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LAW ENFORCEMENT ASSISTANCE ADMINISTRATION (LEAA)

POLICE TECHNICAL ASSISTANCE REPORT

SUBJECT:	Preliminary Communications Study
REPORT NUMBER:	76-166-089
FOR:	Imperial County, California Sheriff's Department
	Population 80,000
	Police Strength 150
	Square Mile Area 4500
CONTRACTOR:	Public Administration Service 1776 Massachusetts Avenue, N.W. Washington, D. C. 20036
SULTANT:	R. J. Evans
TRACT NUMBER:	J-LEAA-002-76
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EXHIBITS

I. INTRODUCTION

The Imperial County Sheriff's Department is located in El Centro, California (County Seat). The County borders Mexico on the south, San Diego County on the west, Riverside County on the north, and the State of Arizona on the east. The terrain varies greatly throughout the County with rugged mountains on east and west sides. A desert valley lies north and south through the central section of the County. The valley in most instances is below sea level. This varying terrain has caused radio communications problems in many areas of the County.

The climate in central Imperial County is typical of the desert with less than three inches of precipitation annually. Temperature ranges between 65 and 115 degrees F. in summer months and between 30 and 75 degrees in the winter months.

The County has a population of approximately 80,000 persons and covers an area of 4500 square miles. A large portion of the residents are involved in farming activities which, by itself, would not create an abnormally high crime rate. The County, however, lies adjacent to the Mexican border which spawns many drug-related crimes. These must be addressed by the Sheriff's Department as well as other law enforcement agencies in the area. The Mexican-Imperial County border is over 80 miles in length. Other crime-related problems arise from the influx of persons from the north during winter months, especially in the area of the Salton Sea.

The need for wide radio coverage in the County is also created by citizens who frequently travel into the desert area or mountains with vehicles. They become stranded or accident victims and require assistance.

The Sheriff's Department operates 52 radio-equipped vehicles in addition to one fixed wing airplane and two helicopters. It has a force of 150 persons. The communications division maintains a 24-hour operation with a total of five civilian radio operators (one per shift) and one communications supervisor. The present radio system has become inadequate to cope with the rising crime problems and the need for more extensive communications coverage.

Nature of the Study

The Imperial County Sheriff's Department requested technical assistance to develop a preliminary design for its communications system. The technical assistance was to address both facilities and equipment design features in order to achieve a completed system within five years.

The on-site tasks of the study involved:

1. Interviews with all persons directly involved with the County-wide communications system.

2. Review of the existing police communications in the area.

3. On-site tests in poor-communications areas.

4. Consultation with Department officials regarding the requirements and space in the proposed new facilities.

5. Review of the maintenance procedures.

Study Methods

On-site evaluations and data collection was conducted between the dates of September 29 and October 1, 1976.

Persons interviewed during the assignment:

J. Leonard Speer,	Sheriff, Imperial County
Frank Fulmer,	Captain,Imperial County Sheriff's Department
Dick Wilson,	Lieutenant, Imperial County Sheriff's Department
Mike Singh,	Lieutenant, Imperial County Sheriff's Department
Alfred Reyes,	Sergeant, Imperial County Sheriff's Department
Kenneth Dukes,	Communications Supervisor, Imperial County Sheriff's Department
Roger Donald,	Two-way radio service
George Hendrix,	Two-way radio service

II. UNDERSTANDING THE PROBLEM

Present County Radio System Design

The following sections of this report discuss some of the important features of Imperial County's present communications network.

Communications Control Center

The present radio dispatch operation utilizes a telephone operator on the 8:00 a.m. to 4:00 p.m. shift, Monday through Friday, and from 4:00 p.m. until 8:00 a.m. the incoming telephone calls are taken by the radio dispatcher. The dispatcher sends and receives messages to the mobile unit, portable units, and other stations in the network. A teletype operator handles the messages to the State data files and the NCIC computer in Washington, D.C., during the 8:00 a.m. to 4:00 p.m. shift. From 4:00 p.m. until 3:00 a.m. the radio operator (dispatcher) operates the teletype in addition to other duties. The telephone, teletype, and radio operators are civilian personnel, who handle messages to the Fish and Game Department, the Emergency Medical Units, and the California Highway Patrol. Intersystem and intercity equipment connects the center with adjacent counties and cities within Imperial County. The County's Park and Recreation boats contain radio units on the Sheriff's frequency to assist in disasters. The dispatch center is equipped with the National Warning System (NAWAS).

The 911 common telephone number has not as yet been installed in Imperial County, however, the County and State plan indicates that it must be installed by 1982. It is expected at an earlier date.

The Sheriff's Department has eight incoming trunk lines and five outgoing trunks. In addition, there are two extra trunks at the Court House that can be used for outgoing calls. The peak periods for emergency calls are between 5:00 a.m. and 11:00 a.m. and from 4:00 p.m. to 10:00 p.m. The frequency of line loading will be checked by the telephone company to determine if there is a call overload. The probability of a busy signal or delay in call processing is not known at the present time.

The dispatch center has direct telephone lines to the Winterhaven substation, the ambulance services, the El Centro police and fire departments, and the California Highway Patrol.

The center's radio and telephone channels are not recorded at the present time, however, a multi-channel recorder is planned for the new Sheriff's headquarters and jail.

The present dispatcher center does not have sufficient space for extra operating personnel during emergencies but this will be alleviated when the new building is completed. There are times when the present operators (5) cannot handle the work load. This frequently occurs during pass days and sick leave.

Radio Control Stations

There are four radio control stations in the County system which are used to send and receive messages through the radio repeater stations. The control stations eliminate the need for the use of costly control lines between the control points and the base stations (repeaters). The two repeater stations associated with the control units are located in mountain areas in the southwest and in the east-central part of the County. The control stations operate on two duplex radio channels. The radio control units are located as follows:

1. Sheriff's control center.
2. Winterhaven sub-station.
3. Salton City sub-station.
4. El Centro police department.

There are three radio channels used in the basic system: one is a simplex channel used for car-to-car communication; the other two are duplex channels used in the mobile repeaters.

There are local base stations operating on channel "1" at three locations: the Sheriff's office, the Winterhaven sub-station and the Salton City sub-station.

Radio Repeater Stations

There are two mobile repeater stations in the network. One is located in the southwest section of the County on Table Mountain and repeats mobile signals on channel "3". The other station operating on channel "2" is located in the east-central section of the County on Black Mountain. The primary use of these two stations is to repeat mobile radio signals. Neither of the repeater stations have redundant transmitting or receiving equipment, nor do they have emergency power. Portable units and aircraft can also use the repeaters.

There are poor signal areas in the County where it is impossible to have communications with the mobile units. These are in the Salton Sea area north of Salton City, and in a mountainous area near Winterhaven (see Figure 1).

Communications Interface

Communications interface is a term used to describe the communications link between different city, county, and state police agencies as well as other related public safety jurisdictions.

In Imperial County this interface is accomplished as follows:

Cities——————————Inter-city radio channel.
Counties——————————Inter-system radio channel.
State agencies——————State computer switching.

Figure I

Poor Signal Areas

Imperial County, California

Civil Defense ——————— NAWAS circuit.
Citizens ——————— C.B. Radio.
Mexico ——————— Long distance telephone.
Other intra-County departments—Radio or telephone.

Central Dispatch

Although the merits of a county-wide centralized communications center have been discussed before by City and County officials, no action has been taken towards implementing the concept.

Mobile and Portable Operation

On the whole, the present mobile and portable radio system provides the officers of the County with adequate communication capability. The exceptions to this statement are the old equipment still in use that cannot be modernized; equipment failure of the repeaters; power failure at the repeater sites; and the poor communication's area (dead spots) in the northwest and the southeast parts of the County.

The mobile and portable units operate on three channels: number "1" is used for unit to unit on a local level; number "2" is used to actuate the repeater at Black Mountain; and number "3" channel is used to actuate the repeater on Table Mountain. A fourth frequency will be installed shortly on the State-wide emergency mobile channel that will allow Imperial County officers to communicate with officers of other areas in California when working on problems of mutual interest.

Some of the Imperial County patrol cars are equipped with an extra communications capability that provides immediate access to other systems. These are as follows:

Two cars in the northeast section of County are on the Riverside County frequency.

Three cars in the southeast section of County are on the Yuma County, Arizona, Sheriff's frequency.

One car in the southwest section of County is on the San Diego County frequency.

Four cars are on the Department of Highway Patrol (DPH) frequency.

Five cars are equipped with CB radios.

In addition to the 54 radio-equipped vehicles, there is an Imperial County radio set installed in the District Attorney's car, as well as one radio in the vehicle for family support, three radios in the animal control vehicles and

two radios in the public works vehicles.

There are 28 portable radio sets that are used for various types of communications; however, they primarily serve the officer while on foot out of the patrol vehicle.

A few cars are provided with channel scan units that allow the officer to immediately hear any signal that appears on one of his three channels. This is a desired function for all radio sets when multi-channel communications are used.

A large number of mobile units have voice scramblers. These accessories prohibit the average citizen from receiving intelligence information from the police frequencies. There are various methods for maintaining security of communications. These include verbal coding of voice messages, scrambling of voice messages, using digital or data transmissions to and from the police vehicles, and so forth. The more sophisticated systems are more costly and, therefore, must be considered on a cost-effective basis.

Data Systems

Data systems are being used at this time in the Sheriff's Department. One type is the State and FBI computer terminal in the dispatch center. The records of the Department are being microfilmed at this time which is a valuable space saver. Additional computer storage will be necessary in the foreseeable future.

Satellite Receivers

Many modern radio systems have a requirement for satellite receivers which relay messages from portable units to signal comparators in the central dispatch office. This type of satellite system is not needed for the Sheriff's Department because of the unique mountain placement and design of its existing mobile repeater stations.

Emergency Power Capability

Emergency power backup, for use during commercial power failures, is presently available at the Sheriff's Office. The sub-stations and the radio repeater sites, however, do not have back up power sources. Presently this creates a major problem, but it will be corrected in the future when new units are purchased. Normally, if only one repeater station is rendered inoperable because of power failure, the mobile units can switch to the other repeater. However, communications between the mobile units and the station can operate only if the mobile units are within the range of the functioning repeater.

Maintenance

The entire radio system for the Imperial County Sheriff's Department is maintained by a private company. The charges or costs of maintenance were reviewed by the consultant and they appear to be within a national average. For example, the monthly charge for maintenance of a mobile

unit, including parts and labor, is $5.00; certainly a reasonable sum.

Problems and Other Considerations

One of the major problems facing communications development in Imperial County is the lack of adequate funds to plan and purchase an up-dated radio system. A second related problem is the lack of local technical expertise in the communications field. Consequently, the Sheriff's Department must depend upon vendors of radio equipment and maintenance services for advice and assistance in determining communication system needs and requirements.

New Facilities

The consultant was asked to review building plans proposed for a new jail and office complex to determine if sufficient space had been allocated for the proposed communications system. The existing plans are adequate to accommodate three control consoles, a switchboard, and teletype machines (see Figure 2). The equipment room appears to be adequate for the planned expansion in equipment items.

Motorist's Telephone Aid System

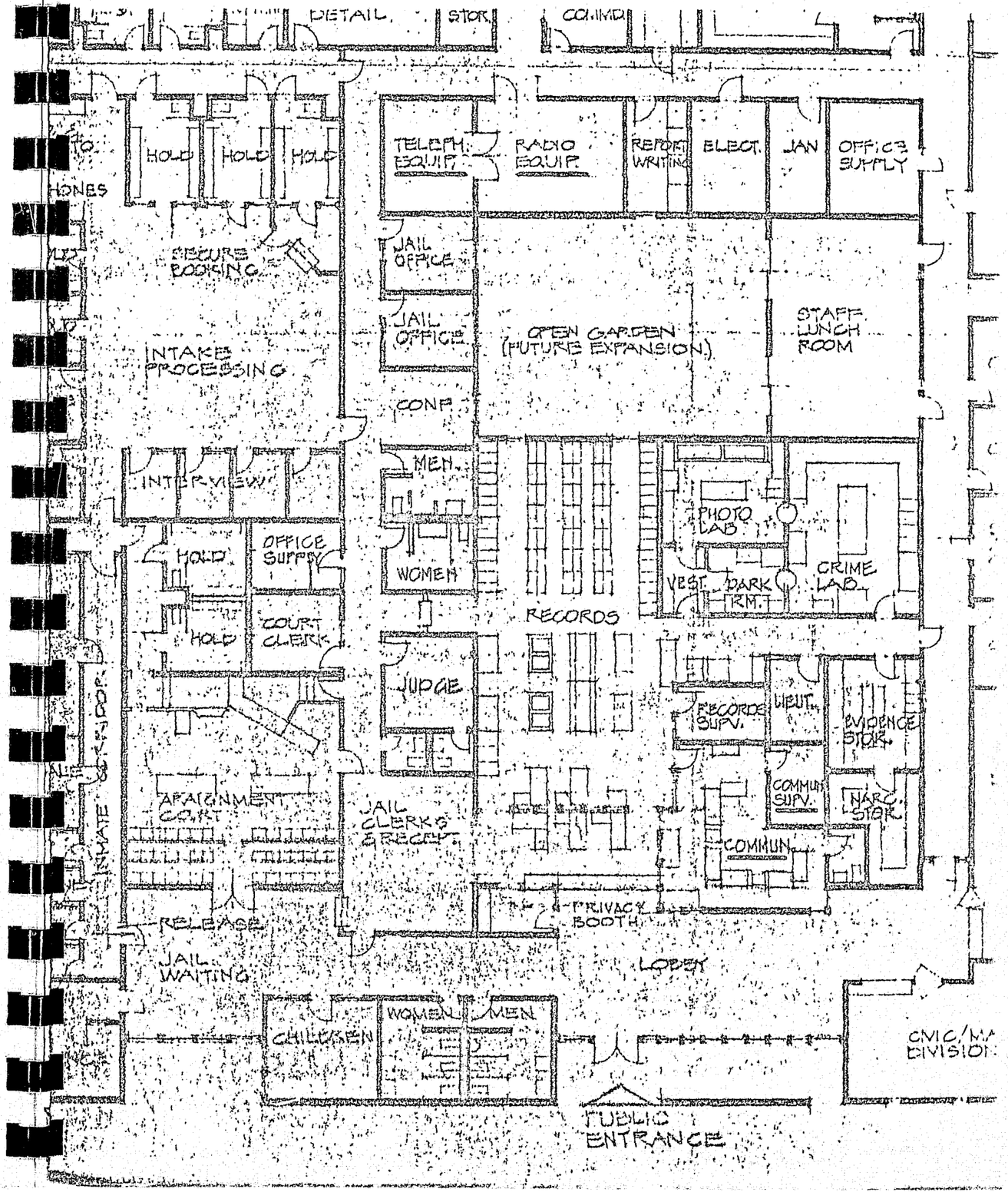
A motorist telephone aid system (telephone for citizens on interstate highways) has not as yet been installed in Imperial County, however, an experimental system is operating in Yuma County and may eventually be extended into Imperial County. Pre-planning in the area of extra radio circuits of microwave channels will insure a less costly and more dependable motorist telephone aid system.

Advanced Communications

The County does not presently feel the need for more advanced systems such as mobile digital, (data from mobile unit directly into the computer and return) computerized dispatching, or the automated vehicle locator. These types of systems all use computer services and are normally installed in high population and high crime areas.

Figure 2

New Proposed Facilities Communications Areas



III. ANALYSIS OF THE PROBLEM

The analysis of the problem included a comprehensive review of the existing equipment, frequencies, and communications system design features. Actual field tests were conducted to derive a first hand knowledge and experience of the poor signal areas.

The Communications Center

The control center, even though it has been greatly improved appears too confined for efficient operation during emergencies when several persons would have to be present to direct operations. The present radio control console was purchased in 1967 and is not equipped to handle additional operating channels. Consequently, it should be replaced when the Department moves to its new quarters.

A review of the operational duties indicates that at least one additional operator needs to be hired immediately. In two years the work load should be re-assessed and, if justified, additional operators should be added. The Department has assessed the work load of the communication dispatchers and finds that at the present time there should be 7.96 persons. The present compliment is 5 persons. Growth in communications work load is illustrated in Figure 3.

The present operation in the center requires a handwritten log of all incoming calls and radio messages. A multi-channel logging recorder should be purchased for installation in the communications room in the new building.

Communications Equipment

Observations made by the consultant during his visit indicate that some of the County's radio equipment need to be replaced immediately. Some of the mobile radios are too old to be converted to multi-channel. These should have an immediate replacement program. The portable radio units also require some updating. A few are inoperative and are not capable of being converted or updated. Also there appears to be an insufficient number of portable units for the officers on duty.

The base station equipment is several years old and a field inspection indicated that at least one unit was operating at only half power. This condition plus loss in a long antenna cable could be the cause of poor communications in the Salton City area. This unit should be either repaired or replaced. If replaced, the radio should be of the battery powered type that has the capability of continued operation during electrical power failures. The antenna system should be checked for loss in power and, if necessary, moved closer to the equipment. A similar check should be made of the equipment at the Winterhaven sub-station. A field inspection of this station indicated it was operating at four-fifths of the rated power output.

Work Program Experience and Estimates
Imperial County Sheriff's Department
Communications Center

WORK UNIT	1971-72 ACTUAL	1972-73 ACTUAL	1973-74 ACTUAL	1974-75 ACTUAL	1975-76 EST /ACT	1976-77 ESTIMATED
Incidents logged					10,244	11,755
CR's Issued		4,020	4,092	4,002	8,495	9,770
Non Crim Incidents					3,300	5,688
Radio Transmissions	143,994	156,131	165,911	239,177	251,278	288,970
Request for Ambulance					1,625	1,865
Teletype Services				27,261	30,630	35,225
Sent				6,566	7,550	8,680
Received				20,695	23,080	26,545
Telephone Service						

Another problem is that the mountain equipment sites are not supplied with emergency backup power, consequently, equipment outages occur due to power failure. The mountain-top repeater stations have had many failures and should be replaced with battery stand-by type of equipment.

System Design Features

The Communications interface with other departments (both intra and inter-County) should be improved. All future planning should include this element of police communications.

Recently, an emergency medical radio system was installed in Imperial County. This network uses microwave between the El Centro and Black Mountain repeater site. All future planning by the County should include expansion of this system to accommodate the County fire and police needs. Futhermore, future requirements should consider the expansion of motorist telephone aid system along I-8, a County-wide 911 telephone system, and centralized dispatch facilities. Future planning should also consider microwave from Black Mountain to the Winterhaven sub-station and point-to-point links between Salton City and the Table Mountain repeater station area (see Figure 4).

The consultant discussed the need of a point-to-point link from El Centro to Salton City with Captain Fulmer. The airline distance is 41 miles over desert area with both terminal locations from 60 to 80 feet below sea level. A single one hop microwave system does not appear workable due to the small tower at Salton City and the temperature inversions over the hot desert. A microwave active repeater at Superstition Mountain would provide a dependable system. The use of passive types of repeaters would not be practical due to the long paths to be covered. The beam-bender repeater (Antennas back to back) have a 65% efficiency, and the passive reflector cannot operate with an angle in excess of 110 degrees. The angle at Superstition Mountain is 167 degrees. Both of these passive repeaters require short paths because of the high signal losses.

The use of microwave to the Salton City area should be considered on a cost-effective basis. The cost of microwave per circuit mile for a 12 channel system with two hops operating at 2 GHZ. is estimated at $74.00 per circuit mile (protected equipment) and $48.00 per circuit mile (unprotected equipment).

The radio frequencies now licensed and in service appear adequate for base and mobile operation over the next several years. This opinion is based upon the repeater system used in the County and the fact that the F.C.C. in Washington recommends a loading factor of 50 vehicles per frequency for public safety operations.

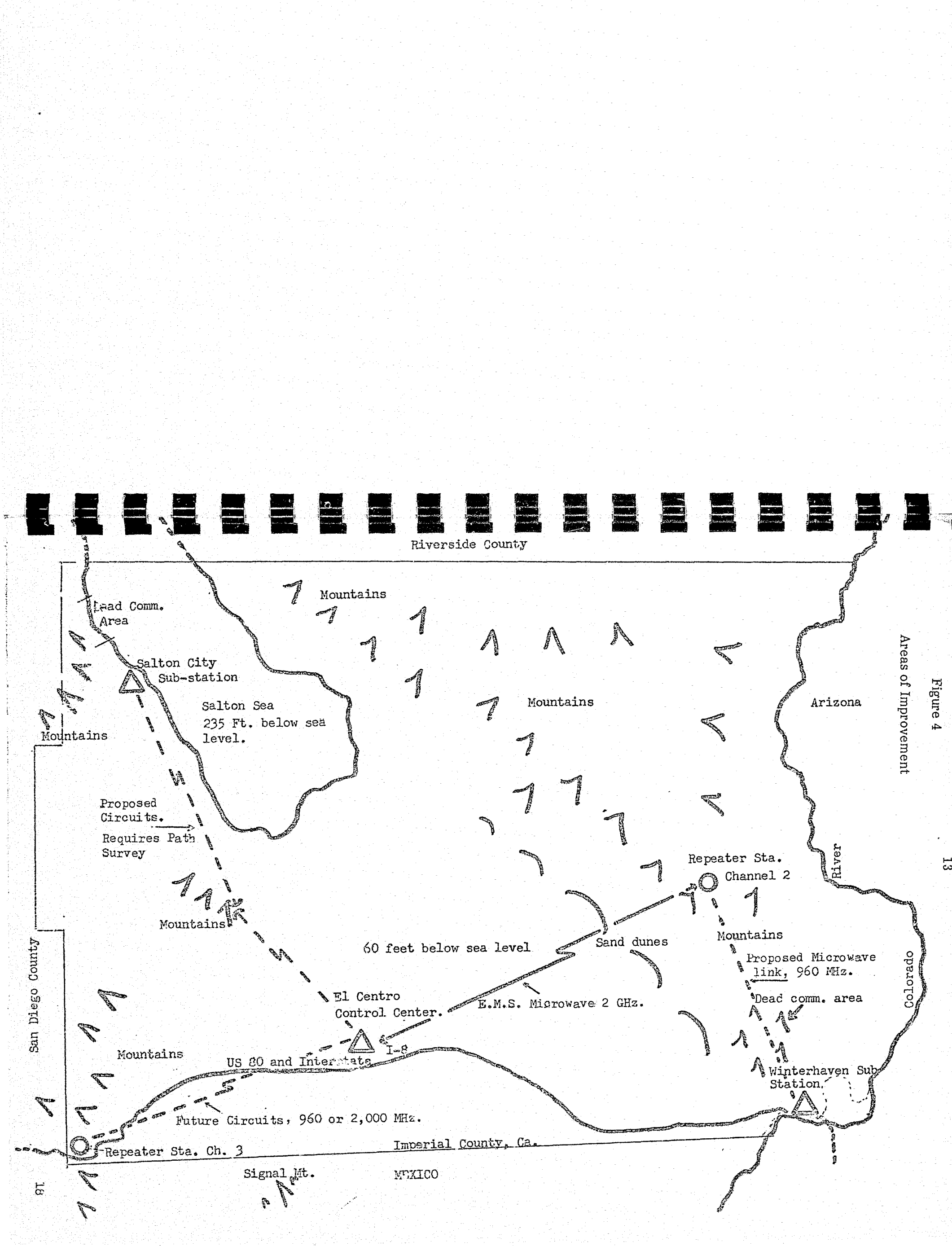


Figure 4

Areas of Improvement

IV. FINDINGS AND CONCLUSION

This chapter highlights the major findings of the study along with some of the consultant's concluding comments.

Findings Requiring Immediate Action

1. There is a need for a comprehensive County-wide communication study. A comprehensive study should be undertaken immediately to formulate a County-wide public safety communications plan. The study should include area system design, features equipment requirements, and purchase specifications. It is advisable to have the system designer follow through the implementation stages.

2. There are poor communications in the Salton City Area. The base station at Salton City is operating at half power. This should be repaired or replaced immediately to improve the poor communications to patrol cars in the area. Antenna changes also are suggested to reduce losses in power. All replacement equipment should have battery "back up."

3. There is a need for a portable base station. Due to the many equipment and power outages in the County a trailer-mounted emergency base/repeater station with antenna and small emergency power generator should be acquired for immediate use in the event of power failures.

4. There is a need for additional radio operators. The Department's present work load would appear to justify 7.8 personnel. Consequently, the Department immediately should hire a minimum of one additional radio/telephone operator. Further, manpower staffing requirements should be re-evaluated when the Department moves to its new quarters.

5. There is a need to replace some mobile and portable radio units. Some of the Department's mobile and portable units are requiring excessive maintenance and cannot be reasonably converted to multi-frequency. These units should be exchanged on a yearly purchase program.

Findings Requiring Longer-Term Action

1. There is a need for a logging recorder at the control center. A logging recorder for telephone and radio messages should be purchased and installed in the new communication center.

2. There is a need to replace the existing communication console. The existing console should be replaced and a second unit

purchased in about two years to coincide with completion of the new building.

3. There is a need to replace the existing mobile repeaters. The mobile repeaters located on the mountain tops should be replaced with updated equipment featuring "backup" battery power supply. This improvement should be accomplished in a two to five year schedule.

4. There is a need for a regular maintenance evaluation program. The present leased maintenance program appears cost effective. Nevertheless, the entire program should be evaluated every two years to determine if County-owned maintenance would be less costly and more effective.

5. There is a need to examine the feasibility of County-wide centralized dispatch. Any future studies or planning should consider, on a cost-effective basis, the implementation of a centralized dispatch for all city and county communications. This should be evaluated and planned prior to the 911 common telephone installation.

6. There is a need to examine all County-wide point to point communications. All future communications planning should take into consideration the Sheriff's Department's needs for telephone and radio from remote points into El Centro. Microwave systems should be designed to carry information for all County functions such as emergency medical, police, fire, motorist aid, and others.

V. RECOMMENDATIONS

General Recommendation

The County Sheriff's Department should proceed immediately to update its communications system. A master telecommunications plan is needed that will assure proper interface in the future for all public safety agencies in Imperial County. The plan should include equipment, specifications, and operations, and incorporate all modern system concepts in mobile and portable radio, microwave radio, central control centers, 911 common telephone number and computerization of files and records. Further, the study should determine operational personnel requirements and examine cost-effective system alternatives.

The action plan must be developed before a viable County-wide system can be purchased. The plan or system will require the assistance of outside communications consultants since the County does not have technical personnel.

Specific Recommendations

1. The new center should contain a paging system.
2. All new mobile and portable equipment should have an eight channel capability.
3. Mobile units should have scanning devices.
4. All base and repeater stations should have emergency power "backup" capability.
5. Change-out of all radio equipment requiring excessive maintenance.
6. New control consoles should be installed in the new center.
7. A radio cross-monitor capability should be developed with Mexicali, Mexico, if traffic warrants (allowable under F.C.C. rules).
8. An additional radio operator should be hired immediately.
9. The new center should be equipped with 30 channel tape recording equipment.

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