	-	-
Det of staff requirements	I	I	-	-	-	I/S	-	-	-	-
Staff hiring	I	I	I	-	-	I	-	-	-	-
Remote/mobile equip-inst.	I	I	I	I	-	-	R/A	R	R	R
Staff training	I	I	-	-	-	I	-	-	-	-
Sys test process	A	A	I	I	I	I	R	R	R	R
System acceptance	R/A	R/A	S	S	S	S	-	-	-	-
Disp auth admin	A	A	-	-	-	-	-	-	-	-

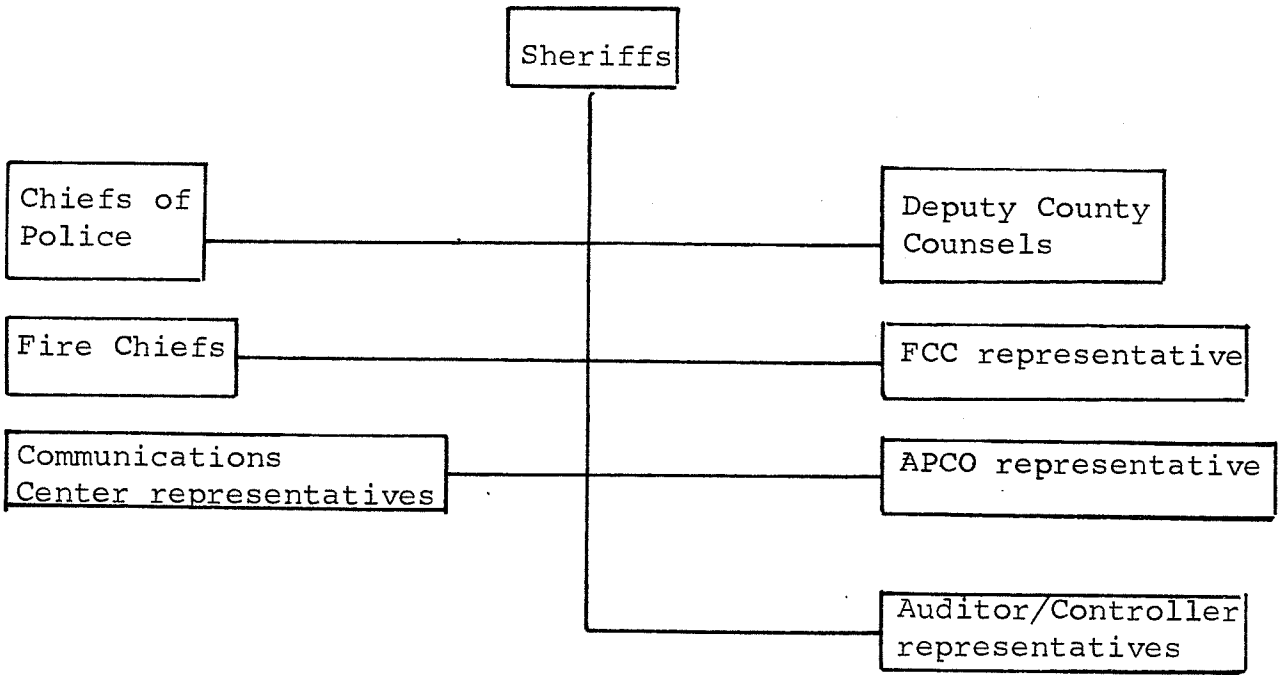
MILESTONE COMPLETION CHART

* = Completion point

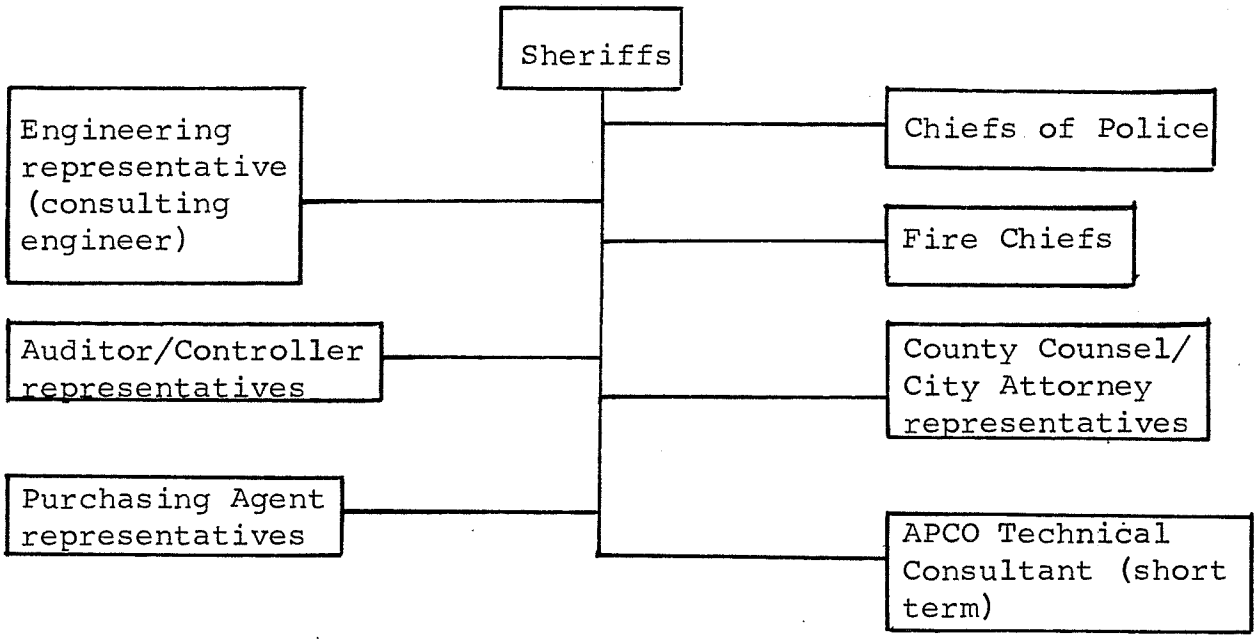
Years: 1 - 10 (and @ 4 mos. beyond)

TASK	. 1 . . 2 . . 3 . . 4 . . 5 . . 6 . . 7 . . 8 . . 9 . . 10 .
Decision to proceed by Sheriffs.	——*
Enlist political support.	———*
Obtain funding source.	——*
Creation of Public Safety Regional Dispatch Authroity via JPA.	——*
Establish project staff.	———*
Select/hire program manager.	———*
Specify system requirements.	————*
Source funding for rest of project.	————*
Expansion of project staff.	————*
Develop detailed RF plan.	————*
Select system design contractor.	———*
Finalize site selection.	———*
Select facility contractor.	———*
Select/hire hardware and software contractors.	————*
Commitment of telephone company engineers.	————*
Select/hire Communications Center Director.	————*
Installation of mobile & remote site equipment, and start of system testing.	———*
Hire and train dispatch center staff.	——*
Final testing of system on-line and acceptance by Dispatch Authority.	——*

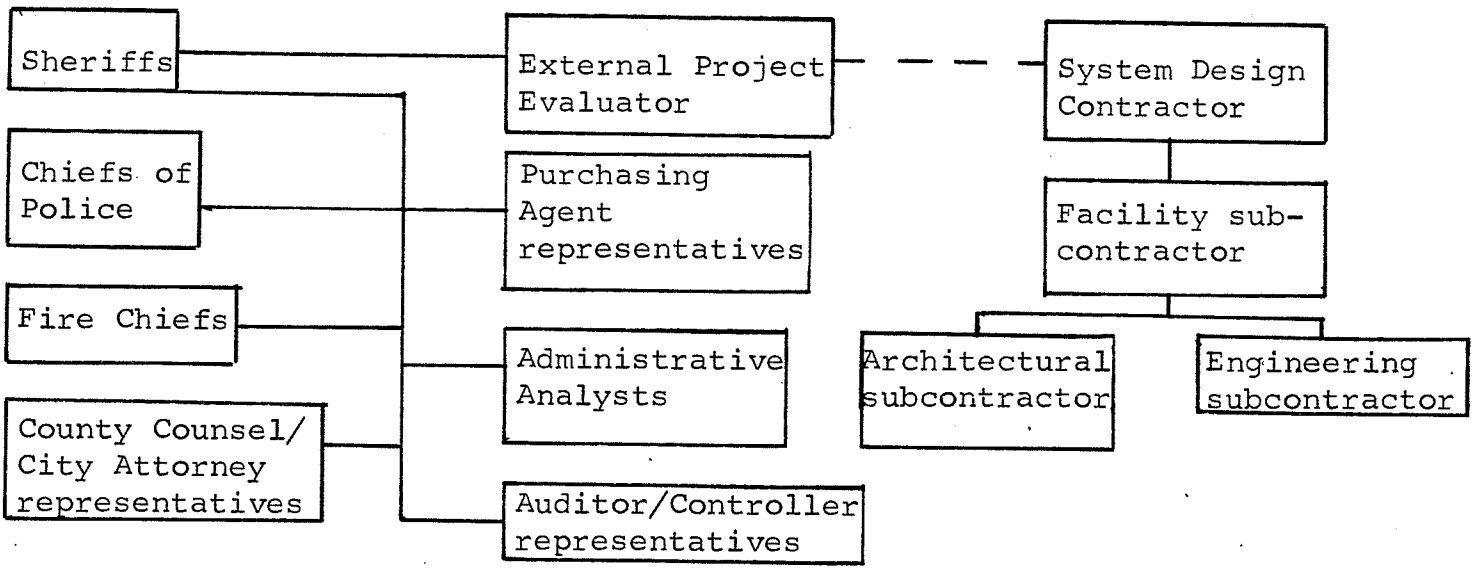
PHASE I - TRANSITION MANAGEMENT GROUP



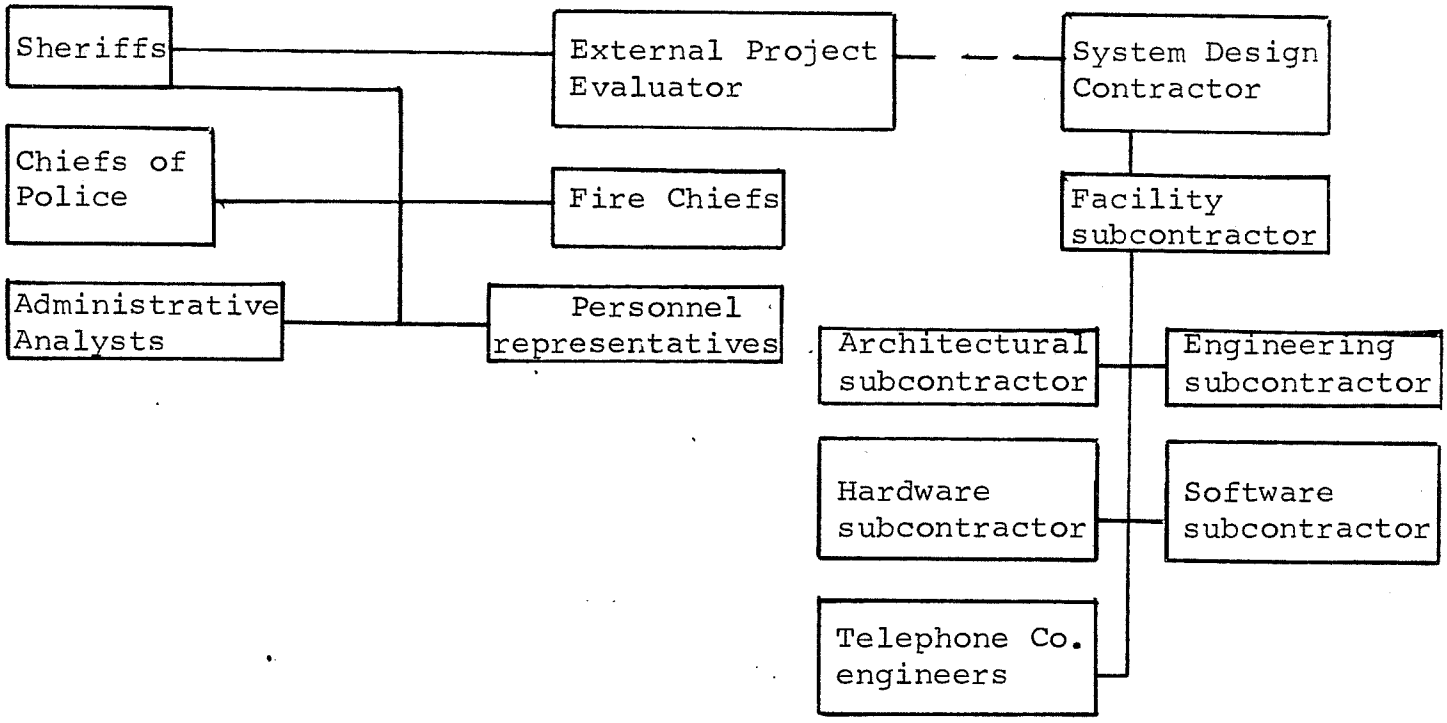
PHASE II - TRANSITION MANAGEMENT GROUP



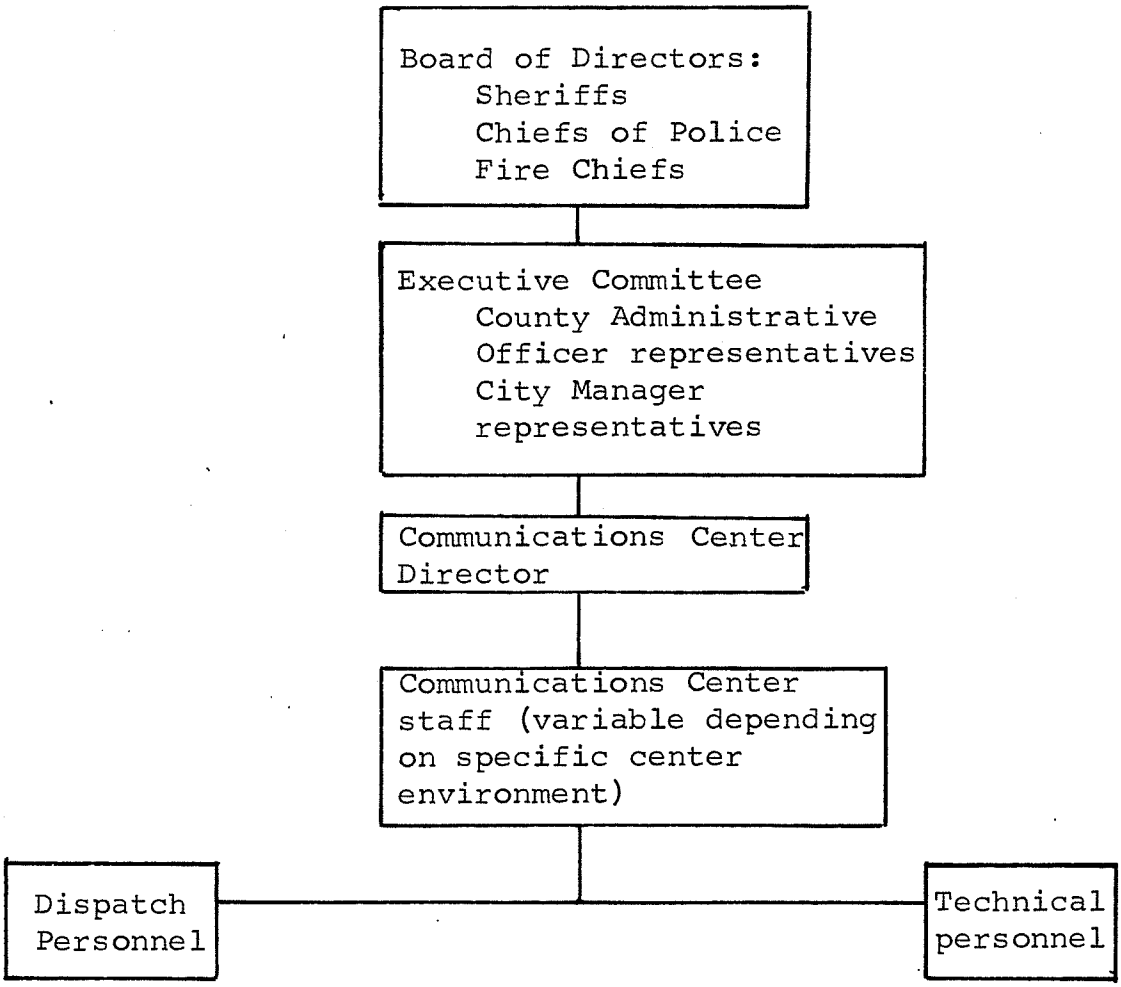
PHASE III - TRANSITION MANAGEMENT GROUP



PHASE IV - TRANSITION MANAGEMENT GROUP
(Stage 1)



PHASE V - Public Safety Regional Dispatch Center
Table of Orgnaization - permanent.
(transition made during stage 2 of Phase IV)



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